REPLIGEN

ANNUAL REPORT


REPLIGEN
INSPIRING ADVANCES IN BIOPROCESSING

Inspiring Advances in Bioprocessing

In this report, we are highlighting our success in five areas of strategic importance for Repligen during 2023: continuing to differentiate the company in bioprocessing through new product launches; strategically managing key accounts to expand our opportunity funnel; optimizing our portfolio to make further inroads in new modalities; completing key buildouts; and rebalancing our resources. I'm happy to report our progress in all these areas and more, despite the macro challenges faced by our industry in 2023. We are optimistic about 2024 as we continue on our path of "inspiring advances in bioprocessing".


REPLIG

2023 business HIGHLIGHTS

$639M
Reported Revenue

$599M
Base Revenue

18%
New Modalities Share of Total Revenue

13%
Share of Revenue from New Product Launches 2021-2023

>50%
Opportunity Funnel Growth

$750M
Cash and Cash Equivalents at Year-End

10
Product Launches

2
Strategic Acquisitions

40%
*Reduction in GHG Emissions**

All dollars and percent figures above are approximate.
** 2022 greenhouse gas (GHG) figure, compared to 2020.*

dear valued SHAREHOLDERS

Welcome to Repligen's 2023 Annual Report. It was a challenging year for our company and the industry, yet we are steadfast in our optimism for Repligen and our unique position in the bioprocessing market. As this report publishes, we have entered 2024, and believe this will be an important transition year for the company and our industry. We made significant progress in the second half of 2023, with order improvement at biopharmaceutical ("Pharma") and CDMO accounts, and a strengthening funnel of opportunities for the company, including progress in new modality markets. I believe we have the right team, products and market position, which we have built up over the last five years, to provide value to our customers and shareholders as we navigate our respective markets and remain true to our company's vision of "inspiring advances in bioprocessing".

A Challenging Year for Bioprocessing

2023 proved to be a challenging year for our industry and our Company, as we adjusted to a post-pandemic environment following three years of capacity expansion and hiring to meet unprecedented acceleration in demand for our products. As the pandemic waned, starting in the second half of 2022, Repligen and the bioprocessing industry faced multiple headwinds. Most significant were elevated inventory levels at both Pharma and CDMO accounts, as customers built excess supply during this long lead-time environment. The de-stocking impact of this persisted through 2023. This was coupled with conservative capital spending and project delays at large Pharma accounts. In addition, a high inflationary environment resulted in significant contraction in funding for startup biotech companies, and regionally, the industry was affected by economic deterioration in China - both of which impacted Repligen.

Positive Signs by Year End

The first half of 2023 was particularly challenging, as the funnel of opportunities across our customer base was limited. In the second half of 2023, our opportunity funnel began to improve and by year end, we were encouraged to see positive signs of recovery. Orders picked up, especially in the third quarter for Pharma accounts, and in the fourth quarter for CDMO accounts. Overall, our orders grew by more than 10% in the second half versus first half of 2023. Our book-to-bill ratio (orders divided by revenue for the same period) was also encouraging and overall, averaged 1.05 in the second half of the year. Our opportunity funnel also increased by 50% since the start of 2023. So all-in-all, an encouraging trend as we enter 2024.

Strong Underlying Markets

We are also encouraged by the strength in the underlying biologics market. In 2023, there were a record number of U.S. FDA approvals of monoclonal antibody-based therapeutics (mAbs), our largest end market, with 12 originator and five biosimilar approvals. The "new modality" end market, which encompasses cell and gene therapies, exosomes and mRNA-based programs, also had a record year for U.S. FDA approvals at seven – this is also Repligen's fastest growing end market. While the early-stage biotech funding pipeline was less than prior years, the number of drugs moving through clinical trials remains the major driver of growth for the bioprocessing tools players.

Making Strides With Advanced Systems

In 2023, our systems integration strategy leapt forward – this included the expansion of our Fluid Management portfolio. We broadened and deepened our portfolio of integrated systems and consumables that are suited to the complexities and pressures of biological drug manufacturing.

"Over the past three years, we've built a first-rate Fluid Management portfolio through six complementary acquisitions and internal R&D. We now offer designed-for-purpose storage and transfer solutions for fluid management, both within and between unit operations. Through our 2023 acquisitions, we're excited to advance innovative single-use mixing solutions, enhancing this strategic portfolio."

Surendra Balekai
Vice President, Fluid Management

2023 Focus: Key Accounts Strategy, New Modality Inroads, Innovation and Rebalancing Resources

When I look at the year in full, I was also very pleased with the way the Repligen team executed. We focused our attention on five areas, aligned with our goals set up at the beginning of 2023. We strengthened the commercial team with the addition of a key accounts team in North America. We intensified our efforts to build a strong opportunity funnel and expand our presence in new modalities. We prioritized R&D as we continued to focus on innovation, committing similar dollars to R&D as in 2022. In addition to these three areas, we took necessary actions to rebalance the organization in response to margin pressures we faced from lower sales volume in the post-pandemic market. This was balanced with investments in key site upgrades.

Key Accounts

We advanced our commercial strategy of building a key accounts team, to improve our portfolio visibility at top accounts, with a core team in place by mid-year. In October, we appointed industry veteran Olivier Loeillot to the newly created position of Chief Commercial Officer, to lead the commercial team and our four franchises. As an indication of impact, orders from our top 10 Pharma accounts were up 20% for the full year compared to 2022, and orders from our top 10 CDMO accounts were up nearly 15% over the same time period.

"I'm thrilled to be leading the product and commercialization strategy for Repligen across our four business units, as the company's first Chief Commercial Officer. I've been watching Repligen's impressive progress over the years and recognize the importance and timing of building on the success of the company's key accounts program. Taking this very focused approach will ensure that our larger Pharma and CDMO accounts can make purchasing decisions with the full, expanded scope of Repligen bioprocessing solutions in mind."

Olivier Loeillot
President and Chief Commercial Officer

New Modalities Momentum

We made inroads in new modalities, which includes cell and gene therapy, exosome and RNA-based programs. Driven by several late-stage and commercial wins in 2023, new modalities had a solid year for both orders and sales, with revenue from customers' new modality programs representing 18% of total revenue. While revenue was driven by existing customers' scaling into late-stage clinical and commercial programs with our products, we also added more than 85 new accounts in 2023, positioning us well for continued success in this important market.

New Modality Revenue 2020-2023

In 2023, despite the significant downturn across the entire bioprocessing market, we had a solid revenue year at new modality accounts. We were encouraged to see a record number of U.S. FDA approvals of cell and gene therapies in 2023, and even more slated for potential approval in 2024. Our closed, flexible systems and single-use technologies are well positioned to succeed in this important area of biological drug development and commercialization.

New Product Launches

Innovation remained a top priority, and we successfully launched 10 new products in 2023. Although these were first- and partial-year product offerings, they generated over $12 million in revenue in 2023. The success of our new product launches were in three areas: Process Analytics, where we are enhancing our KrosFlo® systems; Filtration, where we launched fully integrated systems; and, Upstream Process Intensification, where we introduced our new XCell® ATF LS (large scale) controllers for enhanced performance. *Learn more about a few of our new product launches on page 18 of this report.*

Rebalancing the Organization

Rebalancing of resources was a top priority in 2023. Our entire team focused on cost containment and rolling out programs to right size our organization to address the margin challenges associated with volume decreases and excess capacity in 2023; these efforts advanced under the direction of Chief Financial Officer Jason Garland, who joined the company in September. Through this difficult but prudent process, we have reduced our workforce by more than 15%, and are in the process of consolidating several facilities. We've also adjusted inventories and contained costs across the organization. We expect to complete our rebalancing and streamlining activities within the first half of 2024, and look forward to leveraging our expanded capacity as volumes return.

Facility Enhancements

While a portion of our buildout ambitions were necessarily pushed into 2024, we did complete the construction of our 37,000 square foot assembly center in Waterford, Ireland. Atop this sustainably designed, LEED-certified building are more than 160 solar PV panels that currently generate approximately 25% of the site's power needs. The focus at Waterford is the assembly of Fluid Management products, ProConnex® flowpaths and silicone components, to best serve customers based in Europe and Asia.

In addition, we are close to completing the build out of a large facility in Estonia to manufacture our KRM™ Chromatography and KrosFlo® RS TFF Filtration systems, with a planned opening in the first half of 2024. Also a built-to-purpose, sustainably designed LEED-certified facility, this plant will better serve our customers in Europe and Asia.

2023 Business and Financial Highlights

Revenue Summary

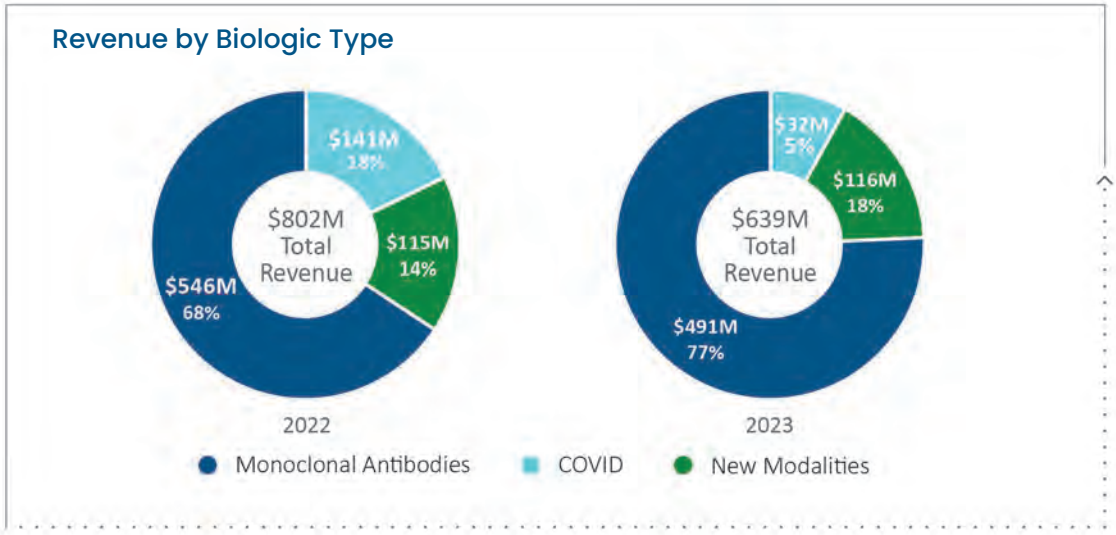
We reported total revenue of $639 million for the year 2023, which included $32 million of COVID-related revenue – down from $141 million in 2022. Our 2023 base revenue, which excludes COVID- and acquisition-related revenue, totaled $599 million and represented a decrease of 9% compared with 2022. Taking a longer-term perspective, for the 3-year period spanning 2020-2023, revenue growth was more aligned to both our historical and aspirational growth. Total reported revenue and base revenue CAGRs remained industry-best, at 20% and 23%, respectively.

Long-Term Growth Still Intact

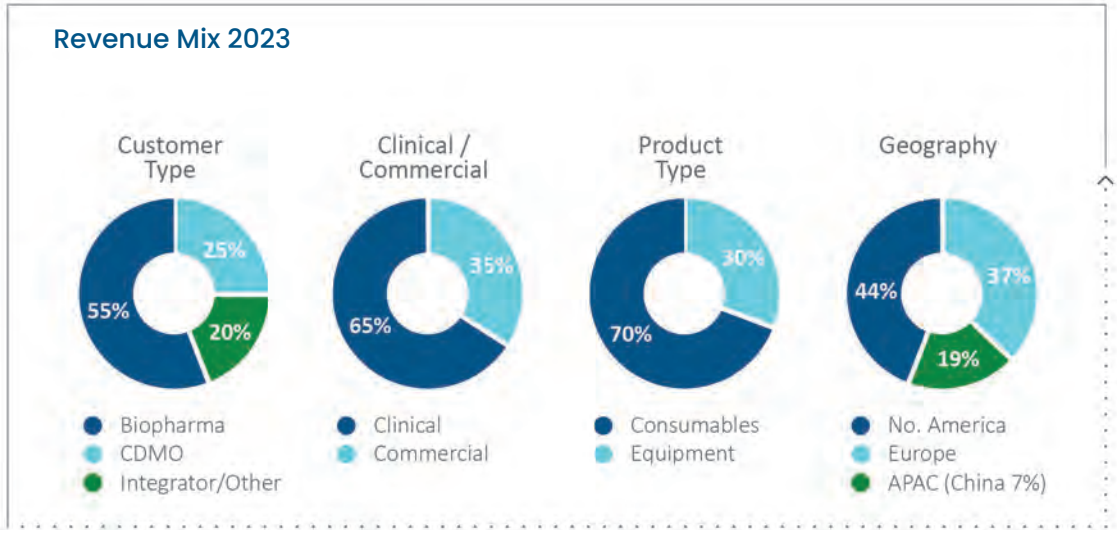
Three-year revenue and adjusted EPS is shown below. Total revenue over the 3-year period represents 20% compound annual growth (CAGR).

Revenue Breakouts

In 2023, monoclonal antibody markets again drove the majority of our revenue, accounting for 77% of the total. Demand from new modality accounts held strong, and revenue increased to 18% of total. With COVID at post-pandemic phase, this source of revenue tapered down to represent only 5% of total in 2023, down from 18% in 2022.



Similar to previous years, the largest contributors to revenue were biopharmaceutical and clinical-stage development programs. A fundamental element of our business strategy is to sell consumables and single-use products that integrate into our advanced systems installed base; in 2023, approximately 70% of our revenue was consumables-based, and 30% came from equipment sales. Regionally, 81% of our revenue came from customers in North America and Europe, and 19% came from customer in Asia Pacific regions, including 7% from China.



Order Improvement

We were encouraged in the second half of the year to see overall book-to-bill improvement with orders up 10% versus the first half of 2023. We finished the year with total Pharma orders up more than 30% in the second half versus first half of 2023, and CDMO orders picked up in the fourth quarter, with sequential CDMO order growth of 25% relative to third quarter.

Strategic M&A

We completed two strategic acquisitions, aligned to our strict M&A criteria and reflecting our focus on growth through innovation. Our acquisitions of FlexBiosys Inc. (April 2023) and Metenova AB (October 2023) support the expansion and diversification of our Fluid Management portfolio within our Filtration franchise. Fluid management is a strategic growth area for the company that provides important advantages for our customers and additional systems consumables revenue for the company. The 2023 acquisitions are intentionally complementary, with FlexBiosys providing single-use bags that we intend to combine with Metenova's single-use mixing technology.

ProConnex® MixOne Carboy System

"We are excited to help build on the market success of Repligen's systems and fluid management assemblies with a focus on the bringing differentiated single-use bag and mixing technologies to the market. Repligen was the ideal partner for us to take this next step of growth and drive additional global demand for our single-use mixing products."

Johan Westman
Managing Director, Metenova

Automated cutting of tubing for ProConnex flow paths assemblies at our single-use manufacturing Center of Excellence in Hopkinton, MA.

Franchise Performance

While three of our four franchises showed revenue declines in 2023, we were encouraged to see order recovery in the second half of the year. By the fourth quarter of 2023, orders increased sequentially for all franchises, versus the prior quarter.

Filtration. Our largest franchise saw a 30% decline in revenue for the full year, driven by the drop-off in COVID-related revenue. Filtration orders picked up as the year progressed, with a book-to-bill ratio of 1.03 in the fourth quarter and 1.13 excluding COVID. The improved order book was driven by strong demand for XCell® ATF, KrosFlo® TFF systems and Fluid Management assemblies. For the year, we reported $348 million in Filtration revenue.

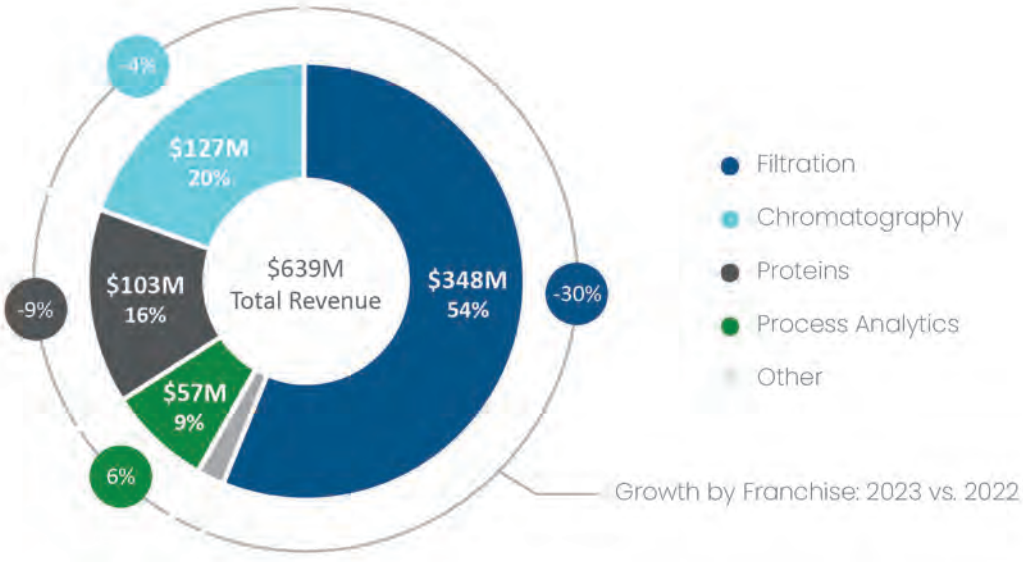
Process Analytics. We reported an increase in franchise revenue of 6% to reach $57 million for the year, and we saw an increase of 10% in orders. The drivers of Analytics growth were our CTech™ FlowVPX® and RPM™ product lines, where RPM represents "real-time process management" – a disruptive innovation that is gaining traction with customers for its speed, accuracy, efficiency and automation benefits.

Chromatography. We reported franchise revenues of $127 million for the year, a decrease of 4%, reflecting a shift in column and resin mix. This mirrors success in our strategy to improve the margin profile for OPUS®, by increasing the number of customers who drop ship to Repligen the resins that we pre-pack for them into our OPUS columns. We were encouraged to see an increase in column unit volume through the year, and we have built a strong opportunity funnel for the OPUS® product line in 2024.

Proteins. Finally, reported revenue for our Proteins business was down 9% in 2023, as our longtime OEM supply agreement with Cytiva wound down.

Franchise Level Revenue and Growth

In 2023, our Process Analytics franchise grew 6%, driven by a successful KrosFlo® KR2i RPM™ launch. Our Filtration franchise was particularly impacted by the drop off in COVID-related demand, declining 30% year-over-year. Our Proteins and Chromatography businesses were down 9% and 4%, respectively, with the phasing out of a key supply agreement impacting Proteins and with OPUS column/resin mix shift reflected in Chromatography.



Franchise Level 3-Year Average Growth

All four of our franchises delivered positive growth over the past three years (2020-2023). Both Chromatography and Process Analytics averaged 20% growth, Filtration averaged 40% growth, and Proteins delivered 10% average growth over the three-year period.

Balance Sheet

In 2023, we generated free cash flow of $75 million and reported cash and cash equivalents $751 million as of December 31, 2023. In December, we took the opportunity to strengthen our balance sheet through a private convertible debt transaction of $600 million.

Capital Expenditures

Our capital expenditures decreased by more than 50%, to $39 million in 2023 compared to $88 million in 2022. With our investments in facility modernization and expansion over the previous two years, we have ample capacity to support increased demand as we continue to drive long term growth over the next five years.

Sustainability

In November 2023, we published our second Sustainability report "*Making An Impact*" to highlight our progress since 2020. The report reflects our belief that corporate responsibility is essential to sustaining business and economic growth in a manner that can also deliver positive environmental and social impact. *Read more about our Sustainability impact on page 21 of this report.*

Spotlight on New Product Launches

Spotlight 1: XCell® ATF LS Controllers

Our XCell® ATF Systems are used for upstream intensification; both N-1 and N perfusion applications. Available in a single-use format since 2017, XCell ATF technology simplifies and fast-tracks upstream intensification by providing an integrated solution consisting of a controller, a cell retention device, bioreactor and permeate conductivity and accessories. The XCell ATF technology suite supports intensification applications from 0.5L to 5,000L culture.

XCell ATF has consistently been a driver of growth within our Filtration portfolio. As the use of the technology expands we have continued to develop next-generation features to ensure an optimal customer experience.

XCell® ATF LS Controllers use an active process that continuously senses the flow between the bioreactor and the XCell ATF device and the permeate pressure. Process parameters are adjusted in real-time to maintain the desired ATF process control. This system enables the XCell ATF technology to provide consistent performance across a wide range of intensified cell culture conditions.

"In 2023, we introduced next-generation XCell Large-Scale ("LS") Controllers, enabling improved process intensification through dual-operation of ATF devices from a single controller, and through advanced monitoring and control of flow rates with smart sensor technology."

Orjana Terova
Senior Director, Product Management

XCell® ATF LS Controller

Spotlight 2: Expanded KrosFlo® RPM™ Systems

In 2023, we continued to expand the KrosFlo® RPM™ offering. Customers can benefit from Real-Time Process Management (RPM) and monitoring, gaining control and efficiency while reducing process risk by ensuring accurate protein concentration throughout the TFF process.

Since the debut of the KrosFlo KR2i RPM (3mL-15L) system toward the end of 2022 for low-volume, high concentration TFF applications, in 2023 we expanded the KrosFlo RPM offering, with the introduction of KrosFlo FS-15 RPM (150mL-15L). These are first-to-market TFF systems to incorporate RPM® technology for in-line protein concentration management.

KrosFlo RPM systems monitor concentration during UF/DF runs without needing to depend on mass inputs and off-line fixed pathlength UV-Vis spectrophotometers. Compared to traditional UV-Vis approaches, use of FlowVPX slope spectroscopy systems delivers multiple process benefits. These include: the elimination of manual dilutions and sample transfers, rapid time to results (minutes versus hours), improved precision, and built-in data quality for improved reporting and validation, and ease of use. Risk is further mitigated with fully enclosed ProConnex® custom flow paths as a part of the automated TFF process.

"Following our vision, we developed this TFF system with advanced analytics, by merging our KrosFlo TFF and FlowVPX technologies. The resulting Real-time Process Management (RPM) Systems enable "walk-away automation" of UF/DF processes controlled by concentration. Further integrating this breakthrough technology across the RS TFF series will cater to diverse UF/DF scales and expand our opportunities."

Pia Darker
Senior Director, Process Analytics

KrosFlo® FS-15 KR2i RPM™

Spotlight 3: Self-Contained TangenX® SC Device

In November, 2023 we introduced TangenX® SC Device as the industry's first holder-free, self-contained Tangential Flow Filtration (TFF) device. The technology is especially suited to the manufacture of antibody drug conjugates (ADCs), viral vectors, nucleic acids and lipid nanoparticles. It can also be applied to monoclonal antibody, and recombinant protein production.

Compared with traditional flat sheet TFF cassettes, "plug-and-play" TangenX SC (self-contained) devices offer several key advantages that drive significant efficiency and productivity gains: significant time savings, reduced risk of product loss and scalability from pilot- to process-scale. TangenX SC devices are aseptically closed and gamma irradiated to reduce bioburden risk and permit use in Controlled not Classified (CNC) manufacturing environments.

"TangenX SC represents a transformative achievement in the advancement of downstream flat sheet TFF technology for ultrafiltration and diafiltration (UF/DF) applications, which are performed in nearly every biopharmaceutical manufacturing process. TangenX SC devices are the first true holder free TFF devices on the market and will enable simpler and de-risked TFF operations."

Christine Gebski
Senior Vice President
Filtration and Chromatography

TangenX® SC Device

Sustainability Report Highlights

At Repligen, sustainability is a strategic priority that impacts all aspects of our organization. We have committed to driving positive impacts across environmental, social and governance topics that we believe are material to our business. Below are highlights from our most recent sustainability report, published in November 2023. Our sustainability reports publish in the year following data collection. The data in this report is as of year-end 2022.

Environmental highlights include the transition to 100% renewable electricity at 9 of our 18 key manufacturing sites as of year-end 2022, which represented 75% of our global energy consumption. Overall energy consumption decreased by 12% (2022 to 2020) on a revenue normalized basis. During this same period, we surpassed our goal to reduce greenhouse gas (GHG) emissions (tons CO_2e) intensity by 10%, reporting a 40% reduction. Water withdrawals (cubic meters) declined by 45% and Waste (tons) increased by 30%, also on a revenue normalized basis.

Social achievements include the strides we made through diversity and inclusion target setting. We created new avenues to encourage and support employee engagement and advancement, and completed our employee engagement survey with greater than 90% participation. To improve engagement and inclusion, we launched our global intranet *The R Circle*, introduced our *Blue Marble* sustainability newsletter, and fomed three new Employee Resource Groups (ERGs). For the reported year (2022) a record 16 of our 18 sites participated in our annual Community Outreach week, and the company contributed over $300,000 to support underrepresented groups and our local communities.

Governance progress includes the introduction of our Repligen Performance System (RPS) for continuous operational process improvement, we fortified our cybersecurity systems and protocols to follow CIS 20 Controls and implement a Zero Trust framework. In addition, we updated our charters and policies to maintain strong governance practices.

Learn more about our sustainability progress, including reporting scope and disclosure frameworks, at www.repligen.com/company/sustainability.

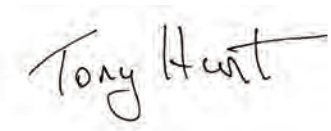
Our Outlook for 2024

We expect 2024 to be a transition year for Repligen, as we complete our rebalancing initiatives during the first half of the year, and work to build on the improved order patterns that we saw during the second half of 2023. We believe that the increased emphasis we've placed on commercial execution is helping to reshape and expand our opportunity funnel, creating momentum as we head into 2024.

As we move through this new year, our strategic priorities will center on the following:

1. Further expanding our opportunity funnel and strengthening our order position at top accounts;
2. Building off our wins in new modality markets;
3. Launching new products, with a focus on Fluid Management and integrated PAT systems;
4. Successfully integrating Metenova into Repligen and launching a portfolio of mixing solutions in the marketplace; and,
5. Controlling our costs and increasing our margins as we advance through the year.

In summary – we are happy to be moving forward here in 2024. We have the right team and expertise in place across all aspects of our business, from operations to finance to commercial. We'll continue to focus on bringing flexibility and efficiency to bioprocessing through internal R&D and M&A. We've entered 2024 with a stronger balance sheet and a clear plan for delivering long-term reward for our shareholders.



Tony J. Hunt
Chief Executive Officer

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FORM 10-K

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

FORM 10-K

☒ **ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the fiscal year ended December 31, 2023

OR

☐ **TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the transition period from to

Commission File Number 000-14656

REPLIGEN CORPORATION

(Exact name of registrant as specified in its charter)

Delaware	**04-2729386**
(State or other jurisdiction of incorporation or organization)	**(I.R.S. Employer Identification No.)**
41 Seyon Street, Bldg. 1, Suite 100	
Waltham, MA	**02453**
(Address of principal executive offices)	**(Zip Code)**

Registrant's telephone number, including area code: (781) 250-0111

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Common Stock, par value $0.01 per share	RGEN	The Nasdaq Global Select Market

Securities registered pursuant to Section 12(g) of the Act: None

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes ☒ No ☐.

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act. Yes ☐ No ☒.

Indicate by checkmark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes ☒ No ☐.

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes ☒ No ☐.

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a smaller reporting company or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company" and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large accelerated filer	☒	Accelerated filer	☐
Non-accelerated filer	☐	Smaller reporting company	☐
		Emerging growth company	☐

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. Yes ☐ No ☐.

Indicate by check mark whether the registrant has filed a report on and attestation to its management's assessment of the effectiveness of its internal control over financial reporting under Section 404(b) of the Sarbanes-Oxley Act (15 U.S.C. 7262(b)) by the registered public accounting firm that prepared or issued its audit report. ☒

If securities are registered pursuant to Section 12(b) of the Act, indicate by check mark whether the financial statements of the registrant included in the filing reflect the correction of an error to previously issued financial statements. ☐.

Indicate by check mark whether any of those error corrections are restatements that required a recovery analysis of incentive-based compensation received by any of the registrant's executive officers during the relevant recovery period pursuant to §240.10D-1(b). ☐

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Act). Yes ☐ No ☒.

The aggregate market value of the voting and non-voting common equity held by non-affiliates as of June 30, 2023, the last business day of the registrant's most recently completed second fiscal quarter, was $6,931,847,028.

The number of shares of the registrant's common stock outstanding as of February 16, 2024, was 55,771,075.

Documents Incorporated By Reference

The registrant intends to file a proxy statement pursuant to Regulation 14A within 120 days of the end of the fiscal year ended December 31, 2023. Portions of such proxy statement are incorporated by reference into Part III of this Annual Report on Form 10-K.

Auditor Firm Id	Auditor Name	Auditor Location
42	Ernst & Young LLP	Boston, Massachusetts, United States

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Summary of the Material Risks Associated with Our Business

Our business is subject to numerous risks and uncertainties that you should be aware of in evaluating our business. These risks include, but are not limited to, the following:

- Our product revenue may be negatively impacted by a number of factors, including without limitation, competition in the bioprocessing market, our historical reliance on a limited number of large customers, our ability to develop or acquire additional bioprocessing products in the future, our ability to manufacture our bioprocessing products sufficiently and timely, supply chain issues and/or disruption, and our ability to effectively penetrate the bioprocessing products market.
- We rely on a limited number of suppliers or, for certain of our products, one supplier, and we may not be able to find replacements or immediately transition to alternative suppliers, which could have a material adverse effect on our financial condition, results of operations and reputation.
- The market may not be receptive to our new bioprocessing products upon their introduction.
- If our products do not perform as expected or the reliability of the technology on which our products are based is questioned, we could experience lost revenue, delayed or reduced market acceptance, increased cost and damage to our reputation.
- If we are unable to manufacture our products in sufficient quantities and in a timely manner, our operating results will be harmed, our ability to generate revenue could be diminished and our gross margin may be negatively impacted.
- Our acquisitions expose us to risks that could adversely affect our business, and we may not achieve the anticipated benefits of acquisitions of businesses or technologies.
- Our results of operations could be negatively affected by potential fluctuations in foreign currency exchange rates.
- Our corporate restructuring and the associated headcount reduction may not result in anticipated savings, could result in total costs and expenses that are greater than expected which could disrupt our business.
- If we are unable to continue to hire and retain skilled personnel, then we will have trouble developing and marketing our products.
- If we are unable to obtain, maintain and protect our intellectual property rights related to our products, we may not be able to succeed commercially.
- Climate change, climate change-related regulation and sustainability concerns could adversely affect our businesses and the operations of our subsidiaries, and any actions we take or fail to take in response to such matters could damage our reputation.
- Natural disasters, geopolitical unrest, war, terrorism, public health issues, the ongoing conflicts between Russia and Ukraine and Israel and Palestine, or other catastrophic events could disrupt the supply, delivery or demand of products, which could negatively affect our operations and performance.
- Our internal computer systems, or those of our customers, collaborators or other contractors, may be subject to cyber-attacks or security breaches, which could result in a material disruption of our product development programs.

FORWARD-LOOKING STATEMENTS

This Annual Report on Form 10-K ("Form 10-K") contains forward-looking statements which are made pursuant to the safe harbor provisions of Section 27A of the Securities Act of 1933, as amended, (the "Securities Act") and Section 21E of the Securities Exchange Act of 1934, as amended. The forward-looking statements in this Form 10-K do not constitute guarantees of future performance. Investors are cautioned that express or implied statements in this Form 10-K that are not strictly historical statements, including, without limitation, statements regarding current or future financial performance, potential impairment of future earnings, management's strategy, plans and objectives for future operations or acquisitions, product development and sales, research and development, selling, general and administrative expenditures, intellectual property and adequacy of capital resources and financing plans constitute forward-looking statements. Such forward-looking statements are subject to a number of risks and uncertainties that could cause actual results to differ materially from those anticipated, including, without limitation, the risks identified under the caption "Risk Factors" and other risks detailed in this Form 10-K and our other filings with the Securities and Exchange Commission. We assume no obligation to update any forward-looking information contained in this Form 10-K, except as required by law.

PART I

ITEM 1. BUSINESS

The following discussion of our business contains forward-looking statements that involve risks and uncertainties. When used in this report, the words "intend," "anticipate," "believe," "estimate," "plan" and "expect" and similar expressions as they relate to us are included to identify forward-looking statements. Our actual results could differ materially from those anticipated in these forward-looking statements and are a result of certain factors, including those set forth under "Risk Factors" and elsewhere in this Annual Report on Form 10-K ("Form 10-K").

References throughout this Form 10-K to "Repligen Corporation", "Repligen", "we", "us", "our", or the "Company" refer to Repligen Corporation and its subsidiaries, taken as a whole, unless the context otherwise indicates.

Overview

Repligen Corporation is a global life sciences company that develops and commercializes highly innovative bioprocessing technologies and systems that increase efficiencies and flexibility in the process of manufacturing biological drugs.

As the overall market for biologics continues to grow and expand, our primary customers – global biopharmaceutical companies, contract development and manufacturing organizations and other life science companies (integrators) – face critical production cost, capacity, quality and time pressures. Built to address these concerns, our products help set new standards for the way biologics are manufactured. We are committed to inspiring advances in bioprocessing as a trusted partner in the production of critical biologic drugs – including monoclonal antibodies ("mAbs") and mAb derivatives, recombinant proteins, vaccines, and cell and gene therapies ("C&GT") – that are improving human health worldwide. Increasingly, our technologies are being implemented to overcome challenges in processing plasmid DNA (a starting material for the production of mRNA) and gene delivery vectors such as lentivirus and adeno-associated viral vectors.

We currently operate as one bioprocessing business, with a comprehensive suite of products to serve both upstream and downstream processes in biological drug manufacturing. Building on over 40 years of industry expertise, we have developed a broad and diversified product portfolio that reflects our passion for innovation and the customer-first culture that drives our entire organization. We continue to capitalize on opportunities to maximize the value of our product platform through both organic growth initiatives (internal innovation and commercial leverage) and targeted acquisitions.

Our corporate headquarters are located in Waltham, Massachusetts, with additional administrative and manufacturing operations worldwide. The majority of our 19 manufacturing sites and assembly centers are located in the United States (California, Massachusetts, New Hampshire, New Jersey, New York and Texas). Outside the United States, we have sites in Estonia, France, Germany, Ireland, the Netherlands and Sweden. Our primary warehouse and distribution centers are located in Massachusetts and California.

Our Products

Our bioprocessing business is comprised of four main franchises: filtration (including fluid management); chromatography; process analytics; and proteins.

Since 2012, we have purposely built a highly diversified portfolio of products offered under these franchises, developing high-value technologies that enable more efficient drug manufacturing processes for our customers, through internal research and development ("R&D") programs and strategic acquisitions. We are committed to sustainable innovation and have earned a reputation as an innovation leader in bioprocessing. We have consistently introduced disruptive new products that solve for specific bioprocessing challenges faced by customers. Our growth strategy continues to expand our geographic scope and customer base and broaden the applications of our technologies.

To support our sales goals for these products, we make ongoing investments in our commercial organization, our R&D programs, our business systems and our manufacturing capacity. We regularly evaluate and invest in these areas as needed to ensure timely deliveries and to stay ahead of customer demand for our products.

The majority of our revenue is derived from consumable and/or single-campaign ("single-use") product sales, as compared to associated hardware and equipment. The customization, scalability and plug-and-play convenience of these products, and in many cases the closed nature of our technologies, make them ideal for use in biologics manufacturing processes where contamination risk is a critical concern of our customers.

Shifting to Integrated Solutions

Since 2012, we have completed 13 acquisitions across our four franchises, building a base of technology assets that we can improve upon and/or develop next-generation versions of through our internal R&D team. Our acquisition strategy is purposeful, considering the potential for integration with our internally-developed technologies, and across products and franchises.

In 2023, the results of our mergers and acquisitions and R&D efforts are reflected in our ability to offer more integrated solutions across the bioproduction workflow. Our commercial approach is shifting from "individual product" to "whole system" sales that can support entire unit operations, the management of fluids between unit operations, and in-line advanced analytics. For example, providing filtration systems for production and harvest steps (upstream), and connecting those to chromatography and filtration systems for purification and formulation steps (downstream).

Key Products Within Each of Our Franchises

FILTRATION

Filtration is our largest franchise with the broadest product offering covering upstream and downstream technologies. Below is a description of some of our key products:

XCell ATF® Cell Retention Systems

Our filtration products offer a number of advantages to manufacturers of biologic drugs and are used in process development and process scale (clinical and commercial) production. Our XCell ATF systems are used in upstream perfusion (continuous) and N-1 (intensified fed-batch or hybrid perfusion) cell culture processing.

XCell ATF is a cell retention technology. The system is comprised of an advanced hollow fiber ("HF") filtration device, a low shear pump and a controller. The XCell ATF system is connected to a bioreactor and enables the cell culture to be run continuously, with cells being retained in the bioreactor, fresh nutrients (cell culture media) being fed into the reactor continuously, and clarified biological product and cell waste being removed (harvested) continuously. The cells are maintained in a consistent nutrient-rich environment and can reach cell densities two- and three-times higher than those achieved by standard fed-batch culture. As a result, product yield is increased, which improves facility utilization and can reduce the size of a bioreactor required to manufacture a given volume of biologic drug product. XCell ATF systems are available in a wide range of sizes that can easily scale from laboratory use through full production with bioreactors as large as 5,000 liters.

Through internal innovation, we developed and launched single-use formats of the original stainless steel XCell ATF devices to address increasing industry demand for single-use sterile systems with "plug-and-play" technology. The XCell ATF device is now available to customers in both its original configuration (steel housing and single-use filters) in all sizes (2, 4, 6 and 10), and/or as a single-use device (disposable housing/filter combination) in most sizes (2, 6, and 10). The availability of XCell ATF technology in a single-use format reduces implementation time by eliminating the time intensive workflow associated with autoclaving and enables our customers to accelerate evaluations of the product with a lower initial overall cost of ownership.

In 2023, we introduced next-generation XCell® Large-Scale controllers, enabling increased process intensification through dual-operation of ATF devices from a single controller, and through advance monitoring and control of flow rates with smart sensor technology. Our ATF large-scale controllers are designed for scalability from bench top to commercial manufacturing, and for versatility of applications, including perfusion and modified fed-batch (N-1) manufacturing.

Tangential Flow Filtration Consumables

Our TangenX® product portfolio includes flat sheet ("FS") tangential flow filtration ("TFF") cassettes that are used primarily in downstream, ultrafiltration processes, e.g., biologic drug concentration, buffer exchange and formulation processes, our single-use SIUS® line, including our reusable PRO line of cassettes, providing customers with a high-performance, cost saving alternative to other companies' TFF cassette offerings and our TangenX SC Device, the industry's first holder-free, self-contained ("SC") TFF device, which was launched in November 2023.

TFF is a rapid and efficient method for the concentration and formulation of biomolecules that is widely used in many applications in biopharmaceutical development and manufacturing. Our TangenX FS TFF cassettes feature high performing-membrane chemistries that offer superior selectivity for a wide range of applications. A controlled manufacturing process that balances flux and selectivity delivers maximum flux for increased productivity and tight control of the membrane pore size for enhanced selectivity and recovery. Each single-use cassette is delivered pre-sanitized and ready to be equilibrated and used for tangential flow, ultrafiltration and diafiltration applications.

Use of SIUS TFF cassettes eliminates non-value-added steps (cleaning, testing between uses, storage and flushing) that are required with reusable TFF products, providing cost and time savings. For process economics requiring reusable cassettes, TangenX PRO cassettes are available with the same high performance membranes used in SIUS cassettes. Our TangenX cassettes are interchangeable with filter hardware from multiple manufacturers, simplifying customer trial and adoption. In 2020, we introduced SIUS Gamma single-use device, which we engineered to harness the performance and efficiencies of TangenX SIUS membranes and cassettes, while also providing the convenience of a fully assembled, aseptically closed and gamma-irradiated, sterile device. The device is delivered as a single unit composed of the cassette, fluid manifold, clamps, tubing and aseptic connectors. The SIUS Gamma device is ideal for adenovirus C&GT and other processes where large volumes need to be concentrated in a sterile, closed environment.

Our TangenX® SC Device simplifies and streamlines downstream flat sheet UF/DF processes by reducing set up time by 80%, eliminating holders and torquing requirements which reduces the risk of product loss caused by changes in compression or cassette misalignment during installation, allowing users to seamlessly transition from traditional cassettes and reducing bioburden risk and enhancing safety because it is aseptically closed and gamma irradiated and isolates operators from potentially hazardous materials.

Tangential Flow Filtration Systems: KrosFlo® TFF

Our KrosFlo systems for TFF combine significant configurability with premium quality manufacturing. Our TFF systems are designed for scalability from small to large (up to 5,000 liters) volumes, flexibility between HF and FS filter formats, and the ability to use the same system in different unit operations while deploying ready-to-use application-specific flow paths.

Our KrosFlo TFF systems are turnkey solutions for TFF, offered with either TangenX FS cassettes or with our HF filters.

KrosFlo® Flat Sheet TFF Systems

Our 2020 acquisition of ARTeSYN Biosolutions Holdings Ireland Limited ("ARTeSYN") enabled us to develop and market KrosFlo RS TFF systems that integrate our consumable and equipment offering, providing greater convenience and efficiency for our customers.

We launched our KrosFlo RS 20 series systems in 2022, focusing their use in mRNA and C&GT therapy applications, where they are used primarily in downstream formulation. These responsive TFF systems completely automate sanitization, concentration and product recovery processes. The combination of injection molded tubing, over-molded connectors and valve blocks significantly lowers product hold-up volume to maximize product recovery. With the same software, hardware, controls and cGMP compliance built into every system, and with pre-assembled flow kits for error-free installation, the KrosFlo RS platform offers operational simplicity that can easily be scalable from lab- through production-scale use. KrosFlo FS systems integrate over 10 components with specifications to process volumes between 140 milliliters and 500 liters.

KrosFlo® Hollow Fiber TFF Systems

Our filtration business is strengthened by a leading portfolio of Spectrum® HF filtration solutions, including fully integrated KrosFlo TFF systems with Konduit automated process monitoring and ProConnex® Flow Path single-use assemblies. The KrosFlo family of HF TFF systems integrate multiple components with specifications to process volume between 2 milliliters and 5,000 liters – from lab-scale through commercial manufacturing.

In early 2023 we introduced our RS 30 series of KrosFlo TFF systems, featuring increased automation capabilities. The RS 30 series systems integrate a single-use tulip tank re-circulation vessel, which allows for dynamic control and response to changing fluid levels for maximum product recovery in fed-batch, batch concentration and diafiltration processes. The cGMP compliant, fully automated 1/2 inch single-use TFF system delivers outstanding performance in a small footprint. In alignment with our integrated systems strategy, the system includes ProConnex flow paths to integrate advanced fluid management technologies including overmolded connections, pump heads, tubing filters and sensors in a single-use device. Flow paths easily attach to the system to simplify operation and increase process efficiency.

Tangential Flow Depth Filtration Systems: KrosFlo® TFDF®

We believe our KrosFlo Tangential Flow Depth Filtration ("TFDF") systems, have the potential to disrupt and displace traditional upstream harvest clarification operations. The KrosFlo TFDF system includes control hardware, novel high throughput tubular depth filters and ProConnex TFDF flow paths. When used for cell culture clarification, single-use KrosFlo TFDF technology delivers unprecedented high flux (>1,000 LMH), high capacity, low turbidity, and minimal dilution, making the technology a high-performance alternative to traditional centrifugation and depth filtration approaches to harvest clarification. TFDF technology also provides benefits such as low hold-up volume, high recovery, small footprint, simple set up and disposal, scalability and reduced process time.

Strengthening our Filtration Franchise through Acquisitions

With our acquisition of Polymem S.A. ("Polymem") on July 1, 2021, we further expanded our HF membrane and module production capabilities and added core R&D, engineering and production expertise in HF technology for both industrial and bioprocessing markets. The Polymem business complements our Spectrum HF product line, which includes KrosFlo HF TFF systems and ProConnex fluid management. The acquisition of Polymem accelerated our HF manufacturing buildout and added a Europe-based HF manufacturing center of excellence.

With our acquisition of BioFlex Solutions LLC ("BioFlex") and Newton T&M Corp. ("NTM") on December 16, 2021, we complemented and expanded our filtration franchise, as both BioFlex and NTM focus on single-use fluid management components, including single-use clamps, adapters, end caps and hose assemblies. These products are essential components in our upstream and downstream product offerings – especially our systems with line-sets and flow paths. These acquisitions streamline and increase our control over many components in our single-use supply chain, which ultimately should drive reduced lead-times for our customers in the coming years.

We acquired FlexBiosys, Inc. ("FlexBiosys") on April 17, 2023, further complementing and expanding our fluid management portfolio of offerings with its expert design and custom manufacturing of single-use bioprocessing products and a comprehensive range of products that include bioprocessing bags, bottles, and tubing assemblies.

With our acquisition of Metenova Holding AB ("Metenova") on October 2, 2023, we strengthened our fluid management portfolio with the addition of magnetic mixing and drive train technologies that are widely used by global biopharmaceutical companies and contract development and manufacturing organizations.

The growth of our filtration business has allowed us to substantially increase our direct sales presence in Europe and Asia and diversify our end markets to include all biologic classes, including mAbs, vaccines, recombinant proteins and C&GT.

CHROMATOGRAPHY

Our chromatography franchise includes a number of products used in downstream purification, development, manufacturing and quality control of biological drugs. The main driver of growth in this portfolio is our OPUS® pre-packed column ("PPC") product line.

In addition to OPUS, with our acquisition of ARTeSYN in 2020, we added chromatography systems to our offerings, providing greater flexibility and market opportunity as we scale and expand our systems portfolio.

Additional chromatography products include our affinity capture resins, such as CaptivA® Protein A resins, which are used in a small number of commercial drug processes and our ELISA test kits, used by quality control departments to detect and measure the presence of leached Protein A and/or growth factor in the final product.

OPUS Pre-Packed Columns

Our chromatography franchise features a wide range of OPUS columns, which we deliver to our customers sealed and pre-packed with their choice of resin. These are single-use or campaign-use disposable columns that replace the use of customer-packed glass columns for downstream purification. By designing OPUS columns to be a technologically advanced and flexible option for the purification of biologics from process development through clinical and commercial-scale manufacturing, Repligen has become a leader in the PPC market. Our biomanufacturing customers value the significant cost savings that OPUS columns can deliver by reducing set up time, labor, equipment and facility costs – in addition to delivering product consistency and "plug-and-play" convenience.

We launched our first production scale OPUS columns in 2012 and have since added larger diameter options that scale up to use with 2,000 liter bioreactors. Our OPUS 80R column is the largest available PPC on the market for use in late-stage clinical or commercial purification processes. We offer unique features such as a resin recovery port on our larger columns, which allows our customers to remove and reuse the recovered resin in other applications. We believe the OPUS 5-80R product line is the most flexible product line available in the market, serving the purification needs of customers manufacturing mAbs and other biologics such as vaccines and C&GT.

In addition to our larger scale OPUS columns, our portfolio includes our smaller-scale OPUS columns, including our RoboColumn®, MiniChrom® and ValiChrom® columns used for process development ("PD") and validation. These columns are used in high-throughput PD screening, viral clearance validation studies and scale down validation of chromatography processes.

We maintain customer-facing centers in both the United States and Europe for our OPUS column customers, and offer a premier ability to pack any of hundreds of chromatography capture resins available, as per our customers' choice.

KRM™ Chromatography Systems

Through our acquisition of ARTeSYN in 2020, we gained state-of-the-art, configurable chromatography systems that can integrate a wide range of hardware, components and consumable products to simplify bioprocessing operations for our customers. Our KRM chromatography systems are precision engineered for high product recovery (low hold-up volumes), high bioactivity (less stress on the product of interest) and reduced risk of deviation (simple changeovers and pre-assembled flow kits). The KRM systems contain closed single-use flow paths (less risk of contamination and product loss) and other advanced fluid management technologies (over-molded connectors, pump heads, filters and pressure sensors), intuitive software and our process analytics technology enabled.

PROCESS ANALYTICS

Our process analytics products complement and support our filtration, chromatography and proteins franchises as they allow end-users to make at-line or in-line absorbance measurements allowing for the determination of protein concentration in filtration, chromatography formulation and fill-finish applications.

SoloVPE® Device

Our SoloVPE slope spectroscopy system is the industry standard for offline and at-line absorbance measurements for protein concentration determination in process development, manufacturing and quality control settings.

FlowVPE® Device

Our FlowVPE slope spectroscopy system enhances the power of slope spectroscopy and provides in-line protein concentration measurement for filtration, chromatography and fill-finish applications. A key benefit of this in-line solution is the ability to monitor a manufacturing process in real time.

FlowVPX® System

FlowVPX slope spectroscopy system is our next-generation FlowVPE launched at the beginning of 2021 and designed to meet the rigors of regulatory GMP requirements. FlowVPX offers reliable real-time results with integrated ease for concentration measurements during every stage of the downstream GMP-compliant production-scale biologics manufacturing.

Use of slope spectroscopy systems delivers multiple process benefits for our biopharmaceutical manufacturing customers, compared to traditional UV-Vis approaches. Key benefits include: the elimination of manual dilutions and sample transfers from process development/manufacturing to labs, rapid time to results (minutes versus hours), improved precision, built-in data quality for improved reporting and validation, and ease of use.

KrosFlo® RPM™ Systems with integrated FlowVPX® Technology

In 2022, we completed the development of a HF system that combines KrosFlo TFF with FlowVPX Real-Time Process Management ("RPM"®) technology, enabling "walk-away automation" of downstream UF/DF processes. Toward the end of 2022, we launched KrosFlo DR2i RPM for low-volume, high concentration applications. This was the first-to-market TFF system to incorporate real-time process monitoring for in-line protein concentration management. By coupling KrosFlo TFF and FlowVPX functionality, customers can benefit from improved process control and efficiency, while reducing process risk by ensuring accurate concentration throughout the TFF process.

KrosFlo RPM systems monitor concentration during UF/DF runs without having to depend on mass inputs and off-line fixed pathlength UV-Vis spectrophotometers. Risk is further mitigated with fully enclosed ProConnex custom flow paths as a part of the automated TFF process.

Since the debut of the KrosFlo KR2i RPM (2 mL-15L) system, we expanded the KrosFlo RPM offering, introducing KrosFlo FS-15 RPM (150mL-15L) toward the end of 2023. The portfolio continues to expand to cover a wide range of volumes from lab-to production-scale requirements. We believe KrosFlo RPM solutions provide key process insights to users to reduce cycling time and minimize batch risks, both highly value attributes for bioprocessing users.

Culpeo® QCL-IR Liquid Analyzer

Pursuant to a 15-year license agreement that we entered into with DRS Daylight Solutions, Inc. ("Daylight") in September 2022, we obtained the exclusive right to use Daylight's quantum cascade laser technology ("QCL"), including its Culpeo® QCL-IR Liquid Analyzer ("Culpeo") specifically in the field of bioprocessing. Culpeo is a compact, intelligent spectrometer that uses the power of QCL to analyze and identify chemicals. Our in-licensing of these rights complements our existing process analytics franchise. Adding mid-IR (higher sensitivity QCL-IR) to UV spectroscopy, we believe this will serve to accelerate and expand adoption of off-line and in-line process monitoring in the bioprocessing industry. Additionally, we are focused on expanding the QCL portfolio, with plans to integrate these solutions into our chromatography and filtration systems.

PROTEINS

Our proteins franchise is represented by our Protein A affinity ligands and viral vector affinity ligands and resins. Our proteins franchise also includes cell culture growth factor products, which are a key component of cell culture media used in upstream bioprocessing to increase cell density and improve product yield.

Protein A Affinity Ligands

We are a leading provider of Protein A affinity ligands to other life sciences companies (integrators), whose final products are Protein A resins. Protein A ligands are an essential "binding" component of Protein A affinity chromatography resins used in the purification of virtually all mAb-based drugs on the market or in development. We manufacture multiple forms of Protein A ligands under long-term supply agreements with major life sciences companies including Cytiva (a standalone operating company owned by Danaher Corporation), MilliporeSigma and Purolite, an Ecolab Inc. company ("Purolite"), who in turn sell their Protein A chromatography resins to end users (mAb manufacturers). We have

two manufacturing sites supporting overall global demand for our Protein A ligands: one in Lund, Sweden and the other in Waltham, Massachusetts.

Protein A chromatography resins are considered the industry "gold standard" for purification of antibody-based therapeutics due to the ability of the Protein A ligand to very selectively bind to or "capture" antibodies from crude protein mixtures. Protein A resins are packed into the first chromatography column of typically three columns used in a mAb purification process. As a result of Protein A's high affinity for antibodies, the mAb product is highly purified and concentrated within this first capture step before moving to polishing steps.

Our Affinity Ligand Collaborations

In June 2018, we entered into an agreement with Navigo Proteins GmbH ("Navigo") for the exclusive co-development of multiple affinity ligands for which Repligen holds commercialization rights. We manufacture and exclusively supply the first of these ligands, NGL-Impact® A, to Purolite, for use with their Praesto® Jetted A50 Protein A resin product.

In September 2021, the Company and Navigo successfully completed co-development of a novel affinity ligand that addresses aggregation issues associated with pH sensitive antibodies and Fc-fusion proteins. We are manufacturing and supplying this ligand, NGL-Impact® HipH, to Purolite for use in a platform use resin product.

We have a long-term supply agreement with Purolite for NGL-Impact and potential additional affinity ligands that may advance from our Navigo collaboration.

Our Purolite Agreement

In October 2022, we extended our long-term supply agreement with Purolite through 2032 and broadened its scope to include affinity ligands targeting antibody fragments in addition to those targeting mAbs and Fc-fusion proteins. This extension and product line expansion aligns with our Proteins strategy and supports the acceleration in market adoption of the Praesto® affinity resin portfolio. It provides Purolite with exclusive access to mAb fragment ligands developed at Avitide, Inc. ("Avitide"), in addition to the NGL portfolio developed at Navigo. Repligen will continue to receive access to Purolite's leading-edge base bead technology, as we proceed with the development and commercialization of novel affinity resins focused on new modalities and C&GT.

mAb Fragment Affinity Ligands and Resins from Avitide

Our acquisition of Avitide also led to our development and 2022 launch of AVIPure® CH1, a cross-linked agarose-based resin specifically engineered for the capture of the CH1 region of antigen-binding fragments ("Fabs") from human immunoglobins ("IgGs") and mAbs. We believe that the high dynamic binding capacity for Fab and IgG1 even at short residence times position these resins well for market success.

Adeno-Associated Virus Affinity Ligands and Resins from Avitide

In September 2021, we completed our strategic acquisition of Avitide, a market leader in affinity ligand discovery and development. This acquisition was a major step forward in building our proteins franchise, moving Repligen into affinity resin solutions for C&GT and other emerging modalities.

In February 2022, we launched three advanced affinity chromatography resins for use in gene therapy manufacturing workflows. The resins AVIPure®-AAV9; AVIPure®-AAV8; and AVIPure®-AAV2, were developed by Avitide and are specific to the major adeno-associated virus ("AAV") C&GT vectors used today. AAV vectors are the leading platform for gene delivery for the treatment of a variety of human diseases. In 2023, a new affinity resin for AAV5 was also launched, expanding the portfolio.

We are integrating these high performance AVIPure® resins with our OPUS PPC and ARTeSYN chromatography systems to provide our customers with a seamless chromatography solution. Caustic stability has been a challenge that the AVIPure resins are designed to overcome without sacrificing high dynamic binding capacity. We believe customers will benefit from superior process economics, including multi-cycle resin capabilities.

Growth Factors

Most biopharmaceuticals are produced through an upstream mammalian cell culture process. In order to stimulate increased cell growth and maximize overall yield from a bioreactor, manufacturers often add growth factors, such as insulin, to their cell culture media. Our cell culture growth factor additives include LONG® R^3 IGF 1, our insulin-like growth factor that has been shown to be up to 100 times more biologically potent than insulin (the industry standard), thereby increasing recombinant protein production in cell culture fermentation applications.

Corporate Information

We are a Delaware corporation with our global headquarters in Waltham, Massachusetts. We were incorporated in 1981 and became a publicly traded company in 1986. Our common stock is listed on the Nasdaq Global Market under the symbol "RGEN". We have approximately 1,800 employees and operate globally with offices and manufacturing sites located at multiple locations in the United States, Europe and Asia. Our principal executive offices are located at 41 Seyon Street, Waltham, Massachusetts 02453, our website is www.repligen.com and our telephone number is (781) 250-0111.

2023 Acquisitions

Metenova Holding AB

On October 2, 2023, our subsidiary, Repligen Sweden AB, acquired Metenova from the former shareholders of Metenova (the "Metenova Seller") pursuant to a Share Sale and Purchase Agreement (the "Share Purchase Agreement"), dated as of September 23, 2023 (such acquisition, the "Metenova Acquisition"), by and among Repligen Sweden AB, the Metenova Seller, and us, in our capacity as guarantor of the obligations of Repligen Sweden AB under the Share Purchase Agreement.

Metenova, which is headquartered in Molndal, Sweden, offers magnetic mixing and drive train technologies that are widely used by global biopharmaceutical companies and contract development and manufacturing organizations. The Metenova Acquisition further strengthens our fluid management portfolio with these products.

FlexBiosys, Inc.

On April 17, 2023, we completed the acquisition of all of the outstanding equity interests in FlexBiosys, pursuant to an Equity Purchase Agreement with FlexBiosys, TSAP Holdings Inc. ("NJ Seller"), Gayle Tarry and Stanley Tarry, as individuals (collectively with NJ Seller, the "FlexBiosys Sellers"), and Stanley Tarry, in his capacity as the representative of the FlexBiosys Sellers.

FlexBiosys, which is headquartered in Branchburg, New Jersey, offers expert design of custom manufacturing of single-use bioprocessing products and a comprehensive range of products that include bioprocessing bags, bottles, and tubing assemblies. These products will complement and expand our fluid management portfolio of offerings.

Our Market Opportunity

Bioprocessing Addressable Market

The global addressable market for bioprocessing products is estimated to be approximately $20 billion of which we estimate Repligen's addressable market to be approximately $12 billion at year end 2023. This market includes bioprocessing products used to manufacture therapeutic antibodies, recombinant proteins and vaccines, as well as C&GTs.

Monoclonal Antibody Market

Antibody-based biologics alone accounted for approximately $175 billion of global biopharma revenue in 2022. Industry sources project the mAbs market to grow in the range of approximately 10% to 12% annually through 2026, driven by new approvals and expanded clinical uses for marketed antibodies, as well as the emergence of biosimilar versions of originator mAbs. As of December 31, 2023, over 150 mAbs were approved by the U.S. Food and Drug Administration ("FDA") to treat a diverse range of diseases. Biological R&D remains robust, with more than 2,000 active mAb clinical trials ongoing to address a wide range of medical conditions.

In addition to investments in the discovery and development of novel biologic drugs, there has been substantial investment in follow-on products (biosimilars) by generic and specialty pharmaceutical as well as large biopharmaceutical companies. Development of follow-on products accelerated as the first major mAbs came off patent in the European Union and United States. Due to the high cost of biologic drugs, many countries in developing and emerging markets have been aggressively investing in biomanufacturing capabilities to supply lower cost biosimilars for the local markets. For both originator and follow-on biologics manufacturing, Repligen products are well-positioned to enable greater manufacturing flexibility, production yields and lower costs through improved process efficiencies.

Cell and Gene Therapy Market

C&GT has emerged in the past few years to become a rapidly growing area of biological drug development, with an estimated global market of greater than $7 billion in 2022, and over 3,000 active clinical trials underway at year-end 2023 according to industry sources. Statements by the FDA are supported by industry reports that estimate annual revenue growth of over 20% for the C&GT market over the next several years. This scientifically advanced therapeutic approach has unique manufacturing challenges that many of our products can help address. We believe we are well positioned to participate in C&GT production, particularly in the manufacture of plasmids and viral vectors. Within the C&GT market, mRNA-based therapeutic programs have become an area of focus and investment by several large biopharmaceutical companies, following the regulatory approval of mRNA-based vaccines for the COVID-19 pandemic, including all subsequent variants of the SARS-CoV-2 coronavirus ("COVID-19").

Our Strategy

We are focused on the development, production and commercialization of highly differentiated, technology-leading systems and solutions that address specific pressure points in the biologics manufacturing process and deliver substantial value to our customers. Our products are designed to optimize our customers' workflow to maximize productivity and we are committed to supporting our customers with strong customer service and applications expertise.

We intend to build on our history of developing market-leading solutions and delivering strong financial performance through the following strategies:

- *Continued innovation*. We plan to capitalize on our internal technological expertise to develop products that address unmet needs in upstream and downstream bioprocessing. We continue to invest in platform and derivative products to support our proteins, filtration, chromatography and process analytics franchises. We plan to strengthen our existing product lines with complementary products and technologies, including fluid management products, that are designed to allow us to provide customers with an integrated, more automated and more efficient manufacturing process on one or more measures including flexibility, convenience, time savings, cost reduction and product yield.
- *Platforming our products.* A key strategy for accelerating market adoption of our products is delivery of enabling technologies that become the standard, or "platform," technology in markets where we compete. We focus our efforts on winning early-stage technology evaluations through direct interaction with the key biomanufacturing decision makers in process development labs. This strategy is designed to establish early adoption of our enabling technologies at key accounts, with opportunity for customers to scale up as the biologic advances to later stages of development and potential commercialization. We believe this approach can accelerate the implementation of our products as platform products, thereby strengthening our competitive advantage and contributing to long-term growth.
- *Targeted acquisitions*. We intend to continue to selectively pursue acquisitions of innovative technologies and products. We intend to leverage our consolidated balance sheets to acquire technologies and products that improve our overall financial performance by improving our competitiveness in filtration (including fluid management), chromatography or process analytics, or by moving us into adjacent markets with common commercial call points.
- *Geographical expansion*. We intend to expand our global commercial presence by continuing to selectively build out our global sales, marketing, field applications and services infrastructure.

- *Operational efficiency*. We seek to expand operating margins through capacity utilization and process optimization strategies designed to increase our manufacturing yields. We plan to invest in systems to support our global operations, optimizing resources across our global footprint to maximize productivity.

Research and Development

Our R&D activities are focused on developing new high-value bioprocessing products across all of our franchises. We strive to continue to introduce truly differentiated products that address specific pain points in the biologics manufacturing process. Our commitment to innovation is core to the Repligen culture and our success as a company.

Sales and Marketing

Our sales and marketing strategy supports our objective of strengthening our position as a leading provider of products and services, addressing upstream, downstream and quality control needs of bioprocessing customers in the biopharmaceutical industry.

Our Commercial Team

To support our sales goals for our direct-to-consumer products, we have invested in our commercial organization. Since 2018, we have significantly expanded our global commercial organization from 103, to a commercial team of 342 employees as of December 31, 2023. This includes 277 people in field positions (sales, field applications and field service), 38 people in customer service and 27 in marketing. Geographically, 173 members of our commercial team are located in North America, 89 in Europe and 80 in Asia-Pacific ("APAC") regions.

Our bioprocess account managers are supported in each region by bioprocess sales specialists with expertise in filtration, chromatography or process analytics, and by technically trained field applications specialists and field service providers, who can work closely with customers on product demonstrations, implementation and support. We believe that this model helps drive further adoption at our key accounts and also open up new sales opportunities within each region.

Ligand Supply Agreements

For our proteins franchise, we are committed to be a partner of choice for our customers with distributor and supply agreements in place with large life sciences companies such as Cytiva, MilliporeSigma and Purolite. The Cytiva Protein A supply agreement relating to our Waltham, Massachusetts facility was amended in September 2021 and pursuant to its amended terms, runs through 2025. Our Protein A amended supply agreement with Purolite was amended in October 2022 and, pursuant to its amended terms, runs through 2032. Our dual manufacturing capability provides strong business continuity and reduces overall supply risk for our ligand customers.

Significant Customers and Geographic Reporting

Customers for our bioprocessing products include major life sciences companies, contract manufacturing organizations, biopharmaceutical companies, diagnostics companies and laboratory researchers.

The following table represents the Company's total revenue by geographic area (based on the location of the customer):

	For the Years Ended December 31,		
	2023	2022	2021
Revenue by customers' geographic locations:			
North America	44%	43%	41%
Europe	37%	37%	40%
APAC/Other	19%	20%	19%
Total revenue	100%	100%	100%

There was no revenue from customers that represented 10% or more of the Company's total revenue for the years ended December 31, 2023 and 2022. Revenue from Pfizer Inc. accounted for 10% of total revenue for the year ended December 31, 2021.

Human Capital

Employees

Repligen performs in a highly competitive industry and recognizes that our continued success hinges upon our ability to attract, develop and retain a diverse team of talented individuals. We place high value on the satisfaction and well-being of our employees and operate with fair labor standards and industry-competitive compensation and benefits globally. As of December 31, 2023, we employed 1,783 full-time and part-time employees, a decrease of 242 since December 31, 2022. This total includes 342 employees in our commercial organization (277 field and 65 internal), 235 in engineering and R&D, 643 in manufacturing, 185 in quality, 82 in supply chain roles and 296 in administrative functions. Each of our employees has signed a confidentiality agreement. None of our U.S. employees are covered by collective bargaining agreements. We have one collective bargaining agreement with two unions that covers 82 employees in Sweden, comprising approximately 5% of our total workforce. We renewed this collective bargaining agreement in March 2023, and it expires at the end of March 2025. In France, 64 employees are under the relevant national and local collective bargaining agreements for metallurgy, comprising approximately 4% of our total workforce.

Code of Business Conduct and Ethics

Repligen is committed to conducting business in accordance with the highest ethical standards. This means how we conduct ourselves and our global work is more than just a matter of policy and law; it's a reflection of our core principles. Our Second Amended and Restated Code of Business Conduct and Ethics reflects Repligen's five core principles – (1) trustworthiness, (2) respectfulness, (3) responsibility, (4) fairness and (5) corporate citizenship. Our Second Amended and Restated Code of Business Conduct and Ethics applies to all Repligen employees, including those who are integrated into the Company through acquisitions.

Inclusive Workforce

Repligen maintains a resolute commitment to fostering a diverse and inclusive workplace. We have established talent acquisition processes, as well as training and employee engagement resources, including the formation of inclusive workforce initiatives, to drive the principles of diversity and inclusion at all levels of our organization starting with our Board of Directors ("Board") and our Leadership team.

In our hiring practices, we strive to hire the most qualified person for the job and believe that, over time, this will lead to an increasingly diverse workforce. As part of finding the most qualified candidates, we are committed to ensuring that qualified, diverse slates of applicants are identified and considered for all roles, from the boardroom and C-suite to all levels of the workforce. We believe our focus on talent identification, development, engagement and succession planning has been particularly successful in developing a deep and diverse talent pipeline.

Employee Engagement and Development

Our goal is to develop and maintain a talented, engaged and diverse workforce that has a positive impact on our performance and on our customers. We regularly conduct engagement surveys to gain insight on employee perspectives. Additional channels for employee engagement include Company-wide all-hands meetings led by our Chief Executive Officer ("CEO") and site town halls ran by site leaders. We are committed to colleague recognition, which includes acknowledging, appreciating and celebrating each other's contributions and achievements. Our CEO-led all-hands meetings serve as a platform for CEO awards and platinum awards, which reward and recognize both teams and individual colleagues who have made significant and notable contributions to Repligen's success. We also offer a range of programs to develop our managers and enhance our leadership across the Company. Our professional development efforts are aimed at increasing organizational talent and capabilities as well as identifying and developing potential successors for key leadership positions.

Health, Safety and Well-Being

We actively promote the safety, health and well-being of our employees and end users of our products. Creating a culture where all employees feel supported and valued is paramount to our corporate mission. Our well-being goals are for employees to physically thrive, flourish mentally and emotionally, be socially connected and achieve financial security. We are proud to provide all of our full time employees in the United States with access to an employee assistance program ("EAP"). Our EAP offers employees and their eligible dependents counseling and well-being resources 24 hours a day, seven days a week by phone, online or via the mobile site. Our environmental health and safety policy advances our vision of zero workplace incidents and our efforts to reduce our environmental impacts.

Repligen Performance System

In 2022, we formalized the Repligen Performance System ("RPS"), to provide the tools and a framework for engaging employees across the organization to continuously improve operational performance, with a focus on product quality, customer lead times, material supply, production costs and sustainability. Through a standard implementation network, all teams were empowered to implement just-do-it process improvements, solve priority problems through stand-up meetings and improve key processes through kaizen events. We believe RPS improved our teams' ability to continuously resolve customer challenges, enhance product quality and improve operational efficiencies. The impact of RPS was seen during 2022 and into 2023 in productivity savings, customer lead-time reductions, manufacturing capacity expansions, product quality improvements and significant reductions in manufacturing scrap at several key sites. There are a number of programs setup using RPS over the next twelve months.

Sustainability - Environmental, Social and Governance Matters

Our Commitment to Sustainability

We believe our commitment to Environmental, Social and Governance ("ESG") topics across all our global facilities matters and is an important part of creating long-term business value for all stakeholders. We are deeply committed to corporate responsibility and transparency, and we continue to factor sustainability into our business decisions and integrate its core principles into our daily operations.

In establishing a formal approach to ESG, we joined the United Nations Global Compact in 2020 in support of its Ten Principles related to human rights, labor, the environment, and anti-corruption. The actions we have taken while building and implementing our robust ESG strategy demonstrate our long-term commitment to being a responsible global corporate citizen.

In preparation for our initial sustainability report, published in 2021, we formed a Corporate Responsibility Team ("CRT") with oversight by our Board. The CRT was headed by a member of our operations leadership team and represented multiple disciplines within the organization. We completed our first materiality assessment gleaning insights from internal and external stakeholders, and we established a financial grade ESG software platform to inform current and future ESG-related reporting and decisions.

Together, we are advancing our ESG initiatives at an ambitious pace and taking bold steps to engage stakeholders throughout our upstream and downstream value chain.

Our Reporting Frameworks

We have become an active participant in the sustainability reporting ecosystem through our alignment with the Greenhouse Gas Protocol and membership with the United Nations Global Compact ("UNGC"), the Global Reporting Initiative ("GRI") and the International Financial Reporting Standards Sustainability Alliance, which now includes the International Sustainability Standards Board standards. Sustainability Accounting Standards Board ("SASB") standards and Task Force on Climate-related Financial Disclosures ("TCFD") recommendations. In 2023, we completed our first CDP Climate and CDP Water surveys, and submitted our commitment letter to the Science Based Targets Initiative to develop a greenhouse gas emissions reduction plan aligned with the latest climate science.

With our 2022 sustainability report, which was published in November 2023 (the "2022 Sustainability Report"), we hope to convey our Progress on Repligen's Integrated Sustainability Management program, which recognizes that an effective sustainability strategy reflects multiple stakeholders' lenses, perspectives on materiality and measurements of success and collaborative engagement. The 2022 Sustainability Report is intended to provide transparency insights into the positive impacts of our ESG programs for all of our stakeholders. To that end, we created reporting indexes for multiple disclosure frameworks including UNGC, SASB, GRI and TCFD.

Oversight of ESG Matters

The Nominating and Corporate Governance ("N&CG") Committee of our Board oversees our ESG program. The N&CG Committee meets regularly and reviews and advises on ESG strategy and apprises the full Board in order to ensure that our ESG program and strategy align with the Company's mission. In addition, the Audit Committee of the Board regularly reviews ESG-related topics such as enterprise risk management, anti-corruption, ethics and compliance, supply chain management, human rights protections, and cybersecurity and data privacy.

The Head of Sustainability, under strategic direction of our CEO and Chief Operating Officer, is responsible for the development and implementation of our expanding ESG program. In collaboration with all key business functions, the mandate of this globally focused role is to consider our existing ESG initiatives, understand stakeholder perspectives, identify business-relevant areas of opportunity to make a positive impact on global ESG efforts, and work collaboratively to drive initiatives designed to accelerate our ESG progress and stretch our ESG ambition.

Our Sustainability Pillars

Our sustainability initiatives are organized around four pillars that reflect our ESG priorities and topics considered material (or potentially material) to the Company and the bioprocessing industry: Principles, People, Product and Planet. Our "4Ps" embody the belief shared by our Board and the executive leadership team that corporate responsibility is essential to sustaining business and economic growth in a manner that can also deliver positive environmental and social impact.

Our ESG pillars are as follows:

1. *Principles.* Our core principles guide how we operate, respecting that our stakeholders depend on us to conduct business honestly, fairly and responsibly.
2. *People.* We recognize that our success as a company depends on the skills and contributions of a diverse group of employees who are engaged as individuals and high-performing teams. We operate in a highly competitive industry and recognize that our continued success and growth hinges upon our ability to attract, develop and retain an all-inclusive team of talented and diverse colleagues.
3. *Product.* Our diversified portfolio of bioprocessing technology solutions unlocks opportunity by enabling our customers to speed the development and manufacture of biological drugs. Our products empower biopharmaceutical manufacturers to generate more product in less space and with less waste, ultimately making a positive impact on overall human health and well-being, which is also Sustainability Development Goal ("SDG") #3 and our #1 SDG priority.
4. *Planet.* Social and environmental impacts of business are a growing concern for our stakeholders and a priority for us. We continue to actively weave sustainability into our corporate culture, and inspire company-wide action to reduce our climate impact.

During 2022 and 2023, we led and participated in numerous stakeholder communications across the business with key customers, critical suppliers, leading institutional investors, industry associations and employee resource groups to better understand their interests, priorities, targets and challenges through the increasingly relevant lens of sustainability. We remain committed to periodically updating our materiality matrices and reviewing the foundational aspects of our 4Ps to ensure close alignment with our stakeholders' priorities in the bioprocessing industry.

Intellectual Property

We are committed to protecting our intellectual property through a combination of patents, trade secrets, copyrights and trademarks, as well as confidentiality and material transfer agreements. As further described below, we own or have exclusive rights to at least 263 active patent grants and 369 pending patent applications in the United States and other foreign jurisdictions including Australia, Canada, China, France, Germany, India, Japan, South Korea, Sweden and the United Kingdom.

Our policy is to require each of our employees, consultants, business partners, potential collaborators and customers to execute confidentiality agreements upon the commencement of an employment, consulting, business relationship, or product related audit or research evaluation. These agreements provide that all confidential information developed or made known to the other party during the course of the relationship with us is to be kept confidential and not disclosed to third parties except in specific circumstances. In the case of employees and consultants, the agreements generally provide that all inventions conceived by the individual in the course of employment or rendering services to Repligen shall be our exclusive property and must be assigned to Repligen.

Filtration

For our filtration franchise, our patent grants include coverage for, ATF filtration, TFDF and TFF HF and FS systems, membranes, filters, mixers flow paths and single-use technologies. We continually seek to improve upon these technologies and have multiple new patent filings including patents covering next generation TFDF filters, next generation ATF filtration technologies, and proprietary reduced cost system components.

Chromatography

Our patent grants include coverage for certain unique methods and features of our OPUS PPC, including methods of manufacturing column components, systems for removing air using specialized tubing and valve systems, medium recovery systems, methods for packing, as well as systems for testing chromatography columns. We strive to improve upon our chromatography technologies, including developing potentially disruptive technology related to gamma irradiated columns and resin packing methods.

Through the ARTeSYN Acquisition in 2020, our patent portfolio includes exo-technology, valves, integrated sensors and integrated flow path systems. We also have multiple patent grants pertaining to our single-use replacement valves and liners used in combination with our modular configurable encapsulated flow systems to provide sterilized flow paths for various bioprocessing applications.

Process Analytics

Through our 2019 acquisition of C Technologies, Inc. ("C Technologies"), we hold patent grants to various slope spectroscopy instruments, including interactive variable pathlength devices and related methods of use. C Technologies' scientists are continually developing new analytical tools using our state-of-the-art slope spectroscopy technology, for which we continue to file patent applications.

Proteins

We currently hold a patent grant for "Nucleic Acids Encoding Recombinant Protein A," which claims sequences that encode a truncated recombinant Protein A but are otherwise identical to the natural Protein A, which is used for bioprocessing applications.

Pursuant to our collaboration with Navigo, we also have multiple patent grants and multiple pending patent applications globally covering Protein A-based affinity ligands through our collaboration with Navigo. These include ligands for antibody purification, as well as ligands for purifying COVID-19 vaccines.

In addition, following the acquisition of Avitide in September 2021, we continue to file multiple patent applications globally covering affinity ligands.

Trademarks

We procure and maintain trademark registrations globally for the Repligen trademark and our various product brands. We prioritize our "housemarks", (e.g., Repligen, the stylized "R" logo, Spectrum, TangenX, C Technologies, ARTeSYN, Polymem, Avitide, Metenova, etc.), and ensure continued protection globally. We also have trademark registrations for various product lines, including OPUS, XCell, XCell ATF, TFDF, KrosFlo, SIUS, ProConnex, Spectra/Por, NGL-Impact, SoloVPE, FlowVPE, FlowVPX, RPM, XO and AVIPure, that provide valuable company recognition and goodwill with our customers.

We have a comprehensive branding policy that includes trademark usage guidelines to ensure Repligen trademarks are used in accordance with our worldwide registrations and we actively police any unauthorized trademark usage as well as enforce the rights we have under our trademarks.

Licensing Agreements

We have entered into multiple licensing and collaboration relationships with third-party business partners in an effort to fully exploit our technology and advance our bioprocessing business strategy. For example, we entered into a 15-year exclusive License Agreement with Daylight (the "Daylight Agreement"), giving us exclusive license and commercialization rights to use certain technology and intellectual property subject to conditions set forth in the Daylight Agreement. See Note 13, *"Commitments and Contingencies"* to our consolidated financial statements included in this report for more information on this license agreement.

Competition

Our bioprocessing products compete on the basis of value proposition, performance, quality, cost effectiveness, and application suitability with numerous established technologies. Additional products using new technologies that may be competitive with our products may also be introduced. Many of the companies selling or developing competitive products have greater financial and human resources, and greater R&D, manufacturing and marketing experience than we do. They may undertake their own development of products that are substantially similar to or compete with our products and they may succeed in developing products that are more effective or less costly than any that we may develop. These competitors may also prove to be more successful in their production, marketing and commercialization activities. We cannot be certain that the research, development and commercialization efforts of our competitors will not render any of our existing or potential products obsolete.

Manufacturing

A majority of our 19 manufacturing sites are located in the United States (California, Massachusetts, New Jersey, New Hampshire, New York and Texas). Outside the United States, we have manufacturing sites in Estonia, France, Germany, Ireland, the Netherlands and Sweden.

The proteins products we provide are manufactured at our sites in Waltham, Massachusetts and Lund, Sweden. Native Protein A ligands and our growth factor products are manufactured in Lund, while recombinant Protein A ligands are manufactured in both Waltham and Lund. Our primary chromatography assembly and manufacturing sites are located in Waltham, Massachusetts, Ravensburg, Germany and Breda, the Netherlands. Our primary filtration manufacturing sites, including manufacturing of fluid management systems, products and consumables, are located in Marlborough, Massachusetts; Rancho Dominguez, California; Clifton Park, New York; Auburn, Massachusetts; Waterford, Ireland; Tallinn, Estonia and Toulouse, France. Our facility in Marlborough, is focused on XCell ATF and FS TFF products, while in Rancho Dominguez the focus is on Spectrum HF, TFDF and ProConnex products. Our process analytics products are manufactured in Bridgewater, New Jersey. Our operating room products are manufactured in Irving, Texas. As part of our capacity expansion activities, we have added a site in Hopkinton, Massachusetts that serves as an assembly center for single-use products and will also have the capacity to manufacture our protein products when the current buildout is completed. With our five acquisitions since the beginning of 2021, we gained manufacturing sites in Molndal, Sweden (Metenova), Branchburg, New Jersey (FlexBiosys), Toulouse, France (Polymem) and Lebanon, New Hampshire (Avitide). We undertook restructuring activities in 2023 that included consolidating a portion of our manufacturing operations between certain U.S. locations, discontinuing the sale of certain product SKUs, and evaluating the fair value of finished goods and raw materials secured during the 2020-2022 COVID-19 pandemic period. As a result of these activities, we closed manufacturing sites in Newton, New Jersey and Oceanside, California.

We utilize our facilities in Waltham, Massachusetts and Lund, Sweden to carry out fermentation and recovery operations, and purification, immobilization, packaging and quality control testing of our protein-based bioprocessing products. Our facilities located in Waltham, Massachusetts; Marlborough, Massachusetts; Lund, Sweden; Ravensburg, Germany; Bridgewater, New Jersey; Clifton Park, New York; and Rancho Dominguez, California among other sites, are ISO® 9001:2015 certified and maintain formal quality systems to maintain process control, traceability, and product conformance. Additionally, our facilities in Irving, Texas and Auburn, Massachusetts are ISO® 13485:2016 certified. We practice continuous improvement initiatives based on routine internal audits as well as external feedback and audits performed by our partners and customers. In addition, we maintain a business continuity management system that focuses on key areas such as contingency planning, security stocks and off-site storage of raw materials and finished goods to ensure continuous supply of our products.

Available Information

We maintain a website with the address www.repligen.com. We are not including the information contained on our website as a part of, or incorporating it by reference into, this Form 10-K. We make available free of charge through our website our Form 10-Ks, Quarterly Reports on Form 10-Q and Current Reports on Form 8-K, including exhibits and amendments to these reports, as soon as reasonably practicable after we electronically file such materials with, or furnish such materials to, the Securities and Exchange Commission ("SEC"). We also provide corporate governance, such as our Second Amended and Restated Code of Business Conduct and Ethics and other information, including our 2022 Sustainability Report, free of charge, through our website.

Our filings with the SEC may be accessed through the SEC's Electronic Data Gathering, Analysis and Retrieval system at www.sec.gov.

ITEM 1A. RISK FACTORS

Investors should carefully consider the risk factors described below before making an investment decision.

If any of the events described in the following risk factors occur, our business, financial condition or results of operations could be materially harmed. In that case, the trading price of our common stock could decline and investors may lose all or part of their investment. Additional risks and uncertainties that we are unaware of or that we currently deem immaterial may also become important factors that affect Repligen.

This Annual Report on Form 10-K ("Form 10-K") contains forward looking statements that involve risks and uncertainties. Our actual results could differ materially from those anticipated in these forward-looking statements as a result of certain factors, including the risks faced by us described below and elsewhere in this Form 10-K.

Risks Related to Our Business

We compete with life sciences, pharmaceutical and biotechnology companies who are capable of developing new approaches that could make our products and technology obsolete.

The bioprocessing market is intensely competitive, subject to rapid change and significantly affected by new product introductions and other market activities of industry participants.

We compete with several medium and small companies in each of our product categories as well as several large companies, including Danaher Corporation (Pall Corporation and Cytiva), Thermo Fisher Scientific Inc., MilliporeSigma and Sartorius. Many of our competitors are large, well-capitalized companies that may have greater financial, manufacturing, marketing, research and development ("R&D") resources than we have, as well as stronger name recognition, longer operating histories and benefits derived from greater economies of scale. As a consequence, they are able to spend more aggressively on product development, marketing, sales and other product initiatives than we can, and may have additional lines of products and the ability to bundle products.

These factors, among others, may enable our competitors to market their products at lower prices or on terms more advantageous to customers than what we can offer. Competition may result in price reduction, reduced gross margins and loss of market share, any of which could have a material adverse effect on our business, financial condition and results of operations.

Our current and future competitors, including certain of our customers, may at any time develop additional products that compete with our products. If any company develops products that compete with or are superior to our products, our revenue may decline. Additionally, new approaches by these competitors may make our products and technologies obsolete or noncompetitive.

If we are unable to continue to hire and retain skilled personnel, then we will have trouble developing and marketing our products.

Our success depends largely upon the continued service of our management and scientific staff and our ability to attract, retain and motivate highly skilled technical, scientific, management and marketing personnel. We also face significant competition in the hiring and retention of such personnel from other companies, research and academic institutions, government and other organizations who have superior funding and resources. The loss of key personnel or our inability to hire and retain skilled personnel could materially adversely affect our product development efforts and our business.

Despite our increasingly diversified client base, we have historically depended on a limited number of customers for a high percentage of our revenues.

The loss of, or a significant reduction in orders from, any of our large customers, including following any termination or failure to renew a long-term supply contract, would significantly reduce our revenues and harm our results of operations. If a large customer purchases fewer of our products, defers orders or fails to place additional orders with us for any reason, including for business continuity purposes, our revenue could decline, and our operating results may not meet market expectations.

In addition, if our customers order our products, but fail to pay on time or at all, our liquidity and operating results could be materially and adversely affected. Furthermore, if any of our current or future products compete with those of any of our largest customers, these customers may place fewer orders with us or cease placing orders with us, which would negatively affect our revenues and operating results.

Certain of our products are used by customers in the production of gene therapies, which represent a relatively new and still-developing mode of treatment. Unforeseen adverse events, negative clinical outcomes, or increased regulatory scrutiny of cell and gene therapy ("C&GT") and its financial cost may damage public perception of the safety, utility, or efficacy of gene therapies and may harm our customers' ability to conduct their business. Such events may negatively impact our revenues and have an adverse effect on our performance.

C&GT remains a relatively new and developing treatment method, with only a limited number of gene therapies approved to date by regulatory authorities. Public perception may be influenced by claims that C&GT is unsafe or ineffective, and C&GT may not gain the acceptance of the public or the medical community. In addition, ethical, social, legal, and financial concerns about C&GT and genetic testing could result in additional regulations, limitations or even prohibitions on certain C&GTs or C&GT-related products. More restrictive regulations or negative public perception could reduce certain of our customers' use of our products, which could negatively affect our revenue and performance.

Risks Related to Product Development and Acquisitions

If we are unable to expand our product portfolio, our ability to generate revenue could be adversely affected.

We are increasingly seeking to develop and commercialize our portfolio of products. Our future financial performance will depend, in part, on our ability to successfully develop and acquire additional bioprocessing products. There is no guarantee that we will be able to successfully acquire or develop additional bioprocessing products, and our financial performance will likely suffer if we are unable to do so.

Our acquisitions expose us to risks that could adversely affect our business, and we may not achieve the anticipated benefits of acquisitions of businesses or technologies.

As a part of our growth strategy, we may make selected acquisitions of complementary products and/or businesses, such as our most recent acquisitions of Metenova Holding AB and FlexBiosys, Inc. Any acquisition involves numerous risks and operational, financial, and managerial challenges, including the following, any of which could adversely affect our business, financial condition, or results of operations:

- difficulties in integrating new operations, technologies, products, and personnel;
- problems maintaining uniform procedures, controls and policies with respect to our financial accounting systems;
- lack of synergies or the inability to realize expected synergies and cost-savings;
- difficulties in managing geographically dispersed operations, including risks associated with entering foreign markets in which we have no or limited prior experience;
- underperformance of any acquired technology, product, or business relative to our expectations and the price we paid;
- negative near-term impacts on financial results after an acquisition, including acquisition-related earnings charges;
- the potential loss of key employees, customers, and strategic partners of acquired companies;
- claims by terminated employees and shareholders of acquired companies or other third parties related to the transaction;
- the assumption or incurrence of additional debt obligations or expenses, or use of substantial portions of our cash;
- the issuance of equity securities to finance or as consideration for any acquisitions that dilute the ownership of our stockholders;
- the issuance of equity securities to finance or as consideration for any acquisitions may not be an option if the price of our common stock is low or volatile which could preclude us from completing any such acquisitions;
- any collaboration, strategic alliance and licensing arrangement may require us to relinquish valuable rights to our technologies or product candidates, or grant licenses on terms that are not favorable to us;
- diversion of management's attention and company resources from existing operations of the business;
- inconsistencies in standards, controls, procedures, and policies;
- assumption of, or exposure to, historical liabilities of the acquired business, including unknown contingent or similar liabilities that are difficult to identify or accurately quantify; and

- risks associated with acquiring intellectual property, including potential disputes regarding acquired companies' intellectual property.

In addition, the successful integration of acquired businesses requires significant efforts and expense across all operational areas, including sales and marketing, R&D, manufacturing, finance, legal, and information technologies. There can be no assurance that any of the acquisitions we may make will be successful or will be, or will remain, profitable. Our failure to successfully address the foregoing risks may prevent us from achieving the anticipated benefits from any acquisition in a reasonable time frame, or at all.

If intangible assets and goodwill that we recorded in connection with our acquisitions become impaired, we may have to take significant charges against earnings.

In connection with the accounting for our completed acquisitions, we recorded a significant amount of intangible assets, including developed technology and customer relationships relating to the acquired product lines, and goodwill. Under accounting principles generally accepted in the United States, we must assess, at least annually and potentially more frequently, whether the value of intangible assets and goodwill has been impaired. Intangible assets and goodwill will be assessed for impairment in the event of an impairment indicator. Any reduction or impairment of the value of intangible assets and goodwill will result in a charge against earnings, which could materially adversely affect our results of operations and shareholders' equity in future periods.

Risks Related to Manufacturing and Supply

If we are unable to manufacture our products in sufficient quantities and in a timely manner, our operating results will be harmed, our ability to generate revenue could be diminished and our gross margin may be negatively impacted.

Our revenues and other operating results will depend in large part on our ability to manufacture and assemble our products in sufficient quantities and in a timely manner. Any interruptions we experience in the manufacturing or shipping of our products could delay our ability to recognize revenues in a particular quarter. Manufacturing problems can and do arise, and as demand for our products increases, any such problems could have an increasingly significant impact on our operating results. While we have not generally experienced problems with, or delays in, our production capabilities that resulted in delays in our ability to ship finished products, there can be no assurance that we will not encounter such problems in the future. We may not be able to quickly ship products and recognize anticipated revenues for a given period if we experience significant delays in the manufacturing process. In addition, we must maintain sufficient production capacity in order to meet anticipated customer demand, which carries fixed costs that we may not be able to offset if orders were to slow, which would adversely affect our operating margins. If we are unable to manufacture our products consistently, in sufficient quantities, and on a timely basis, our bioprocessing revenue, gross margins and our other operating results will be materially and adversely affected.

We rely on a limited number of suppliers or, for certain of our products, one supplier, and we may not be able to find replacements or immediately transition to alternative suppliers, which could have a material adverse effect on our financial condition, results of operations and reputation.

There are only a limited number of suppliers of materials for certain of our products. An interruption in operations of the business related to these products could occur if we encounter delays or difficulties in securing the required materials, or if we cannot then obtain an acceptable substitute. Any such interruption could significantly affect the business related to these products and our financial condition, results of operations and reputation. For example, we believe that only a small number of suppliers are currently qualified to supply materials for the XCell ATF® systems. The use of materials furnished by these replacement suppliers would require us to alter our operations related to the XCell ATF systems. Transitioning to a new supplier for our products would be time-consuming and expensive, may result in interruptions in our operations, could affect the performance specifications of our product lines or could require that we revalidate the materials.

There can be no assurance that we will be able to secure alternative materials and bring such materials online and revalidate them without experiencing interruptions in our workflow. If we should encounter delays or difficulties in securing, reconfiguring or revalidating the materials required for our products, our business related to these products and our financial condition, results of operations and reputation could be adversely affected.

Risks Related to Our Financial Position and Need for Additional Capital

Servicing our debt will require a significant amount of cash, and we may not have sufficient cash flow from our business to make payments on our debt and we may not have the ability to raise the funds necessary to settle for cash conversions of our Notes or to repurchase the Notes for cash upon a fundamental change, which could adversely affect our business and results of operations.

In December 2023, we incurred significant indebtedness with the issuance of $600.0 million in aggregate principal amount of 1.00% Convertible Senior Notes due 2028 (the "2023 Notes") where $309.9 million principal amount of the 2023 Notes were issued in exchange for $217.7 million principal amount of our 0.375% Convertible Senior Notes due 2024 (the "2019 Notes", and together with the 2023 Notes, the "Notes") and $290.1 million principal amount of the 2023 Notes were issued for $290.1 million in cash. As of December 31, 2023, $69.7 million in aggregate principal amount of the 2019 Notes remain outstanding. Our ability to make scheduled payments of the principal of, to pay interest on, or to refinance our indebtedness, including the Notes, depends on our future performance, which is subject to economic, financial, competitive and other factors that may be beyond our control. Our business may not continue to generate cash flow from operations in the future sufficient to service our debt and make necessary capital expenditures. If we are unable to generate such cash flow, we may be required to adopt one or more alternatives, such as selling assets, restructuring debt or obtaining additional equity capital on terms that may be onerous or highly dilutive. Our ability to refinance our indebtedness will depend on the capital markets and our financial condition at such time. We may not be able to engage in any of these activities or engage in these activities on desirable terms, which could result in a default on our debt obligations, including the Notes.

In addition, holders of the Notes have the right, subject to certain conditions, to require us to repurchase all or any portion of their Notes upon the occurrence of a "fundamental change" (as defined in the indentures governing the Notes) at a fundamental change repurchase price equal to 100% of the principal amount of the Notes to be repurchased, plus accrued and unpaid interest, if any, but excluding the fundamental change repurchase date. Upon any conversion of Notes, we will also be required to make cash payments for each $1,000 principal amount of 2023 Notes converted of at least the lesser of $1,000 and the sum of the "daily conversion values" (as defined in the indenture governing the 2023 Notes). However, we may not have enough available cash or be able to obtain financing at the time we are required to make repurchases of Notes surrendered therefor or pay cash with respect to Notes being converted. In addition, our ability to repurchase the Notes or to pay cash upon conversions of the Notes may be limited by law, by regulatory authority or by agreements governing our future indebtedness. Our failure to repurchase Notes at a time when the repurchase is required by the applicable indenture or to pay any cash payable on future conversions of the Notes as required by the applicable indenture would constitute a default under such indenture. A default under either indenture governing the Notes or the fundamental change itself could also lead to a default under agreements governing our future indebtedness. If the repayment of the related indebtedness were to be accelerated after any applicable notice or grace periods, we may not have sufficient funds to repay the indebtedness and repurchase the Notes or make cash payments upon conversions thereof.

In addition, our significant indebtedness, combined with our other financial obligations and contractual commitments, could have other important consequences. For example, it could:

- make us more vulnerable to adverse changes in general U.S. and worldwide economic, industry and competitive conditions and adverse changes in government regulation;
- limit our flexibility in planning for, or reacting to, changes in our business and our industry;
- place us at a disadvantage compared to our competitors who have less debt; and
- limit our ability to borrow additional amounts for working capital and other general corporate purposes, including to fund possible acquisitions of, or investments in, complementary businesses, products, services and technologies.

Any of these factors could materially and adversely affect our business, financial condition and results of operations. In addition, if we incur additional indebtedness, the risks related to our business and our ability to service or repay our indebtedness would increase.

The conditional conversion feature of the Notes, if triggered, may adversely affect our financial condition and liquidity.

In the event the conditional conversion feature of the Notes is triggered, holders of Notes will be entitled to convert the Notes at any time during specified periods at their option, as described in the indentures governing the Notes. If one or more holders elect to convert their Notes, we would be required to settle any converted principal through the payment of cash, which could adversely affect our liquidity. In addition, even if holders do not elect to convert their Notes, we could be required under applicable accounting rules to reclassify all or a portion of the outstanding principal of the notes as a current rather than long-term liability, which would result in a material reduction of our net working capital. As a result of the satisfaction of one of the conversion triggers, the 2019 Notes are convertible at the option of the holders thereof during the calendar quarter ending March 31, 2024. Because the 2019 Notes mature within one year of the report date, the Company classifies the carrying value of the 2019 Notes of $69.5 million as current liabilities on the Company's consolidated balance sheets at December 31, 2023.

Future strategic transactions or acquisitions may require us to seek additional financing, which we may not be able to secure on favorable terms, if at all.

We plan to continue a strategy of growth and development for our bioprocessing business, and we actively evaluate various strategic transactions on an ongoing basis, including licensing or acquiring complementary products, technologies or businesses that would complement our existing portfolio of development programs. In order to complete such strategic transactions, we may need to seek additional financing to fund these investments and acquisitions. Should we need to do so, we may not be able to secure such financing, or obtain such financing on favorable terms because of the volatile nature of the biotechnology marketplace. In addition, future acquisitions may require the issuance or sale of additional equity or debt securities, which may result in additional dilution to our stockholders.

Our corporate restructuring and the associated headcount reduction may not result in anticipated savings, could result in total costs and expenses that are greater than expected and could disrupt our business.

In July 2023, our Board of Directors ("Board") authorized the Company's management team to undertake restructuring activities to simplify and streamline our organization and strengthen the overall effectiveness of our operations (the "Restructuring Plan"). As part of the Restructuring Plan, we consolidated a portion of our manufacturing business between certain U.S. locations and reduced our headcount. We may not realize, in full or in part, the anticipated benefits, savings and improvements in our cost structure from our restructuring efforts due to unforeseen difficulties, delays or unexpected costs. If we are unable to realize the expected operational efficiencies and cost savings from the restructuring, our operating results and financial condition could be adversely affected. Furthermore, the Restructuring Plan may be disruptive to our operations. For example, our headcount reductions could yield unanticipated consequences, such as increased difficulties in implementing our business strategy, including retention of our remaining employees.

Our exposure to political, economic and other risks that arise from operating a multinational business has and may continue to increase.

We operate on a global basis with offices or activities in Japan, South Korea, China, India, Europe and North America. Our operations and sales outside of the United States have increased as a result of our strategic acquisitions and the continued expansion of our commercial organization. Risks related to these increased foreign operations include:

- fluctuations in foreign currency exchange rates, which may affect the costs incurred in international operations and foreign acquisitions and could harm our results of operations and financial condition;
- changes in general economic and political conditions in countries where we operate, particularly as a result of ongoing economic instability within foreign jurisdictions;
- the occurrence of a trade war, or other governmental action related to tariffs or trade agreements;
- differing protection of intellectual property, technology and data in foreign jurisdictions;
- difficulty in staffing and managing widespread operations;
- being subject to complex and restrictive employment and labor laws and regulations, as well as union and works council restrictions;

- changes in tax laws or rulings in the United States or other foreign jurisdictions that may have an adverse impact on our effective tax rate;
- being subject to burdensome foreign laws and regulations, including regulations that may place an increased tax burden on our operations;
- being subject to longer payment cycles from customers and experiencing greater difficulties in timely accounts receivable collections; and
- required compliance with a variety of foreign laws and regulations, such as data privacy requirements, real estate and property laws, anti-competition regulations, import and trade restrictions, export requirements, U.S. laws such as the Foreign Corrupt Practices Act of 1977 (the "FCPA") and the U.S. Department of Commerce's Export Administration Regulations, and other U.S. federal laws and regulations established by the Office of Foreign Assets Control, local laws such as the U.K. Bribery Act of 2010 or other local laws that prohibit corrupt payments to governmental officials or certain payments or remunerations to customers.

Our business success depends in part on our ability to anticipate and effectively manage these and other related factors. We cannot assure you that these and other related factors will not materially adversely affect our international operations or business as a whole.

In addition, a deterioration in diplomatic relations between the United States and any country where we conduct business could adversely affect our future operations and lead to a decline in profitability.

We may be unable to efficiently manage our growth as a larger and more geographically diverse organization.

Our strategic acquisitions, the continued expansion of our commercial sales operations, and our organic growth have increased the scope and complexity of our business. As a result, we will face challenges inherent in efficiently managing a more complex business with an increased number of employees over large geographic distances, including the need to implement appropriate systems, policies, benefits and compliance programs. Our inability to manage successfully the geographically and culturally diverse, and substantially larger combined organization could materially adversely affect our operating results and, as a result, the market price of our common stock.

Our results of operations could be negatively affected by potential fluctuations in foreign currency exchange rates.

We conduct a large portion of our business in international markets. For the fiscal year ended December 31, 2023, 38.5% of our revenues were denominated in foreign currencies with the primary foreign currency exposures being the Swedish krona, Euro and Chinese yuan. We are exposed to the risk of an increase or decrease in the value of the foreign currencies relative to the U.S. dollar, which could decrease the value of our revenue and increase the value of our expenses and costs when measured in U.S. dollars. These fluctuations could also adversely affect the demand for products and services provided by us. As a result, our results of operation may be influenced by the effects of future exchange rate fluctuations and such effects may have an adverse impact on our common stock price.

Natural disasters, geopolitical unrest, war, terrorism, public health issues or other catastrophic events could disrupt the supply, delivery or demand of products, which could negatively affect our operations and performance.

We are subject to the risk of disruption by earthquakes, floods and other natural disasters, fire, power shortages, geopolitical unrest, war, terrorist attacks and other hostile acts, public health issues, epidemics or pandemics and other events beyond our control and the control of the third parties on which we depend. Any of these catastrophic events may have a strong negative impact on our employees, facilities, partners, suppliers, distributors or customers, and could decrease demand for our products, create delays and inefficiencies in our supply chain and make it difficult or impossible for us to deliver products to our customers.

In addition, a catastrophic event that results in the destruction or disruption of our data centers or our critical business or information technology systems would severely affect our ability to conduct normal business operations and, as a result, our operating results would be adversely affected.

Our business, financial condition and results from operations could be adversely affected by disruptions in the global economy caused by geopolitical events, such as the ongoing conflicts between Russia and Ukraine and Israel and Palestine.

Global conflicts could increase costs and limit availability of fuel, energy, and other resources we depend upon for our business operations. For example, while we do not operate in Russia or Ukraine, the increasing tensions between the United States and Russia and the other effects of the ongoing conflict of Ukraine, have resulted in many broader economic impacts such as the United States and European Union imposing sanctions and bans against Russia and Russian products imported into the United States and Europe, respectively. Such sanctions and bans have impacted and may continue to impact commodity pricing such as fuel and energy costs, making it more expensive for us and our partners to deliver products to our customers. Further sanctions, bans or other economic actions in response to the ongoing conflict between Russia and Ukraine or in response to any other global conflict such as the ongoing conflict between Israel and Palestine, could result in, among other things, cyber-attacks, supply disruptions, lower consumer demand, and changes to foreign exchange rates and financial markets, any of which may adversely affect our business and supply chain. In addition, the effects of the ongoing conflict could heighten many of our known risks described in this section.

Adverse developments affecting the financial services industry, such as actual events or concerns involving liquidity, defaults, or non-performance by financial institutions or transactional counterparties, could adversely affect our current and projected business operations and our financial condition and results of operations.

Actual events involving limited liquidity, defaults, non-performance or other adverse developments that affect financial institutions, transactional counterparties or other companies in the financial services industry or the financial services industry generally, or concerns or rumors about any events of these kinds or other similar risks, have in the past and may in the future lead to market-wide liquidity problems. For example, on March 10, 2023, Silicon Valley Bank ("SVB") was closed by the California Department of Financial Protection and Innovation, which appointed the Federal Deposit Insurance Corporation ("FDIC") as receiver. Similarly, on March 12, 2023, Signature Bank and Silvergate Capital Corp. were each swept into receivership. If any of our lenders or counterparties to any such instruments were to be placed into receivership, we may be unable to access such funds. We have a banking relationship with SVB and hold cash, cash equivalents and marketable securities of $0.1 million as of December 31, 2023 in SVB depository accounts to cover short-term operational payments. While we have not experienced any losses in such accounts, the recent failure of SVB caused us to utilize our accounts at other financial institutions in order to mitigate potential operational risks stemming from the temporary inability to access funds in our SVB operating accounts. In addition, if any of our customers, suppliers or other parties with whom we conduct business are unable to access funds pursuant to such instruments or lending arrangements with such a financial institution, such parties' ability to pay their obligations to us or to enter into new commercial arrangements requiring additional payments to us could be adversely affected.

Inflation and rapid increases in interest rates have led to a decline in the trading value of previously issued government securities with interest rates below current market interest rates. Although the U.S. Department of Treasury, FDIC and Federal Reserve Board have announced a program to provide up to $25 billion of loans to financial institutions secured by certain of such government securities held by financial institutions to mitigate the risk of potential losses on the sale of such instruments, widespread demands for customer withdrawals or other liquidity needs of financial institutions for immediately liquidity may exceed the capacity of such program. Additionally, there is no guarantee that the U.S. Department of Treasury, FDIC and Federal Reserve Board will provide access to uninsured funds in the future in the event of the closure of other banks or financial institutions, or that they would do so in a timely fashion.

Although we assess our banking and customer relationships as we believe necessary or appropriate, our access to funding sources and other credit arrangements in amounts adequate to finance or capitalize our current and projected future business operations could be significantly impaired by factors that affect the Company, the financial institutions with which the Company has credit agreements or arrangements directly, or the financial services industry or economy in general. These factors could include, among others, events such as liquidity constraints or failures, the ability to perform obligations under various types of financial, credit or liquidity agreements or arrangements, disruptions or instability in the financial services industry or financial markets, or concerns or negative expectations about the prospects for companies in the financial services industry. These factors could involve financial institutions or financial services industry companies with which the Company has financial or business relationships, but could also include factors involving financial markets or the financial services industry generally. The results of events or concerns that involve one or more of these factors could include a variety of material and adverse impacts on our current and projected business operations and our financial condition and results of operations.

In addition, investor concerns regarding the U.S. or international financial systems could result in less favorable commercial financing terms, including higher interest rates or costs and tighter financial and operating covenants, or systemic limitations on access to credit and liquidity sources, thereby making it more difficult for us to acquire financing on acceptable terms or at all. Any decline in available funding or access to our cash and liquidity resources could, among other risks, adversely impact our ability to meet our operating expenses, financial obligations or fulfill our other obligations, result in breaches of our financial and/or contractual obligations or result in violations of federal or state wage and hour laws. Any of these impacts, or any other impacts resulting from the factors described above or other related or similar factors not described above, could have material adverse impacts on our liquidity and our current and/or projected business operations and financial condition and results of operations.

In addition, any further deterioration in the macroeconomic economy or financial services industry, could lead to losses or defaults by our suppliers, which in turn, could have a material adverse effect on our current and/or projected business operations and results of operations and financial condition.

Risks Related to Ownership of Our Common Stock

Risks Related to Investment in Our Securities

Our operating results may fluctuate significantly, our customers' future purchases are difficult to predict and any failure to meet financial expectations may result in a decline in our stock price.

Our quarterly operating results may fluctuate in the future due to many factors, such as the impact of seasonal spending patterns, changes in overall spending levels in the life sciences industry, the inability of some of our customers to consummate anticipated purchases of our products due to changes in end-user demand, and other unpredictable factors that may affect ordering patterns. Because our revenue and operating results are difficult to predict, we believe that our past results of operations are not necessarily a good indicator of our future performance. Additionally, if revenue declines in a quarter, whether due to a delay in recognizing expected revenue, adverse economic conditions or otherwise, our results of operations will be harmed because many of our expenses are relatively fixed. In particular, a large portion of our manufacturing costs, our R&D, sales and marketing and general and administrative expenses are not significantly affected by variations in revenue. Further, our gross margins are dependent on product mix. A shift in sales away from our higher-margin products to lower margin products will adversely affect our gross margins. If our quarterly operating results fail to meet investor expectations, the price of our common stock may decline.

Securities or industry analysts may not publish favorable research or reports about our business or may publish no information, which could cause our stock price or trading volume to decline.

The trading market for our common stock is influenced by the research and reports that industry or securities analysts publish about us and our business. We do not have any control over these analysts, and we cannot provide any assurance that analysts will cover us or provide favorable coverage. If any of the analysts who cover us issue an adverse opinion regarding our stock price, our business or stock price would likely decline. If one or more of these analysts cease coverage of our company or fail to regularly publish reports covering us, we could lose visibility in the market, which in turn could cause our stock price or trading volume to decline.

Our stock price could be volatile, which could cause shareholders to lose part or all of their investment.

The market price of our common stock, like that of the common stock of many other companies with similar market capitalizations, is highly volatile. The stock market in general, and the market for life sciences, biotechnology and pharmaceutical companies in particular, have experienced extreme price and volume fluctuations that have often been unrelated or disproportionate to the operating performance of specific companies, the conflict in Ukraine and Israel, and rising inflation and interest rates in the United States, which have resulted in decreased stock prices for many companies notwithstanding the lack of a fundamental change in their underlying business models or prospects. Broad market and industry factors, including potentially worsening economic conditions, may adversely affect the market price of our common stock, regardless of our actual operating performance.

If we fail to maintain an effective system of internal controls, we may not be able to accurately report financial results or prevent fraud. If we identify a material weakness in our internal control over financial reporting, our ability to meet our reporting obligations and the trading price of our stock could be negatively affected.

Effective internal controls are necessary to provide reliable financial reports and to assist in the effective prevention of fraud. Any inability to provide reliable financial reports or prevent fraud could harm our business. We regularly review and update our internal controls, disclosure controls and procedures, and corporate governance policies. In addition, we are required under the Sarbanes-Oxley Act of 2002 to report annually on our internal control over financial reporting. Any system of internal controls, however well designed and operated, is based in part on certain assumptions and can provide only reasonable, not absolute, assurances that the objectives of the system are met, including objectives that may involve our reliance on third-party advisors and professionals. If we, or our independent registered public accounting firm, determine that our internal control over financial reporting are not effective, discover areas that need improvement in the future or discover a material weakness, these shortcomings could have an adverse effect on our business and financial results, and the price of our common stock could be negatively affected. A material weakness is a deficiency, or a combination of deficiencies, in internal control over financial reporting, such that there is a reasonable possibility that a material misstatement of our annual or interim financial statements will not be prevented or detected on a timely basis. Accordingly, a material weakness increases the risk that the financial information we report contains material errors.

If we cannot conclude that we have effective internal control over our financial reporting, or if our independent registered public accounting firm is unable to provide an unqualified opinion regarding the effectiveness of our internal control over financial reporting, investors could lose confidence in the reliability of our financial statements, which could lead to a decline in our stock price. Failure to comply with reporting requirements could also subject us to sanctions and/or investigations by the Securities and Exchange Commission, the Nasdaq Global Select Market or other regulatory authorities.

We have previously implemented several significant enterprise resource planning ("ERP") modules and expect to implement additional ERP modules in the future. The implementation of the ERP system represents a change in our internal control over financial reporting. Although we continue to monitor and assess our internal controls in the new ERP system environment as changes are made and new modules are implemented, and we have taken additional steps to modify and enhance the design and effectiveness of our internal control over financial reporting, there is a risk that deficiencies may occur that could aggregate to a material weakness.

As discussed below in Part II, Item 9A, *"Controls and Procedures,"* of this report, we identified a material weakness in our internal control over financial reporting related to the accounting for deferred income taxes on the December 2023 exchange of a portion of our 2019 Notes and issuance of our 2023 Notes. As a result of this material weakness, our management concluded that our internal control over financial reporting was not effective as of December 31, 2023.

We have designed and are implementing a remediation plan for the material weakness. However, we may not be successful in remediating this material weakness in the near-term, or at all, particularly in light of the infrequency with which we are likely to undertake the types of transactions that could test our remediation efforts, or be able to identify and remediate any additional control deficiency, including any material weakness, that may arise in the future. If we fail to remediate the material weakness or any future deficiencies or fail to otherwise maintain the adequacy of our internal controls, we could be subject to regulatory scrutiny, civil or criminal penalties or shareholder litigation. In addition, failure to maintain adequate internal controls could result in financial statements that do not accurately reflect our operating results or financial condition and could prevent us from preparing and filing financial statements within required time periods.

Risks Related to Our Charter and Bylaws

Anti-takeover provisions in our charter documents, certain of our contracts with third parties, and under Delaware law could make an acquisition of us, even one that may be beneficial to our stockholders, more difficult and may prevent attempts by our stockholders to replace or remove our current management.

Provisions in our certificate of incorporation and by-laws may delay or prevent an acquisition of us or a change in our management. These provisions include the ability of our Board to issue preferred stock without stockholder approval. In addition, because we are incorporated in Delaware, we are governed by the provisions of Section 203 of the Delaware General Corporation Law, which limits the ability of stockholders owning in excess of 15% of our outstanding voting stock to merge or combine with us. Although we believe these provisions collectively provide for an opportunity to obtain greater value for stockholders by requiring potential acquirers to negotiate with the Board, they would apply even if an offer rejected by our board was considered beneficial by some stockholders. Additionally, certain of our contracts with third parties allow for termination upon specified change of control transactions. Anti-takeover provisions may frustrate or prevent any attempts by our stockholders

to replace or remove our current management by making it more difficult for stockholders to replace members of the Board, which is responsible for appointing the members of our management, and anti-takeover or change of control contract termination rights may frustrate or prevent any attempts by a third-party to acquire or attempt to acquire us.

Risks Related to Tax Matters

The enactment of legislation implementing changes in taxation of international business activities, the adoption of other corporate tax reform policies, or changes in tax legislation or policies, or interpretations thereof, could materially impact our financial position and results of operations.

Corporate tax reform, base-erosion efforts and tax transparency continue to be high priorities in many tax jurisdictions where we have business operations. As a result, policies regarding corporate income and other taxes in numerous jurisdictions are under heightened scrutiny and tax reform legislation is being proposed or enacted in a number of jurisdictions. There is no assurance that our actual income tax liability will not be materially different than what is reflected in our income tax provisions and accruals as a result of changes in tax laws.

In addition, many countries are beginning to implement legislation and other guidance to align their international tax rules with the Organisation for Economic Co-operation and Development's Base Erosion and Profit Shifting recommendations and action plan that aim to standardize and modernize global corporate tax policy, including changes to cross-border tax, transfer pricing documentation rules, and nexus-based tax incentive practices. Because of the heightened scrutiny of corporate taxation policies, prior decisions by tax authorities regarding treatments and positions of corporate income taxes could be subject to enforcement activities, and legislative investigation and inquiry, which could also result in changes in tax policies or prior tax rulings. Any such changes in policies or rulings may also result in the taxes we previously paid being subject to change.

Due to the large scale of our international business activities, any substantial changes in international corporate tax policies, enforcement activities or legislative initiatives may materially adversely affect our business, the amount of taxes we are required to pay and our financial condition and results of operations generally.

Our ability to use net operating loss and tax credit carryforwards and certain built-in losses to reduce future tax payments is limited by provisions of the Internal Revenue Code, and it is possible that certain transactions or a combination of certain transactions may result in material additional limitations on our ability to use our net operating loss and tax credit carryforwards.

Section 382 and 383 of the Internal Revenue Code of 1986, as amended, contain rules that limit the ability of a company that undergoes an ownership change, which is generally any change in ownership of more than 50 percentage points of its stock over a three-year period, to utilize its net operating loss and tax credit carryforwards and certain built-in losses recognized in years after the ownership change. These rules generally operate by focusing on ownership changes involving stockholders owning directly or indirectly 5% or more of the stock of a company and any change in ownership arising from a new issuance of stock by the company. Generally, if an ownership change occurs, the yearly taxable income limitation on the use of net operating loss and tax credit carryforwards and certain built-in losses is equal to the product of the applicable long-term, tax-exempt rate and the value of the company's stock immediately before the ownership change. We may be unable to offset our taxable income with losses, or our tax liability with credits, before such losses and credits expire and therefore would incur larger federal income tax liability. Federal net operating losses generated after December 31, 2017, are not subject to expiration and generally may not be carried back to prior taxable years except that, under the Coronavirus Aid, Relief, and Economic Security Act, net operating losses generated in 2018, 2019 and 2020 may be carried back five taxable years. Additionally, for taxable years beginning after December 31, 2020, the deductibility of such deferral net operating losses is limited to 80% of our taxable income in any future taxable year.

Risks Related to Government Regulation

Risks Related to Regulations and Compliance

We are subject to export and import control laws and regulations that could impair our ability to compete in international markets or subject us to liability if we violate such laws and regulations.

We are subject to U.S. export controls and sanctions regulations that restrict the shipment or provision of certain products and services to certain countries, governments, and persons. While we take precautions to prevent our products and services from being exported in violation of these laws, we cannot guarantee that the precautions we take will prevent violations of export control and sanctions laws. We believe that, in the past, we and our subsidiaries may have exported certain products without a required export license in apparent violation of U.S. export control laws. As a result, we have submitted to the U.S. Department of Commerce's Bureau of Industry and Security various notices of voluntary self-disclosure concerning potential violations. If we are found to be in violation of U.S. sanctions or export control laws, it could result in substantial fines and penalties for us and for the individuals working for us. We may also be adversely affected through other penalties, reputational harm, loss of access to certain markets, or otherwise.

Complying with export control and sanctions regulations may be time-consuming and may result in the delay or loss of sales opportunities or impose other costs. Any change in export or import regulations, economic sanctions or related legislation, or change in the countries, governments, persons or technologies targeted by such regulations, could result in our decreased ability to export or sell certain products to existing or potential customers in affected jurisdictions.

Our business is subject to a number of environmental risks.

Our manufacturing business involves the controlled use of hazardous materials and chemicals and is therefore subject to numerous environmental and safety laws and regulations and periodic inspections for possible violations of these laws and regulations. In addition to these hazardous materials and chemicals, our facility in Sweden also uses Staphylococcus aureus and toxins produced by Staphylococcus aureus in some of its manufacturing processes. Staphylococcus aureus and the toxins it produces, particularly enterotoxins, can cause severe illness in humans. The costs of compliance with environmental and safety laws and regulations are significant. Any violations, even if inadvertent or accidental, of current or future environmental and safety laws or regulations and the cost of compliance with any resulting order or fine could adversely affect our operations.

Climate change, climate change-related regulation and sustainability concerns could adversely affect our businesses and the operations of our subsidiaries, and any actions we take or fail to take in response to such matters could damage our reputation.

Investor advocacy groups, certain institutional investors, investment funds, other market participants and other stakeholders have focused increasingly on the Environmental, Social and Governance ("ESG") practices of companies, including those associated with climate change. These parties have placed increased importance on the importance on the implications of the social cost of their investments. If our ESG practices do not meet investor or other industry stakeholder expectations and standards, which continue to evolve, our reputation and associate retention may be negatively impacted based on an assessment of our ESG practices. Any sustainability disclosures we make may include our policies and practices on a variety of social and ethical matters, including corporate governance, environmental compliance, employee health and safety practices, human capital management, product quality, supply chain management, and workforce inclusion and diversity. It is possible that stakeholders may not be satisfied with our ESG practices or the speed of their adoption, or that we may not sufficiently communicate our ESG practices sufficiently to stakeholders. We could also incur additional costs and require additional resources to monitor, report, and comply with various ESG practices. In addition, investors may decide to refrain from investing in us as a result of their assessment of our approach to and consideration of the ESG factors.

In addition, we face physical risks associated with climate change. These physical risks include risks to our manufacturing and supply chain from flooding, severe storms, wildfires, droughts or extreme temperatures, all of which could increase costs and impair our ability to meet customer demands in a timely manner. To date, we have not experienced material losses or disruptions to our operations related to climate change, and we do not anticipate that these risks will have a material impact to our Company in the near term.

Health care reform measures could adversely affect our business.

The efforts of governmental and third-party payors to contain or reduce the costs of health care may adversely affect the business and financial condition of pharmaceutical and biotechnology companies, including ours. Specifically, in both the United States and some foreign jurisdictions, there have been a number of legislative and regulatory proposals to change the health care system in ways that could affect our ability to sell our products profitably. For the Patient Protection and Affordable Care Act, as amended by the Health Care and Education Reconciliation Act of 2010 (together, the "ACA"), substantially changed the way health care is financed by both governmental and private insurers. The ACA and other federal and state proposals and health care reforms could limit the prices that can be charged for the products we develop and may limit our commercial opportunity.

In August 2022, the Inflation Reduction Act of 2022 (the "IRA") was signed into law. The IRA includes several provisions that will impact our business to varying degrees, including provisions that create a $2,000 out-of-pocket cap for Medicare Part D beneficiaries, impose new manufacturer financial liability on all drugs in Medicare Part D, allow the U.S. government to negotiate Medicare Part B and Part D pricing for certain high-cost drugs and biologics without generic or biosimilar competition, require companies to pay rebates to Medicare for drug prices that increase faster than inflation, and delay the rebate rule that would require pass through of pharmacy benefit manager rebates to beneficiaries. The implementation of the IRA is currently subject to ongoing litigation challenging the constitutionality of the IRA's Medicare drug price negotiation program. The effect of IRA on our business and the healthcare industry in general is not yet known.

Additionally, the federal government and individual states in the United States have also become increasingly active in passing legislation and implementing regulations designed to control pharmaceutical product pricing, including price or patient reimbursement constraints, discounts, restrictions on certain product access and marketing cost disclosure and transparency measures, and, in some cases, designed to encourage importation from other countries and bulk purchasing. President Biden has issued multiple executive orders that have sought to reduce prescription drug costs. In February 2023, HHS also issued a proposal in response to an October 2022 executive order from President Biden that includes a proposed prescription drug pricing model that will test whether targeted Medicare payment adjustments will sufficiently incentivize manufacturers to complete confirmatory trials for drugs approved through the U.S. Food and Drug Administration's ("FDA's") accelerated approval pathway. Although a number of these and other proposed measures may require authorization through additional legislation to become effective, and the Biden administration may reverse or otherwise change these measures, both the Biden administration and Congress have indicated that they will continue to seek new legislation measures to control drug costs.

Legally mandated price controls on payment amounts by third-party payors or other restrictions could harm our business, financial condition, results of operations and prospects. In addition, regional healthcare authorities and individual hospitals are increasingly using bidding procedures to determine what pharmaceutical products and which suppliers will be included in their prescription drug and other healthcare programs. This could reduce the ultimate demand for our products or put pressure on drug pricing, which could negatively affect our business, financial condition, results of operations and prospects. We expect that additional state and federal healthcare reform measures will be adopted in the future.

We may be exposed to liabilities under the Foreign Corrupt Practices Act, and any determination that we violated the Foreign Corrupt Practices Act could have a material adverse effect on our business.

We are subject to the FCPA and other laws that prohibit improper payments or offers of payments to foreign governments and their officials and political parties by U.S. persons and issuers as defined by the statute for the purpose of obtaining or retaining business. We have operations and agreements with third parties and make sales in jurisdictions outside of the United States, which may experience corruption. Our activities in jurisdictions outside of the United States create the risk of unauthorized payments or offers of payments by one of our employees, consultants, sales agents or distributors, because these parties are not always subject to our control. These risks have increased following our recent acquisitions of overseas operations and facilities. It is our policy to implement safeguards to discourage these practices by our employees. However, our existing safeguards and any future improvements may prove to be less than effective, and the employees, consultants, sales agents or distributors of Repligen may engage in conduct for which we might be held responsible. Violations of the FCPA may result in severe criminal or civil sanctions, and we may be subject to other liabilities, which could negatively affect our business, operating results and financial condition. In addition, the government may seek to hold us liable for successor liability FCPA violations committed by any companies in which we invest or that we acquire.

Changes in accounting standards and subjective assumptions, estimates, and judgments by management related to complex accounting matters could significantly affect our financial results or financial condition.

Generally accepted accounting principles and related accounting pronouncements, implementation guidelines, and interpretations with regard to a wide range of matters that are relevant to our business, such as revenue recognition, asset impairment and fair value determinations, inventories, business combinations and intangible asset valuations, leases, and litigation, are highly complex and involve many subjective assumptions, estimates, and judgments. Changes in these rules or their interpretation or changes in underlying assumptions, estimates, or judgments could significantly change our reported or expected financial performance or financial condition.

Risks Related to Data and Privacy

Our internal computer systems, or those of our customers, collaborators or other contractors, may be subject to cyber-attacks or security breaches, which could result in a material disruption of our product development programs.

Despite the implementation of security measures, our internal computer systems and those of our customers, collaborators cloud-based platform service providers, and other contractors are vulnerable to damage from unauthorized access and from cyber-attacks, such as computer viruses, malware, ransomware, phishing denial-of-service attacks, social engineering and other means to affect service reliability and threaten the confidentiality, integrity and availability of information. A material cyber-attack or security breach could cause interruptions in our operations and could result in a material disruption of our business operations, damage to our reputation or a loss of revenues.

In the ordinary course of our business, we collect and store sensitive data, including, among other things, personally identifiable information about our employees, intellectual property, and proprietary business information. In addition, we could be subject to risks caused by misappropriation, misuse, leakage, falsification or intentional or accidental release or loss of information maintained in the information systems and networks of our company and our vendors, including personal information of our employees, and company and vendor confidential data. Like other companies, we have on occasion experienced, and believe we will continue to experience, data security incidents involving access to company data threats to our data and systems. If a material breach of our information technology systems or those of our vendors occurs, the market perception of the effectiveness of our security measures could be harmed and our reputation and credibility could be damaged.

We could be required to expend significant amounts of money and other resources to respond to these threats or breaches, and to repair or replace information systems or networks and could suffer financial loss or the loss of valuable confidential information. In addition, we could be subject to regulatory actions and/or claims made by individuals and groups in private litigation involving privacy issues related to data collection and use practices and other data privacy laws and regulations, including claims for misuse or inappropriate disclosure of data, as well as unfair or deceptive practices. Moreover, despite our efforts, the possibility of these events occurring cannot be eliminated entirely and there can be no assurance that any measures we take will prevent cyber-attacks or security breaches that could adversely affect our business.

Changes in laws and regulations governing the privacy and protection of data and personal information could adversely affect our business.

We are subject to data privacy and protection laws and regulations that apply to the collection, transmission, storage and use of proprietary information and personally-identifying information, which among other things, imposes certain requirements relating to the privacy, security and transmission of certain individually identifiable information. In addition, numerous other federal and state laws, including state security breach notification laws, state health information privacy laws and federal and state consumer protection laws, govern the collection, use, disclosure and security of personal information. These laws continue to change and evolve and are increasing in breadth and impact.

For example, the European Union's and United Kingdom's General Data Protection Regulations impose significant requirements on how we collect, process and transfer personal data, as well as significant regulatory penalties and legal liability for non-compliance. Complying with these laws may impose significant costs or otherwise require us to divert resources or implement changes to our business processes, and any actual or perceived non-compliance could result in significant penalties, claims and reputational damage.

Additionally, we face risks from evolving and uncertain privacy standards in our industry. For example, the California Privacy Rights Act imposes additional obligations on companies covered by the legislation and will significantly modify the California Consumer Privacy Act by expanding consumers' rights with respect to certain sensitive personal information. The law also created a new regulatory agency in California and that agency's finalized and proposed regulations are continuing to change the standard of privacy protection we are required to meet. More than a dozen other states, including Virginia, Colorado and Connecticut, have passed similar privacy laws that are or will be implemented and enforced by various state regulators.

In addition, federal and state legislators and regulators are imposing new and heightened protections for health and other sensitive information that could impact our business. For example, the Federal Trade Commission ("FTC") has imposed stringent requirements on the collection and disclosure of sensitive categories of personal information, including health information, and has expanded the application of its Health Breach Notification Rule. Washington's My Health My Data Act requires regulated entities to obtain consent to collect health information, grants consumers certain rights, including to request deletion, and provides for robust enforcement mechanisms, including enforcement by the state attorney-general and by litigants through a private right of action for consumer claims. These current and future data privacy laws and regulations may require us to modify our data collection or processing practices and policies, incur substantial costs and expenses in an effort to comply and increase our potential exposure to regulatory enforcement, reputational damage, and/or litigation.

Also, our customers may be subject to different privacy laws, rules and legislation, which may mean that they require us to be bound by varying contractual requirements applicable to certain other jurisdictions. Adherence to such contractual requirements may impact our collection, use, processing, storage, sharing and disclosure of information. As we expand our customer base, these requirements may vary from customer to customer, further increasing the cost of compliance and doing business.

Risks Related to Our Products and Technology

Risks Related to Our Intellectual Property

If we are unable to obtain or maintain our intellectual property, we may not be able to succeed commercially.

We endeavor to obtain and maintain trade secrets and pursue strategic patent protection in order to protect our products and processes from unauthorized use, and to produce a financial return consistent with the significant time and expense required to bring our products to market and continue to be competitive in our technical fields. Our success depends, in part, on our ability to:

- preserve our trade secrets, know-how and confidential information;
- operate without infringing the proprietary rights of third parties;
- obtain and maintain patent protection for our products and processes; and
- secure any necessary licenses from others on acceptable terms.

We consider trade secrets, know-how and other forms of market protection to be among the most important elements of our proprietary position, in particular, as it relates to many of the products that currently account for a majority of our revenue. We also own or have exclusive rights to U.S. patents and U.S. pending patent applications as well as corresponding foreign patents and patent applications. We continue to actively and selectively pursue patent protection and seek to expand our patent estate, particularly for our products currently in development, and we cannot be sure that any patent applications that we will file in the future or that any currently pending applications will issue on a timely basis, if ever. We cannot be certain that we were the first to conceive the invention(s) described by each of our pending patent applications or that we were the first to file patent applications for such invention(s). Even if patents are issued, the degree of protection afforded by such patents will depend upon the:

- scope of the patent claims;
- validity and enforceability of the claims obtained in such patents; and
- our willingness and financial ability to enforce and/or defend them.

Patents that may be granted to us in certain foreign countries may be subject to opposition proceedings brought by third parties or result in suits by us, which may be costly and result in adverse consequences for us.

In some cases, litigation or other proceedings may be necessary to assert claims of infringement, to enforce patents issued to us or our licensors, to protect trade secrets, know-how or other intellectual property rights we own or to determine the scope and validity of the proprietary rights of third parties. Such litigation could result in substantial costs to us and diversion of our resources. An adverse outcome in any such litigation or proceeding could have a material adverse effect on our business, financial condition and results of operations. If our competitors prepare and file patent applications that claim technology also claimed by us, we may be required to participate in interference proceedings declared by Patent Offices to determine priority of invention, which would result in substantial costs to us.

While we continue to obtain patent grants directed towards Protein A, other patent grants directed towards Protein A have expired, and as a result, we may face increased competition, which could harm our results of operations, financial condition, cash flow and future prospects.

Other companies could begin manufacturing and selling native or some of the commercial forms of recombinant Protein A in the United States and may directly compete with us on certain Protein A products. This may induce us to sell Protein A at lower prices and may erode our market share, which could adversely affect our results of operations, financial condition, cash flow and future prospects.

Our freedom to develop our products may be challenged by others, and we may have to engage in litigation to determine the scope and validity of competitors' patents and proprietary rights, which, if we do not prevail, could harm our business, results of operations, financial condition, cash flow and future prospects.

There has been substantial litigation and other proceedings regarding the complex patent and other intellectual property rights in the life sciences industry. We have been a party to, and in the future may become a party to, patent litigation or other proceedings regarding intellectual property rights.

We may become involved in patent litigation or other intellectual property proceedings, including the following situations:

- We may initiate litigation or other proceedings against third parties to seek to invalidate the patents held by such third parties or to obtain a judgment that our products or services do not infringe on such third parties' patents.
- We may initiate litigation or other proceedings against third parties to seek to enforce our patents against infringers.
- If our competitors file patent applications that claim technology also claimed by us, we may participate in interference or opposition proceedings to determine the priority of invention.
- If third parties initiate litigation claiming that our processes or products infringe their patent or other intellectual property rights, we will need to defend against such claims.

The cost to us of any patent litigation or other proceeding, even if resolved in our favor, could be substantial. Some of our competitors may be able to sustain the cost of such litigation or proceedings more effectively than we can because of their substantially greater financial resources. If a patent litigation or other intellectual property proceeding is resolved in a way that is unfavorable to us, we or our collaborative or strategic partners may be enjoined from manufacturing or selling our products and services without a license from the other party and be held liable for significant damages. The failure to obtain any required license on commercially acceptable terms or at all may harm our business, results of operations, financial condition, cash flow and future prospects.

Uncertainties resulting from the initiation and continuation of patent litigation or other proceedings could have a material adverse effect on our ability to compete in the marketplace. Patent litigation and other proceedings may also absorb significant management time, attention and resources.

Risks Related to Our Products

The market may not be receptive to our new bioprocessing products upon their introduction.

We expect a portion of our future revenue growth to come from introducing new bioprocessing products, including line extensions and new features for our OPUS® disposable chromatography columns, our XCell ATF system, our SIUS® tangential flow filtration ("TFF") cassettes, our Spectrum® hollow fiber modules TFF line of cassettes, our process analytics products and our growth factors. The commercial success of all of our products will depend upon their acceptance by the life science and biopharmaceutical industries. Many of the bioprocessing products that we are developing are based upon new technologies or approaches. As a result, there can be no assurance that these new products, even if successfully developed and introduced, will be accepted by customers. If customers do not adopt our new products and technologies, our results of operations may suffer and, as a result, the market price of our common stock may decline.

Our products are subject to quality control requirements.

Whether a product is produced by us or purchased from outside suppliers, it is subjected to quality control procedures, including the verification of porosity and with certain products, the complete validation for good manufacturing practices, FDA, CE and ISO® compliance, prior to final packaging. Quality control is performed by a staff of technicians utilizing calibrated equipment. In the event we, or our manufacturers, produce products that fail to comply with required quality standards, it may incur delays in fulfilling orders, write-downs, damage to our reputation and damages resulting from product liability claims.

If our products do not perform as expected or the reliability of the technology on which our products are based is questioned, we could experience lost revenue, delayed or reduced market acceptance of our products, increased costs and damage to our reputation.

Our success depends on the market's confidence that we can provide reliable, high-quality bioprocessing products. We believe that customers in our target markets are likely to be particularly sensitive to product defects and errors. Our reputation and the public image of our products and technologies may be impaired if our products fail to perform as expected. Although our products are tested prior to shipment, defects or errors could nonetheless occur in our products. Furthermore, the Protein A that we manufacture is subsequently incorporated into products that are sold by other life sciences companies and we have no control over the manufacture and production of those products. In the future, if our products experience, or are perceived to experience, a material defect or error, this could result in loss or delay of revenues, delayed market acceptance, damaged reputation, diversion of development resources, legal claims, increased insurance costs or increased service and warranty costs, any of which could harm our business. Such defects or errors could also narrow the scope of the use of our products, which could hinder our success in the market. Even after any underlying concerns or problems are resolved, any lingering concerns in our target market regarding our technology or any manufacturing defects or performance errors in our products could continue to result in lost revenue, delayed market acceptance, damaged reputation, increased service and warranty costs and claims against us.

Risks Related to Litigation

We may become involved in litigation or other proceedings with collaborative partners, which may be time consuming, costly and could result in delays in our development and commercialization efforts.

In connection with our decision to focus efforts on the growth of our core bioprocessing business, we sought development and commercialization partnerships for our remaining portfolio of clinical stage assets. Any disputes with such partners that lead to litigation or similar proceedings may result in us incurring legal expenses, as well as facing potential legal liability. Such disputes, litigation or other proceedings are also time-consuming and may cause delays in our development and commercialization efforts. If we fail to resolve these disputes quickly and with terms that are no less favorable to us than the current terms of the arrangements, our business, results of operations, financial condition, cash flow and future prospects may be harmed.

We may become subject to litigation, which could result in substantial costs and divert management's attention and resources from our business.

From time to time, we may become involved in litigation or other legal proceedings relating to claims arising from the ordinary course of business. Litigation is subject to inherent risks and uncertainties that may cause actual results to differ materially from our expectations. If we receive an adverse judgment in any litigation, we could be required to pay substantial damages. With or without merit, litigation can be complex, can extend for a protracted period of time, can be very expensive and the expense can be unpredictable. Litigation initiated by us could also result in counterclaims against us, which could increase the costs associated with the litigation and result in our payment of

damages or other judgments against us. In addition, litigation, and any related publicity, may divert the efforts and attention of some of our management and key personnel, which could adversely affect our business.

ITEM 1B. UNRESOLVED STAFF COMMENTS

None.

ITEM 1C. CYBERSECURITY

Governance Related to Cybersecurity Risks

Our Board of Directors ("Board") holds overall oversight responsibility for the Company's strategy and risk management, including in relation to cybersecurity risks. Our Board exercises its oversight function through the Audit Committee, which oversees the management of risk exposure across various areas, including data security risks, in accordance with its charter. The Audit Committee receives quarterly reports from our Chief Information Officer ("CIO") on the status of the Company's cybersecurity program, including measures implemented to monitor and address cybersecurity risks and threats, as appropriate.

Under the leadership of our general counsel, we have constituted an enterprise risk management committee ("ERMC") composed of senior management, including the CIO and other senior executives. The ERMC monitors and oversees risk areas that potentially could pose a high impact to the business, and cybersecurity currently is one of the ERMC's priority focus areas. The ERMC reports on our top identified risks and steps to address those risks to the full Board on a semi-annual basis.

Our IT Infrastructure & Operations team manages the day-to-day administration of our cybersecurity program. We also work with a managed security service provider to monitor for vulnerabilities and threats, which are reported to the IT Infrastructure & Operations team and up to the CIO and other members of senior management, where appropriate. We engage employees in our cybersecurity efforts through a quarterly process for employees to complete security and awareness training as well as periodic simulated phishing campaigns. We also conduct specific training and tabletop exercises for key personnel involved in cybersecurity risk management.

Cybersecurity Risk Management and Strategy

We maintain a cybersecurity program, which is informed by industry standards, that includes processes for identification, assessment, and management of cybersecurity risks. We conduct periodic risk assessments, including with support from external vendors, to assess our cyber program, identify areas of enhancement, and develop strategies for the mitigation of cyber risks. We also conduct regular security testing and have established a vulnerability management process supported by security testing, for the treatment of identified security risks based on severity. Third-parties that access, process, collect, share, create, store, transmit or destroy our information or have access to our systems may have additional contractual controls.

Our IT Infrastructure & Operations team is informed about and monitors the prevention, detection, mitigation, and remediation of cybersecurity risks through various means, including by leveraging managed security service providers and other third-party security software and technology services. In addition, we institute processes and technologies for the monitoring of security alerts from internal parties and external resources, including from information security research sources. We also have implemented processes and technologies for network monitoring and data loss prevention procedures.

We maintain processes to inform and update management and, as needed, the Audit Committee, about security incidents that may pose a significant risk for the business, as applicable. Although risks from cybersecurity threats have to date not materially affected us, our business strategy, results of operations or financial condition, we have, from time to time, experienced threats and security incidents relating to our and our third party vendors' information systems. See Item 1A, *"Risk Factors,"* to this report for more information.

ITEM 2. PROPERTIES

Our material office, manufacturing and warehouse leases are detailed below:

Location	Square Feet	Principal Use	Lease Expiration
Waltham, Massachusetts	182,243	Corporate headquarters, manufacturing, research and development, marketing and administrative offices	October 31, 2030
Marlborough, Massachusetts	130,700	Manufacturing operations	November 30, 2033
Rancho Dominguez, California	68,908	Manufacturing, research and development, marketing and administrative operations	July 15, 2035
Toulouse, France	67,285 (1)	Manufacturing and administrative operations	March 31, 2032
Lund, Sweden	65,240	Manufacturing and administrative operations	December 31, 2026
Hopkinton, Massachusetts	64,000	Manufacturing, assembly site	July 13, 2034
Bridgewater, New Jersey	57,739	Manufacturing and administrative operations	February 1, 2034
Compton, California	54,060	Warehouse	May 31, 2029
Waterford, Ireland	50,311	Manufacturing, administrative operations and assembly site	January 31, 2037
Clifton Park, New York	34,386	Manufacturing operations	November 30, 2029
Lebanon, New Hampshire	31,313	Research and development and administrative operations	July 31, 2026

(1) On April 1, 2023, we expanded our space in Toulouse, France by approximately 4,000 square feet for additional office and warehouse space.

The Company entered into a lease agreement to lease approximately 76,000 square feet of office, manufacturing and storage space in Jüri, Estonia. The Company gained access to the space and the right to control the use of the space was conveyed effective January 1, 2024.

In addition to the above, the Company also entered into a lease agreement to lease approximately 139,000 square foot of primarily warehouse space in Shrewsbury, Massachusetts. The Company gained access to the space and the right to control the use of the space was conveyed effective February 1, 2024.

During the year ended December 31, 2023, we incurred total rental costs for all facilities of $25.1 million.

ITEM 3. LEGAL PROCEEDINGS

From time to time, we may be subject to legal proceedings and claims in the ordinary course of business. We are not currently aware of any such proceedings or claims that we believe will have, individually or in the aggregate, a material adverse effect on our business, financial condition or results of operations.

ITEM 4. MINE SAFETY DISCLOSURES

Not applicable.

PART II

ITEM 5. MARKET FOR REGISTRANT'S COMMON EQUITY, RELATED STOCKHOLDER MATTERS AND ISSUER PURCHASES OF EQUITY SECURITIES

Market Information for Common Stock

Our common stock is traded on the Nasdaq Global Select Market under the symbol "RGEN."

Stockholders and Dividends

As of February 16, 2024, there were 259 stockholders of record of our common stock. We have not paid any dividends since our inception and do not intend to pay any dividends on our common stock in the foreseeable future. We anticipate that we will retain all earnings, if any, to support our operations. Any future determination as to the payment of dividends will be at the sole discretion of our Board of Directors ("Board") and will depend on our financial condition, results of operations, capital requirements and other factors the Board deems relevant.

Equity Compensation Plan Information

The following table sets forth information as of December 31, 2023, regarding shares of common stock that may be issued under the Company's equity compensation plans, consisting of the Amended and Restated 2012 Stock Option and Incentive Plan and the 2018 Stock Option and Incentive Plan.

Plan Category	Number of securities to be issued upon exercise of outstanding options, warrants and rights (a)		Weighted-average exercise price of outstanding options, warrants and rights (b)		Number of securities remaining available for future issuance under equity compensation plans (excluding securities reflected in column (a)) (c)
Equity compensation plans approved by security holders	1,123,450	(1)	$ 85.97	(2)	1,671,408

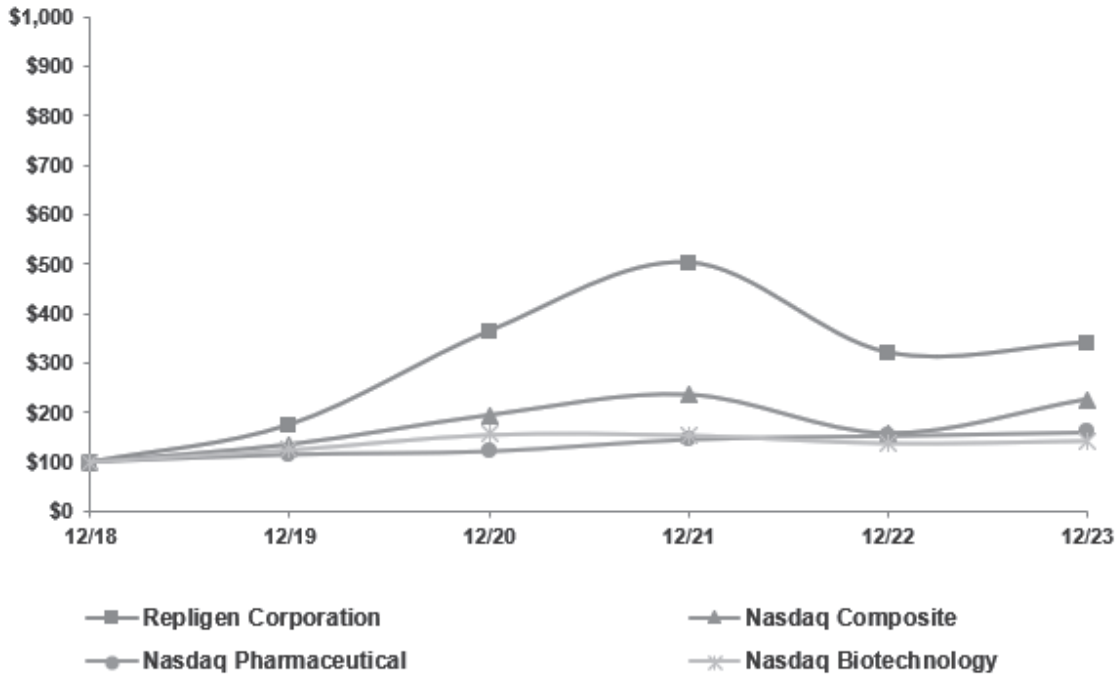
(1) Includes 649,130 shares of common stock issuable upon the exercise of outstanding options and 474,320 shares of common stock issuable upon the vesting of stock units, which include restricted stock units and performance stock units. No shares of restricted stock are outstanding.

(2) Since stock units do not have any exercise price, such units are not included in the weighted average exercise price calculation.

Stock Performance Graph

The graph below matches Repligen Corporation's cumulative 5-year total shareholder return on common stock with the cumulative total returns of the Nasdaq Composite index, the Nasdaq Pharmaceutical index, and the Nasdaq Biotechnology index. The graph tracks the performance of a $100 investment in our common stock and in each index (with the reinvestment of all dividends) from December 31, 2018 to December 31, 2023. The comparisons shown in the graph below are based upon historical data. We caution that the stock price performance shown in the graph below is not necessarily indicative of, nor is it intended to forecast, the potential future performance of our common stock.

COMPARISON OF 5 YEAR CUMULATIVE TOTAL RETURN*
Among Repligen Corporation, the Nasdaq Composite Index,
the Nasdaq Pharmaceutical Index and the Nasdaq Biotechnology Index



*$100 invested on 12/31/18 in stock or index, including reinvestment of dividends. Fiscal year ending December 31.

The information contained in the performance graph shall not be deemed to be "soliciting material" or to be "filed" with the Securities and Exchange Commission, and such information shall not be incorporated by reference into any future filing under the Securities Act of 1933, as amended (the "Securities Act") or the Securities Exchange Act of 1934, as amended (the "Exchange Act"), except to the extent that Repligen specifically incorporates it by reference into such filing.

Issuer Purchases of Equity Securities

In June 2008, the Board authorized a program to repurchase up to 1.25 million shares of our common stock to be repurchased at the discretion of management from time to time in the open market or through privately negotiated transactions (the "2008 Share Repurchase Program"). The 2008 Repurchase Program has no set expiration date and may be suspended or discontinued at any time. We did not repurchase any shares of common stock under the 2008 Repurchase Program during the year ended December 31, 2023. In prior years, we repurchased a total of 592,827 shares, leaving 657,173 shares remaining under this authorization.

In December 2023, the Board authorized and approved a stock repurchase, separate from the 2008 Share Repurchase Program, of up to $25.0 million of our common stock concurrent with the issuance of $600.0 million aggregate principal amount of 1.00% Convertible Senior Notes due 2028 ("2023 Notes"). See Note 14, "*Convertible Senior Notes,*" included in this report for more information on the issuance. We used $14.4 million of the proceeds from the issuance of the 2023 Notes to repurchase 92,090 shares at a price of $156.22, including transaction costs, to offset the impact of dilution from the issuance of 2023 Notes and equity compensation programs as well as to reduce our outstanding share count ("2023 Share Repurchase Program"). We have elected to retire the shares repurchased to date under the 2023 Share Repurchase Program. Retired shares become part of the pool of authorized but unissued shares. The purchase price of the retired shares in excess of par value, including transaction costs, is recorded as a decrease to additional paid-in capital in our consolidated balance sheets as of December 31, 2023.

ITEM 6. RESERVED

ITEM 7. MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

Information pertaining to fiscal years 2022 and 2021 was included in the Company's Annual Report on Form 10-K ("Form 10-K") for the year ended December 31, 2022, on pages 37 through 53 under Part II, Item 7, "Management's Discussion and Analysis of Financial Condition and Results of Operations," which was filed with the Securities and Exchange Commission on February 22, 2023.

Repligen and its subsidiaries, collectively doing business as Repligen Corporation ("Repligen", "we", "our", or "the Company") is a global life sciences company that develops and commercializes highly innovated bioprocessing technology and systems that increase efficiencies and flexibility in the process of manufacturing biological drugs.

As the overall market for biologics continues to grow and expand, our customers – primarily large biopharmaceutical companies and contract development and manufacturing organizations and other life sciences companies (integrators) – face critical production cost, capacity, quality and time pressures. Built to address these concerns, our products help set new standards for the way biologics are manufactured. We are committed to inspiring advances in bioprocessing as a trusted partner in the production of critical biologic drugs – including monoclonal antibodies ("mAbs"), recombinant proteins, vaccines and cell and gene therapies ("C&GT") – that are improving human health worldwide. Increasingly, our technologies are being implemented to overcome challenges in processing plasmid DNA (a starting material for the production of mRNA) and gene delivery vectors such as lentivirus and adeno-associated viral vectors. For more information regarding our business, products and acquisitions, see above sections in Part I, Item 1. *"Business"* including "Overview", "Our Products", "2023 Acquisitions", "2021 Acquisitions" and "Our Market Opportunity" sections therein.

Macroeconomic Trends

As a result of our global presence, a significant portion of our revenue and expenses is denominated in currencies other than the U.S. dollar. We are therefore subject to non-U.S. exchange exposure. Exchange rates can be volatile and a substantial weakening or strengthening of foreign currencies against the U.S. dollar could increase or reduce our revenue and gross profit margin and impact the comparability of results from period to period.

We have experienced, and expect to continue to experience, cost inflation, primarily in raw materials, and other supply chain costs, as a result of global macroeconomic trends, including global geopolitical conflicts and labor shortages. Actions taken to mitigate supply chain disruptions and inflation, including price increases and productivity improvements, have generally been successful in offsetting the impact of these trends. In addition, decreasing demand for vaccines for the COVID-19 pandemic, including all subsequent variants of the SARS-CoV-1 coronavirus ("COVID-19") is driving a reduction in future demand of our products related to these vaccines. We expect that these trends will continue to impact our results for 2024 as well.

Critical Accounting Policies and Estimates

While our significant accounting policies are more fully described in the notes to our consolidated financial statements, we have identified the policies and estimates below as being critical to our business operations and the understanding of our results of operations. These policies require management's most difficult, subjective or complex judgments, often as a result of the need to make estimates about the effect of matters that are inherently uncertain. The impact of and any associated risks related to these policies on our business operations are discussed throughout "Management's Discussion and Analysis of Financial Condition and Results of Operations," specifically in the "Results of Operations" section, where such policies affect our reported and expected financial results. Although we believe that our estimates, assumptions, and judgments are reasonable, they are based upon information presently available. Actual results may differ significantly from these estimates under different assumptions, judgments, or conditions.

Revenue recognition

We generate revenue from the sale of bioprocessing products, equipment devices, and related consumables used with these equipment devices to customers in the life science and biopharmaceutical industries. Under Accounting Standards Codification No. ("ASC") 606, "*Revenue from Contracts with Customers,"* revenue is recognized when, or as, obligations under the terms of a contract are satisfied, which occurs when control of the promised products or services is transferred to customers. Revenue is measured as the amount of consideration we expect to receive in exchange for transferring products or services to a customer ("transaction price"). To the extent the transaction price includes variable consideration, we estimate the amount of variable consideration that should be included in the transaction price utilizing the expected value method or the most likely amount method, depending on the facts and circumstances relative to the contract. Variable consideration is included in the transaction price if, in our judgment, it is probable that a significant future reversal of cumulative revenue under the contract will

not occur. Estimates of variable consideration and determination of whether to include estimated amounts in the transaction price are based largely on an assessment of our anticipated performance and all information (historical, current and forecasted) that is reasonably available. Sales, value add, and other taxes collected on behalf of third parties are excluded from revenue.

When determining the transaction price of a contract, an adjustment is made if payment from a customer occurs either significantly before or significantly after performance, resulting in a significant financing component. Applying the practical expedient in paragraph 606-10-32-18, we do not assess whether a significant financing component exists if the period between when we perform our obligations under the contract and when the customer pays is one year or less. None of our contracts contained a significant financing component as of December 31, 2023.

Contracts with customers may contain multiple performance obligations. For such arrangements, the transaction price is allocated to each performance obligation based on the estimated relative standalone selling prices of the promised products or services underlying each performance obligation. We determine standalone selling prices based on the price at which the performance obligation is sold separately. If the standalone selling price is not observable through past transactions, we estimate the standalone selling price taking into account available information such as market conditions and internally approved pricing guidelines related to the performance obligations.

We recognize product revenue under the terms of each customer agreement upon transfer of control to the customer, which occurs at a point in time.

Shipping and handling fees are recorded as a component of product revenue, with the associated costs recorded as a component of cost of product revenue in our consolidated statements of comprehensive income.

Allowance for credit losses

We evaluate our global accounts receivable through a continuous process of assessing our portfolio on an individual customer and overall basis. This process consists of a thorough review of historical collection experience, current aging status of the customer accounts, financial condition of our customers, and whether the receivables involve retainages. We also consider the economic environment of our customers, both from a marketplace and geographic perspective, in evaluating the need for an allowance. Based on our review of these factors, we establish or adjust allowances for specific customers. Credit losses can vary substantially over time and the process involves judgment and estimation that require a number of assumptions about matters that are uncertain. Accordingly, our results of operations can be affected by adjustments to the allowance due to actual write-offs that differ from estimated amounts. See Note 8, *"Credit Losses,"* to our consolidated financial statements included in this report for more information.

Inventories

We value inventory at cost or, if lower, net realizable value, using the first-in, first-out method. We review our inventory at least quarterly and record a provision for excess and obsolete inventory based on our estimates of expected sales volume, production capacity and expiration dates of raw materials, work-in-process and finished products. We write down inventory that has become obsolete, inventory that has a cost basis in excess of its expected net realizable value, and inventory in excess of expected requirements to cost of product revenue in our consolidated statements of comprehensive income. Manufacturing of bioprocessing finished goods is done to order and tested for quality specifications prior to shipment.

A change in the estimated timing or amount of demand for our products could result in additional provisions for excess inventory quantities on hand. Any significant unanticipated changes in demand or unexpected quality failures could have a significant impact on the value of inventory and reported operating results. In 2023, we recorded a $23.6 million in inventory adjustments, which included the impact of the Company discontinuing the sale of certain product SKUs and the impact of having proactively secured materials during the 2020-2022 COVID-19 pandemic period (the "COVID-19 Period") to meet accelerated demand during a challenging supply chain environment in the industry. Where demand has reduced, finished goods and raw materials, whose value exceeded the projected requirements to be used before reaching their expiration date, were adjusted down to their net realizable value. In addition, these adjustments include inventory that could not be repurposed as a result of the closing of manufacturing facilities and production lines as part of the Company's restructuring activities during 2023.

Business combinations

Total consideration transferred for acquisitions is allocated to the tangible and intangible assets acquired and liabilities assumed, if any, based on their fair values at the dates of acquisition. This purchase price allocation process requires management to make significant estimates and assumptions with respect to intangible assets and deferred revenue obligations. The fair value of identifiable intangible assets is based on detailed valuations that use information and assumptions determined by management. Any excess of purchase price over the fair value of the net tangible and intangible assets acquired is allocated to goodwill. While we use our best estimates and assumptions to accurately value assets acquired and liabilities assumed at the acquisition date as well as any contingent consideration, where applicable, our estimates are inherently uncertain and subject to refinement. As a result, during the measurement period, which may be up to one year from the acquisition date, we record adjustments to the assets acquired and liabilities assumed with the corresponding offset to goodwill. Upon conclusion of the measurement period or final determination of the values of assets acquired or liabilities assumed, whichever comes first, any subsequent adjustments are recorded to our consolidated statements of comprehensive income. The Company estimates the fair value of the contingent consideration earnouts using the Monte Carlo Simulation and updates the fair value of the contingent consideration at each reporting period based on the estimated probability of achieving the earnout targets and applying a discount rate that captures the risk associated with the expected contingent payments. To the extent that our estimates change in the future regarding the likelihood of achieving these targets, we may need to record material adjustments to our accrued contingent consideration. Such changes in the fair value of contingent consideration are recorded as contingent consideration in our consolidated statements of comprehensive income. We recorded a net decrease to the fair value of the contingent consideration obligations for the twelve months ended December 31, 2023 of ($30.6) million primarily related to the change in estimated contingent consideration obligations from the acquisition of Avitide, Inc. (“Avitide”) in September 2021.

We use the income approach to determine the fair value of certain identifiable intangible assets including customer relationships and developed technology. This approach determines fair value by estimating after-tax cash flows attributable to these assets over their respective useful lives and then discounting these after-tax cash flows back to a present value. We base our assumptions on estimates of future cash flows, expected growth rates, expected trends in technology, etc. We base the discount rates used to arrive at a present value as of the date of acquisition on the time value of money and certain industry-specific risk factors. We believe the estimated purchased customer relationships, developed technologies, trademark/tradename, patents, non-competition agreements and in-process research and development ("R&D") amounts so determined represent the fair value at the date of acquisition and do not exceed the amount a third-party would pay for the assets.

Intangible assets and goodwill

Intangible assets

Intangible assets with a definite life are amortized over their useful lives using the straight-line method and the amortization expense is recorded within cost of product revenue, R&D and selling, general and administrative expense in the consolidated statements of comprehensive income. Intangible assets and their related useful lives are reviewed at least annually to determine if any adverse conditions exist, that would indicate the carrying value of these assets may not be recoverable. More frequent impairment assessments are conducted if certain conditions exist, including a change in the competitive landscape, any internal decisions to pursue new or different technology strategies, a loss of a significant customer, or a significant change in the marketplace, including changes in the prices paid for the Company’s products or changes in the size of the market for the Company’s products. If impairment indicators are present, the Company determines whether the underlying intangible asset is recoverable through estimated future undiscounted cash flows. If the asset is not found to be recoverable, it is written down to the estimated fair value of the asset based on the sum of the future discounted cash flows expected to result from the use and disposition of the asset. If the estimate of an intangible asset’s remaining useful life is changed, the remaining carrying amount of the intangible asset is amortized prospectively over the revised remaining useful life. The Company continues to believe that its definite-lived intangible assets are recoverable at December 31, 2023.

Indefinite-lived intangible assets are tested for impairment at least annually. There has been no impairment of our intangible assets for the periods presented.

Goodwill

We test goodwill for impairment on an annual basis and between annual tests if events and circumstances indicate it is more likely than not that the fair value of a reporting unit is less than its carrying value. Events that would indicate impairment and trigger an interim impairment assessment include, but are not limited to, macroeconomic conditions, industry and market conditions, entity specific factors such as strategies and financial performance, a significant adverse change in legal factors and an adverse action or assessment by a regulator. Goodwill is tested for impairment as of December 31st of each year, or more frequently as warranted by events or changes in circumstances mentioned above. Accounting guidance also permits an optional qualitative assessment for goodwill to determine whether it is more likely than not that the carrying value of a reporting unit exceeds its fair value. If, after this qualitative assessment, we determine that it is not more likely than not that the fair value of a reporting unit is less than its carrying amount, then no further quantitative testing would be necessary. A quantitative assessment is performed if the qualitative assessment results in a more likely than not determination or if a qualitative assessment is not performed. The quantitative assessment considers whether the carrying amount of a reporting unit exceeds its fair value, in which case an impairment charge is recorded to the extent the reporting unit's carrying value exceeds its fair value.

We operate as one reporting unit. We performed a qualitative assessment for our reporting unit as of December 31, 2023, 2022 and 2021. Based on the assessment, we concluded that it was more likely than not that the estimated fair value of our reporting unit for 2023, 2022 and 2021 was higher than its carrying value for such years, and that the performance of the quantitative impairment test was not required. Therefore, no impairment was required for any of the periods presented.

We have historically tested for impairment on our goodwill annually as of our measurement date of December 31st pursuant to Company policy. Subsequent to the 2023 annual impairment test, which was completed on December 31, 2023, we voluntarily changed our annual impairment assessment date from December 31st to October 1st, the first day of our fourth quarter, beginning on October 1, 2024. The change is being made to better align the annual impairment assessment date with our annual planning and budgeting process as well as the long-term planning and forecasting process. We have determined that this voluntary change in accounting principle is preferable and will not impact our consolidated financial statements nor is it being done to accelerate, avoid or trigger an impairment charge. This change is not going to be applied retrospectively as it is impracticable to do so because retrospective application would require application of significant estimates and assumptions with the use of hindsight. Therefore, the change will be applied prospectively.

Accrued liabilities

We estimate accrued liabilities by identifying services performed on our behalf, estimating the level of service performed and determining the associated cost incurred for such service as of each balance sheet date. For example, we would accrue for professional and consulting fees incurred with law firms, audit and accounting service providers and other third-party consultants. These expenses are determined by either requesting those service providers to estimate unbilled services at each reporting date for services incurred or tracking costs incurred by service providers under fixed fee arrangements.

We have processes in place to estimate the appropriate amounts to record for accrued liabilities, which principally involve the applicable personnel reviewing the services provided. In the event that we do not identify certain costs that have begun to be incurred or we under or over-estimate the level of services performed or the costs of such services, the reported expenses for that period may be too low or too high. The date on which certain services commence, the level of services performed on or before a given date, and the cost of such services often require the exercise of judgment. We make these judgments based upon the facts and circumstances known at the date of the financial statements.

A change in the estimated cost or volume of services provided could result in additional accrued liabilities. Any significant unanticipated changes in such estimates could have a significant impact on our accrued liabilities and reported operating results. There have been no material adjustments to our accrued liabilities in any of the periods presented in the accompanying consolidated financial statements.

Debt accounting

In December 2023, we issued $600.0 million aggregate principal amount of 1.00% Convertible Senior Notes due 2028 ("2023 Notes") in a private placement pursuant to separate, privately negotiated exchange and subscription agreements (the "Exchange and Subscription Agreements") with a limited number of holders of our outstanding 0.375% Convertible Senior Notes due 2024 ("2019 Notes") and certain other qualified institutional buyers pursuant to Rule 144A under the Securities Act of 1933, as amended. Pursuant to the Exchange and Subscription Agreements, we exchanged $217.7 million of our 2019 Notes for $309.9 million aggregate principal amount of the 2023 Notes (the "Exchange Transaction") and issued $290.1 million aggregate principal amount of the 2023 Notes in a private placement to accredited institutional buyers (the "Subscription

Transactions") for cash. Immediately following the closing of the aforementioned transactions, $69.7 million in aggregate principal amount of the 2019 Notes remained outstanding.

We evaluated the Exchange Transaction and determined approximately $29.6 million of the $217.7 million principal of the exchanged 2019 Notes were accounted for as extinguishments of debt and approximately $188.1 million were accounted for as modification of debt. As a result, we recognized a $12.7 million loss on extinguishment of debt in our consolidated statements of comprehensive income for the year ended December 31, 2023. This included unamortized debt issuance costs related to the extinguished 2019 Notes. Under modification accounting, the carrying amount of the modified 2019 Notes was reduced by $2.8 million, with the offset going to additional paid-in capital, to account for the increase in fair value of the embedded conversion option in the modification. The increase in principal, along with the increased option value, totaling $82.1 million, is reflected as a debt discount and is a direct reduction from the carrying value of the debt on our consolidated balance sheets. This amount will be accreted as an adjustment to interest expense using the effective interest method and will accrete up to the full face value of the 2023 Notes of $600.0 million.

Proceeds from the Subscription Transactions amounted to $276.1 million after debt issuance costs of $14.0 million. The exchange resulted in $6.2 million of the debt issuance costs related to the modified notes to be recorded to amortization of debt issuance costs in our 2023 consolidated statement of comprehensive income under the rules of modification accounting. The remaining debt issuance costs of $7.8 million as well as $0.7 million of unamortized costs carried over from the 2019 Notes at the exchange date, were capitalized within long-term debt (as a contra-liability) in our consolidated balance sheets as of December 31, 2023 and will be amortized as an adjustment to amortization of debt issuance costs over the five-year term of the 2023 Notes in our consolidated statement of comprehensive income. The carrying value of the 2023 Notes of $510.1 million is included in long-term debt on our consolidated balance sheets as of December 31, 2023.

Prior to the close of business on the business day immediately preceding September 15, 2028, the 2023 Notes will be convertible at the option of the holders of 2023 Notes only upon the satisfaction of specified conditions and during certain periods into cash up to their principal amount, and into cash, shares of the Company's common stock or a combination of cash and the Company's common stock, at the Company's election, for the conversion value above the principal amount, if any. Thereafter until the close of business on the second scheduled trading day immediately preceding the maturity date, the 2023 Notes will be convertible at the options of the holders of 2023 Notes at any time regardless of these conditions. The Company may redeem for cash, all or a portion of the 2023 Notes, at its option, on or after December 18, 2026 and prior to the 21st scheduled trading day immediately preceding the maturity date at a redemption price of 100% of the principal amount of the 2023 Notes to be redeemed, plus accrued and unpaid interest to, but excluding the redemption date, if certain conditions are met in accordance to the indenture.

Our short-term debt balance is related to our 2019 Notes, which were issued in July 2019. Prior to the adoption of Accounting Standards Update No. ("ASU") 2020-06, *"Debt - Debt with Conversion and Other Options (Subtopic 470-20) and Derivatives and Hedging - Contracts in Entity's Own Equity (Subtopic 815-40)",* the 2019 Notes were carried at their principal amount less unamortized debt discount and unamortized debt issuance costs. We had accounted for our convertible notes as separate liability and equity components prior to the adoption of 2020-06. We estimated the carrying amount of the liability component by estimating the fair value of a similar liability that did not have an associated conversion feature. The Company allocated transaction costs related to the issuance of convertible notes to the liability and equity components using the same proportions as the initial carrying value of the convertible notes. The carrying value of the equity component was calculated by deducting the carrying value of the liability component from the principal amount of the convertible notes as a whole. The difference represented a debt discount that, prior to the adoption of ASU 2020-06, was amortized to interest expense in our consolidated statements of comprehensive income over the term of the convertible notes using the effective interest rate method. We assessed the equity classification of the cash conversion feature quarterly. We allocated transaction costs related to the issuance of the 2019 Notes to the liability and equity components using the same proportions as the initial carrying value of the 2019 Notes. Effective January 1, 2022, the Company adopted ASU 2020-06. After adoption, the Company now accounts for the 2019 Notes as a single liability measured at amortized cost. See Note 14, *"Convertible Senior Notes,"* to our consolidated financial statements included in this report for more information on our adoption of ASU 2020-06.

During the fourth quarter of 2023, the closing price of the Company's common stock exceeded 130% of the conversion price of the 2019 Notes for more than 20 trading days of the last 30 consecutive trading days of the quarter. As a result, the remaining $69.7 million aggregate principal amount of 2019 Notes are convertible at the option of the holders of the 2019 Notes during the first quarter of 2024, the quarter immediately following the quarter when conditions are met, as stated in the terms of the 2019 Notes. These conditions have been met since the third quarter of 2020. Since the 2019 Notes mature within one year of the report date, we classify the carrying value of the 2019 Notes of $69.5 million as current liabilities on our consolidated balance sheets as of December 31, 2023.

Stock-based compensation

We use the Black-Scholes option pricing model to calculate the fair value of stock option awards on the grant date. The expected term of options granted represents the period of time for which the options are expected to be outstanding and is derived from our historical stock option exercise experience and option expiration data. For purposes of estimating the expected term, we have aggregated all individual option awards into one group, as we do not expect substantial differences in exercise behavior among our employees. The expected volatility is a measure of the amount by which our stock price is expected to fluctuate during the expected term of options granted. We determined the expected volatility based upon the historical volatility of our common stock over a period commensurate with the option's expected term. The risk-free interest rate is the implied yield available on U.S. treasury zero-coupon issues with a remaining term equal to the option's expected term on the grant date. We have never declared or paid any cash dividends on any of our capital stock and do not expect to do so in the foreseeable future. Accordingly, we use an expected dividend yield of zero to calculate the grant-date fair value of a stock option.

The fair value for stock units, which include restricted stock units and performance stock units, is calculated using the closing price of the Company's common stock on the date of grant. We recognize compensation expense on awards that vest based on service conditions on a straight-line basis over the requisite service period based upon the number of options that are ultimately expected to vest, and accordingly, such compensation expense has been adjusted by an amount of estimated forfeitures. We recognize compensation expense on awards that vest based on performance conditions following our assessment of the probability that the performance condition will be achieved over the service period. Forfeitures represent only the unvested portion of surrendered options, restricted stock units and performance stock units. Forfeitures are estimated at the time of grant and revised, if necessary, in subsequent periods if actual forfeitures differ from those estimates. Based on an analysis of historical data, we have calculated an 8% annual forfeiture rate for non-executive level employees, a 3% annual forfeiture rate for executive level employees, and a 0% forfeiture rate for non-employee members of the Board of Directors ("Board"), which we believe are reasonable assumptions to estimate forfeitures. However, the estimation of forfeitures requires significant judgment and, to the extent actual results or updated estimates differ from our current estimates, a cumulative adjustment to stock-based compensation expense will be recorded in the period estimates are revised.

For the years ended December 31, 2023, 2022 and 2021, we recorded stock-based compensation expense of $25.6 million, $27.3 million and $27.5 million, respectively, for share-based awards granted under all of the Company's stock plans.

As of December 31, 2023, there was $63.8 million of total unrecognized compensation cost related to unvested share-based awards. This cost is expected to be recognized over a weighted average remaining requisite service period of 2.84 years. We expect 2,185,873 unvested options and stock units to vest over the next five years.

Income taxes

Deferred taxes are determined based on the difference between the consolidated financial statements and tax basis of assets and liabilities using enacted tax rates in effect in the years in which the differences are expected to reverse. Valuation allowances are provided, if, based upon the weight of available evidence, it is more likely than not that some or all of the deferred tax assets will not be realized. We account for uncertain tax positions using a "more-likely-than-not" threshold for recognizing and resolving uncertain tax positions. The evaluation of uncertain tax positions is based on factors including, but not limited to, changes in tax law, the measurement of tax positions taken or expected to be taken in tax returns, the effective settlement of matters subject to audit, new audit activity and changes in facts or circumstances related to a tax position. We evaluate our tax position on a quarterly basis. We also accrue for potential interest and penalties related to unrecognized tax benefits in income tax expense. We are subject to a territorial tax system under the Tax Cuts and Jobs Act enacted in December 2017, in which we are required to provide for tax on Global Intangible Low-Taxed Income ("GILTI") earned by certain foreign subsidiaries. We adopted an accounting policy to provide for the tax expense related to GILTI in the year the tax is incurred as a period expense.

In addition, we are subject to the continual examination of our income tax returns by the U.S. Internal Revenue Service and other domestic and foreign tax authorities. We regularly assess the likelihood of outcomes resulting from these examinations to determine the adequacy of our provision for income taxes and have reserved for potential adjustments that may result from such examinations. We believe such estimates to be reasonable; however, the final determination of any of these examinations could significantly impact the amounts provided for income taxes in our consolidated financial statements.

Recent accounting standards update

See Note 2, *"Summary of Significant Accounting Policies – Recent Accounting Standards Updates,"* to our consolidated financial statements included in this report for more information.

Results of Operations

The following discussion of the financial condition and results of operations should be read in conjunction with the accompanying consolidated financial statements and the related footnotes thereto.

Revenues

Total revenues for years ended December 31, 2023 and 2022 were comprised of the following:

	For the Years Ended December 31,		2023 vs 2022	
	2023	2022	$ Change	% Change
	(Amounts in thousands, except for percentage data)			
Revenue:				
Product	$ 638,381	$ 801,183	$ (162,802)	(20.3%)
Royalty and other income	383	353	30	8.5%
Total revenue	$ 638,764	$ 801,536	$ (162,772)	(20.3%)

Product revenues

Since 2016, we have been increasingly focused on selling our products directly to customers in the pharmaceutical industry and to our contract manufacturers. These direct sales have represented 85.8% of our total product revenue during 2023 compared to 87.8% of our total product revenue in 2022. Sales of our bioprocessing products can be impacted by the timing of large-scale production orders and the regulatory approvals for such antibodies, which may result in significant quarterly fluctuations.

Product revenues were comprised of the following:

	For the Years Ended December 31,	
	2023[1]	2022
	(Amounts in thousands)	
Filtration products	$ 347,781	$ 495,930
Chromatography products	126,629	131,680
Process analytics products	56,820	53,512
Proteins products	103,463	114,320
Other	3,688	5,741
Total product revenue	$ 638,381	$ 801,183

(1) 2023 revenue for filtration products includes revenue related to FlexBiosys, Inc. ("FlexBiosys") from April 17, 2023, as well as Metenova Holding AB ("Metenova") from October 2, 2023.

(2) 2021 revenue for filtration products includes revenue related to Polymem S.A. ("Polymem") from July 1, 2021, as well as BioFlex Solutions LLC ("BioFlex") and Newton T&M Corp ("NTM") from December 16, 2021 through December 31, 2021. 2021 revenue for proteins products includes revenue related to Avitide from September 20, 2021 through December 31, 2021.

Revenue from the sale of our products which make up our filtration, chromatography, process analytics and proteins franchises comes from the sale of a number of products as described in Part I, Item 1. "*Business - Our Products*" of this report. Other revenue primarily consists of revenue from the sale of our operating room products to hospitals as well as freight revenue.

For 2023, product revenue decreased by $162.8 million, or 20.3%, as compared to 2022. This is mainly due to a decrease in revenue from programs related to COVID-19 as customers' inventory has reduced at a slower pace than initially expected, which has primarily affected revenue from sales of our filtration products. Partially offsetting these revenue declines in 2023, as compared to 2022, were price increases and strong performances within our chromatography and process analytics franchises, specifically from chromatography systems and flowpaths, as well as slope spectroscopy, consumables and service. The impact of our acquisitions of FlexBiosys and Metenova also increased revenue in 2023, as compared to 2022.

Sales of our bioprocessing products are impacted by the timing of orders, development efforts at our customers or end-users and regulatory approvals for biologics that incorporate our products, which may result in significant quarterly fluctuations. Such quarterly fluctuations are expected, but they may not be predictive of future revenue or otherwise indicate a trend.

Royalty revenues

Royalty revenues for all periods presented relate to royalties received from a third-party systems manufacturer associated with our OPUS® chromatography columns. Royalty revenues are variable and are dependent on sales generated by our partner.

Costs and operating expenses

Total costs and operating expenses for the years ended December 31, 2023 and 2022 were comprised of the following:

	For the Years Ended December 31,		2023 vs 2022	
	2023	2022	$ Change	% Change
	(Amounts in thousands, except for percentage data)			
Cost of product revenue	$ 353,922	$ 345,830	$ 8,092	2.3%
Research and development	42,722	43,936	(1,214)	(2.8)%
Selling, general and administrative	218,113	215,829	2,284	1.1%
Contingent consideration	(30,569)	(28,729)	(1,840)	6.4%
Total costs and operating expenses	$ 584,188	$ 576,866	$ 7,322	1.3%

Cost of product revenue

In 2023, cost of product revenue increased $8.1 million, or 2.3%, compared to 2022, primarily due to restructuring charges, including $23.6 million in inventory adjustments to reflect inventory at net realizable value, a $3.8 million charge for accelerated depreciation on equipment related to manufacturing facilities closed and $3.0 million in severance and other charges during 2023 as a result of our restructuring activities, which commenced in July 2023. See Note 5, "*Restructuring Plan*" of this report for more information on the restructuring activities to simplify and streamline our organization and strengthen our overall effectiveness of our operations ("Restructuring Plan"). Our restructuring activities include consolidating a portion of our manufacturing facilities between certain U.S. locations, discontinuing the sale of certain product SKUs, and evaluating the fair value of finished goods and raw materials secured during the COVID-19 Period to meet increasing demand during a challenging supply chain environment in the industry. Where demand has reduced, finished goods and raw materials, whose value exceeded the projected requirements to be used before reaching their expiration date, were written down to their net realizable value. The inventory adjustments include reserved values which may be recoverable in future periods, if salvageable. Also contributing to the increase in cost of product revenue is cost inflation, primarily in raw materials as well as freight charges due to fuel costs and carrier market conditions in 2023, compared to 2022. Also, our occupancy costs and depreciation expense increased during 2023, as compared to 2022, due to expanded facilities and manufacturing equipment being placed into service towards the end of 2022 and throughout 2023. These increases were partially offset by a decrease in costs associated with lower revenue as well as a decrease in employee-related costs not related to the restructuring activities in 2023, as compared to 2022.

Gross margin was 44.6% in 2023, compared to 56.9% in 2022. The reduction in gross margin in 2023 as compared to 2022, is primarily due to restructuring activities as noted above during 2023 to simplify and streamline our organization and strengthen the overall effectiveness of our operations for which there were no comparable costs in 2022. In addition, lower margins were a result of lower overall sales and production volumes, and a change in product mix, where we saw a significant decline in revenue associated with higher-margin consumable products due to the decrease in COVID-19 vaccine demand. We also experienced an increase in manufacturing costs from an increase in occupancy costs due to added capacity and an increase in depreciation expense.

Research and development expenses

R&D expenses are related to bioprocessing products, which include personnel, supplies and other research expenses. Due to the fact that these various programs share personnel and fixed costs, we do not track all of our expenses or allocate any fixed costs by program, and therefore, have not provided historical costs incurred by project.

R&D expenses decreased $1.2 million, or 2.8%, during 2023, compared to 2022. The decrease during the periods is primarily due to a decrease in occupancy costs for facilities where R&D work is performed, which more than offset the increase in employee-related costs, depreciation expense and spending on new product development during 2023, as compared to 2022.

R&D expense also includes payments made to expand our proteins product offering through our development agreement with Navigo Proteins GmbH ("Navigo"). Such expenses were $3.8 million in 2023, $2.6 million in 2022 and $2.3 million in 2021 in the form of milestone payments to Navigo.

Selling, general and administrative expenses

Selling, general and administrative ("SG&A") expenses include the costs associated with selling our commercial products and costs required to support our marketing efforts, including legal, accounting, patent, shareholder services, amortization of intangible assets and other administrative functions.

SG&A costs increased by $2.3 million, or 1.1%, in 2023, as compared to 2022 primarily due to an increase in SG&A costs related to the operations of FlexBiosys and Metenova, which have been included in our results of operations since their acquisition dates in April 2023 and October 2023, respectively. In addition, there were $1.7 million in one-time costs incurred from restructuring activities during 2023, for which there were no comparable costs in 2022. Partially offsetting this increase was a decrease in the amount of commissions paid out resulting from lower revenue and a decrease in employee-related costs.

Contingent consideration

Contingent consideration represents the change in fair value of the contingent consideration obligation included in current and noncurrent contingent consideration on the consolidated balance sheets as of the end of each period. Remeasurement of the contingent consideration obligation is done each quarter and the carrying value of the obligation is adjusted to the current fair value through our consolidated statements of comprehensive income. In 2023, 2022 and 2021, actual and expected results and a change in market inputs used to calculate the discount rate, resulted in adjustments to the fair value of the contingent consideration obligation for the years ended December 31, 2023, 2022 and 2021 of ($30.6) million, ($28.7) million and $5.9 million, respectively.

Other income (expenses), net

The table below provides detail regarding our other income (expenses), net:

	For the Years Ended December 31,		2023 vs 2022	
	2023	2022	$ Change	% Change
	(Amounts in thousands, except for percentage data)			
Investment income	$ 24,135	$ 6,978	$ 17,157	245.9%
Interest expense	(1,951)	(1,162)	(789)	67.9%
Loss on extinguishment of debt	(12,676)	—	(12,676)	100.0%
Amortization of debt issuance costs	(8,075)	(1,815)	(6,260)	344.9%
Other income (expenses)	8,123	(9,531)	17,654	(185.2)%
Total other income (expenses), net	$ 9,556	$ (5,530)	$ 15,086	(272.8)%

Investment income

Investment income includes income earned on invested cash balances. Our investment income increased by $17.2 million in 2023, as compared to 2022 due to an increase in interest rates on higher average invested cash balances since December 31, 2022, as well as interest earned on U.S. treasury bills purchased at the end of 2022.

Interest expense

Interest expense in 2023 is primarily from contractual coupon interest on the convertible debt outstanding as of December 31, 2023. On December 14, 2023, we entered into a privately negotiated exchange and subscription agreement with certain holders of the 2019 Notes and certain new investors pursuant to which we issued $600.0 million aggregate principal amount of the 2023 Notes. Interest expense in 2023 includes $1.0 million of interest on the 2019 Notes, compared to $1.1 million of interest expense on the 2019 Notes in 2022. Interest expense in 2023 also includes $0.3 million of contractual coupon interest on the 2023 Notes for which there were no comparable amounts in 2022 as well as $0.6 million in accretion of the $82.1 million debt discount on the modified notes, which includes the accretion of an increase in principal and the accretion of increased fair value of the conversion option in 2023, for which there were no comparable costs in 2022. See Note 14, *"Convertible Senior Notes,"* to our consolidated financial statements included in this report for more information on this transaction.

Loss on extinguishment of debt

In 2023, as part of the Exchange Transaction, we exchanged $217.7 million in aggregate principal amount of the 2019 Notes for $309.9 million in aggregate principal amount of the 2023 Notes. Upon evaluation of the Exchange Transaction, approximately $29.6 million, of the $217.7 million in aggregate principal amount of the 2019 Notes were deemed extinguished. As a result, we recorded a $12.7 million loss on extinguishment of debt in our consolidated statements of comprehensive income in 2023, which includes a $12.6 million write-off for the increase in principal of the converted notes being extinguished and a $0.1 million write-off of unamortized debt issuance costs related to the converted notes being extinguished.

Amortization of debt issuance costs

Transaction costs related to the issuance of the 2019 Notes and the 2023 Notes are amortized to amortization of debt issuance costs on the consolidated statements of comprehensive income. Amortization of debt issuance costs increased during 2023, as compared to 2022. Under ASC 470, *"Debt",* any third-party costs directly related to the modification or exchange are expensed as incurred. Therefore, in 2023, we recorded $6.4 million to amortization of debt issuance costs in accordance to this guidance, which included $6.2 million of debt issuance costs directly related to the modified notes and $0.2 million of amortization of the capitalized debt issuance costs.

Other income (expenses), net

The changes in other expenses, net in 2023, as compared to 2022, is primarily attributable to realized and unrealized foreign currency gains and losses related to transactions with customers and vendors, as well as the revaluation impact of intercompany loans with subsidiaries.

Income tax provision

Income tax provision for the years ended December 31, 2023 and 2022 was as follows:

	For the Years Ended December 31,		2023 vs 2022	
	2023	2022	$ Change	% Change
	(Amounts in thousands, except for percentage data)			
Income tax provision	$ 22,555	$ 33,181	$ (10,626)	(32.0)%
Effective tax rate	35.2%	15.1%		

For 2023, we recorded an income tax provision of $22.6 million. The effective tax rate was 35.2% for 2023 and is based upon the income for the year ended December 31, 2023 and the composition of income in different jurisdictions. The difference in effective tax rates between 2023 and 2022 was primarily due to a loss on extinguishment of debt and a debt discount basis difference, partially offset by increased benefits from business tax credits and nontaxable contingent consideration. Our effective tax rate for 2023 was higher than the U.S. statutory rate of 21% primarily due to a debt discount basis difference partially offset by business tax credits and nontaxable contingent consideration.

Non-GAAP Financial Measures

In addition to our key financial metrics presented above, we provide non-GAAP adjusted income from operations, adjusted net income and adjusted EBITDA as supplemental measures to accounting principles generally accepted in the United States ("GAAP") measures regarding our operating performance. These financial measures exclude the items detailed below and, therefore, have not been calculated in accordance with GAAP. A detailed explanation and a reconciliation of each non-GAAP financial measures to its most comparable GAAP financial measure are provided below.

We include this financial information because we believe these measures provide a more accurate comparison of our financial results between periods that more accurately reflects how management reviews its financial results and measures the performance of our ongoing operations for the periods in which such changes incurred. We excluded the impact of certain acquisition-related items and items related to the issuance of our 2023 Notes and 2019 Notes because we believe that the resulting charges do not accurately reflect the performance of our ongoing operations for the period in which such charges are incurred.

Non-GAAP adjusted income from operations

Non-GAAP adjusted income from operations is measured by taking income from operations as reported in accordance with GAAP and excluding inventory step-up charges, acquisition and integration costs, restructuring costs, contingent consideration fair value adjustments and intangible amortization booked through our consolidated statements of comprehensive income. The following is a reconciliation of income from operations in accordance with GAAP to non-GAAP adjusted income from operations for the years ended December 31, 2023 and 2022:

	For the Years Ended December 31,	
	2023	2022
	(Amounts in thousands)	
GAAP income from operations	$ 54,576	$ 224,670
Non-GAAP adjustments to income from operations:		
Inventory step-up charges	1,238	—
Acquisition and integration costs	5,861	9,253
Restructuring costs[(1)]	32,200	—
Contingent consideration	(30,569)	(28,729)
Intangible amortization	30,981	27,016
Non-GAAP adjusted income from operations	$ 94,287	$ 232,210

Non-GAAP adjusted net income and adjusted earnings per share

Non-GAAP adjusted net income and adjusted earnings per share is measured by taking net income as reported in accordance with GAAP and excluding inventory step-up charges, acquisition and integration costs, restructuring costs, contingent consideration fair value adjustments, intangible amortization, loss on extinguishment of debt, non-cash interest expense, amortization of debt issuance costs, foreign currency impact of certain intercompany loans and the tax effects on these items. The following are reconciliations of net income and fully diluted

earnings per share in accordance with GAAP to non-GAAP adjusted net income and adjusted fully diluted earnings per share for the years ended December 31, 2023 and 2022:

	For the Years Ended December 31,			
	2023		2022	
	Amount	Fully Diluted Earnings per Share*	Amount	Fully Diluted Earnings per Share*
	(Amounts in thousands, except per share data)			
GAAP net income	$ 41,577	$ 0.74	$ 185,959	$ 3.24
Non-GAAP adjustments to net income:				
Inventory step-up charges	1,238	0.02	—	—
Acquisition and integration costs	5,861	0.10	9,514	0.17
Restructuring costs[1]	32,200	0.57	—	—
Contingent consideration	(30,569)	(0.54)	(28,729)	(0.50)
Intangible amortization	30,981	0.55	27,016	0.47
Loss on extinguishment of debt	12,676	0.22	—	—
Non-cash interest expense	620	0.01	—	—
Amortization of debt issuance costs[2]	8,075	0.14	1,815	0.03
Foreign currency impact of certain intercompany loans[4]	(7,743)	(0.14)		
Tax effect of non-GAAP charges	3,485	0.06	(7,002)	(0.12)
Non-GAAP adjusted net income	$ 98,401	$ 1.75	$ 188,573	$ 3.28

* Note that earnings per share amounts may not add due to rounding.

Adjusted EBITDA

Adjusted EBITDA is measured by taking net income as reported in accordance with GAAP, excluding investment income, interest expense, amortization of debt issuance costs, income tax provision, depreciation and amortization, inventory step-up charges, acquisition and integration costs, restructuring costs, contingent consideration fair value adjustments booked through our consolidated statements of comprehensive income, loss on extinguishment of debt and foreign currency impact of certain intercompany loans. The following is a reconciliation of net income in accordance with GAAP to adjusted EBITDA for years ended December 31, 2023 and 2022:

	For the Years Ended December 31,	
	2023	2022
	(Amounts in thousands)	
GAAP net income	$ 41,577	$ 185,959
Non-GAAP EBITDA adjustments to net income:		
Investment income	(24,135)	(6,978)
Interest expense	1,951	1,162
Amortization of debt issuance costs	8,075	1,815
Income tax provision	22,555	33,181
Depreciation	36,994	23,859
Intangible amortization	31,091	27,126
EBITDA	118,108	266,124
Other non-GAAP adjustments:		
Inventory step-up charges	1,238	—
Acquisition and integration costs	5,861	9,514
Restructuring costs[1][3]	28,384	—
Contingent consideration	(30,569)	(28,729)
Loss on extinguishment of debt	12,676	—
Foreign currency impact of certain intercompany loans[4]	(7,743)	—
Adjusted EBITDA	$ 127,955	$ 246,909

(1) See Note 5, "*Restructuring Plan,*" in this report, for more information on the restructuring activities in 2023.

(2) See Note 2, "*Summary of Significant Accounting Policies - Earnings Per Share,*" in this report, for more information on the effects of adopting ASU 2020-06, "*Debt - Debt with Conversion and Other Options (Subtopic 470-20) and Derivatives and Hedging - Contracts in Entity's Own Equity (Subtopic 815-40),*" which we adopted effective January 1, 2022, to these financial statement line items.

(3) Excludes $3.8 million of accelerated depreciation related to the Restructuring Plan. This amount is included in the depreciation line item of this table.

(4) In 2023 we recorded foreign currency gains on certain intercompany loans. The impact was recorded to other income (expenses), net in our consolidated statements of comprehensive income.

Liquidity and Capital Resources

We have financed our operations primarily through revenues derived from product sales, the issuance of the 2016 Notes in May 2016, our 2019 Notes in July 2019, the 2023 Notes in December 2023 and the issuance of common stock in our December 2020, July 2019 and May 2019 public offerings. Our revenue for the foreseeable future will primarily be limited to our bioprocessing product revenue.

At December 31, 2023, we had cash and cash equivalents of $751.3 million compared to cash and cash equivalents of $523.5 million at December 31, 2022. There were no restrictions on cash as of December 31, 2023.

On March 10, 2023, Silicon Valley Bank ("SVB") was closed by the California Department of Financial Protection and Innovation, which appointed the Federal Deposit Insurance Corporation ("FDIC") as receiver. Subsequently, the U.S. Treasury, Federal Reserve and FDIC announced that SVB depositors would have access to all of their money. We have a banking relationship with SVB and hold cash, cash equivalents and marketable securities of $0.1 million as of December 31, 2023 in SVB depository accounts to cover short-term operational payments. While we have not experienced any losses in such accounts, the recent failure of SVB caused us to utilize our accounts at other financial institutions in order to mitigate potential operational risks stemming from the temporary inability to access funds in our SVB operating accounts. As a result of bank failures, such as SVB, our access to funding sources in amounts adequate to finance or capitalize our current and projected future business operations could be significantly impaired and could negatively impact the financial institutions with which we have direct arrangements, or the financial services industry or economy in general.

In 2023, we acquired two companies for an aggregate of $186.6 million in cash, net of cash acquired. In connection with the acquisitions, the Company has an obligation to pay up to $52.0 million (undiscounted) in contingent consideration earnout payments in cash over a two-year earnout period beginning January 1, 2023 and ending December 31, 2024). See Note 3, "*Fair Value Measurements,*" and Note 4, "*Acquisitions,*" for additional information.

On December 14, 2023, we issued $600.0 million aggregate principal amount of our 2023 Notes in Exchange and Subscription Agreements with a limited number of holders of our outstanding 2019 Notes and certain other investors. Pursuant to the Exchange and Subscription Agreements, we exchanged $217.7 million aggregate principal amount of the 2019 Notes for $309.9 million in aggregate principal amount of the 2023 Notes (the "Exchange Transaction") and issued $290.1 million aggregate principal amount of the 2023 Notes (the "Subscription Transactions") for $290.1 million in cash. Immediately following the closing of the aforementioned transactions, the exchanged 2019 Notes were cancelled and $69.7 million in aggregate principal amount of the 2019 Notes remained outstanding. We evaluated all exchanges and determined approximately $29.6 million of the exchanged notes were accounted for as extinguishment of debt and approximately $188.1 million were accounted for as modification of debt. As a result, we recognized a $12.7 million loss on extinguishment of debt on our consolidated statement of comprehensive income in 2023.

Proceeds from the Subscription Transactions amounted to $276.1 million after debt issuance costs of $14.0 million. The exchange resulted in $6.2 million of the debt issuance costs related to the modified notes to be recorded to amortization of debt issuance costs in our 2023 consolidated statement of comprehensive income under the rules of modification accounting. The remaining debt issuance costs of $7.8 million as well as $0.7 million of unamortized costs carried over from the 2019 Notes at the exchange date, were capitalized within long-term debt (as a contra-liability) in our consolidated balance sheets as of December 31, 2023 and will be amortized as an adjustment to amortization of debt issuance costs over the five-year term of the 2023 Notes in our consolidated statements of comprehensive income. The 2023 Notes are senior, unsecured obligations of the Company, and bear interest at a rate of 1.00% per year. Interest is payable semi-annually in arrears on each June 15 and December 15, commencing on June 15, 2024. The 2023 Notes will mature on December 15, 2028, unless earlier redeemed, repurchased or converted.

Prior to the close of business on the business day immediately preceding September 15, 2028, the 2023 Notes will be convertible at the option of the holders of 2023 Notes only upon the satisfaction of specified conditions and during certain periods into cash up to their principal amount, and into cash, shares of the Company's common stock or a combination of cash and the Company's common stock, at the Company's election, for the conversion value above the principal amount, if any. Thereafter until the close of business on the second scheduled trading day immediately preceding the maturity date, the 2023 Notes will be convertible at the options of the holders of 2023 Notes at any time regardless of these conditions.

During the fourth quarter of 2023, the closing price of our common stock exceeded 130% of the conversion price of the 2019 Notes for more than 20 trading days of the last 30 consecutive trading days of the quarter. As a result, the 2019 Notes are convertible at the option of the holders of the 2019 Notes during the first quarter of 2024, the quarter immediately following the quarter when the conditions are met, as stated in the terms of the 2019 Notes. These conditions have been met each quarter since the third quarter of 2020. As a result, as of the date of this filing and prior to the Exchange Transaction, we received requests to convert $0.2 million aggregate principal amount of the 2019 Notes and all but $0.1 million of the requests have been settled as of December 31, 2023. The remaining conversions will settle in the first quarter of 2024. The conversions resulted in the issuance of a nominal number of shares of our common stock to the note holders. Because the 2019 Notes mature within one year of the report date, we classify the carrying value of the 2019 Notes of $69.5 million as current liabilities on our consolidated balance sheets at December 31, 2023.

In 2023, our Board authorized the repurchase of up to $25.0 million of our common stock concurrent with the issuance of the 2023 Notes. The authorization does not obligate us to acquire a specific number of shares during any period and does not have an expiration date, but it may be modified, suspended, or discontinued at any time at the discretion of our Board. In December 2023, we used $14.4 million of cash of the proceeds from the issuance of the 2023 Notes to repurchase and retire 92,090 shares of our common stock at an average price of $156.22 per share, including $0.02 per share commission.

In 2023, we had lease arrangements for certain equipment and facilities including corporate and manufacturing sites. As of December 31, 2023, the Company had fixed lease payment obligations of $132.2 million, with $5.6 million payable within 12 months. See Note 6, *"Leases,"* for additional information.

In 2023, we had other purchase obligations primarily consisting of purchase commitments with certain vendors and open purchase orders for the procurement of raw materials for manufacturing. As of December 31, 2023, the Company had other purchase obligations of $34.3 million, payable within 12 months.

Cash flows

	For the Years Ended December 31,		2023 vs 2022
	2023	2022	$ Change
	(Amounts in thousands)		
Cash provided by (used in):			
Operating activities	$ 113,918	$ 172,083	$ (58,165)
Investing activities	(123,275)	(233,236)	109,961
Financing activities	248,961	(13,337)	262,298
Effect of exchange rate changes on cash, cash equivalents and restricted cash	(11,739)	(5,866)	(5,873)
Net increase (decrease) in cash, cash equivalents and restricted cash	$ 227,865	$ (80,356)	$ 308,221

Operating activities

For 2023, our operating activities provided cash of $113.9 million reflecting net income of $41.6 million and non-cash charges totaling $81.0 million primarily related to amortization of inventory step-up charges, depreciation, intangible amortization, amortization of debt discount and issuance costs, contingent consideration fair value adjustments, deferred income taxes, stock-based compensation charges and loss on extinguishment of debt. A decrease in inventory provided $41.0 million of which $23.6 million was related to the Restructuring Plan. An increase in prepaid expenses, primarily related to prepaid taxes and insurance as well as subscriptions, consumed $13.0 million. A decrease in accounts payable and accrued expenses consumed $37.7 million and was due to the timing of payments to vendors as well as the payment of employee bonuses related to 2022 during 2023. The remaining cash provided by operating activities resulted from favorable changes in various other working capital accounts.

For 2022, our operating activities provided cash of $172.1 million reflecting net income of $186.0 million and non-cash charges totaling $49.9 million primarily related to depreciation, amortization, contingent consideration adjustments, amortization of debt issuance costs, deferred income taxes and stock-based compensation charges. An increase in accounts receivable consumed $3.6 million of cash and was primarily driven by the 19.5% year-to-date increase in revenue in 2022, as compared to 2021. Additionally, we had an increase in inventory of $57.2 million to support expected increases in future revenue. Accounts payable decreased $8.2 million due to the timing of payments to vendors and accrued expenses decreased $2.0 million due to corporate income taxes paid. Offsetting these uses of cash was a $4.1 million net increase in operating lease liabilities due to new operating leases entered into during 2022 and a $2.4 million decrease in prepaid expenses, including corporate income taxes. The remaining cash used in operating activities resulted from unfavorable changes in various other working capital accounts.

Investing activities

Our investing activities consumed $123.3 million of cash in 2023, primarily due to $186.6 million in cash (net of cash received) used for the 2023 acquisitions of Metenova and FlexBiosys, in the aggregate. Capital expenditures consumed $39.0 million in 2023, as we continue to increase our manufacturing capacity worldwide. Of these expenditures, $2.8 million represented capitalized costs related to our internal-use software for 2023. These uses of cash were partially offset by the maturity of our short-term investment in U.S. treasury securities in June 2023, which provided cash of $102.3 million.

Our investing activities consumed $233.2 million of cash during 2022, mainly due to $88.3 million of capital expenditures in 2022 as we continued to increase our manufacturing capacity worldwide. Of these expenditures, $3.5 million represented capitalized costs related to our internal-use software for 2022. In addition, in September 2022, the Company paid a one-time, non-refundable, non-creditable upfront payment to Daylight as required under the Daylight Agreement for the commercialization and sale of Culpeo®QCL-IR Liquid Analyzer. In December 2022, the Company invested $100.0 million in short-term U.S. treasury securities.

Financing activities

In 2023, cash provided by financing activities of $249.0 million included $290.1 million of proceeds from the issuance of the 2023 Notes in December 2023 and proceeds from stock option exercises during 2023 were $1.1 million. Offsetting these activities was $14.4 million for the buyback of 92,090 shares of our common stock, $13.2 million in cash disbursed for shares withheld to cover employee income tax due upon the vesting and release of restricted stock units, $7.3 million paid for debt issuance costs related to the 2023 Notes and the payment of $7.3 million to settle the cash portion of the First Earnout Year contingent earnout obligation related to our acquisition of Avitide in September 2021.

Our financing activities consumed $13.3 million of cash in 2022, which included cash disbursed in relation to shares withheld to cover employee income tax due upon the vesting and release of restricted stock units of $17.0 million. This was partially offset by proceeds received from stock option exercises during the period of $3.7 million.

Working capital increased by $359.0 million to $952.9 million at December 31, 2023 from $593.9 million at December 31, 2022 due to various changes noted above, primarily the exchange of $217.7 million in aggregate principal of the 2019 Notes in December 2023.

Effect of exchange rate changes on cash, cash equivalents and restricted cash

The effect of exchange rate changes on cash during 2023 is a result of the strengthening of the Swedish krona against the U.S. dollar by 3%, the strengthening of the Euro against the U.S. dollar by 3% and the strengthening of the British pound against the U.S. dollar by 5%.

Off-Balance Sheet Arrangements

We do not have any special purpose entities or off-balance sheet financing arrangements.

Capital Requirements

Our future capital requirements will depend on many factors, including the following:

- the expansion of our bioprocessing business;
- the ability to sustain sales and profits of our bioprocessing products and successfully integrate them into our business;
- our ability to acquire additional bioprocessing products;
- the scope of and progress made in our R&D activities;

- the scope of investment in our intellectual property portfolio;
- contingent consideration earnout payments resulting from our acquisitions;
- the extent of any share repurchase activity;
- the success of any proposed financing efforts;
- general economic and capital markets;
- change in accounting standards;
- the impact of inflation on our operations, including our expenditures on raw material and freight charges;
- fluctuations in foreign currency exchange rates; and
- costs associated with our ability to comply with emerging environmental, social and governance standards.

Absent acquisitions of additional products, product candidates or intellectual property, we believe our current cash balances are adequate to meet our cash needs for at least the next 24 months. We expect operating expenses in 2024 to increase as we continue to expand our bioprocessing business. We expect to incur continued spending related to the development and expansion of our bioprocessing product lines and expansion of our commercial capabilities for the foreseeable future. Our future capital requirements may include, but are not limited to, purchases of property, plant and equipment, the acquisition of additional bioprocessing products and technologies to complement our existing manufacturing capabilities, and continued investment in our intellectual property portfolio.

We plan to continue to invest in our bioprocessing business and in key R&D activities associated with the development of new bioprocessing products. We actively evaluate various strategic transactions on an ongoing basis, including licensing or acquiring complementary products, technologies or businesses that would complement our existing portfolio. We continue to seek to acquire such potential assets that may offer us the best opportunity to create value for our shareholders. In order to acquire such assets, we may need to seek additional financing to fund these investments. If our available cash balances and anticipated cash flow from operations are insufficient to satisfy our liquidity requirements, for example, due to acquisition-related financing needs or lower demand for our products, among potential other events, we may seek to sell common or preferred equity or convertible debt securities, enter into a credit facility or another form of third-party funding, or seek other debt funding. The sale of equity and convertible debt securities may result in dilution to our shareholders, and those securities may have rights senior to those of our common shares. If we raise additional funds through the issuance of preferred stock, convertible debt securities or other debt financing, these securities or other debt could contain covenants that would restrict our operations. Any other third-party funding arrangement could require us to relinquish valuable rights. We may require additional capital beyond our currently anticipated amounts. Additional capital may not be available on reasonable terms, if at all.

Net Operating Loss Carryforwards

At December 31, 2023, we had federal net operating loss carryforwards of $31.1 million, state net operating loss carryforwards of $1.5 million, and foreign net operating loss carryforwards of $4.9 million. The state net operating loss carryforwards will expire at various dates through 2043, while the federal and foreign net operating loss carryforwards have unlimited carryforward periods and do not expire. We had federal and state business tax credits carryforwards of $5.0 million available to reduce future federal and state income taxes. The business tax credits carryforwards will expire at various dates through December 2043. Net operating loss carryforwards and available tax credits are subject to review and possible adjustment by the Internal Revenue Service, state and foreign jurisdictions and may be limited in the event of certain changes in the ownership interest of significant stockholders.

Foreign Earnings

As of December 31, 2023, we have accumulated undistributed earnings generated by our foreign subsidiaries of approximately $212.4 million. Because $5.7 million of such earnings have previously been subject to the one-time transition tax on foreign earnings required by the Tax Cuts and Jobs Act enacted in December 2017, any additional taxes due with respect to such earnings or the excess of the amount for financial reporting over the tax basis of our foreign investments would generally be limited to foreign and state taxes. At December 31, 2023, we have not provided for taxes on outside basis differences of our foreign subsidiaries as it is not practicable and we have the ability and intent to indefinitely reinvest the undistributed earnings of our foreign subsidiaries, and there are no needs for such earnings in the United States that would contradict our plan to indefinitely reinvest.

Effects of Inflation

Our assets are primarily monetary, consisting of cash and cash equivalents and marketable securities. Because of their liquidity, these assets are not directly affected by inflation. Since we intend to retain and continue to use our equipment, furniture, fixtures and office equipment, computer hardware and software and leasehold improvements, we believe that the incremental inflation related to replacement costs of such items will not materially affect our operations. However, the rate of inflation affects our expenses, such as those for employee compensation and contract services, which could increase our level of expenses and the rate at which we use our resources.

ITEM 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

We are exposed to market risk in the ordinary course of our business. Market risk represents the risk of loss that may impact our financial position due to adverse changes in financial market prices and rates. Our market risk exposure is primarily a result of fluctuations in interest rates and foreign currency exchange rates.

Interest Rate Risk

We have historically held investments in commercial paper, U.S. treasury and government securities as well as corporate bonds and other debt securities. As a result, we have been exposed to potential loss from market risks that may occur as a result of changes in interest rates, changes in credit quality of the issuer or otherwise. We do not have any such investments as of December 31, 2023. Our investment portfolio consists of cash and cash equivalents (cash and money market funds) that total $751.3 million on the consolidated balance sheets as of December 31, 2023. Our cash equivalent investments (money market funds) have short-term maturity periods that dampen the impact of market or interest rate risk. As a result, a hypothetical 100 basis point increase in interest rates would have no effect on our cash position as of December 31, 2023.

We manage our investment portfolio in accordance with our investment policy or approval by the Board of Directors. The primary objectives of our investment policy are to preserve principal, maintain a high degree of liquidity to meet operating and other needs, and obtain competitive returns subject to prevailing market conditions without significantly increasing risk. To achieve this objective, we maintain our portfolio of cash equivalents in high-quality securities, including money market funds.

Foreign Exchange Risk

The reporting currency of the Company is U.S. dollars, and the functional currency of each of our foreign subsidiaries is its respective local currency. Our foreign currency exposures include the Swedish krona, Euro, British pound, Chinese yuan, Japanese yen, Singapore dollar, South Korean won and Indian rupee; of these, the primary foreign currency exposures are the Swedish krona, Euro and Chinese yuan. Exchange gains or losses resulting from the translation between the transactional currency and the functional currency are included in net income. Fluctuations in exchange rates may adversely affect our results of operations, financial position and cash flows. We currently do not seek to hedge this exposure to fluctuations in exchange rates.

Although a majority of our contracts are denominated in U.S. dollars, 38.5% and 38.2% of total revenues were denominated in foreign currencies during 2023 and 2022, respectively.

ITEM 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

Financial statements and supplementary data required by Item 8 are set forth at the pages indicated in Item 15(a) below and are incorporated herein by reference.

ITEM 9. CHANGES IN AND DISAGREEMENTS WITH ACCOUNTANTS ON ACCOUNTING AND FINANCIAL DISCLOSURE.

None.

ITEM 9A. CONTROLS AND PROCEDURES

(a) Disclosure Controls and Procedures.

The Company's management, with the participation of our principal executive officer and principal financial officer, has evaluated the effectiveness of the Company's disclosure controls and procedures (as defined in Rules 13a-15(e) or 15d-15(e) under the Securities Exchange Act of 1934 ("Exchange Act") and as required by paragraph (b) of Rules 13a-15 or 15d-15 under the Exchange Act) as of the end of the period covered by this report. Based on such evaluation, our principal executive officer and principal financial officer have concluded that, as of December 31, 2023, the Company's disclosure controls and procedures were not effective as of such date due to a material weakness in our internal control over financial reporting, as described below.

(b) Report of Management on Internal Control Over Financial Reporting.

Management of the Company is responsible for establishing and maintaining adequate internal control over financial reporting. Internal control over financial reporting is defined in Rule 13a-15(f) and 15d-15(f) under the Exchange Act as a process designed by, or under the supervision of, the Company's principal executive and principal financial officers and effected by the Company's Board of Directors ("Board"), management and other personnel, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with U.S. generally accepted accounting principles and includes those policies and procedures that:

- pertain to the maintenance of records that in reasonable detail accurately and fairly reflect the transactions and dispositions of the assets of the Company;
- provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the Company are being made only in accordance with authorizations of management and directors of the Company; and
- provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use or disposition of the Company's assets that could have a material effect on the financial statements.

Management assessed the effectiveness of the Company's internal control over financial reporting as of December 31, 2023. In making this assessment, management used the criteria established in *Internal Control – Integrated Framework*, issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework) (COSO).

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Projections of any evaluation of effectiveness to future periods are subject to the risks that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

We acquired FlexBiosys Inc. ("FlexBiosys") on April 17, 2023 and Metenova Holding AB ("Metenova") on October 2, 2023. The financial results of each of these acquisitions are included in our audited consolidated financial statements as of December 31, 2023. The Company's consolidated total assets as of December 31, 2023 includes $43.7 million and $197.2 million from the FlexBiosys and Metenova businesses, respectively. The Company's consolidated revenue for the year ended December 31, 2023 includes $2.5 million and $5.0 million from the FlexBiosys and Metenova businesses, respectively. As these acquisitions occurred during 2023, the scope of our assessment of our internal control over financial reporting does not include these acquisitions. These exclusions are in accordance with the Security and Exchange Commission's general guidance that an assessment of a recently acquired business may be omitted from our scope in the year of such acquisition.

In connection with our initiative to integrate and enhance our global information technology systems and business processes, we continued the phased implementation of a new enterprise resource planning ("ERP") system. The Company is implementing the ERP system in phases and will continue until all current and future subsidiaries are using it. The fifth phase of implementation was completed during the second

quarter of 2023. As a result of this implementation, we modified certain existing internal control over financial reporting as well as implemented new controls and procedures related to the new ERP system as of December 31, 2023.

In conjunction with management's assessment of internal control over financial reporting in the fourth quarter of 2023, management identified a material weakness in the operation of our controls over the deferred income tax accounting for complex and non-routine transactions. Specifically, management did not have adequate supervision and review controls over the complex accounting for deferred income tax on the exchange of our outstanding 0.375% Convertible Senior Notes due 2024 and the issuance of 1.00% Convertible Senior Notes due 2028, including work performed by external advisors and the internal review of such transaction and related analyses. This material weakness did not result in an error in any of our previously issued consolidated financial statements including the consolidated financial statements as of and for the year ended December 31, 2023. Based on this material weakness, the Company's management concluded that at December 31, 2023, the Company's internal control over financial reporting was not effective.

Income tax accounting related to non-routine transactions

Following identification of the material weakness, and as part of our commitment to strengthen our internal control over financial reporting, we are implementing remedial actions under the oversight of the Audit Committee of our Board to address these deficiencies. On highly-technical, non-routine and complex accounting transactions, we will continue to engage nationally recognized third-party advisors with the requisite skills and technical expertise to assist us in assessing, performing and reviewing such transactions; however we will:

- Improve our process to identify and select qualified third-party advisors, including enhanced review of capabilities and work performed, specifically related to the review of tax advice and related accounting guidance.
- Implement a process to verify the controls, processes and internal reviews performed by third-party advisors.
- Consider whether the non-routine transaction warrants additional advisor oversight or validation of analyses based on complexity or changes in applicable regulations.
- Increase education for internal resources on complex transactions to enhance diligence capabilities with third-party advisors.

We will continue to monitor the design and operating effectiveness of these and other processes, procedures and controls and make any further changes management determines appropriate.

Our CEO and CFO have certified that, based on their knowledge, our consolidated financial statements and other financial information included in this Annual Report on Form 10-K ("Form 10-K"), fairly present, in all material respects, our financial condition, results of operations and cash flows as of, and for, the periods presented in this Form 10-K.

Ernst & Young LLP, the independent registered public accounting firm that audited our consolidated financial statements included in this Form 10-K, has issued an unqualified opinion on our consolidated financial statements and has issued an attestation report on our internal control over financial reporting as of December 31, 2023.

Changes in Internal Control Over Financial Reporting

Except for the material weakness described above, there has been no change in our internal control over financial reporting as defined in Rules 13a-15(f) and 15d-15(f) that occurred during the quarter ended December 31, 2023 that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting. Consolidated financial statements reflected in our current Form 10-K are accurately stated.

(c) Attestation Report of the Independent Registered Public Accounting Firm.

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the Stockholders and the Board of Directors of Repligen Corporation:

Opinion on Internal Control Over Financial Reporting

We have audited Repligen Corporation's internal control over financial reporting as of December 31, 2023, based on criteria established in Internal Control—Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework) (the COSO criteria). In our opinion, because of the effect of the material weakness described below on the achievement of the objectives of the control criteria, Repligen Corporation (the Company) has not maintained effective internal control over financial reporting as of December 31, 2023, based on the COSO criteria.

As indicated in the accompanying Report of Management on Internal Control Over Financial Reporting, management's assessment of and conclusion on the effectiveness of internal control over financial reporting did not include the internal controls of Metenova Holding AB ("Metenova") and FlexBiosys Inc. ("FlexBiosys"), which is included in the 2023 consolidated financial statements of the Company and constituted $197.2 million and $43.7 million of total assets, respectively, as of December 31, 2023 and $5.0 million and $2.5 million of revenues, respectively, for the year then ended. Our audit of internal control over financial reporting of the Company also did not include an evaluation of the internal control over financial reporting of Metenova and FlexBiosys.

A material weakness is a deficiency, or combination of deficiencies, in internal control over financial reporting, such that there is a reasonable possibility that a material misstatement of the company's annual or interim financial statements will not be prevented or detected on a timely basis. The following material weakness has been identified and included in management's assessment. Management has identified a material weakness in controls related to income tax accounting related to non-routine transactions.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the consolidated balance sheets of the Company as of December 31, 2023 and 2022, the related consolidated statements of comprehensive income, stockholders' equity and cash flows for each of the three years in the period ended December 31, 2023, and the related notes. This material weakness was considered in determining the nature, timing and extent of audit tests applied in our audit of the 2023 consolidated financial statements, and this report does not affect our report dated February 22, 2024, which expressed an unqualified opinion thereon.

Basis for Opinion

The Company's management is responsible for maintaining effective internal control over financial reporting and for its assessment of the effectiveness of internal control over financial reporting included in the accompanying Report of Management on Internal Control Over Financial Reporting. Our responsibility is to express an opinion on the Company's internal control over financial reporting based on our audit. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether effective internal control over financial reporting was maintained in all material respects.

Our audit included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, testing and evaluating the design and operating effectiveness of internal control based on the assessed risk, and performing such other procedures as we considered necessary in the circumstances. We believe that our audit provides a reasonable basis for our opinion.

Definition and Limitations of Internal Control Over Financial Reporting

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

/s/ Ernst & Young LLP

Boston, Massachusetts
February 22, 2024

(d) Changes in Internal Control Over Financial Reporting

There have been no changes in our internal control over financial reporting identified in connection with the evaluation required by paragraph (d) of Exchange Act Rule 13a-15 or Rule 15d-15 that occurred in the three months ended December 31, 2023 that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

ITEM 9B. OTHER INFORMATION

Rule 10b5-1 Trading Plans

During the fourth quarter of 2023, Tony J. Hunt, Chief Executive Officer, adopted a trading plan intended to satisfy Rule 10b5-1(c) under the Securities Exchange Act of 1934 ("Exchange Act") on November 9, 2023 to sell up to 78,216 shares of our common stock between March 8, 2024 and November 15, 2024, the date this plan expires. The trading plan will cease upon the earlier of November 15, 2024 or the sale of all shares subject to the trading plan.

During the fourth quarter of 2023, none of our other directors or officers (as defined in Rule 16a-1(f) of the Exchange Act) adopted, modified, or terminated a Rule 10b5-1 trading arrangement.

ITEM 9C. DISCLOSURE REGARDING FOREIGN JURISDICTIONS THAT PREVENT INSPECTIONS

Not applicable.

PART III

Pursuant to General Instructions G to Form 10-K, the information required for Part III, Items 10, 11, 12, 13 and 14, is incorporated herein by reference from the Company's proxy statement for the 2024 Annual Meeting of Stockholders.

PART IV

ITEM 15. EXHIBITS AND FINANCIAL STATEMENT SCHEDULES

The following documents are filed as part of this Annual Report on Form 10-K ("Form 10-K"):

(a) (1) *Financial Statements*:

The financial statements required by this item are submitted in a separate section beginning on page 67 of this report, as follows:

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(a) (2) *Financial Statement Schedules*:

None.

(a) (3) *Exhibits*:

The Exhibits which are filed as part of this Form 10-K or which are incorporated by reference are set forth in the Exhibit Index hereto.

EXHIBIT INDEX

Exhibit Number	Document Description
3.1	Restated Certificate of Incorporation dated June 30, 1992, as amended September 17, 1999 (filed as Exhibit 3.1 to Repligen Corporation's Quarterly Report on Form 10-Q for the quarter ended September 30, 1999 and incorporated herein by reference).
3.2	Certificate of Amendment to the Certificate of Incorporation of Repligen Corporation, effective as of May 16, 2014 (filed as Exhibit 3.1 to Repligen Corporation's Current Report on Form 8-K filed on May 19, 2014 and incorporated herein by reference).
3.3	Certificate of Amendment to the Certificate of Incorporation of Repligen Corporation, effective as of May 19, 2023 (filed as Exhibit 3.1 to Repligen Corporation's Current Report on Form 8-K filed on May 22, 2023 and incorporated herein by reference).
3.4	Third Amended and Restated Bylaws (filed as Exhibit 3.1 to Repligen Corporation's Current Report on Form 8-K filed on January 28, 2021 and incorporated herein by reference).
4.1	Specimen Stock Certificate (filed as Exhibit 4.1 to Repligen Corporation's Annual Report on Form 10-K for the year ended March 31, 2002 and incorporated herein by reference).
4.2	Base Indenture, dated as of July 19, 2019, by and between Repligen Corporation and Wilmington Trust, National Association (filed as Exhibit 4.1 to Repligen Corporation's Current Report on Form 8-K filed on July 22, 2019 and incorporated herein by reference).
4.3	First Supplemental Indenture, dated as of July 19, 2019, by and between Repligen Corporation and Wilmington Trust, National Association (filed as Exhibit 4.2 to Repligen Corporation's Current Report on Form 8-K filed on July 22, 2019 and incorporated herein by reference).
4.4	Second Supplemental Indenture, dated as of March 4, 2022, by and between Repligen Corporation and Wilmington Trust, National Association, as trustee (filed as Exhibit 4.1 to Repligen Corporation's Form 8-K filed on March 8, 2022).
4.5	Form of 0.375% Convertible Senior Notes due 2024 (included in Exhibit 4.3).
4.6	Base Indenture, dated as of December 14, 2023, by and between Repligen Corporation and Wilmington Trust, National Association (filed as Exhibit 4.1 to Repligen Corporation's Current Report on Form 8-K filed on December 15, 2023 and incorporated herein by reference).
4.7	Form of 1.00% Convertible Senior Notes due 2028 (included in Exhibit 4.6).
4.8	Description of Certain Registrant's Securities (filed as Exhibit 4.5 to Repligen Corporation's Annual Report on Form 10-K for the year ended December 31, 2019 and incorporated by reference).
10.1*	Repligen Executive Incentive Compensation Plan (filed as Exhibit 10.1 to Repligen Corporation's Current Report on Form 8-K filed on December 14, 2005 and incorporated herein by reference).
10.2	Lease Between Repligen Corporation as Tenant and West Seyon LLC as Landlord, 35 Seyon Street, Waltham, MA (as amended to date) (filed as Exhibit 10.4 to Repligen Corporation's Annual Report on Form 10-K for the year ended December 31, 2019 and incorporated herein by reference).
10.3#	Strategic Supplier Alliance Agreement dated January 28, 2010 by and between Repligen Corporation and GE Healthcare Bio-Sciences AB (as amended to date) (filed as Exhibit 10.1 to Repligen Corporation's Quarterly Report on Form 10-Q for the quarter ended March 31, 2016 and incorporated herein by reference).
10.4*	Repligen Corporation Amended and Restated 2012 Stock Option and Incentive Plan (filed as Exhibit 99.1 to Repligen Corporation's Form S-8 filed on June 2, 2014 and incorporated herein by reference).

10.5*+	Repligen Corporation Amended and Restated Non-Employee Directors' Compensation Policy.
10.6	Form of Indemnification Agreement (filed as Exhibit 10.1 to Repligen Corporation's Current Report on Form 8-K filed on May 12, 2016 and incorporated herein by reference).
10.7	Lease Agreement, dated February 6, 2018, by and between Repligen Corporation and U.S. REIF 111 Locke Drive Massachusetts, LLC (filed as Exhibit 10.1 to Repligen Corporation's Current Report on Form 8-K filed on February 8, 2018 and incorporated herein by reference).
10.8*	2018 Repligen Corporation Stock Option and Incentive Plan (filed as Exhibit 10.1 to Repligen Corporation's Quarterly Report on Form 10-Q for the quarter ended June 30, 2018 and incorporated herein by reference).
10.9*	Letter Agreement, dated as of September 3, 2016 by and between Repligen Corporation and Ralf Kuriyel (filed as Exhibit 10.17 to Repligen Corporation's Annual Report on Form 10-K for the year ended December 31, 2018 and incorporated herein by reference).
10.10*	Repligen Corporation Amended and Restated Severance and Change in Control Plan, effective as of May 26, 2022 (filed as Exhibit 10.1 to Repligen Corporation's Form 8-K filed June 1, 2022).
10.11*	Employment Agreement, dated as of September 8, 2023, by and between Repligen Corporation and Olivier Loeillot (filed as Exhibit 10.1 to Repligen Corporation's Form 10-Q for the quarter ended September 30, 2023).
10.12*	Employment Agreement, dated as of September 8, 2023, by and between Repligen Corporation and Jason Garland (filed as Exhibit 10.1 to Repligen Corporation's Current Report on Form 8-K filed on September 12, 2023).
10.13	First Amendment to Lease Agreement, dated as of July 7, 2020 by and between Repligen Corporation and U.S. REIF 111 Locke Drive Massachusetts, LLC (filed as Exhibit 10.1 to Repligen Corporation's Current Report on Form 8-K filed on July 10, 2020 and incorporated herein by reference).
10.14*	Repligen Corporation 2018 Stock Option and Incentive Plan, Sub-Plan for French-Qualified Restricted Stock Units (filed as Exhibit 10.1 to Repligen Corporation's Form 10-Q for the quarter ended June 30, 2021 and incorporated herein by reference).
19.1	Repligen Corporation Amended and Restated Statement of Company Policy on Insider Trading and Disclosure & Trading Procedures for Insiders.
21.1+	Subsidiaries of the Registrant.
23.1+	Consent of Ernst & Young LLP, Independent Registered Accounting Firm.
24.1+	Power of Attorney (included on signature page).
31.1+	Rule 13a-14(a)/15d-14(a) Certification.
31.2+	Rule 13a-14(a)/15d-14(a) Certification.
32.1+	Certification Pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.
97.1	Repligen Corporation Compensation Recovery Policy.
101.INS	Inline XBRL Instance Document-the instance document does not appear in the Interactive Data File because its XBRL tags are embedded within the Inline XBRL document.
101.SCH	Inline XBRL Taxonomy Extension Schema With Embedded Linkbase Documents.
104	Cover page formatted as Inline XBRL and contained in Exhibits 101.*).

Confidential treatment obtained as to certain portions.

* Management contract or compensatory plan or arrangement.

+ Filed electronically herewith.

The exhibits listed above are not contained in the copy of the Annual Report on Form 10-K distributed to stockholders. Upon the request of any stockholder entitled to vote at the 2024 Annual Meeting, the Registrant will furnish that person without charge a copy of any exhibits listed above. Requests should be addressed to Repligen Corporation, 41 Seyon Street, Waltham, MA 02453.

ITEM 16. 10-K SUMMARY

We may voluntarily include a summary of information required by Annual Report on Form 10-K under Item 16. We have elected not to include such summary information.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

REPLIGEN CORPORATION

Date: February 22, 2024

By: /S/ TONY J. HUNT

Tony J. Hunt

Chief Executive Officer

POWER OF ATTORNEY

KNOW ALL PERSONS BY THESE PRESENTS, that each person whose signature appears below hereby makes, constitutes and appoints Tony J. Hunt and Jason K. Garland with full power to act without the other, his true and lawful attorney-in-fact and agent, with full power of substitution and resubstitution, for him and in his name, place and stead, in any and all capacities to sign any or all amendments to this Annual Report on Form 10-K, and to file the same with all exhibits thereto, and other documents in connection therewith, with the Securities and Exchange Commission, granting unto said attorney-in-fact and agents, and each of them, full power and authority to do and perform each and every act and thing requisite and necessary to be done in connection therewith, as fully to all intents and purposes as he might or could do in person, hereby ratifying and confirming all that said attorney-in-fact and agents of any of them, or any substitute or substitutes, lawfully do or cause to be done by virtue hereof.

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the registrant and in the capacities and on the dates indicated.

Signature	Title	Date
/S/ TONY J. HUNT **Tony J. Hunt**	Chief Executive Officer and Director (Principal executive officer)	February 22, 2024
/S/ JASON K. GARLAND **Jason K. Garland**	Chief Financial Officer (Principal financial and accounting officer)	February 22, 2024
/S/ KAREN DAWES **Karen Dawes**	Chairperson of the Board	February 22, 2024
/S/ NICOLAS M. BARTHELEMY **Nicolas M. Barthelemy**	Director	February 22, 2024
/S/ CARRIE EGLINTON MANNER **Carrie Eglinton Manner**	Director	February 22, 2024
/S/ KONSTANTIN KONSTANTINOV **Konstantin Konstantinov**	Director	February 22, 2024
/S/ MARTIN D. MADAUS **Martin D. Madaus**	Director	February 22, 2024
/S/ ROHIN MHATRE **Rohin Mhatre**	Director	February 22, 2024
/S/ GLENN P. MUIR **Glenn P. Muir**	Director	February 22, 2024

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REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the Stockholders and the Board of Directors of Repligen Corporation:

Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheets of Repligen Corporation (the Company) as of December 31, 2023 and 2022, the related consolidated statements of comprehensive income, stockholders' equity and cash flows for each of the three years in the period ended December 31, 2023, and the related notes (collectively referred to as the "consolidated financial statements"). In our opinion, the consolidated financial statements present fairly, in all material respects, the financial position of the Company at December 31, 2023 and 2022, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2023, in conformity with U.S. generally accepted accounting principles.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the Company's internal control over financial reporting as of December 31, 2023, based on criteria established in Internal Control—Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework), and our report dated February 22, 2024 expressed an adverse opinion thereon.

Adoption of ASU No. 2020-06

As discussed in Note 2 to the consolidated financial statements, the Company changed its method for accounting for convertible debt in 2022 due to the adoption of ASU No. 2020-06, *Debt - Debt with Conversion and Other Options (Subtopic 470-20).*

Basis for Opinion

These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on the Company's financial statements based on our audits. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. Our audits included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audits provide a reasonable basis for our opinion.

Critical Audit Matters

The critical audit matters communicated below are matters arising from the current period audit of the financial statements that were communicated or required to be communicated to the audit committee and that: (1) relate to accounts or disclosures that are material to the financial statements and (2) involved our especially challenging, subjective or complex judgments. The communication of critical audit matters does not alter in any way our opinion on the consolidated financial statements, taken as a whole, and we are not, by communicating the critical audit matters below, providing separate opinions on the critical audit matters or on the accounts or disclosures to which they relate.

Accounting for acquisitions

Description of the Matter

As disclosed in Note 4 to the consolidated financial statements, during 2023, the Company completed two acquisitions. The most significant of the two acquisitions was the acquisition of Metenova Holding AB for total consideration of approximately $172.6 million. The transactions were accounted for as business combinations.

Auditing the Company's accounting for its acquisition of Metenova Holding AB was complex due to the significant estimation uncertainty in the Company's determination of the fair value of identified intangible assets of $58.8 million, which principally consisted of customer relationships and developed technology. The significant estimation uncertainty

was primarily due to the sensitivity of the respective customer relationship and developed technology fair values to underlying assumptions about the future performance of the acquired business. The Company used a discounted cash flow model to measure the customer relationship and developed technology intangible assets. The significant assumptions used to estimate the value of the intangible assets included discount rates and certain assumptions that form the basis of the forecasted results, including revenue growth, and cost of revenues and operating expenses as a percentage of revenue. These significant assumptions are forward looking and could be affected by future economic and market conditions.

How We Addressed the Matter in Our Audit

We tested the Company's controls over its accounting for acquisitions. Our tests included controls over the determination of the fair value of customer relationship and developed technology intangible assets. We also tested management's review of assumptions used in the valuation models.

To test the estimated fair value of the customer relationship and developed technology intangible assets, we performed audit procedures that included, among others, evaluating the Company's selection of the valuation methodology, evaluating the methods and significant assumptions used by the Company, and evaluating the completeness and accuracy of the underlying data supporting the significant assumptions and estimates. This includes comparing the significant assumptions to current industry, market and economic trends, to the assumptions used to value similar assets in other acquisitions, to the historical results of the acquired business and to other guidelines used by companies within the same industry. We involved our valuation professionals to assist in our evaluation of the methodology used by the Company and significant assumptions included in the fair value estimates.

Accounting for convertible notes

Description of the Matter

As disclosed in Note 14 to the consolidated financial statements, during 2023, the Company issued $600.0 million aggregate principal amount of 1.00% Convertible Senior Notes due in 2028 (the "2023 Notes"). The Company privately negotiated exchange and subscription agreements (the "Exchange and Subscription Agreements") with a limited number of holders of its outstanding 2019 Notes and certain other qualified institutional buyers. Pursuant to the Exchange and Subscription Agreements, the Company exchanged $217.7 million of its 2019 Notes for $309.9 million aggregate principal of the 2023 Notes (the "Exchange Transaction") and issued $290.1 million aggregate principal amount of the 2023 Notes in a private placement to accredited institutional buyers (the "Subscription Transactions") for $290.1 million in cash. The Company evaluated the Exchange Transaction for extinguishment or modification accounting and recorded an extinguishment loss of $12.7 million and an aggregate debt discount of $82.1 million related to the settlement of the Exchange Transaction.

Auditing the accounting treatment for the 2023 Notes and the Exchange Transaction involved especially challenging and complex auditor judgment and required team members with specialized knowledge and skills in accounting and valuation in order to evaluate the Company's accounting assessment, and the determination of the related extinguishment loss upon settlement of the Exchange Transaction.

How We Addressed the Matter in Our Audit

We obtained an understanding, evaluated the design and tested the operating effectiveness of the Company's controls over the issuance of the 2023 Notes and the accounting for the Exchange Transaction, including the valuation of the conversion feature used in the extinguishment test and incorporated into the accounting assessment for the Exchange Transaction to determine the extinguishment loss and debt discount recorded.

Our testing of the Company's accounting for the issuance of the 2023 Notes and Exchange Transaction included, among other procedures, inspection of the underlying Exchange and Subscription Agreements and testing management's application of the relevant accounting guidance. To test the Exchange Transaction, we evaluated the Company's extinguishment accounting assessment, including the Company's determination of the change in fair value of the conversion feature associated with the Exchange Transaction, which included testing the appropriateness of the methodology and underlying assumptions used to determine such fair value. We involved our valuation professionals to assist in our evaluation of the valuation methodology used by the Company and significant assumptions included in the fair value estimate. Also, we tested the Company's key inputs into the calculation of the extinguishment loss and evaluated the appropriateness of the Company's disclosures.

/s/ Ernst & Young LLP

We have served as the Company's auditor since 2002.

Boston, Massachusetts
February 22, 2024

REPLIGEN CORPORATION
CONSOLIDATED BALANCE SHEETS
(Amounts in thousands, except share data)

	December 31, 2023	December 31, 2022
ASSETS		
Current assets:		
Cash and cash equivalents	$ 751,323	$ 523,458
Marketable securities held to maturity	—	100,299
Accounts receivable, net of reserves of $2,122 and $1,365 at December 31, 2023 and December 31, 2022, respectively	124,161	116,247
Inventories, net	202,321	238,277
Prepaid expenses and other current assets	33,238	19,837
Total current assets	1,111,043	998,118
Noncurrent assets:		
Property, plant and equipment, net	207,440	190,673
Intangible assets, net	400,486	353,676
Goodwill	987,120	855,513
Deferred tax assets	1,530	840
Operating lease right of use assets	115,515	125,023
Other noncurrent assets	1,277	815
Total noncurrent assets	1,713,368	1,526,540
Total assets	$ 2,824,411	$ 2,524,658
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Accounts payable	$ 19,563	$ 27,554
Operating lease liability	5,631	6,957
Current contingent consideration	12,983	13,950
Accrued liabilities	50,533	71,120
Convertible Senior Notes due 2024, net	69,452	284,615
Total current liabilities	158,162	404,196
Noncurrent liabilities:		
Convertible Senior Notes due 2028, net	510,143	—
Deferred tax liabilities	40,466	23,000
Noncurrent operating lease liability	126,578	131,389
Noncurrent contingent consideration	14,070	51,559
Other noncurrent liabilities	3,789	3,814
Total noncurrent liabilities	695,046	209,762
Total liabilities	853,208	613,958
Commitments and contingencies (Note 13)		
Stockholders' equity:		
Preferred stock, $0.01 par value, 5,000,000 shares authorized, no shares issued or outstanding	—	—
Common stock, $0.01 par value; 80,000,000 shares authorized; 55,766,078 shares at December 31, 2023 and 55,557,698 shares at December 31, 2022 issued and outstanding	558	556
Additional paid-in capital	1,569,227	1,547,266
Accumulated other comprehensive loss	(37,431)	(34,394)
Accumulated earnings	438,849	397,272
Total stockholders' equity	1,971,203	1,910,700
Total liabilities and stockholders' equity	$ 2,824,411	$ 2,524,658

The accompanying notes are an integral part of these consolidated financial statements.

REPLIGEN CORPORATION
CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME
(Amounts in thousands, except per share data)

	For the Years Ended December 31,		
	2023	**2022**	**2021**
Revenue:			
Products	$ 638,381	$ 801,183	$ 670,319
Royalty and other revenue	383	353	215
Total revenue	638,764	801,536	670,534
Costs and operating expenses:			
Cost of product revenue	353,922	345,830	279,280
Research and development	42,722	43,936	34,274
Selling, general and administrative	218,113	215,829	183,866
Contingent consideration	(30,569)	(28,729)	5,865
Total costs and operating expenses	584,188	576,866	503,285
Income from operations	54,576	224,670	167,249
Other income (expenses):			
Investment income	24,135	6,978	176
Interest expense	(1,951)	(1,162)	(11,278)
Loss on extinguishment of debt	(12,676)	—	—
Amortization of debt issuance costs	(8,075)	(1,815)	(1,436)
Other income (expenses)	8,123	(9,531)	(1,168)
Other income (expenses), net	9,556	(5,530)	(13,706)
Income before income taxes	64,132	219,140	153,543
Income tax provision	22,555	33,181	25,252
Net income	$ 41,577	$ 185,959	$ 128,291
Earnings per share:			
Basic	$ 0.75	$ 3.35	$ 2.33
Diluted	$ 0.74	$ 3.24	$ 2.24
Weighted average common shares outstanding:			
Basic	55,720	55,460	55,015
Diluted	56,377	57,455	57,264
Net income	$ 41,577	$ 185,959	$ 128,291
Other comprehensive income (loss):			
Foreign currency translation adjustment	(3,037)	(17,508)	(18,971)
Comprehensive income	$ 38,540	$ 168,451	$ 109,320

The accompanying notes are an integral part of these consolidated financial statements.

REPLIGEN CORPORATION
CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY
(Amounts in thousands, except share data)

	Common Stock					
	Number of Shares (#)	Par Value	Additional Paid-In Capital	Accumulated Other Comprehensive Income (Loss)	Accumulated Earnings/ (Deficit)	Total Stockholders' Equity
Balance at December 31, 2020	54,760,837	$ 548	$ 1,460,748	$ 2,085	$ 65,769	$ 1,529,150
Net income	—	—	—	—	128,291	128,291
Issuance of common stock for debt conversion	7	0	2	—	—	2
Exercise of stock options and vesting of stock units	300,721	3	3,876	—	—	3,879
Issuance of common stock pursuant to the acquisition of Avitide Inc.	271,096	2	82,966	—	—	82,968
Tax withholding on vesting of restricted stock	(11,204)	(0)	(2,897)	—	—	(2,897)
Stock-based compensation expense	—	—	27,500	—	—	27,500
True-up of costs related to the December 2020 issuance of common stock	—	—	145	—	—	145
Translation adjustment	—	—	—	(18,971)	—	(18,971)
Balance at December 31, 2021	55,321,457	$ 553	$ 1,572,340	$ (16,886)	$ 194,060	$ 1,750,067
Net income	—	—	—	—	185,959	185,959
Issuance of common stock for debt conversion	21	1	(7)	—	—	(6)
Exercise of stock options and vesting of stock units	326,192	3	3,704	—	—	3,707
Tax withholding on vesting of restricted stock	(89,972)	(1)	(17,017)	—	—	(17,018)
Stock-based compensation expense	—	—	27,316	—	—	27,316
Impact of the adoption of ASU 2020-06	—	—	(39,070)	—	17,253	(21,817)
Translation adjustment	—	—	—	(17,508)	—	(17,508)
Balance at December 31, 2022	55,557,698	$ 556	$ 1,547,266	$ (34,394)	$ 397,272	$ 1,910,700
Net income	—	—	—	—	41,577	41,577
Issuance of common stock for debt conversion	8	0	(13)	—	—	(13)
Exercise of stock options and vesting of stock units	251,886	3	1,073	—	—	1,076
Repurchase of common stock	(92,090)	(1)	(14,385)	—	—	(14,386)
Tax withholding on vesting of restricted stock	(77,759)	(1)	(13,226)	—	—	(13,227)
Issuance of common stock pursuant to the acquisition of FlexBiosys, Inc.	31,415	0	5,465	—	—	5,465
Issuance of common stock pursuant to the acquisition of Metenova Holding AB	52,299	1	8,103	—	—	8,104
Issuance of common stock pursuant to the Avitide, Inc. contingent consideration earnout payment	42,621	0	7,229	—	—	7,229
Stock-based compensation expense	—	—	25,575	—	—	25,575
Convertible note modification	—	—	2,791	—	—	2,791
Deferred tax impact on conversion feature	—	—	(651)	—	—	(651)
Translation adjustment	—	—	—	(3,037)	—	(3,037)
Balance at December 31, 2023	55,766,078	$ 558	$ 1,569,227	$ (37,431)	$ 438,849	$ 1,971,203

The accompanying notes are an integral part of these consolidated financial statements.

REPLIGEN CORPORATION
CONSOLIDATED STATEMENTS OF CASH FLOWS
(Amounts in thousands)

	For the Years Ended December 31,		
	2023	**2022**	**2021**
Cash flows from operating activities:			
Net income	$ 41,577	$ 185,959	$ 128,291
Adjustments to reconcile net income to net cash provided by operating activities:			
Inventory step-up charges	1,238	—	2,130
Depreciation and amortization	68,085	50,985	38,447
Amortization of debt discount and issuance costs	2,448	1,815	11,530
Stock-based compensation	25,575	27,316	27,500
Deferred income taxes, net	2,317	(1,352)	6,517
Contingent consideration	(30,569)	(28,729)	5,865
Non-cash interest income	(2,023)	—	—
Loss on extinguishment of debt	12,676	—	—
Other	1,231	(100)	864
Changes in operating assets and liabilities, excluding impact of acquisitions:			
Accounts receivable	(3,312)	(3,596)	(46,523)
Inventories	40,973	(57,204)	(89,781)
Prepaid expenses and other assets	(13,030)	2,396	(10,192)
Operating lease right of use assets	14,059	(24,549)	(4,315)
Other assets	(461)	(231)	430
Accounts payable	(9,803)	(8,197)	19,523
Accrued expenses	(27,921)	(2,019)	23,196
Operating lease liability	(9,229)	28,623	6,958
Long-term liabilities	87	966	(1,424)
Total cash provided by operating activities	113,918	172,083	119,016
Cash flows from investing activities:			
Purchase of marketable securities held to maturity	—	(100,000)	—
Redemption of marketable securities	102,323	—	—
Additions to capitalized software costs	(2,766)	(3,512)	(4,187)
Acquisitions, net of cash acquired	(186,642)	—	(149,893)
Purchases of property, plant and equipment	(36,222)	(84,834)	(67,089)
Purchase of intellectual property	—	(45,000)	—
Other investing activities	32	110	—
Total cash used in investing activities	(123,275)	(233,236)	(221,169)
Cash flows from financing activities:			
Repurchase of common stock	(14,386)	—	—
Proceeds from issuance of 2023 Convertible Senior Notes	290,094	—	—
Proceeds from exercise of stock options	1,076	3,707	3,879
Payment of debt issuance costs	(7,253)	—	—
Payment of tax withholding obligation on vesting of restricted stock	(13,227)	(17,018)	(2,897)
Payment of earnout consideration	(7,298)	—	—
Other financing activities	(45)	(26)	(21)
Total cash provided by (used in) financing activities	248,961	(13,337)	961
Effect of exchange rate changes on cash and cash equivalents	(11,739)	(5,866)	(12,286)
Net increase (decrease) in cash and cash equivalents	227,865	(80,356)	(113,478)
Cash and cash equivalents, beginning of period	523,458	603,814	717,292
Cash and cash equivalents, end of period	$ 751,323	$ 523,458	$ 603,814
Supplemental disclosure of cash flow information:			
Income taxes paid	$ 26,963	$ 34,365	$ 16,515
Interest paid	$ 988	$ 1,033	$ 1,066
Supplemental disclosure of non-cash investing and financing activities:			
Assets acquired under operating leases	$ 4,335	$ 29,126	$ 85,312
Fair value of shares of common stock issued for acquisitions	$ 13,569	$ —	$ 82,968
Fair value of shares of common stock issued for contingent consideration earnouts	$ 7,229	$ —	$ —
Acquisition date fair value of contingent consideration earnouts	$ 6,640	$ —	$ 88,373
Issuance of 2023 Notes in exchange of 2019 Notes	$ 42,179	$ —	$ —
Extinguished 2019 Notes	$ 29,634	$ —	$ —

The accompanying notes are an integral part of these consolidated financial statements.

1. Organization and Nature of Business

Repligen Corporation (NASDAQ: RGEN) is a global life sciences company that develops and commercializes highly innovative bioprocessing technologies and systems that increase efficiencies and flexibility in the process of manufacturing biological drugs. The Company's franchises include filtration, chromatography, process analytics and proteins. See Part I, Item 1. "*Business - Our Products",* of this report for additional information related to the Company's products. The Company's bioprocessing products are sold to major life sciences companies, biopharmaceutical development companies and contract manufacturing organizations worldwide. The Company operates under one reportable segment. The Company's chief operating decision maker ("CODM"), its Chief Executive Officer ("CEO"), reviews financial information presented on a consolidated basis for purposes of allocating resources and evaluating financial performance. See Note 2, *"Summary of Significant Accounting Policies – Segment Reporting,"* for more information on the Company's segment.

A majority of our 19 manufacturing sites are located in the United States (California, Massachusetts, New Hampshire, New Jersey, New York and Texas). Outside the United States, we have manufacturing sites in Estonia, France, Germany, Ireland, the Netherlands and Sweden.

The Company is subject to a number of risks typically associated with companies in the biotechnology industry. These risks principally include the Company's dependence on key customers, development by the Company or its competitors of new technological innovations, dependence on key personnel, protection of proprietary technology, compliance with the U.S. Food and Drug Association and other governmental regulations and approval requirements, as well as the ability to grow the Company's business and obtain adequate funding to finance this growth.

2. Summary of Significant Accounting Policies

Use of Estimates

The preparation of financial statements in conformity with accounting principles generally accepted in the United States requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting periods.

Significant estimates and assumptions by management affect the Company's revenue recognition for multiple element arrangements, allowance for credit losses, the net realizable value of inventory, valuations and purchase price allocations related to business combinations, contingent consideration, estimated fair values of intangible assets and goodwill, amortization methods and periods, warranty reserves, certain accrued expenses, estimates related to the fair value of the conversion features of the convertible notes for purposes of assessing whether debt extinguishment or modification accounting applies to the Company's debt exchange, stock-based compensation, tax reserves and recoverability of the Company's net deferred tax assets and related valuation allowance.

Although the Company regularly assesses these estimates, actual results could differ materially from these estimates. Changes in estimates are recorded in the period in which they become known. The Company bases its estimates on historical experience and various other assumptions that it believes to be reasonable under the circumstances.

Basis of Presentation

The consolidated financial statements include the accounts of the Company and its wholly-owned subsidiaries. All significant intercompany accounts and transactions have been eliminated in consolidation. Certain prior year balances have changed to reflect current year presentation.

Foreign Currency

The Company translates the assets and liabilities of its foreign subsidiary at rates in effect at the end of the reporting period. Revenues and expenses are translated at average rates in effect during the reporting period. Translation adjustments include adjustments related to the Company's various intercompany loans with foreign subsidiaries. Intercompany loans determined to be permanent are remeasured at each period end and included in accumulated other comprehensive loss on the consolidated balance sheets. Intercompany loans with foreign subsidiaries determined to be repayable are remeasured at each period end and included in other income (expenses) on the consolidated statements of comprehensive income.

Revenue Recognition

The Company generates revenue from the sale of bioprocessing products, equipment devices, and related consumables used with these equipment devices to customers in the life sciences and biopharmaceutical industries. Under Accounting Standard Codification No. ("ASC") 606, "*Revenue from Contracts with Customers,*" revenue is recognized when, or as, obligations under the terms of a contract are satisfied, which occurs when control of the promised products or services is transferred to customers. Revenue is measured as the amount of consideration the Company expects to receive in exchange for transferring products or services to a customer ("transaction price"). To the extent the transaction price includes variable consideration, the Company estimates the amount of variable consideration that should be included in the transaction price utilizing the expected value method or the most likely amount method, depending on the facts and circumstances relative to the contract. Variable consideration is included in the transaction price if, in the Company's judgment, it is probable that a significant future reversal of cumulative revenue under the contract will not occur. Estimates of variable consideration and determination of whether to include estimated amounts in the transaction price are based largely on an assessment of the Company's anticipated performance and all information (historical, current and forecasted) that is reasonably available. Sales, value add, and other taxes collected on behalf of third parties are excluded from revenue.

When determining the transaction price of a contract, an adjustment is made if payment from a customer occurs either significantly before or significantly after performance, resulting in a significant financing component. Applying the practical expedient in paragraph 606-10-32-18, the Company does not assess whether a significant financing component exists if the period between when the Company performs its obligations under the contract and when the customer pays is one year or less. None of the Company's contracts contained a significant financing component as of December 31, 2023.

Contracts with customers may contain multiple performance obligations. For such arrangements, the transaction price is allocated to each performance obligation based on the estimated relative standalone selling prices of the promised products or services underlying each performance obligation. The Company determines standalone selling prices based on the price at which the performance obligation is sold separately. If the standalone selling price is not observable through past transactions, the Company estimates the standalone selling price taking into account available information such as market conditions and internally approved pricing guidelines related to the performance obligations.

The Company recognizes product revenue under the terms of each customer agreement upon transfer of control to the customer, which occurs at a point in time.

Shipping and handling fees are recorded as a component of product revenue, with the associated costs recorded as a component of cost of product revenue.

Risks and Uncertainties

The Company evaluates its operations periodically to determine if any risks and uncertainties exist that could impact its operations in the near term. The Company does not believe that there are any significant risks that have not already been disclosed in the consolidated financial statements. A loss of certain suppliers could temporarily disrupt operations, although alternate sources of supply exist for these items. The Company has mitigated these risks by working closely with key suppliers, identifying alternate sources and developing contingency plans.

Cash, Cash Equivalents and Restricted Cash

Cash and cash equivalents include cash on hand and on deposit. Highly liquid investments in money market mutual funds with an original maturity of three months or less are classified as cash equivalents. All cash equivalents are carried at cost, which approximates fair value. Restricted cash represents cash that is restricted as to withdrawal or usage. There was no restriction on the Company's cash balance as of December 31, 2023 and 2022.

The Company's cash, cash equivalents and restricted cash total as presented in the Company's consolidated statements of cash flows for the years ended December 31, 2023, 2022 and 2021 was $751.3 million, $523.5 million and $603.8 million, respectively.

Investment Securities

We classify our investment securities in one of three categories: held to maturity, trading, or available for sale. Our investment portfolio at December 31, 2022 consisted of an investment in U.S. treasury bills classified as held to maturity which was included in the Company's consolidated balance sheets under marketable securities held to maturity. These marketable securities matured in June 2023 and there are no comparable investments as of December 31, 2023. Securities that we have the positive intent and ability to hold to maturity are classified as held to maturity and stated at amortized cost in the consolidated balance sheets. Management determines the appropriate classification of securities at the time of purchase based upon management's intent with regards to such investment and reevaluates such designation as of each balance sheet date. The Company's investment policy requires that it only invest in high-rated securities and limit its exposure to any single-user. There were no realized or unrealized gains or losses on investments recorded as of December 31, 2023, 2022 and 2021.

The Company classifies marketable securities as short-term when they have remaining contractual maturities of one year or less from the balance sheet date. The Company periodically assesses its marketable securities, if any, for impairment or credit losses.

Fair Value Measurement

In determining the fair value of its assets and liabilities, the Company uses various valuation approaches. The Company employs a hierarchy for inputs used in measuring fair value that maximizes the use of observable inputs and minimizes the use of unobservable inputs by requiring that observable inputs be used when available. Observable inputs are inputs that market participants would use in pricing the asset or liability based on market data obtained from sources independent of the Company. Unobservable inputs are inputs that reflect the Company's assumptions about the inputs that market participants would use in pricing the asset or liability and are developed based on the best information available in the circumstances. The fair value hierarchy is broken down into three levels based on the source of inputs as follows:

Level 1 – Valuations based on unadjusted quoted prices in active markets for identical assets or liabilities that the Company has the ability to access.

Level 2 – Valuations based on quoted prices for similar assets or liabilities in active markets, quoted prices for identical or similar assets or liabilities.

Level 3 – Valuations based on inputs that are unobservable and significant to the overall fair value measurement.

The availability of observable inputs can vary among the various types of financial assets and liabilities. To the extent that the valuation is based on models or inputs that are less observable or unobservable in the market, the determination of fair value requires more judgment. In certain cases, the inputs used to measure fair value may fall into different levels of the fair value hierarchy. In such cases, for financial statement disclosure purposes, the level in the fair value hierarchy within which the fair value measurement is categorized is based on the lowest level input that is significant to the overall fair value measurement.

Allowance for credit losses

We establish an allowance for credit losses through a review of several factors, including historical collection experience, current aging status of the customer accounts, and current financial condition of our customers. Losses are charged against the allowance when the customer accounts are determined to be uncollectible.

Inventories

Inventories relate to the Company's bioprocessing business. The Company values inventory at cost or, if lower, net realizable value, using the first-in, first-out method. The Company reviews its inventories at least quarterly and records a provision for excess and obsolete inventory based on its estimates of expected sales volume, production capacity and expiration dates of raw materials, work-in-process and finished products. The Company writes down inventory that has become obsolete, inventory that has a cost basis in excess of its expected net realizable value, and inventory in excess of expected requirements to cost of product revenue. Manufacturing of bioprocessing finished goods is done to order and tested for quality specifications prior to shipment.

A change in the estimated timing or amount of demand for the Company's products could result in additional provisions for excess inventory quantities on hand. Any significant unanticipated changes in demand or unexpected quality failures could have a significant impact on the value of inventory and reported operating results. During all periods presented in the accompanying consolidated financial statements, there have been no material adjustments related to a revised estimate of inventory valuations.

Work-in-process and finished products inventories consist of material, labor, outside processing costs and manufacturing overhead.

Lease Accounting

The Company adopted Accounting Standards Update No. ("ASU") 2016-02, *"Leases (Topic 842)"* ("ASC 842") as of January 1, 2019. Under ASC 842, the Company determines whether the arrangement contains a lease at the inception of an arrangement. If a lease is identified in an arrangement, the Company recognizes a right-of-use asset and liability on its consolidated balance sheets and determines whether the lease should be classified as a finance or operating lease. The Company does not recognize assets or liabilities for leases with lease terms of less than 12 months.

A lease qualifies as a finance lease if any of the following criteria are met at the inception of the lease: (i) there is a transfer of ownership of the leased asset to the Company by the end of the lease term, (ii) the Company holds an option to purchase the leased asset that it is reasonably certain to exercise, (iii) the lease term is for a major part of the remaining economic life of the leased asset, (iv) the present value of the sum of lease payments equals or exceeds substantially all of the fair value of the leased asset, or (v) the nature of the leased asset is specialized to the point that it is expected to provide the lessor no alternative use at the end of the lease term. All other leases are recorded as operating leases.

Finance and operating lease assets and liabilities are recognized at the lease commencement date based on the present value of the lease payments over the lease term using the discount rate implicit in the lease. If the rate implicit is not readily determinable, the Company utilizes its incremental borrowing rate at the lease commencement date. Operating lease assets are further adjusted for prepaid or accrued lease payments. Operating lease payments are expensed using the straight-line method as an operating expense over the lease term. Finance lease assets are amortized to depreciation expense using the straight-line method over the shorter of the useful life of the related asset or the lease term. Finance lease payments are bifurcated into (i) a portion that is recorded as imputed interest expense and (ii) a portion that reduces the finance liability associated with the lease.

The Company does not separate lease and non-lease components when determining which lease payments to include in the calculation of its lease assets and liabilities. Variable lease payments are expensed as incurred. If a lease includes an option to extend or terminate the lease, the Company reflects the option in the lease term if it is reasonably certain it will exercise the option.

Finance leases are recorded in property, plant and equipment, net, other current liabilities and long-term finance lease liabilities and operating leases are recorded in operating lease right of use assets, operating lease liability and operating lease liability, long-term on the Company's consolidated balance sheets.

Certain of the Company's operating leases where the Company is the lessee provide for minimum annual payments that increase over the life of the lease. Some of these leases include obligations to pay for other services, such as operations and maintenance. For leases of property, the Company accounts for these other services as a component of the lease. The aggregate minimum annual payments are expensed on the straight-line basis beginning when the Company takes possession of the property and extending over the term of the related lease, including renewal options when the exercise of the option is reasonably certain as an economic penalty may be incurred if the option is not exercised. The Company also accounts in its straight-line computation for the effect of any "rental holidays."

Operating lease assets represent the Company's right to use an underlying asset for the lease term and lease liabilities represent the Company's obligation to make lease payments arising from the lease. Operating lease assets and liabilities are recognized at the lease commencement date based on the estimated present value of the fixed lease payments, reduced by landlord incentives using a discount rate based on similarly secured borrowings available to the Company. Most of the leases do not provide implicit interest rates and therefore the Company determines the discount rate based on its incremental borrowing rate. The incremental borrowing rate for the Company's leases is determined based on lease term and currency in which the lease payments are made.

Accrued Liabilities

The Company estimates accrued liabilities by identifying services performed on the Company's behalf, estimating the level of service performed and determining the associated cost incurred for such service as of each balance sheet date. For example, the Company would accrue for professional and consulting fees incurred with law firms, audit and accounting service providers and other third-party consultants. These expenses are determined by either requesting those service providers to estimate unbilled services at each reporting date for services incurred or tracking costs incurred by service providers under fixed fee arrangements.

The Company has processes in place to estimate the appropriate amounts to record for accrued liabilities, which principally involve the applicable personnel reviewing the services provided. In the event that the Company does not identify certain costs that have begun to be incurred or the Company under or over-estimates the level of services performed or the costs of such services, the reported expenses for that period may be too low or too high. The date on which certain services commence, the level of services performed on or before a given date, and the cost of such services often require the exercise of judgment. The Company makes these judgments based upon the facts and circumstances known at the date of the consolidated financial statements.

Income Taxes

Deferred taxes are determined based on the difference between the consolidated financial statements and tax basis of assets and liabilities using enacted tax rates in effect in the years in which the differences are expected to reverse. Valuation allowances are provided, if, based upon the weight of available evidence, it is more likely than not that some or all of the deferred tax assets will not be realized. The Company accounts for uncertain tax positions using a "more-likely-than-not" threshold for recognizing and resolving uncertain tax positions. The evaluation of uncertain tax positions is based on factors including, but not limited to, changes in tax law, the measurement of tax positions taken or expected to be taken in tax returns, the effective settlement of matters subject to audit, new audit activity and changes in facts or circumstances related to a tax position. The Company evaluates this tax position on a quarterly basis. The Company also accrues for potential interest and penalties related to unrecognized tax benefits in income tax expense. The Company is subject to a territorial tax system under the Tax Cuts and Jobs Act enacted in December 2017, in which the Company is required to provide for tax on Global Intangible Low-Taxed Income ("GILTI") earned by certain foreign subsidiaries. The Company has adopted an accounting policy to provide for the tax expense related to GILTI in the year the tax is incurred as a period expense.

Property, Plant & Equipment

Property, plant & equipment is recorded at cost less allowances for depreciation. Depreciation is calculated using the straight-line method over the estimated useful life of the asset as follows:

Classification	Estimated Useful Life
Buildings	Thirty years
Leasehold improvements	Shorter of the term of the lease or estimated useful life
Equipment	Three to twelve years
Furniture, fixtures and office equipment	Three to eight years
Computer hardware and software	Three to seven years or estimated useful life
Vehicles	Five years

Upon disposal of property, plant & equipment, the cost of the asset and the accumulated depreciation are removed from the accounts and the resulting gain or loss is reflected in our results of operations. Fully depreciated assets are not removed from the accounts until they are physically disposed of.

Certain systems development costs related to the purchase, development and installation of computer software developed or obtained for internal use are capitalized and depreciated over the estimated useful life of the related project. Costs incurred prior to the development stage, as well as maintenance, training costs, and general and administrative expenses are expensed as incurred.

Earnings Per Share

The Company reports earnings per share ("EPS") in accordance with ASC 260, *"Earnings Per Share,"* which establishes standards for computing and presenting EPS. Basic EPS is computed by dividing net income available to common shareholders by the weighted average number of common shares outstanding during the period. Diluted EPS is computed by dividing net income available to common shareholders by the weighted-average number of common shares and dilutive common share equivalents outstanding during the period. Potential common share equivalents consist of restricted stock awards (including performance stock units) and the incremental common shares issuable upon the exercise of stock options and warrants. Under the treasury stock method, unexercised "in-the-money" stock options are assumed to be exercised at the beginning of the period or at issuance, if later. The assumed proceeds are then used to purchase common shares at the average market price during the period. In periods when the Company has a net loss, stock awards are excluded from the calculation of earnings per share as their inclusion would have an antidilutive effect.

A reconciliation of basic and diluted weighted average share outstanding is as follows:

	For the Years Ended December 31,		
	2023	2022	2021
	(Amounts in thousands, except per share data)		
Numerator:			
Net income	$ 41,577	$ 185,959	$ 128,291
Effect of dilutive securities:			
Charges associated with convertible debt instruments, net of tax	—	387	—
Numerator for diluted earnings per share - net income available to common stockholders after the effect of dilutive securities	$ 41,577	$ 186,346	$ 128,291
Denominator:			
Weighted average shares used in computing net income per share - basic	55,720	55,460	55,015
Effect of dilutive shares:			
Options and stock units	457	608	915
Convertible senior notes[(1)]	181	1,360	1,253
Contingent consideration	8	11	—
Dilutive effect of unvested performance stock units	11	16	81
Dilutive potential common shares	657	1,995	2,249
Denominator for diluted earnings per share - adjusted weighted average shares used in computing net income per share - diluted	56,377	57,455	57,264
Earnings per share:			
Basic	$ 0.75	$ 3.35	$ 2.33
Diluted	$ 0.74	$ 3.24	$ 2.24

(1) Represents the dilutive impact for the Company's 0.375% Convertible Senior Notes due 2024 (the " 2019 Notes") and its 1.00% Convertible Senior Notes due 2028 (the "2023 Notes"). As of December 31, 2023, the if-converted value is less than the outstanding principal of the 2023 Notes and are therefore anti-dilutive. Refer to Note 14, "*Convertible Senior Notes,*" for more information.

For the years ended December 31, 2023, 2022 and 2021, 306,849 shares, 177,318 shares and 68,968 shares, respectively, of the Company's common stock were excluded from the calculation of diluted earnings per share because they would have had an anti-dilutive effect for years presented.

In July 2019, the Company issued $287.5 million aggregate principal amount of its 2019 Notes. As provided by the terms of the indenture underlying the 2019 Notes, prior to March 4, 2022, conversion of the 2019 Notes could have been settled in cash, shares of the Company's common stock or a combination thereof, at the Company's election. On March 4, 2022, we entered into the Second Supplemental Indenture for the 2019 Notes, which irrevocably elected to settle the conversion of the 2019 Notes using a combination of cash and shares of the Company's common stock, settling the par value of the 2019 Notes in cash and any excess conversion premium in shares. On December 14, 2023, the Company exchanged, in a privately negotiated exchange, $309.9 million principal amount of 2023 Notes for $217.7 million principal amount of 2019 Notes and issued $290.1 million aggregate principal amount of 2023 Notes for $290.1 million in cash. Following the close of the Exchange Transaction, $69.7 million in aggregate principal amount of 2019 Notes remains outstanding with terms unchanged.

As provided by the terms of the Second Supplemental Indenture underlying the 2019 Notes, the Company irrevocably elected to settle the conversion obligation for the 2019 Notes in a combination of cash and shares of the Company's common stock. This means the Company will settle the par value of the 2019 Notes in cash and any excess conversion premium in shares. As mentioned in Note 14, "*Convertible Senior Notes,*" the Company adopted ASU 2020-06 effective January 1, 2022. Under ASU 2020-06, the Company is required to reflect the dilutive effect of the convertible securities by application of the "if-converted" method, which means the denominator of the EPS calculation would include the total number of shares assuming the 2019 Notes had been fully converted at the beginning of the period. Prior to March 4, 2022, the Company had the choice to settle the conversion of the 2019 Notes in cash, stock or a combination of the two. Therefore, from January 1, 2022 (the date the Company adopted ASU 2020-06) to March 4, 2022, the Company included 3,474,429 shares in the denominator of the EPS calculation, applying the if converted method. Subsequent to March 4, 2022, after the Second Supplemental Indenture became effective, the Company irrevocably elected to settle the conversion obligation for the 2019 Notes in a combination of

cash and shares of the Company's common stock, and from March 5, 2022 forward, only the excess premium will be settled with shares. Under the if-converted method of calculating dilutive shares, the Company was also required to exclude amortization of debt issuance costs and interest charges applicable to the convertible debt from the numerator of the dilutive EPS calculation for the period from January 1, 2022 to March 4, 2022, as if the interest on convertible debt was never recognized for that period. As a result, the Company excluded interest charges of $0.4 million (net of tax) from the numerator and included 1,359,957 shares in the calculation of diluted earnings as the dilutive effect of the conversion premium for the year ended December 31, 2022. There were no comparable amounts included in 2023 or 2021.

Prior to the adoption of ASU 2020-06, the Company applied the provisions of ASC 260, "*Earnings Per Share,*" subsection 10-45-44, to determine the diluted weighted average shares outstanding as it related to the conversion spread on its convertible notes. Accordingly, the par value of the 2019 Notes was not included in the calculation of diluted EPS, but the dilutive effect of the conversion premium was considered in the calculation of diluted EPS using the treasury stock method. The dilutive impact of the 2019 Notes was based on the difference between the Company's current period average stock price and the conversion price of the convertible notes, provided there is a premium. Pursuant to this accounting standard, there was no dilution from the accreted principal of the 2019 Notes.

Segment Reporting

Operating segments are components of an enterprise that engage in business activities for which discrete financial information is available and regularly reviewed by the CODM in deciding how to allocate resources and assess performance. Our CEO has been identified as our CODM.

The Company views its operations, makes decisions regarding how to allocate resources and manages its business as one reportable segment and one reporting unit. As a result, the financial information disclosed herein represents all of the material financial information related to the Company.

The following table represents product revenues by product line:

	For the Years Ended December 31,	
	2023[1]	2022
	(Amounts in thousands)	
Filtration products	$ 347,781	$ 495,930
Chromatography products	126,629	131,680
Process analytics products	56,820	53,512
Proteins products	103,463	114,320
Other	3,688	5,741
Total product revenue	$ 638,381	$ 801,183

(1) 2023 revenue for filtration products includes revenue related to FlexBiosys, Inc. ("FlexBiosys") from April 17, 2023, as well as Metenova Holding AB ("Metenova") from October 2, 2023.

(2) 2021 revenue for filtration products includes revenue related to Polymem S.A. ("Polymem") from July 1, 2021, as well as BioFlex Solutions LLC ("BioFlex") and Newton T&M Corp. ("NTM") from December 16, 2021 through December 31, 2021. 2021 revenue for proteins products includes revenue related to Avitide, Inc. ("Avitide") from September 20, 2021 through December 31, 2021.

Revenue from filtration products includes the XCell ATF® systems and consumables as well as the KrosFlo® and SIUS® filtration products. Revenue from chromatography products includes the OPUS® chromatography pre-packed columns, chromatography resins and ELISA test kits. Revenue from process analytics products includes the SoloVPE®, FlowVPE® RPM® and FlowVPX® devices. Revenue from protein products includes the Protein A affinity ligands and cell culture growth factors. Other revenue primarily consists of revenue from the sale of operating room products to hospitals as well as freight revenue.

The following table represents the Company's total revenue by our country of domicile (the United States) and other countries where our major subsidiaries are domiciled for the periods presented (based on the location of the customer):

	For the Years Ended December 31,		
	2023	2022	2021
Revenue by customers' geographic locations:			
North America	44%	43%	41%
Europe	37%	37%	40%
APAC/Other	19%	20%	19%
Total revenue	100%	100%	100%

The following table represents the Company's total assets by our country of domicile (the United States) and other countries where our major subsidiaries are domiciled for the periods presented:

	December 31,	
	2023	2022
	(Amounts in thousands)	
Total assets by geographic locations:		
North America	$ 2,371,208	$ 2,209,244
Europe	426,034	287,543
APAC	27,169	27,871
Total assets by geographic location	$ 2,824,411	$ 2,524,658

The following table represents the Company's long-lived assets by our country of domicile (the United States) and other countries where our major subsidiaries are domiciled for the periods presented:

	December 31,	
	2023	2022
	(Amounts in thousands)	
Long-lived assets by geographic locations:		
North America	$ 278,033	$ 275,151
Europe	43,280	38,541
APAC	2,919	2,819
Total long-lived assets by geographic location	$ 324,232	$ 316,511

Concentrations of Credit Risk and Significant Customers

Financial instruments that subject the Company to significant concentrations of credit risk primarily consist of cash and cash equivalents, marketable securities and accounts receivable. Per the Company's investment policy, cash equivalents and marketable securities are invested in financial instruments with high credit ratings, limit its credit exposure to any one issuer (with the exception of U.S. treasury obligations) and type of instrument is limited. At December 31, 2023, the Company had no investments associated with foreign exchange contracts, options contracts or other foreign hedging arrangements.

Concentration of credit risk with respect to accounts receivable is limited to customers to whom the Company makes significant sales. While a reserve for the potential write-off of accounts receivable is maintained, the Company has not written off any significant accounts to date. To control credit risk, the Company performs regular credit evaluations of its customers' financial condition.

There was no revenue from customers that represented 10% or more of the Company's total revenue for the year ended December 31, 2023 or 2022. Revenue from Pfizer Inc. accounted for 10% of total revenue for the year ended December 31, 2021.

No accounts receivable balance from a specific customer represented 10% or more of the Company's total trade accounts receivable at December 31, 2023. Significant accounts receivable balances representing 10% or more of the Company's total trade accounts receivable balances at December 31, 2022 came from our accounts receivable balance outstanding with Purolite, an Ecolab Inc. company ("Purolite"), which was 12.7% of the Company's total trade accounts receivable balance.

Business Combinations, Goodwill and Intangible Assets

Business Combinations

Total consideration transferred for acquisitions is allocated to the tangible and intangible assets acquired and liabilities assumed, if any, based on their fair values at the dates of acquisition. This purchase price allocation process requires management to make significant estimates and assumptions with respect to intangible assets and deferred revenue. The fair value of identifiable intangible assets is based on detailed valuations that use information and assumptions determined by management. Any excess of purchase price over the fair value of the net tangible and intangible assets acquired is allocated to goodwill. While the Company uses its best estimates and assumptions to accurately value assets acquired and liabilities assumed at the acquisition date as well as any contingent consideration, where applicable, the Company's estimates are inherently uncertain and subject to refinement. As a result, during the measurement period, which may be up to one year from the acquisition date, the Company records adjustments to the assets acquired and liabilities assumed with the corresponding offset to goodwill. Upon conclusion of the measurement period or final determination of the values of assets acquired or liabilities assumed, whichever comes first, any subsequent adjustments are recorded to the Company's consolidated statements of comprehensive income. Any excess of the fair value of the net tangible and intangible assets acquired over the purchase price is recognized in the consolidated statements of comprehensive income. The fair value of contingent consideration includes estimates and judgments made by management regarding the probability that future contingent payments will be made and the extent of royalties to be earned in excess of the defined minimum royalties. Management updates these estimates and the related fair value of contingent consideration at each reporting period. These changes in the fair value of contingent consideration are recorded to contingent consideration in the Company's consolidated statements of comprehensive income. For the years ended December 31, 2023 and 2022, we recorded a decrease of $(30.6) million and $(28.7) million, respectively, to the estimated contingent consideration obligation, primarily related to the acquisition of Avitide (the "Avitide Acquisition").

The Company uses the income approach to determine the fair value of certain identifiable intangible assets including customer relationships and developed technology. This approach determines fair value by estimating after-tax cash flows attributable to these assets over their respective useful lives and then discounting these after-tax cash flows back to a present value. The Company bases its assumptions on estimates of future cash flows, expected growth rates, expected trends in technology, etc. Discount rates used to arrive at a present value as of the date of acquisition are based on the time value of money and certain industry-specific risk factors. The Company believes the estimated purchased customer relationships, developed technologies, trademark/tradename, patents, non-compete agreements and in-process research and development amounts so determined represent the fair value at the date of acquisition, and do not exceed the amount a third-party would pay for such assets.

Goodwill

Goodwill is not amortized and is tested for impairment at least annually at the reporting unit level. The Company operates as one reporting unit as of the goodwill impairment measurement date of December 31, 2023. During the qualitative assessment of the Company's one reporting unit during the 2023 goodwill impairment testing, it was determined that it was not more likely than not that its fair value was less than its carrying amount. As such, a quantitative impairment assessment was not required as of December 31, 2023. If an event occurs or circumstances change that would more likely than not reduce the fair value of its reporting unit below its carrying value, the Company will evaluate its goodwill for impairment between annual tests. There was no impairment to goodwill and therefore no impairment charge recorded for the years ended December 31, 2023, 2022 and 2021.

The Company has historically tested for impairment on its goodwill annually as of its measurement date of December 31st pursuant to company policy. Subsequent to the 2023 annual impairment test, the Company voluntarily changed its annual impairment assessment date from December 31st to October 1st, the first day of the Company's fourth quarter, beginning on October 1, 2024. The change is being made to better align the annual impairment assessment date with the Company's annual planning and budgeting process as well as long-term planning and forecasting process. The Company has determined this voluntary change in accounting principle is preferable and will not impact its consolidated financial statements nor is it being done to accelerate, avoid or trigger an impairment charge. This change is not going to be applied retrospectively as it is impracticable to do so because retrospective application would require application of significant estimates and assumptions with the use of hindsight. Accordingly, the change will be applied prospectively.

Intangible Assets

Intangible assets with a definite life are amortized over their useful lives using the straight-line method and the amortization expense is recorded within cost of product revenue, research and development ("R&D") and selling, general and administrative expense in the consolidated statements of comprehensive income. Intangible assets and their related useful lives are reviewed at least annually to determine if any adverse conditions existed that would indicate the carrying value of these assets may not be recoverable. More frequent impairment assessments are conducted if certain conditions exist, including a change in the competitive landscape, any internal decisions to pursue new or different technology strategies, a loss of a significant customer, or a significant change in the marketplace, including changes in the prices paid for the Company's products or changes in the size of the market for the Company's products. If impairment indicators are present, the Company determines whether the underlying intangible asset is recoverable through estimated future undiscounted cash flows. If the asset is not found to be recoverable, it is written down to the estimated fair value of the asset based on the sum of the future discounted cash flows expected to result from the use and disposition of the asset. If the estimate of an intangible asset's remaining useful life is changed, the remaining carrying amount of the intangible asset is amortized prospectively over the revised remaining useful life. The Company continues to believe that its definite-lived intangible assets are recoverable at December 31, 2023.

Indefinite-lived intangible assets are reviewed for impairment at least annually. There has been no impairment of our intangible assets for the periods presented.

Stock Based Compensation

The Company measures stock-based compensation cost at the grant date based on the estimated fair value of the award and recognizes it as an expense over the employee's requisite service period on a straight-line basis. The Company records the expense for share-based awards subject to performance-based milestone vesting over the remaining service period when management determines that achievement of the milestone is probable. Management evaluates whether the achievement of a performance-based milestone is probable as of the reporting date. The Company has no awards that are subject to market conditions. The Company recognizes stock-based compensation expense based upon options that are ultimately expected to vest, and accordingly, such compensation expense has been adjusted by an amount of estimated forfeitures.

The Company uses the Black-Scholes option pricing model to calculate the fair value of share-based awards on the grant date. The following assumptions are used in calculating the fair value of share-based awards:

Expected term – The expected term of options granted represents the period of time for which the options are expected to be outstanding. For purposes of estimating the expected term, the Company has aggregated all individual option awards into one group as the Company does not expect substantial differences in exercise behavior among its employees.

Expected volatility – The expected volatility is a measure of the amount by which the Company's stock price is expected to fluctuate during the expected term of options granted. The Company determines the expected volatility based primarily upon the historical volatility of the Company's common stock over a period commensurate with the option's expected term.

Risk-free interest rate – The risk-free interest rate is the implied yield available on U.S. treasury zero-coupon issues with a remaining term equal to the option's expected term on the grant date.

Expected dividend yield – The Company has never declared or paid any cash dividends on any of its capital stock and does not expect to do so in the foreseeable future. Accordingly, the Company uses an expected dividend yield of zero to calculate the grant-date fair value of a stock option.

Estimated forfeiture rates – The Company has applied, based on an analysis of its historical forfeitures, annual forfeiture rates of 8% for awards granted to non-executive level employees, 3% for awards granted to executive level employees and 0% for awards granted to non-employee members of the Board of Directors ("Board") to all unvested stock options as of December 31, 2023. The Company reevaluates this analysis periodically and adjusts these estimated forfeiture rates as necessary. Ultimately, the Company will only recognize an expense for those shares that vest.

Advertising Costs

The Company expenses advertising costs as they are incurred. Advertising expense for the years ended December 31, 2023, 2022 and 2021 was $0.8 million, $0.6 million and $0.6 million, respectively.

Recent Accounting Standards Updates

We consider the applicability and impact of all ASUs and other accounting guidance on the Company's consolidated financial statements. Updates not listed below were assessed and determined to be either not applicable or are expected to have minimal impact on the Company's consolidated financial position or results of operations. Recently issued accounting guidance that we feel may be applicable to the Company are as follows:

Recently Issued Accounting Guidance – Adopted During the Fiscal Year

In July 2023, the U.S. Securities and Exchange Commission (the "SEC") adopted the final rule under SEC Release No. 33-11216, "*Cybersecurity Risk Management, Strategy, Governance, and Incident Disclosure,"* requiring current reporting about material cybersecurity incidents and annual disclosures on management's processes for assessing, identifying, and managing material cybersecurity risks, the material impacts of cybersecurity threats and previous cybersecurity incidents, the Board's oversight of cybersecurity risks, and management's role and expertise in assessing and managing material cybersecurity risks. SEC Release No. 33-11216 was effective for us during the third quarter of 2023. The adoption of this guidance did not have a material impact on the Company's consolidated financial statements and disclosures.

In December 2022, the SEC adopted the final rule under SEC Release No. 33-11138, *"Insider Trading Arrangements and Related Disclosures*," which requires new disclosures regarding insider trading policies and procedures, the use of Rule 10b5-1 plans by directors and officers, and stock option grants issued in close proximity to the release of material nonpublic information. SEC Release No. 33-11138 was effective for us for our second quarter of 2023, and did not have a material impact on our consolidated financial statements and disclosures.

Recently Issued Accounting Guidance – Not Yet Adopted

In December 2023, the Financial Accounting Standards Board ("FASB") issued ASU 2023-09, "*Income Taxes (Topic 740) - Improvements to Income Tax Disclosures."* ASU 2023-09 enhances the transparency and decision usefulness of income tax disclosures by requiring consistent categories and greater disaggregation of information in the rate reconciliation and income taxes paid disaggregated by jurisdiction. ASU 2023-09 will be effective for the Company in its income tax disclosure included in its 2025 Annual Report on Form 10-K and will be applied on a prospective basis. However, retrospective application is permitted. Early adoption is also permitted. Besides a change in income tax disclosures, the Company does not expect the adoption of ASU 2023-09 to have a material impact on its consolidated financial statements.

In November 2023, the FASB issued ASU 2023-07, "*Segment Reporting (Topic 820) - Improvements to Reportable Segment Disclosures."* ASU 2023-07 will improve reportable segment disclosure requirements, primarily through enhanced annual and interim disclosures about significant segment expenses that are regularly provided to the CODM. The disclosure required under ASU 2023-07 are also required for public entities with a single reportable segment. ASU 2023-07 will be effective for the Company for annual periods beginning on January 1, 2024 and interim periods beginning on January 1, 2025. The amendments of this guidance apply retrospectively to all prior periods

presented in the consolidated financial statements. Early adoption is permitted. Besides presentation in the segment footnote for its interim reporting, the Company does not expect the adoption of ASU 2023-07 to have a material impact on its consolidated financial statements.

3. Fair Value Measurements

Cash, Cash Equivalents and Marketable Securities Held to Maturity

The following table summarizes the Company's cash, cash equivalents and marketable securities held to maturity as of December 31, 2023:

	As of December 31, 2023			
	Amortized Costs	Gross Unrealized Gains	Gross Unrealized Losses	Estimated Fair Value
Cash and cash equivalents:				
Cash and money market funds	$ 751,323	$ —	$ —	$ 751,323
Total cash and cash equivalents	$ 751,323	$ —	$ —	$ 751,323

	As of December 31, 2022			
	Amortized Cost	Gross Unrealized Gains	Gross Unrealized Losses	Estimated Fair Value
Cash and cash equivalents:				
Cash and money market funds	$ 523,458	$ —	$ —	$ 523,458
Total cash and cash equivalents	523,458	—	—	523,458
Marketable securities held to maturity:				
U.S. treasury bills - short-term	100,299	24	—	100,323
Total cash, cash equivalents and marketable securities	$ 623,757	$ 24	$ —	$ 623,781

During the fourth quarter of 2022, the Company purchased $100.0 million of 6-month U.S. treasury bills with the positive intent and ability to hold them until maturity. Therefore, the Company classified this investment as held to maturity and stated it at amortized cost on the consolidated balance sheets. There is no comparable investment as of December 31, 2023.

The amortized cost and fair value of the Company's held to maturity securities by contractual maturity at December 31, 2022 are summarized below. There were no comparable investments as of December 31, 2023:

	December 31, 2022	
	Amortized Costs	Estimated Fair Value
Maturity of one year or less	$ 100,299	$ 100,323
Total	$ 100,299	$ 100,323

Fair Value Measured on a Recurring Basis

Financial assets and financial liabilities measured at fair value on a recurring basis consist of the following as of December 31, 2023 and 2022:

	As of December 31, 2023			
	Level 1	**Level 2**	**Level 3**	**Total**
Assets:				
Money market accounts	$ 658,574	$ —	$ —	$ 658,574
Liabilities:				
Short-term contingent consideration	$ —	$ —	$ 12,983	$ 12,983
Long-term contingent consideration	$ —	$ —	$ 14,070	$ 14,070

	As of December 31, 2022			
	Level 1	**Level 2**	**Level 3**	**Total**
Assets:				
Money market accounts	$ 343,929	$ —	$ —	$ 343,929
Liabilities:				
Short-term contingent consideration	$ —	$ —	$ 13,950	$ 13,950
Long-term contingent consideration	$ —	$ —	$ 51,559	$ 51,559

Contingent Consideration – Earnout

As of December 31, 2023, the maximum amount of future contingent consideration (undiscounted) that the Company could be required to pay in connection with each of the completed acquisitions is; $125.0 million over a three-year earnout period for Avitide, which was acquired in September 2021 and for which the earnout periods run from January 1, 2022 through December 31, 2024; $42.0 million over a two-year earnout period for FlexBiosys, which was acquired in April 2023 and for which the earnout periods run from January 1, 2023 through December 31, 2024; and approximately $10 million over a one-year earnout period for Metenova, which was acquired in October 2023 and for which the earnout period runs from January 1, 2024 through December 31, 2024. See Note 4, *"Acquisitions"* to this report for more information on the contingent consideration earnouts.

During 2023, expected results and change in market inputs used to calculate the discount rate, resulted in a decrease in amounts reported as of December 31, 2023. A reconciliation of the change in fair value of contingent consideration – earnout is included in the following table (amounts in thousands):

Balance at December 31, 2022	$ 65,509
Acquisition date fair value of contingent consideration earnouts	6,640
Payment of contingent consideration earnouts	(14,527)
Decrease in fair value of contingent consideration earnouts	(30,569)
Balance at December 31, 2023	$ 27,053

The recurring Level 3 fair value measurement of our contingent consideration – earnout that we expect to be required to settle our 2023, 2024 and 2025 contingent consideration obligation for Avitide, FlexBiosys and Metenova include the following significant unobservable inputs (amounts in thousands, except percent data):

Contingent Consideration Earnout	Fair Value as of December 31, 2023	Valuation Technique	Unobservable Input	Range	Weighted Average[1]
Commercialization-based payments	$ 20,094	Monte Carlo Simulation	Probability of Success	100%	100%
			Earnout Discount Rate	5.8%-5.9%	5.9%
Revenue and Volume-based payments	$ 1,454	Monte Carlo Simulation	Volatility	12.5%-24.6%	21.9%
			Revenue & Volume Discount Rate	2.5%-9.3%	8.3%
			Earnout Discount Rate	5.8%-7.2%	6.1%
Manufacturing line expansions	$ 5,505	Probability-weighted present value	Probability of Success	100%	100%
			Earnout Discount Rate	6.1%-6.4%	6.3%

(1) Unobservable inputs were weighted by the relative fair value of the contingent consideration liability.

The Company estimates the fair value of the contingent consideration earnouts using a Monte Carlo simulation. Changes in the projected performance of the acquired business could result in a higher or lower contingent consideration obligation in the future.

Fair Value Measured on a Nonrecurring Basis

During 2023, there were no re-measurements to fair value of financial assets and liabilities that are measured at fair value on a nonrecurring basis.

Convertible Senior Notes

In July 2019, the Company issued $287.5 million aggregate principal amount of the 2019 Notes. Interest is payable semi-annually in arrears on January 15 and July 15 of each year. The 2019 Notes will mature on July 15, 2024, unless earlier converted or repurchased in accordance with their terms. At December 31, 2023 and 2022, subsequent to the adoption of ASU 2020-06, the carrying value of the 2019 Notes was $69.5 million and $284.6 million, respectively, net of unamortized debt issuance costs and the fair value of the 2019 Notes was $109.8 million and $452.0 million, respectively. The fair value of the 2019 Notes is a Level 1 valuation and was determined based on the most recent trade activity of the 2019 Notes as of December 31, 2023 and 2022. The 2019 Notes are discussed in more detail in Note 14, *"Convertible Senior Notes,"* to these consolidated financial statements.

On December 14, 2023, the Company issued $600.0 million aggregate principal amount of its 2023 Notes in a private placement pursuant to separate, privately negotiated exchange and subscription agreements (the "Exchange and Subscription Agreements") with a limited number of holders of its outstanding 2019 Notes and certain other qualified institutional buyers pursuant to Rule 144A under the Securities Act of 1933, as amended ("Securities Act"). Pursuant to the Exchange and Subscription Agreements, the Company exchanged $217.7 million of its 2019 Notes for $309.9 million aggregate principal amount of the 2023 Notes (the "Exchange Transaction") and issued $290.1 million aggregate principal amount of the 2023 Notes (the "Subscription Transactions") for $290.1 million in cash. At December 31, 2023, the carrying value of the 2023 Notes was $510.1 million, net of unamortized debt issuance costs, and the fair value of the 2023 Notes was $596.0 million. The fair value of the 2023 Notes is a Level 1 valuation and was determined based on the most recent trade activity of the 2023 Notes as of December 31, 2023. The 2023 Notes are discussed in more detail in Note 14, "*Convertible Senior Notes,*" to these consolidated financial statements.

4. Acquisitions

2023 Acquisitions

Metenova Holding AB

On October 2, 2023, the Company's subsidiary, Repligen Sweden AB acquired Metenova from the former shareholders of Metenova (the "Metenova Seller") pursuant to a Share Sale and Purchase Agreement (the "Share Purchase Agreement"), dated as of September 23, 2023 (such acquisition, the "Metenova Acquisition"), by and among Repligen Sweden AB, the Metenova Seller, and the Company, in its capacity as guarantor of the obligations of Repligen Sweden AB under the Share Purchase Agreement.

Metenova, which is headquartered in Molndal, Sweden, offers magnetic mixing and drive train technologies that are widely used by global biopharmaceutical companies and contract development and manufacturing organizations. The Metenova Acquisition further strengthens our fluid management portfolio with these products.

Consideration Transferred

The Company accounted for the Metenova Acquisition as a purchase of business under ASC 805, "*Business Combinations,*" and the Company engaged a third-party valuation firm to assist with the valuation of Metenova. Under the Share Purchase Agreement, all outstanding equity interests of Metenova were acquired for consideration with a value totaling $172.6 million. The Metenova Acquisition was funded through payment of $164.5 million in cash, the issuance of 52,299 unregistered shares of the Company's common stock totaling $8.1 million and contingent consideration with an immaterial fair value.

Under the acquisition method of accounting, the assets acquired and liabilities assumed of Metenova were recorded as of the acquisition date, at their respective fair values, and consolidated with those of the Company. The fair value of the net liabilities acquired is estimated to be $2.0 million, the fair value of the intangible assets acquired is estimated to be $58.8 million and the residual goodwill is estimated to be $115.8 million. The estimated consideration and preliminary purchase price information has been prepared using a preliminary valuation. Acquisition-related costs are not included as a component of consideration transferred but are expensed in the periods in which costs are incurred. The Company has incurred $3.5 million of transaction and integration costs associated with the Metenova Acquisition from the date of acquisition to December 31, 2023. The transaction costs are included in operating expenses in the consolidated statements of comprehensive income in 2023.

Fair Value of Net Assets Acquired

The preliminary allocation of purchase price is based on the fair value of assets acquired and liabilities assumed as of the acquisition date. As of December 31, 2023, the purchase accounting for this acquisition had not been finalized. As additional information becomes available, the Company may further revise its preliminary purchase price allocation during the remainder of the measurement period. Besides tax implications of the purchase price allocation, the final allocation may result in changes to other assets and liabilities.

The components and estimated allocation of the purchase price consist of the following (amounts in thousands):

Cash and cash equivalents	$	5,768
Accounts receivable		3,730
Inventory		4,421
Prepaid expenses and other current assets		470
Property and equipment		433
Operating lease right of use asset		615
Customer relationships		12,659
Developed technology		44,377
Trademark and tradename		939
Non-competition agreements		787
Goodwill		115,778
Accounts payable		(1,432)
Accrued liabilities		(2,934)
Operating lease liability		(275)
Deferred tax liability, long-term		(12,481)
Operating lease liability, long-term		(255)
Fair value of net assets acquired	$	172,600

Acquired Goodwill

The goodwill of $115.8 million represents future economic benefits expected to arise from anticipated synergies from the integration of Metenova into the Company. These synergies include operating efficiencies and strategic benefits projected to be achieved as a result of the Metenova Acquisition. Substantially all of the goodwill recorded is expected to be nondeductible for income tax purposes.

Intangible Assets

The following table sets forth the components of the identified intangible assets associated with the Metenova Acquisition and their estimated useful lives:

	Useful life	**Fair Value (Amounts in thousands)**	
Customer relationships	15 years	$	12,659
Developed technology	15 years		44,377
Trademark and tradename	15 years		939
Non-competition agreements	2 years		787
		$	58,762

FlexBiosys, Inc.

On April 17, 2023, the Company completed its acquisition of all of the outstanding equity interests in FlexBiosys, pursuant to an Equity Purchase Agreement with FlexBiosys, TSAP Holdings Inc. ("NJ Seller"), Gayle Tarry and Stanley Tarry, as individuals (collectively with NJ Seller, the "FlexBiosys Sellers"), and Stanley Tarry, in his capacity as the representative of the FlexBiosys Sellers (the "FlexBiosys Acquisition").

FlexBiosys, which is headquartered in Branchburg, New Jersey, offers expert design and custom manufacturing of single-use bioprocessing products and a comprehensive range of products that include bioprocessing bags, bottles, and tubing assemblies. These products will complement and expand our fluid management portfolio of offerings.

Consideration transferred

The FlexBiosys Acquisition was accounted for as a purchase of a business under ASC 805, "*Business Combinations,*" and the Company engaged a third-party valuation firm to assist with the valuation of FlexBiosys. Under the terms of the EPA, all outstanding equity interests of FlexBiosys were acquired for consideration with a value totaling $41.0 million. The FlexBiosys Acquisition was funded through payment of $29.0 million in cash, which includes $6.3 million deposited in escrow for future payments, the issuance of 31,415 unregistered shares of the Company's common stock totaling $5.4 million and contingent consideration with fair value of approximately $6.6 million.

Under the acquisition method of accounting, the assets acquired and liabilities assumed of FlexBiosys were recorded as of the acquisition date, at their respective fair values, and consolidated with those of the Company. The fair value of the net assets acquired is estimated to be $14.1 million, the fair value of the intangible assets acquired is estimated to be $12.6 million and the residual goodwill is estimated to be $14.3 million. The estimated consideration and preliminary purchase price information has been prepared using a preliminary valuation. Acquisition-related costs are not included as a component of consideration transferred but are expensed in the periods in which costs are incurred. The Company has incurred $1.1 million of transaction and integration costs associated with the FlexBiosys Acquisition from the date of acquisition to December 31, 2023 with $0.2 million of the transaction and integration costs incurred during the three months ended December 31, 2023. The transaction costs are included in operating expenses in the consolidated statements of comprehensive income in 2023.

Fair Value of Net Assets Acquired

The preliminary allocation of purchase price is based on the fair value of assets acquired and liabilities assumed as of the acquisition date. As of December 31, 2023, the purchase accounting for this acquisition had not been finalized. As additional information becomes available, the Company may further revise its preliminary purchase price allocation during the remainder of the measurement period, which ends on April 17, 2024. The final allocation may result in changes to other assets and liabilities.

The components and estimated allocation of the purchase price consist of the following (amounts in thousands):

Cash and cash equivalents	$	1,090
Accounts receivable		683
Inventory		667
Prepaid expenses and other current assets		35
Property and equipment		12,034
Operating lease right of use asset		3,537
Customer relationships		2,530
Developed technology		9,860
Trademark and tradename		30
Non-competition agreements		220
Goodwill		14,321
Other long-term assets		10
Accounts payable		(136)
Accrued liabilities		(314)
Operating lease liability		(39)
Operating lease liability, long-term		(3,498)
Fair value of net assets acquired	$	41,030

During 2023, the Company recorded an immaterial net working capital adjustment related to the FlexBiosys Acquisition, which is included in goodwill in the table above.

Acquired Goodwill

The goodwill of $14.3 million represents future economic benefits expected to arise from anticipated synergies from the integration of FlexBiosys into the Company. These synergies include operating efficiencies and strategic benefits projected to be achieved as a result of the FlexBiosys Acquisition. Substantially all of the goodwill recorded is expected to be deductible for income tax purposes.

Intangible Assets

The following table sets forth the components of the identified intangible assets associated with the FlexBiosys Acquisition and their estimated useful lives:

	Useful life	Fair Value (Amounts in thousands)
Customer relationships	12 years	$ 2,530
Developed technology	16 years	9,860
Trademark and tradename	4 years	30
Non-competition agreements	5 years	220
		$ 12,640

2021 Acquisitions

BioFlex Solutions LLC and Newton T&M Corp.

On November 29, 2021, the Company entered into an Equity Purchase Agreement with BioFlex ("BioFlex EPA"), NTM and each of Ralph Meola and Jason Nisler, to acquire 100% of the outstanding securities of BioFlex and NTM (collectively, the "NTM Acquisition"). The transaction closed on December 16, 2021.

NTM, which is headquartered in Newton, New Jersey, is the parent company of BioFlex and focuses on manufacturing of products, while BioFlex, also headquartered in Newton, New Jersey, commercializes branded products to biotech customers. The NTM Acquisition complements and expands our filtration offering paths as the industry migrates to single-use flow paths solutions for monoclonal antibody ("mAb"), vaccine and cell and gene therapy ("C&GT") applications, with a focus on single-use fluid management components, including single-use clamps, adapters, end caps and hose assemblies. The NTM Acquisition streamlines and increases control over many components in our single-use supply chain which ultimately should drive reduced lead-times for Repligen customers in the coming years.

Consideration Transferred

The NTM Acquisition was accounted for as a purchase of businesses under ASC 805, *"Business Combinations"* and the Company engaged a third-party valuation firm to assist with the valuation of the business acquired. Under the terms of the BioFlex EPA, all outstanding shares of capital stock of BioFlex were acquired for consideration with a value totaling $31.6 million, which includes $3.0 million deposited into an escrow against which the Company may make claims for indemnification.

Under the acquisition method of accounting, the assets acquired and liabilities assumed of BioFlex were recorded as of the acquisition date, at their respective fair values, and consolidated with those of the Company. The fair value of the net assets acquired is $4.6 million, the fair value of the intangible assets acquired is $17.2 million, and the residual goodwill is $9.8 million. Acquisition-related costs are not included as a component of consideration transferred but are expensed in the periods in which costs are incurred. The Company incurred $3.0 million of transaction and integration costs associated with the NTM Acquisition from the date of acquisition to December 31, 2022, with $2.7 million of transaction and integration costs incurred in 2022 and $0.3 million incurred in 2021. The transaction and integration costs are included in operating expenses in the consolidated statements of comprehensive income for the periods ended December 31, 2022 and 2021.

Fair Value of Net Assets Acquired

The allocation of purchase price is based on the fair value of assets acquired and liabilities assumed as of the acquisition date, based on the final valuation. The Company has made appropriate adjustments to the purchase price allocation during the measurement period, which ended December 16, 2022.

The components and estimated allocation of the purchase price consist of the following (amounts in thousands):

Cash and cash equivalents	$	2,870
Accounts receivable		1,408
Inventory		741
Prepaid expenses and other current assets		126
Property and equipment		34
Operating lease right of use asset		1,034
Customer relationships		13,240
Developed technology		3,540
Trademark and tradename		310
Non-competition agreements		60
Goodwill		9,834
Long term deferred tax asset		81
Accounts payable		(224)
Accrued liabilities		(450)
Operating lease liability		(1,030)
Operating lease liability, long-term		(3)
Fair value of net assets acquired	$	31,571

During 2022, the Company recorded net working capital adjustments of approximately $0.3 million related to pre-acquisition liabilities, which are included in goodwill and accrued liabilities in the table above.

Acquired Goodwill

The goodwill of $9.8 million represents future economic benefits expected to arise from anticipated synergies from the integration of BioFlex and NTM into the Company. These synergies include certain operating efficiencies and strategic benefits projected to be achieved as a result of the NTM Acquisition. Substantially all of the goodwill recorded is expected to be deductible for income tax purposes.

Intangible Assets

The following table sets forth the components of the identified intangible assets associated with the NTM Acquisition and their estimated useful lives:

	Useful life		**Fair Value (Amounts in thousands)**
Customer relationships	10 years	$	13,240
Developed technology	11 years		3,540
Trademark and tradename	15 years		310
Non-competition agreements	3 years		60
		$	17,150

Avitide, Inc.

On September 16, 2021, the Company entered into an Agreement and Plan of Merger and Reorganization ("Avitide Merger Agreement") with Avalon Merger Sub, Inc., a Delaware corporation and a wholly owned direct subsidiary of the Company, Avalon Merger Sub LLC, a Delaware limited liability company and a wholly owned direct subsidiary of the Company, Avitide, a Delaware corporation, and Shareholder Representative Services LLC, a Colorado limited liability company, solely in its capacity as the representative, agent and attorney-in-fact of Avitide's securityholders to purchase Avitide. The transaction closed on September 20, 2021, and on the terms set forth in the Avitide Merger Agreement.

Avitide, which is headquartered in Lebanon, New Hampshire, offers diverse libraries and leading technology in affinity ligand discovery and development resulting in best-in-class ligand discovery and development lead-times. The acquisition gives the Company a new platform for affinity resin development, including C&GT, and advances and expands the Company's proteins and chromatography franchises to address the unique purification needs of gene therapies and other emerging modalities.

Consideration Transferred

The Avitide Acquisition was accounted for as a purchase of a business under ASC 805, *"Business Combinations"* and the Company engaged a third-party valuation firm to assist with the valuation of the business acquired. Under the terms of the Avitide Merger Agreement, all outstanding shares of capital stock of Avitide were cancelled and converted into the right to receive merger consideration with a value totaling up to $275.0 million, which consisted of upfront payments in aggregate of $150.0 million ($149.4 million, net of cash acquired) and up to an additional $125.0 million (undiscounted) in contingent consideration earnout payments if certain performance targets are achieved. Total consideration paid also included $0.8 million deposited into an escrow account against which the Company may make claims for indemnification. The Avitide Acquisition was funded through payment of $75.0 million in cash, the issuance of 271,096 unregistered shares of the Company's common stock totaling $83.0 million and contingent consideration with fair value of approximately $88.4 million.

Under the acquisition method of accounting, the assets acquired and liabilities assumed of Avitide were recorded as of the acquisition date, at their respective fair values, and consolidated with those of the Company. The fair value of the net assets acquired is $2.1 million, fair value of the intangible assets acquired is $46.7 million, and the residual goodwill is $197.5 million. The Company has incurred $5.6 million of transaction and integration costs associated with the Avitide Acquisition from the date of acquisition to December 31, 2022, with $3.0 million of transaction and integration costs incurred in 2022 and $2.6 million in 2021. The transaction costs are included in operating expenses in the consolidated statements of comprehensive income for the periods ended December 31, 2022 and 2021.

The preparation of the valuation required the use of significant assumptions and estimates. Critical estimates included, but were not limited to, future expected cash flows, including projected revenues and expenses, and the applicable discount rates. These estimates were based on assumptions that the Company believes to be reasonable. However, actual results may differ from these estimates.

Total consideration transferred is as follows (amounts in thousands):

Cash consideration	$	74,962
Equity consideration		82,968
Contingent consideration - earnout		88,373
Fair value of net assets acquired	$	246,303

Fair Value of Net Assets Acquired

The allocation of purchase price is based on the fair value of assets acquired and liabilities assumed as of the acquisition date, based on the final valuation of Avitide. The Company has made appropriate adjustments to the purchase price allocation during the measurement period, which ended on September 20, 2022.

The components and estimated allocation of the purchase price consist of the following (amounts in thousands):

Cash and cash equivalents	$	572
Accounts receivable		228
Inventory		332
Prepaid expenses and other current assets		114
Property and equipment		1,862
Operating lease right of use asset		3,648
Customer relationships		24,580
Developed technology		20,650
Trademark and tradename		1,210
Non-competition agreements		210
Goodwill		197,476
Long term deferred tax asset		1,525
Accounts payable		(215)
Accrued liabilities		(2,183)
Operating lease liability		(698)
Operating lease liability, long-term		(2,950)
Other liabilities		(58)
Fair value of net assets acquired	$	246,303

Acquired Goodwill

The goodwill of $197.5 million represents future economic benefits expected to arise from anticipated synergies from the integration of Avitide. These synergies include certain cost savings, operating efficiencies and other strategic benefits projected to be achieved as a result of the Avitide Acquisition. Substantially all of the goodwill recorded is expected to be nondeductible for income tax purposes. During 2022, the Company recorded adjustments to goodwill of $1.8 million related to a change in estimated tax benefits associated with the net operating loss carryforward filed on the Avitide pre-acquisition tax return. The offset of these adjustments is included in long term deferred tax asset in the table above.

Intangible Assets

The following table sets forth the components of the identified intangible assets associated with the Avitide Acquisition and their estimated useful lives:

	Useful life		Fair Value (Amounts in thousands)
Customer relationships	13 years	$	24,580
Developed technology	15 years		20,650
Trademark and tradename	18 years		1,210
Non-competition agreements	3 years		210
		$	46,650

Polymem S.A.

On June 22, 2021, the Company entered into a Stock Purchase Agreement with Polymem, a company organized under the laws of France, and Jean-Michel Espenan and Franc Saux, acting together jointly and severally as the representatives of the sellers pursuant to which Repligen acquired all of the outstanding common stock of Polymem for $47.0 million in cash. The transaction closed on July 1, 2021 (the "Polymem Acquisition.").

Polymem, which is headquartered in, Toulouse, France, is a manufacturer of hollow fiber ("HF") membranes, membrane modules and systems for industrial and bioprocessing applications. Polymem products will complement and expand the Company's portfolio of HF systems and consumables. The acquisition substantially increases Repligen's membrane and module manufacturing capacity and establishes a world-class center of excellence in Europe to address the accelerating global demand for these innovative products.

Consideration Transferred

The Company accounted for the Polymem Acquisition as a purchase of a business under ASC 805 and the Company engaged a third-party valuation firm to assist with the valuation of the business acquired. Payment for the transaction was denominated in Euros but is reflected here in U.S. dollars for presentation purposes based on an exchange rate of 0.8437 as of July 1, 2021, the date of acquisition. Total consideration paid was $47.0 million, which included $4.3 million deposited into an escrow account against which the Company may make claims for indemnification.

Under the acquisition method of accounting, the assets acquired and liabilities assumed of Polymem were recorded as of the acquisition date, at their respective fair values, and consolidated with those of the Company. The fair value of the net assets acquired is $2.2 million, the fair value of the intangible assets acquired is $9.1 million, and the residual goodwill is $35.7 million. Acquisition-related costs are not included as a component of consideration transferred but are expensed in the periods in which costs are incurred. The Company incurred $8.2 million of transaction and integration costs associated with the Polymem Acquisition from the date of acquisition to December 31, 2022, with $5.1 million incurred in 2022 and $3.1 million incurred from the date of acquisition to December 31, 2021. The transaction costs are included in operating expenses in the consolidated statements of comprehensive income for the periods ended December 31, 2022 and 2021.

Fair Value of Net Assets Acquired

The allocation of purchase price is based on the fair value of assets acquired and liabilities assumed as of the acquisition date, based on the final valuation of Polymem. The Company has made appropriate adjustments to the purchase price allocation during the measurement period, which ended on July 1, 2022.

The components and final allocation of the purchase price consist of the following (amounts in thousands):

Cash and cash equivalents	$	353
Net working capital (excluding cash and inventory step-up)		414
Inventory step-up		543
Operating lease right of use assets		1,424
Property and equipment		3,145
Other assets		41
Developed technology		8,274
Trademark and tradenames		510
Non-compete agreements		312
Goodwill		35,680
Operating lease liability		(1,253)
Long term deferred tax liability		(2,327)
Other long-term liabilities		(143)
Fair value of net assets acquired	**$**	**46,973**

Acquired Goodwill

The goodwill of $35.7 million represents future economic benefits expected to arise from anticipated synergies from the integration of Polymem. These synergies include certain operating efficiencies and strategic benefits projected to be achieved as a result of the Polymem Acquisition. Substantially all of the goodwill recorded is expected to be nondeductible for income tax purposes.

Intangible Assets

The following table sets forth the components of the identified intangible assets associated with the Polymem Acquisition and their estimated useful lives:

	Useful life	Fair Value
		(Amounts in thousands)
Developed technology	13 years	$ 8,274
Trademark and tradename	14 years	510
Non-competition agreements	5 years	312
		$ 9,096

5. Restructuring Plan

In July 2023, the Board authorized the Company's management team to undertake restructuring activities to simplify and streamline our organization and strengthen the overall effectiveness of our operations. In addition to the initial streamlining and re-balancing efforts contemplated in July, the Company is undertaking further restructuring activities (collectively, the "Restructuring Plan") which include consolidating a portion of our manufacturing operations between certain U.S. locations, discontinuing the sale of certain product SKUs, and evaluating the fair value of finished goods and raw materials, mostly secured during the 2020-2022 COVID-19 pandemic period (the "COVID-19 Period") to meet increasing demand during a challenging supply chain environment in the industry.

The Company recorded pre-tax costs of $32.2 million in 2023 related to the Restructuring Plan and expects the Restructuring Plan to be completed by the end of the third quarter of 2024. Of the $32.2 million in pre-tax costs in 2023, $27.6 million is non-cash, relating primarily to inventory adjustments to record inventory at net realizable value and accelerated depreciation on equipment related to the shutdown of manufacturing facilities and production lines, the remaining costs are cash expenses, primarily related to severance and employee-related costs.

The following table summarizes the charges related to restructuring activities by type of cost:

	For the Year Ended December 31, 2023				
	Severance & Employee-Related Costs	Inventory Adjustments	Accelerated Depreciation	Facility and Other Exit Costs	Total
			(Amounts in thousands)		
Cost of product revenue	$ 2,077	$ 23,588	$ 3,788	$ 933	$ 30,386
Research and development	116	—	—	—	116
Selling, general and administrative	1,532	—	28	138	1,698
	$ 3,725	$ 23,588	$ 3,816	$ 1,071	$ 32,200

Severance and employee-related costs under the Restructuring Plan are associated with actual headcount reductions. Costs incurred include cash severance and non-cash severance, including other termination benefits. Severance and other termination benefit packages are based on established benefit arrangements or local statutory requirements and we recognized the contractual component of these benefits when payment was probable and could be reasonably estimated.

The inventory adjustments include the impact of the Company discontinuing the sale of certain product SKUs and the impact of having proactively secured materials during the COVID-19 Period to meet accelerated demand during a challenging supply chain environment in the industry. Where demand has reduced, finished goods and raw materials, whose value exceeded the projected requirements to be used before reaching their expiration date, were written down to their realizable value. The Restructuring Plan also includes the closing of manufacturing facilities and production lines, which included inventory that could not be repurposed.

Non-cash charges for accelerated depreciation were recognized on long-lived assets that were taken out of service before the end of their normal service due to the shutdown of manufacturing facilities and production lines, in which case depreciation estimates were revised to reflect the use of the assets over their shortened useful life.

The restructuring accrual is included in accrued liabilities on the condensed consolidated balance sheets as of December 31, 2023 and the balance has been paid as of that date. Activity related to the Restructuring Plan for 2023 was as follows (amounts in thousands):

	Restructuring Costs	Amounts Paid in 2023	Non-Cash Restructuring Items	Restructuring Liability
Severance & employee-related costs	$ 3,725	$ (3,044)	$ (217)	$ 464
Inventory adjustments	23,588	—	(23,588)	—
Accelerated depreciation	3,816	—	(3,816)	—
Facility exit and other exit costs	1,071	(1,061)	(10)	—
Total	$ 32,200	$ (4,105)	$ (27,631)	$ 464

6. Leases

The Company is a lessee under leases of manufacturing facilities, office spaces, machinery, certain office equipment and vehicles. A majority of the Company's leases are operating leases with remaining lease terms between one month and 13 years. Finance leases are immaterial to the Company's consolidated financial statements. The Company determines if an arrangement qualifies as a lease and what type of lease it is at inception. The Company elected the package of practical expedients permitted under the transition guidance within the new lease standard, which among other things, allowed it to continue to account for existing leases based on the historical lease classification. The Company also elected the practical expedients to combine lease and non-lease components and to exclude right of use assets and lease liabilities for leases with an initial term of 12 months or less from the balance sheet.

Some of the lease agreements the Company enters into include Company options to either extend and/or early terminate the lease, the costs of which are included in the Company's operating lease liabilities to the extent that such options are reasonably certain of being exercised. Leases with renewal options allow the Company to extend the lease term typically between 1 and 5 years per option, some of its leases have multiple options to extend. When determining if a renewal option is reasonably certain of being exercised, the Company considers several economic factors, including but not limited to, the significance of leasehold improvements incurred on the property, whether the asset is difficult to replace, underlying contractual obligations, or specific characteristics unique to that particular lease that would make it reasonably certain that the Company would exercise such options.

As of December 31, 2023 and 2022, operating lease right of use assets were $115.5 million and $125.0 million, respectively and operating lease liabilities were $132.2 million and $138.3 million, respectively. The addition of FlexBiosys and Metenova in 2023 added 43,833 square feet to our leased properties and as a result of that and the expansion in Toulouse, France, the operating right of use asset balance increased $4.0 million in 2023, as compared to 2022. However, the consolidated right of use assets balance decreased due to the normal amortization of existing leases during 2023.

The maturities of the Company's operating lease liabilities as of December 31, 2023 are as follows (amounts in thousands):

As of December 31, 2023	Amount
2024	$ 22,585
2025	25,645
2026	25,406
2027	23,944
2028	24,382
2029 and thereafter	79,435
Total future minimum lease payments[1]	201,397
Less lease incentives	(9,765)
Less amount of lease payment representing interest	(32,595)
Total operating lease liabilities	$ 159,037

(1) The future minimum lease payments include obligations for leases not yet commenced of $26.8 million for manufacturing, office and warehouse facilities. These leases have terms of between 5 and 10 years and commence during the first quarter of 2024.

Total operating lease liabilities included on the Company's consolidated balance sheets are as follows (amounts in thousands):

	December 31,	
	2023	2022
Operating lease liability	$ 5,631	$ 6,957
Operating lease liability, long-term	126,578	131,389
Minimum operating lease payments	$ 132,209	$ 138,346

Lease expense for these leases is recognized on a straight-line basis over the lease term, with variable lease payments recognized in the period those payments are incurred. For the years ended December 31, 2023, 2022 and 2021, total lease cost is comprised of the following:

	For the Years Ended December 31,		
Lease Cost	**2023**	**2022**	**2021**
		(Amounts in thousands)	
Operating lease cost	$ 20,981	$ 17,833	$ 9,838
Variable operating lease cost	4,075	11,317	7,118
Lease cost	$ 25,056	$ 29,150	$ 16,956

The following information represents supplemental disclosure for the consolidated statements of cash flows related to operating leases (amounts in thousands):

	For the Years Ended December 31,		
	2023	2022	2021
Operating lease cost	$ (17,862)	$ (13,757)	$ (8,863)

Most of the leases do not provide implicit interest rates and therefore the Company determines the discount rate based on its incremental borrowing rate. The incremental borrowing rate for the Company's leases is determined based on lease term and currency in which the lease payments are made.

The weighted average remaining lease term and the weighted average discount rate used to measure the Company's operating lease liabilities as of December 31, 2023, were:

Weighted average remaining lease term (years)	7.74
Weighted average discount rate	4.13%

Revenue Recognition

The Company generates revenue from the sale of bioprocessing products, equipment devices, and related consumables used with these equipment devices to customers in the life science and biopharmaceutical industries. Under ASC 606, *"Revenue from Contracts with Customers,"* revenue is recognized when, or as, obligations under the terms of a contract are satisfied, which occurs when control of the promised products or services is transferred to customers.

Disaggregation of Revenue

Revenue for the years ended December 31, 2023, 2022 and 2021 was as follows:

	For the Years Ended December 31,	
	2023	2022
	(Amounts in thousands)	
Product revenue	$ 638,381	$ 801,183
Royalty and other income	383	353
Total revenue	$ 638,764	$ 801,536

When disaggregating revenue, the Company considered all of the economic factors that may affect its revenues. Because its revenues are from bioprocessing customers, there are no differences in the nature, timing and uncertainty of the Company's revenues and cash flows from any of its product lines. However, given that the Company's revenues are generated in different geographic regions, factors such as regulatory and geopolitical factors within those regions could impact the nature, timing and uncertainty of the Company's revenues and cash flows.

Disaggregated revenue from contracts with customers by geographic region can be found in Note 2, *"Summary of Significant Accounting Policies – Segment Reporting,"* above.

There was no revenue from customers that represented 10% or more of the Company's total revenue for the year ended December 31, 2023 and 2022. Revenue from Pfizer Inc. was $68.3 million, or 10%, of the Company's total revenue for the year ended December 31, 2021.

Filtration Products

The Company's filtration products generate revenue through the sale of KrosFlo and ARTeSYN tangential flow filtration ("TFF") systems, TangenX® flat sheet ("FS") cassettes, Spectrum® HF filters, membranes and modules, XCell ATF systems and related consumables. Supporting our systems, we also sell ProConnex® Flow Path assemblies and custom silicone-based, single-use flow path assemblies and components from Metenova, FlexBiosys, BioFlex, Polymem, ARTeSYN Biosolutions Holdings Ireland Limited, NMS and EMT, seven acquisitions completed since 2020.

The Company's KrosFlo and ARTeSYN systems are used in the filtration, isolation, purification and concentration of biologics and diagnostic products. TFF is a rapid and efficient method for separation and purification of biomolecules that is widely used in laboratory, process development and process scale applications in biopharmaceutical manufacturing. Sales of large-scale systems generally include components and consumables as well as training and installation services at the request of the customer. Because the initial sale of components and consumables is necessary for the operation of the system, such items are combined with the systems as a single performance obligation. Training and installation services do not significantly modify or customize these systems and therefore represent a distinct performance obligation.

The Company's TangenX FS cassettes (SIUS, SIUS Gamma® and PRO) are not highly interdependent on one another and are therefore considered distinct products that represent separate performance obligations. Product revenue from the sale of TangenX FS cassettes is generally recognized at a point in time upon transfer of control of the customer.

The Company's other filtration product offerings are not highly interdependent of one another and are therefore considered distinct products that represent separate performance obligations. Revenue on these products is generally recognized at a point in time upon transfer of control to the customer. The Company invoices the customer for the installation and training services in an amount that directly corresponds with the value to the customer of the Company's performance to date; therefore, revenue recognized is based on the amount billable to the customer in accordance with the practical expedient under ASC 606-10-55-18.

The Company also markets XCell ATF controllers, which are technologically advanced filtration devices used in upstream processes to continuously remove cellular metabolic waste products during the course of a fermentation run, freeing healthy cells to continue producing the biologic drug of interest. XCell ATF controllers are typically sold with consumables (i.e., tubing sets, metal stands) as well as training and installation services at the request of the customer. The controllers and consumables are considered distinct products and therefore represent separate performance obligations. First time purchasers of the controllers typically purchase a controller that is shipped with the tubing set(s) and metal stand(s). The training and installation services do not significantly modify or customize the XCell ATF controllers and therefore represent a distinct performance obligation. XCell ATF product revenue related to controllers and consumables is generally recognized at a point in time upon transfer of control to the customer.

Chromatography Products

The Company's chromatography products include a number of products used in the downstream purification and quality control of biological drugs. The majority of chromatography revenue relates to the OPUS pre-packed chromatography column product line. OPUS columns are designed to be disposable following a production campaign. Each OPUS column is delivered pre-packaged with the customer's choice of chromatography resin, which is either provided by the Company for the customer or is customer supplied. Chromatography product revenue is generally recognized at a point in time upon transfer of control to the customer and represents a single performance obligation.

Process Analytics Products

The process analytics franchise generates revenue primarily through the sale of the SoloVPE and FlowVPX slope spectroscopy systems, consumables and service. These products complement and support the Company's existing filtration, chromatography and proteins franchises as they allow end-users to make in-line protein concentration measurements in filtration, chromatography and fill-finish applications, designed to allow for real-time process management. Process analytics product revenue is generally recognized at a point in time upon transfer of control to the customer.

Protein Products

The Company's protein franchise generates revenue primarily through the sale of Protein A affinity ligands and growth factors. Protein A ligands are an essential component of Protein A chromatography resins (media) used in the purification of virtually all mAb-based drugs on the market or in development. The Company manufactures multiple forms of Protein A ligands under long-term supply agreements with major life sciences companies, who in turn sell their Protein A chromatography media to end users (biopharmaceutical manufacturers). The Company also manufactures growth factors for sale under long-term supply agreements with certain life sciences companies as well as for direct sales to its customers. Each protein product is considered distinct and therefore represents a separate performance obligation. Protein product revenue is generally recognized at a point in time upon transfer of control to the customer.

In 2021, the Company completed the Avitide Acquisition and added its diverse libraries and leading technology in affinity ligand discovery and development to its proteins franchise. The acquisition gives the Company a new platform for affinity resin development, including C&GT, and advances and expands the Company's proteins and chromatography franchises to address the unique purification needs of gene therapies and other emerging modalities.

Other Products

The Company's other products include operating room products sold to hospitals. Other product revenue is generally recognized at a point in time upon transfer of control to the customer.

Transaction Price Allocated to Future Performance Obligations

Remaining performance obligations represent the transaction price of contracts for which work has not been performed or has been partially performed. The Company's future performance obligations relate primarily to the installation and training of certain of its systems sold to customers. These performance obligations are completed within one year of receipt of a purchase order from its customers. Accordingly, the Company has elected to not disclose the value of these unsatisfied performance obligations as provided under ASC 606-10-50-14.

Contract Balances from Contracts with Customers

The following table provides information about receivables and deferred revenue from contracts with customers as of December 31, 2023 (amounts in thousands):

	December 31, 2023	December 31, 2022
Balances from contracts with customers only:		
Accounts receivable	$ 124,161	$ 116,247
Deferred revenue (included in accrued liabilities and other noncurrent liabilities in the consolidated balance sheets)	$ 10,755	$ 19,631
Revenue recognized during periods presented relating to:		
The beginning deferred revenue balance	$ 18,751	$ 13,390

The timing of revenue recognition, billings and cash collections results in the accounts receivable and deferred revenue balances on the Company's consolidated balance sheets.

A contract asset is created when the Company satisfies a performance obligation by transferring a promised good to the customer. Contract assets may represent conditional or unconditional rights to consideration. The right is conditional and recorded as a contract asset if the Company must first satisfy another performance obligation in the contract before it is entitled to payment from the customer. Contract assets are transferred to billed receivables once the right becomes unconditional. If the Company has the unconditional right to receive consideration from the customer, the contract asset is accounted for as a billed receivable and presented separately from other contract assets. A right is unconditional if nothing other than the passage of time is required before payment of that consideration is due.

When consideration is received, or such consideration is unconditionally due, from a customer prior to transferring goods or services to the customer under the terms of a contract, a contract liability is recorded. Contract liabilities are recognized as revenue after control of the products or services is transferred to the customer and all revenue recognition criteria have been met.

Costs to Obtain or Fulfill a Customer Contract

The Company's sales commission structure is based on achieving revenue targets. The commissions are driven by revenue derived from customer purchase orders which are short term in nature.

Applying the practical expedient in paragraph 340-40-25-4, the Company recognizes the incremental costs of obtaining contracts as an expense when incurred if the amortization period of the assets that the Company otherwise would have recognized is one year or less. These costs are included in selling, general, and administrative expenses in our consolidated statements of comprehensive income. When shipping and handling costs are incurred after a customer obtains control of the products, the Company accounts for these as costs to fulfill the promise and not as a separate performance obligation.

8. Credit Losses

The Company is exposed to credit losses primarily through sales of products and services. The Company's expected loss allowance methodology for accounts receivable is developed using historical collection experience, current and future economic and market conditions and a review of the current status of customers' trade accounts receivable. Customers are pooled based on sharing specific risk factors, including geographic location. Due to the short-term nature of such receivables, the estimated accounts receivable that may not be collected is based on aging of the accounts receivable balances.

Customers are assessed for credit worthiness upfront through a credit review, which includes assessment based on the Company's analysis of their financial statements when a credit rating is not available. The Company evaluates contract terms and conditions, country and political risk, and may require prepayment to mitigate risk of loss. Specific allowance amounts are established to record the appropriate provision for customers that have a higher probability of default. The Company monitors changes to the receivables balance on a timely basis, and balances are written off as they are determined to be uncollectible after all collection efforts have been exhausted.

Estimates of potential credit losses are used to determine the allowance. It is based on assessment of anticipated payment and all other historical, current and future information that is reasonably available.

The accounts receivable balance on the Company's consolidated balance sheets as of December 31, 2023 was $124.2 million, net of $2.1 million of allowances. The following table provides a roll-forward of the allowance for credit losses in 2023 and 2022 that is deducted from the amortized cost basis of accounts receivable to present the net amount expected to be collected (amounts in thousands):

	For the Years Ended December 31,	
	2023	2022
Balance of allowance for credit losses, beginning of period	$ (1,365)	$ (1,417)
Current period change for write-offs	82	126
Current period change for expected credit losses	(839)	(74)
Balance of allowance for credit losses, end of period	$ (2,122)	$ (1,365)

9. Goodwill and Intangible Assets

Goodwill

Goodwill represents the difference between the purchase price and the estimated fair value of identifiable assets acquired and liabilities assumed. Goodwill acquired in a business combination and determined to have an indefinite useful life is not amortized, but instead is tested for impairment at least annually in accordance with ASC 350. The following table represents the changes in the carrying value of goodwill for the years ended December 31, 2023 and 2022 (amounts in thousands):

Balance as of December 31, 2021	$ 860,362
Measurement period adjustment - BioFlex	(346)
Measurement period adjustment - Avitide	(1,768)
Cumulative translation adjustment	(2,735)
Balance as of December 31, 2022	$ 855,513
Acquisition of FlexBiosys, Inc.	14,321
Acquisition of Metenova Holding AB	115,778
Cumulative translation adjustment	1,508
Balance as of December 31, 2023	$ 987,120

During each of the fourth quarters of 2023, 2022 and 2021, the Company completed its annual impairment assessments and concluded that goodwill was not impaired in any of those years.

Intangible Assets

Intangible assets with a definitive life are amortized over their useful lives using the straight-line method, and the amortization expense is recorded within cost of product revenue and selling, general and administrative expense in the Company's consolidated statements of comprehensive income. Intangible assets and their related useful lives are reviewed at least annually to determine if any adverse conditions existed that would indicate the carrying value of these assets may not be recoverable. More frequent impairment assessments are conducted if certain conditions exist, including a change in the competitive landscape, any internal decisions to pursue new or different technology strategies, a loss of a significant customer, or a significant change in the marketplace, including changes in the prices paid for the Company's products or changes in the size of the market for the Company's products. If impairment indicators are present, the Company determines whether the underlying intangible asset is recoverable through estimated future undiscounted cash flows. If the asset is not found to be recoverable, it is written down to the estimated fair value of the asset based on the sum of the future discounted cash flows expected to result from the use and disposition of the asset. If the estimate of an intangible asset's remaining useful life is changed, the remaining carrying amount of the intangible asset is amortized prospectively over the revised remaining useful life. The Company continues to believe that its definite-lived intangible assets are recoverable at December 31, 2023.

Indefinite-lived intangible assets are tested for impairment at least annually. There has been no impairment of our intangible assets for the periods presented.

Intangible assets, net consisted of the following at December 31, 2023:

	December 31, 2023			
	Gross Carrying Value	Accumulated Amortization	Net Carrying Value	Weighted Average Useful Life (in years)
	(Amounts in thousands)			
Finite-lived intangible assets:				
Technology - developed	$ 249,594	$ (44,162)	$ 205,432	16
Patents	240	(240)	—	8
Customer relationships	269,949	(83,963)	185,986	15
Trademarks	8,757	(1,789)	6,968	19
Other intangibles	3,914	(2,514)	1,400	3
Total finite-lived intangible assets	532,454	(132,668)	399,786	15
Indefinite-lived intangible asset:				
Trademarks	700	—	700	—
Total intangible assets	$ 533,154	$ (132,668)	$ 400,486	

Intangible assets consisted of the following at December 31, 2022:

	December 31, 2022			
	Gross Carrying Value	Accumulated Amortization	Net Carrying Value	Weighted Average Useful Life (in years)
	(Amounts in thousands)			
Finite-lived intangible assets:				
Technology - developed	$ 190,463	$ (30,992)	$ 159,471	16
Patents	240	(240)	—	8
Customer relationships	252,934	(66,559)	186,375	15
Trademarks	7,682	(1,319)	6,363	19
Other intangibles	2,811	(2,044)	767	4
Total finite-lived intangible assets	454,130	(101,154)	352,976	16
Indefinite-lived intangible asset:				
Trademarks	700	—	700	—
Total intangible assets	$ 454,830	$ (101,154)	$ 353,676	

Amortization expense for finite-lived intangible assets was $31.1 million, $27.1 million and $22.1 million for the years ended December 31, 2023, 2022 and 2021, respectively. As of December 31, 2023, the Company expects to record the following amortization expense (amounts in thousands):

For the Years Ended December 31,	Estimated Amortization Expense
2024	$ 34,314
2025	33,879
2026	33,524
2027	33,421
2028	32,689
2029 and thereafter	231,959
Total	$ 399,786

10. Consolidated Balance Sheet Detail

Inventories, net

Inventories, net consists of the following:

	December 31,	
	2023	2022
	(Amounts in thousands)	
Raw materials	$ 123,598	$ 149,438
Work-in-process	4,492	6,183
Finished products	74,231	82,656
Total inventories, net	$ 202,321	$ 238,277

Prepaid Expenses and Other Current Assets

Prepaid expenses and other current assets consist of the following:

	December 31,	
	2023	2022
	(Amounts in thousands)	
Equipment maintenance and services	$ 6,605	$ 7,135
Prepaid income taxes	10,229	519
Prepaid insurance	3,087	1,909
Other	13,317	10,274
Total prepaid expenses and other current assets	$ 33,238	$ 19,837

Property, Plant and Equipment

Property, plant and equipment consist of the following:

	December 31,	
	2023	2022
	(Amounts in thousands)	
Land	$ 992	$ 1,003
Buildings	1,667	1,599
Leasehold improvements	126,663	115,672
Equipment	114,606	94,613
Furniture, fixtures and office equipment	9,077	8,307
Computer hardware and software	35,528	29,813
Construction in progress	47,086	31,553
Other	544	420
Total property, plant and equipment	336,163	282,980
Less - Accumulated depreciation	(128,723)	(92,307)
Total property, plant and equipment, net	$ 207,440	$ 190,673

Depreciation expense totaled $37.0 million, $23.9 million and $16.4 million in the fiscal years ended December 31, 2023, 2022 and 2021, respectively.

Accrued Liabilities

Accrued liabilities consist of the following:

	December 31,	
	2023	2022
	(Amounts in thousands)	
Employee compensation	$ 16,660	$ 33,522
Deferred revenue	10,287	19,283
Income taxes payable	6,814	2,459
Other	16,772	15,856
Total accrued liabilities	$ 50,533	$ 71,120

11. Income Taxes

The components of income before income taxes are as follows:

	For the Years Ended December 31,		
	2023	2022	2021
	(Amounts in thousands)		
Domestic	$ (17,601)	$ 153,446	$ 81,984
Foreign	81,733	65,694	71,559
Income before income taxes	$ 64,132	$ 219,140	$ 153,543

The components of the income tax provision are as follows:

	For the Years Ended December 31,		
	2023	2022	2021
	(Amounts in thousands)		
Components of the income tax provision:			
Current	$ 20,238	$ 34,800	$ 20,166
Deferred	2,317	(1,619)	5,086
Total	$ 22,555	$ 33,181	$ 25,252
Jurisdictional components of the income tax provision:			
Federal	$ 3,512	$ 17,662	$ 8,321
State	142	1,381	1,251
Foreign	18,901	14,138	15,680
Total	$ 22,555	$ 33,181	$ 25,252

At December 31, 2023, the Company had federal net operating loss carryforwards of $31.1 million, state net operating loss carryforwards of $1.5 million, and foreign net operating loss carryforwards of $4.9 million. The state net operating loss carryforwards will expire at various dates through 2043, while the federal and foreign net operating loss carryforwards have unlimited carryforward periods and do not expire. At December 31, 2023, the Company had federal and state business tax credits carryforwards of $5.0 million available to reduce future federal and state income taxes. The business tax credit carryforwards will expire at various dates through 2043. The net operating loss and business tax credit carryforwards are subject to review and possible adjustment by the Internal Revenue Service and may be limited in the event of certain changes in the ownership interest of significant shareholders.

The components of deferred income taxes are as follows:

	December 31,	
	2023	2022
	(Amounts in thousands)	
Deferred tax assets:		
Stock-based compensation expense	$ 5,120	$ 5,323
Operating leases	30,727	31,564
Capitalized research and development	17,568	9,102
Inventory	10,131	5,983
Net operating loss carryforwards	7,578	9,808
Business tax credit carryforwards	4,697	2,639
Other	5,314	4,440
Total deferred tax assets	81,135	68,859
Less: valuation allowance	(20)	(19)
Net deferred tax assets	81,115	68,840
Deferred tax liabilities:		
Fixed assets	(17,716)	(18,965)
Acquired intangible assets	(56,956)	(43,549)
Operating lease right of use assets	(26,373)	(28,486)
Debt discount	(19,006)	—
Total deferred tax liabilities	(120,051)	(91,000)
Total net deferred tax liabilities	$ (38,936)	$ (22,160)

The net change in the total valuation allowance for the year ended December 31, 2023 and 2022 was an increase of approximately $1,000 and a decrease of approximately $0.7 million, respectively.

The reconciliation of the federal statutory rate to the effective income tax rate for the years ended December 31, 2023, 2022 and 2021 is as follows:

	For the Years Ended December 31,					
	2023		2022		2021	
	Amount	%	Amount	%	Amount	%
	(Amounts in thousands, except percentages)					
Income before income taxes	$ 64,132		$ 219,140		$ 153,543	
Expected tax at statutory rate	13,469	21.0%	46,020	21.0%	32,247	21.0%
Adjustments due to:						
Difference between U.S. and foreign tax	1,084	1.7%	1,024	0.5%	530	0.3%
State income taxes	1,387	2.2%	3,509	1.6%	1,462	1.0%
Business tax credits	(4,522)	(7.1%)	(5,139)	(2.3%)	(2,239)	(1.5%)
Stock-based compensation expense	(2,461)	(3.8%)	(5,638)	(2.6%)	(9,049)	(5.9%)
U.S. taxation of foreign earnings	343	0.5%	83	0.0%	30	0.0%
Foreign-derived intangible income	(88)	(0.1%)	(5,042)	(2.3%)	(2,547)	(1.7%)
Executive compensation	3,084	4.8%	5,441	2.5%	3,397	2.2%
Contingent consideration	(6,412)	(10.0%)	(6,033)	(2.8%)	1,232	0.8%
Loss on extinguishment of debt	2,634	4.1%	—	0.0%	—	0.0%
Debt discount	16,650	26.0%	—	0.0%	—	0.0%
Foreign exchange loss	(2,288)	(3.6%)	—	0.0%	—	0.0%
Uncertain tax provisions	165	0.3%	234	0.1%	(443)	(0.3%)
Change in valuation allowance	—	0.0%	(688)	(0.3%)	(48)	(0.0%)
Return to provision adjustments	(1,255)	(2.0%)	(498)	(0.2%)	(50)	(0.0%)
Other	765	1.2%	(92)	(0.0%)	730	0.5%
Income tax provision	$ 22,555	35.2%	$ 33,181	15.1%	$ 25,252	16.4%

The Company's tax returns are subject to examination by federal, state and foreign tax authorities. The Company's two major tax jurisdictions are subject to examination for the following periods:

Jurisdiction	Fiscal Years Subject to Examination
United States - federal and state	2019-2023
Sweden	2018-2023

The following is a tabular reconciliation of the total amounts of unrecognized tax benefits:

	For the Years Ended December 31,	
	2023	2022
	(Amounts in thousands)	
Balance of gross unrecognized tax benefits, beginning of period	$ 2,996	$ 2,786
Gross amounts of increases in unrecognized tax benefits as a result of tax positions taken in the current period	178	146
Gross amounts of increases in unrecognized tax benefits as a result of tax positions taken in the prior period	53	64
Gross amounts of decreases due to release	(88)	—
Balance of gross unrecognized tax benefits, end of period	$ 3,139	$ 2,996

Included in the balance of unrecognized tax benefits as of December 31, 2023, are $3.1 million of tax benefits that, if recognized, would affect the effective tax rate. The Company classifies interest and penalties related to income taxes as components of its income tax provision. In 2023, a net expense of approximately $15,000, was recorded to the income tax provision related to interest and penalties while in 2022, a net expense of approximately $24,000 was recorded. The amount of interest and penalties recorded in the accompanying consolidated balance sheets was approximately $67,000 and $52,000 as of December 31, 2023 and 2022, respectively. In the next twelve months, it is reasonably possible the Company will reduce its gross unrecognized tax benefits, excluding interest by up to $1.1 million due to expiring statutes of limitations.

In 2021, the Organization of Economic Co-operation and Development announced an Inclusive Framework on Base Erosion and Profit Sharing with the goal of achieving consensus around substantial changes to international tax policies, including the implementation of a minimum global effective tax rate of 15%. We continue to evaluate the impacts of enacted legislation and pending legislation in the tax jurisdictions in which we operate. While various countries have implemented the legislation as of January 1, 2024, we do not expect a resulting material change to our income tax provision for the 2024 fiscal year.

As of December 31, 2023, the Company has accumulated undistributed earnings generated by its foreign subsidiaries of approximately $212.4 million. Because $5.7 million of such earnings have previously been subject to the one-time transition tax on foreign earnings required by the Tax Cuts and Jobs Act enacted in December 2017, any additional taxes due with respect to such earnings or the excess of the amount for financial reporting over the tax basis of our foreign investments would generally be limited to foreign and state taxes. At December 31, 2023, the Company has not provided for taxes on outside basis differences of its foreign subsidiaries as it is not practicable and the Company has the ability and intent to indefinitely reinvest the undistributed earnings of its foreign subsidiaries, and there are no needs for such earnings in the United States that would contradict its plan to indefinitely reinvest.

12. Stockholders' Equity

Share Repurchases

In December 2023, the Board authorized and approved a stock repurchase of up to $25.0 million of the Company's common stock concurrent with the issuance of $600.0 million aggregate principal amount of its 2023 Notes. See Note 14, "*Convertible Senior Notes,*" for more information on the issuance. The Company used $14.4 million of the proceeds from the issuance of the 2023 Notes to repurchase 92,090 shares at a price of $156.22, including transaction costs, to offset the impact of dilution from the issuance of 2023 Notes and equity compensation programs as well as to reduce its outstanding share count. The Company has elected to retire the shares repurchased to date. Retired shares become part of the pool of authorized but unissued shares. The purchase price of the retired shares in excess of par value, including transaction costs, is recorded as a decrease to additional paid-in capital in the Company's consolidated balance sheets as of December 31, 2023.

Stock Option and Incentive Plans

At the Company's 2018 Annual Meeting of Stockholders held on May 16, 2018, the Company's shareholders approved the 2018 Stock Option and Incentive Plan (the "2018 Plan"). Under the 2018 Plan the number of shares of the Company's common stock that are reserved and available for issuance shall be 2,778,000 plus the number of shares of common stock available for issuance under the Company's Amended and Restated 2012 Stock Option and Incentive Plan (the "2012 Plan"). The shares of common stock underlying any awards under the 2018 Plan and 2012 Plan that are forfeited, canceled or otherwise terminated (other than by exercise) shall be added back to the shares of stock available for issuance under the 2018 Plan. At December 31, 2023, 1,671,408 shares were available for future grants under the 2018 Plan.

Stock Issued for Earnout Payment

In May 2023, the Company issued 42,621 shares of its common stock to former securityholders of Avitide to satisfy the contingent consideration obligation established under the Agreement and Plan of Merger and Reorganization (the "Avitide Agreement") which the Company entered into as part of the Avitide Acquisition. See Note 4, "*Acquisitions*" above for additional information on the Avitide Acquisition and the contingent consideration. The shares represent 50% of the earnout consideration earned in the First Earnout Year (as defined in the Avitide Agreement).

Stock-Based Compensation

The Company recorded stock-based compensation expense of $25.6 million, $27.3 million and $27.5 million for the years ended December 31, 2023, 2022 and 2021, respectively, for share-based awards granted under the Plans. The following table presents stock-based compensation expense in the Company's consolidated statements of comprehensive income:

	For the Years Ended December 31,		
	2023	2022	2021
	(Amounts in thousands)		
Cost of product revenue	$ 1,933	$ 2,525	$ 2,021
Research and development	2,855	2,622	2,856
Selling, general and administrative	20,787	22,169	22,623
Total stock-based compensation	$ 25,575	$ 27,316	$ 27,500

Stock Options

The Company uses the Black-Scholes option pricing model to calculate the fair value of stock option awards on the grant date, and measures stock-based compensation costs of stock options at the grant date based on the estimated fair value of the award. The Company recognizes expense on awards with service-based vesting over the employee's requisite service period on a straight-line basis. The Company recognizes stock-based compensation expense for options that are ultimately expected to vest, and accordingly, such compensation expense has been adjusted for estimated forfeitures.

The fair value of stock option awards granted during the years ended December 31, 2023, 2022 and 2021 were calculated using the following estimated assumptions:

	For the Years Ended December 31,		
	2023	2022	2021
Expected term (in years)	5.14-6.5	5.5-6.5	5.5-6.5
Expected volatility (range)	44.78-46.58%	41.44-43.96%	44.57-45.27%
Risk-free interest rate	3.56-4.71%	1.86-4.07%	0.77-1.07%
Expected dividend yield	0%	0%	0%

Information regarding option activity for the year ended December 31, 2023, under the Plans is summarized below:

	Shares	Weighted average exercise price	Weighted-Average Remaining Contractual Term (in Years)	Aggregate Intrinsic Value (in Thousands)
Options outstanding at December 31, 2022	609,965	$ 71.74		
Granted	90,305	$ 168.22		
Exercised	(40,211)	$ 26.76		
Forfeited/expired/cancelled	(10,929)	$ 189.46		
Options outstanding at December 31, 2023	649,130	$ 85.97		
Options exercisable at December 31, 2023	364,443	$ 65.53		
Vested and expected to vest at December 31, 2023[1]	635,834	$ 85.49	5.59	$ 61,888

(1) Represents the number of vested options as of December 31, 2023 plus the number of unvested options expected to vest as of December 31, 2023, based on the unvested outstanding options at December 31, 2023 adjusted for estimated forfeiture rates of 8% for awards granted to non-executive level employees and 3% for awards granted to executive level employees.

The aggregate intrinsic value in the table above represents the total pre-tax intrinsic value (the difference between the closing price of the common stock on December 29, 2023, the last business day of 2023, of $179.80 per share and the exercise price of each in-the-money option) that would have been received by the option holders had all option holders exercised their options on December 31, 2023. The

aggregate intrinsic value of stock options exercised during the years ended December 31, 2023, 2022 and 2021 was $5.8 million, $14.1 million and $20.3 million, respectively.

The weighted average grant date fair value of options granted during the years ended December 31, 2023, 2022 and 2021 was $84.37, $87.40 and $88.01, respectively. The total fair value of stock options that vested during the years ended December 31, 2023, 2022 and 2021 was $4.7 million, $3.1 million and $3.0 million, respectively.

Stock Units

The fair value of stock units is calculated using the closing price of the Company's common stock on the date of grant. The Company recognizes expense on awards with service-based vesting over the employee's requisite service period on a straight-line basis. The Company recognizes expense on performance-based awards over the vesting period based on the probability that the performance metrics will be achieved. Information regarding stock unit activity, which includes activity for restricted stock units and performance stock units, for the year ended December 31, 2023 under the Plans is summarized below:

	Shares	Weighted Average Grant Date Fair Value
Unvested at December 31, 2022	531,034	$ 142.57
Awarded	212,338	$ 170.03
Vested	(195,672)	$ 124.58
Forfeited/cancelled	(73,380)	$ 177.81
Unvested at December 31, 2023	474,320	$ 155.59
Vested and expected to vest at December 31, 2023[(1)]	413,249	$ 152.74

(1) Represents the number of vested stock units as of December 31, 2023, plus the number of unvested stock units expected to vest as of December 31, 2023, based on the unvested outstanding stock units at December 31, 2023 adjusted for estimated forfeiture rates of 8% for awards granted to non-executive level employees and 3% for awards granted to executive level employees.

The aggregate intrinsic value of stock units vested during the years ended December 31, 2023, 2022 and 2021 was $35.7 million, $43.9 million and $46.5 million, respectively. The total fair value of stock units that vested during the years ended December 31, 2023, 2022 and 2021 was $26.2 million, $22.7 million and $13.9 million, respectively.

As of December 31, 2023, there was $63.8 million of total unrecognized compensation cost related to unvested share-based awards. This cost is expected to be recognized over a weighted average remaining requisite service period of 2.84 years. The Company expects 2,185,873 unvested options and stock units to vest over the next five years.

13. Commitments and Contingencies

License Agreement

On September 19, 2022, the Company entered into a 15-year exclusive License Agreement (the "Daylight Agreement") with DRS Daylight Solutions, Inc. ("Daylight"), giving the Company exclusive license and commercialization rights to use certain technology and intellectual property subject to conditions set forth in the Daylight Agreement. The Company agreed to pay Daylight (i) an initial, one-time, non-refundable, non-creditable upfront cash payment and (ii) certain quarterly royalty payments.

Pursuant to the Daylight Agreement, the Company obtains the exclusive, non-transferrable, right and license to use specifically in the field of bioprocessing, the Daylight intellectual property called Culpeo® QCL-IR Liquid Analyzer ("Culpeo"), which is a compact, intelligent spectrometer that uses the power of quantum cascade lasers to analyze and identify chemicals. Under the Daylight Agreement, the Company assumes responsibility for the commercialization and sale of Culpeo, in addition to the ability to incorporate the intellectual

property into optimized products over the term of the Daylight Agreement. Daylight will continue to sell the products in the specified fields of Aerospace and Defense.

Collaboration Agreements

The Company licenses certain technologies that are, or may be, incorporated into its technology under several agreements and also has entered into several clinical research agreements that require the Company to fund certain research projects. Generally, the license agreements require the Company to pay annual maintenance fees and royalties on product sales once a product has been established using the technologies. R&D expenses associated with license agreements were immaterial amounts for the years ended December 31, 2023, 2022 and 2021.

In June 2018, the Company secured an agreement with Navigo Proteins GmbH ("Navigo") for the exclusive co-development of multiple affinity ligands for which Repligen holds commercialization rights. The Company is manufacturing and supplying the first of these ligands, NGL-Impact®, exclusively to Purolite, who is pairing the Company's high-performance ligand with Purolite's agarose jetting base bead technology used in their Jetted A50 Protein A resin product. The Company also signed a long-term supply agreement with Purolite for NGL-Impact and other potential additional affinity ligands that may advance from the Company's Navigo collaboration. In September 2020, the Company and Navigo successfully completed co-development of an affinity ligand targeting the SARS-CoV-2 spike protein, to be utilized in the purification of vaccines for the COVID-19 pandemic, including emerging variants of the SARS-CoV-2 coronavirus. The Company has proceeded with scaling up and manufacturing this ligand and the development and validation of the related affinity chromatography resin, which is marketed by the Company. In September 2021, the Company and Navigo successfully completed co-development of a novel affinity ligand that addresses aggregation issues associated with pH sensitive antibodies and Fc-fusion proteins. The Company is manufacturing and supplying this ligand, NGL-Impact® HipH, to Purolite. The Navigo and Purolite agreements are supportive of the Company's strategy to secure and reinforce the Company's proteins business. The Company made royalty payments to Navigo of $3.8 million, $2.6 million and $2.3 million in the years ended December 31, 2023, 2022 and 2021, respectively, in connection with this program, which are recorded to research and development expenses in the Company's consolidated statements of comprehensive income.

Purchase Orders, Supply Agreements and Other Contractual Obligations

In the normal course of business, the Company has entered into purchase orders and other agreements with manufacturers, distributors and others. Outstanding obligations at December 31, 2023 of $34.3 million are expected to be completed within one year.

Legal Proceedings

From time to time, in the normal course of its operations, the Company is subject to litigation matters and claims relating to employee relations, business practices and patent infringement. Litigation can be expensive and disruptive to normal business operations. Moreover, the results of complex legal proceedings are difficult to predict, and the Company's view of these matters may change in the future as the litigation and events related thereto unfold. The Company expenses legal fees as incurred. The Company records a provision for contingent losses when it is both probable that a liability has been incurred and the amount of the loss can be reasonably estimated. An unfavorable outcome to any legal matter, if material, could have an adverse effect on the Company's operations or its financial results.

14. Convertible Senior Notes

The carrying value of the Company's convertible senior notes is as follows:

	December 31, 2023	December 31, 2022
	(Amounts in thousands)	
0.375% Convertible Senior Notes due 2024:		
Principal amount	$ 69,700	$ 287,470
Unamortized debt issuance costs	(248)	(2,855)
Carrying amount - Convertible Senior Notes due 2024, net	$ 69,452	$ 284,615
1.00% Convertible Senior Notes due 2028:		
Principal amount	$ 600,000	$ —
Unamortized debt discount	(81,457)	—
Unamortized debt issuance costs	(8,400)	—
Carrying amount - Convertible Senior Notes due 2028, net	$ 510,143	$ —

1.00% Convertible Senior Notes due 2028

On December 14, 2023, the Company issued $600.0 million aggregate principal amount of its 2023 Notes in the Exchange and Subscription Agreements with a limited number of holders of its outstanding 2019 Notes and certain other qualified institutional buyers pursuant to Rule 144A under the Securities Act. Pursuant to the Exchange and Subscription Agreements, the Company exchanged $217.7 million of its 2019 Notes, which were cancelled upon exchange, for $309.9 million aggregate principal amount of the 2023 Notes (the "Exchange Transaction") and issued $290.1 million aggregate principal amount of the 2023 Notes in a private placement to accredited institutional buyers (the "Subscription Transactions") for $290.1 million in cash.

The Company evaluated the Exchange Transaction and determined approximately $29.6 million of the $217.7 million principal of the exchanged 2019 Notes should be accounted for as extinguishments of debt and approximately $188.1 million should be accounted for as modification of debt. As a result, we recognized a $12.7 million loss on extinguishment of debt in our consolidated statements of comprehensive income for the year ended December 31, 2023, inclusive of $0.1 million of unamortized debt issuance costs. Under modification accounting, the carrying amount of the modified 2019 Notes was reduced by $2.8 million, with a corresponding increase to additional paid-in capital, to account for the increase in the fair value of the embedded conversion option, representing a debt discount of the modified 2019 Notes. The aggregate debt discount of $82.1 million, comprised of $79.3 million increase in principal of the modified 2019 Notes and a $2.8 million increase in the fair value of the embedded conversion option, is as a direct reduction from the carrying value of the convertible debt on our consolidated balance sheets. This amount will be accreted into interest expense in the consolidated statements of comprehensive income using the effective interest method over the term of the 2023 Notes.

Proceeds from the Subscription Transactions were $276.1 million, net of debt issuance costs of $14.0 million. The Exchange Transaction resulted in $6.2 million of the debt issuance costs related to the modified 2019 Notes, which were expensed as incurred in accordance with modification accounting, and $7.8 million of deferred debt issuance costs related to the 2023 Notes, which were recorded as a direct deduction to the carrying value of the 2023 Notes on the Company's consolidated balance sheets. The Company will amortize the $7.8 million of debt issuance costs of the 2023 Notes into amortization of debt issuance costs in the Company's consolidated statements of comprehensive income over the remaining term of the 2023 Notes. The carrying value of the 2023 Notes of $510.1 million is included in long-term debt on the Company's consolidated balance sheets as of December 31, 2023.

The Company used $14.4 million of the proceeds from the Subscription Transactions to repurchase shares of its common stock from certain purchasers of the 2023 Notes. See Note 12, *"Stockholders' Equity - Share Repurchases"* for additional information related to this repurchase. The Company will also use a portion of the proceeds to finance in part, the settlement upon conversion or repurchase of the remaining 2019 Notes at or prior to maturity. The remainder of the proceeds will be used for working capital and general corporate purposes, including to fund possible acquisitions of, or investments in, complementary businesses, products, services and technologies.

The 2023 Notes are senior, unsecured obligations of the Company, and bear interest at a rate of 1.00% per year. Interest is payable semi-annually in arrears on each June 15 and December 15, commencing on June 15, 2024. The 2023 Notes will mature on December 15, 2028, unless earlier redeemed, repurchased or converted. The initial conversion rate for the 2023 Notes is 4.9247 shares of the Company's common stock per $1,000 principal amount of 2023 Notes, which is equivalent to an initial conversion price of $203.06 per share and represents a 30% premium over the last reported sale price of $156.20 per share on December 6, 2023, the date on which the 2023 Notes were priced. Prior to the close of business on the business day immediately preceding September 15, 2028, the 2023 Notes will be convertible at the options of the holders of 2023 Notes only upon the satisfaction of specified conditions and during certain periods into cash up to their principal amount, and into cash, shares of the Company's common stock or a combination thereof, at the Company's election, for the conversion value above the principal amount, if any. Thereafter until the close of business on the second scheduled trading day immediately preceding the maturity date, the 2023 Notes will be convertible at the option of the holders of 2023 Notes at any time regardless of these conditions. The Company may redeem for cash, all or a portion of the 2023 Notes, at its option, on or after December 18, 2026 and prior to the 21st scheduled trading day immediately preceding the maturity date at a redemption price of 100% of the principal amount of the 2023 Notes to be redeemed, plus accrued and unpaid interest to, but excluding the redemption date, if certain conditions are met in accordance to the indenture governing the 2023 Notes (the "2023 Notes Indenture").

If the Company undergoes a "fundamental change" (as defined in the 2023 Notes Indenture), the holders of the 2023 Notes may require the Company to repurchase for cash all or part of their 2023 Notes at a purchase price equal to 100% of the principal amount of the 2023 Notes to be repurchased, plus accrued and unpaid interest, if any, up to, but excluding, the fundamental change repurchase date. In addition, if certain "make-whole fundamental changes" (as defined in 2023 Notes Indenture) occur or the Company calls all or a portion of the 2023 Notes for redemption, the Company will, in certain circumstances, increase the conversion rate for any 2023 Notes converted in connection with such make-whole fundamental change or any 2023 Notes called for redemption that are converted during the related redemption period.

Interest expense recognized on the 2023 Notes in 2023 was $0.2 million and $0.6 million for the contractual coupon interest and accretion of the debt discount, respectively. Amortization of debt issuance costs recorded in 2023 related to the 2023 Notes was $6.3 million, which includes the $6.2 million of debt issuance costs recorded under modification accounting mentioned above and $0.1 million amortization of debt issuance costs related to the capitalized portion of the costs. The effective interest rate on the 2023 Notes is 4.39%, which included the interest on the 2023 Notes and amortization of the debt discount and issuance costs. As of December 31, 2023, the carrying value of the 2023 Notes was $510.1 million and the fair value of the principal was $596.0 million. The fair value of the 2023 Notes was determined based on the most recent trade activity of the 2023 Notes as of December 31, 2023.

The 2023 Notes Indenture contains customary terms and events of default. If an event of default (other than certain events of bankruptcy, insolvency or reorganization involving the Company) occurs and is continuing, the holders of at least 25% in aggregate principal amount of the outstanding 2023 Notes may declare 100% of the principal of, and any accrued and unpaid interest on, all of the 2023 Notes to be due and payable. Upon the occurrence of certain events of bankruptcy, insolvency or reorganization involving the Company, 100% of the principal of and accrued and unpaid interest, if any, on all of the 2023 Notes will become due and payable automatically. Notwithstanding the foregoing, the 2023 Notes provide that, to the extent the Company elects and for up to 365 days, the sole remedy for an event of default relating to certain failures by the Company to comply with certain reporting covenants consist exclusively of the right to receive additional interest on the 2023 Notes. The Company is not aware of any events of default that would allow holders to declare the principal of, and any accrued and unpaid interest on, all of the 2023 Notes to be due and payable.

0.375% Convertible Senior Notes due 2024

The Company issued $287.5 million aggregate principal amount of the 2019 Notes on July 19, 2019 in a transaction which included the underwriters' exercise in full of an option to purchase an additional $37.5 million aggregate principal amount of 2019 Notes (the "Notes Offering"). The net proceeds of the Notes Offering, after deducting underwriting discounts and commissions and other related offering expenses payable by the Company, were approximately $278.5 million. Immediately following the closing of the Exchange Transaction mentioned above, $69.7 million in aggregate principal amount of the 2019 Notes remain outstanding.

The 2019 Notes are senior, unsecured obligations of the Company, and bear interest at a rate of 0.375% per year. Interest is payable semi-annually in arrears on January 15 and July 15 of each year, beginning on January 15, 2020. The remaining 2019 Notes will mature on July 15, 2024, unless earlier repurchased or converted in accordance with their terms. The initial conversion rate for the 2019 Notes is 8.6749 shares of the Company's common stock per $1,000 principal amount of 2019 Notes (which is equivalent to an initial conversion price of approximately $115.28 per share). Prior to the close of business on the business day immediately preceding April 15, 2024, the 2019 Notes will be convertible at the option of the holders of 2019 Notes only upon the satisfaction of specified conditions and during certain periods. Thereafter until the close of business on the second scheduled trading day immediately preceding the maturity date, the remaining 2019 Notes will be convertible at the options of the holders of 2019 Notes at any time regardless of these conditions. Prior to March 4, 2022, conversion of the 2019 Notes could have been settled in cash, shares of the Company's common stock or a combination thereof, at the Company's election. On March 4, 2022, the Company entered into the Second Supplemental Indenture for the 2019 Notes, which irrevocably elected to settle the conversion of the 2019 Notes using a combination of cash and the Company's common stock, settling the par value of the 2019 Notes in cash and any excess conversion premium in shares. The 2019 Notes are not redeemable by the Company prior to maturity.

Holders of 2019 Notes may require the Company to repurchase their 2019 Notes upon the occurrence of a fundamental change prior to maturity at a repurchase price equal to 100% of the principal amount thereof, plus accrued and unpaid interest to, but excluding, the date of repurchase. In connection with certain corporate events, the Company will, under certain circumstances, increase the conversion rate for holders of 2019 Notes who elect to convert their 2019 Notes in connection with such corporate events.

During the fourth quarter of 2023, the closing price of the Company's common stock exceeded 130% of the conversion price of the 2019 Notes for more than 20 trading days of the last 30 consecutive trading days of the quarter. As a result, the 2019 Notes are convertible at the option of the holders of the 2019 Notes during the first quarter of 2024, the quarter immediately following the quarter when conditions are met, as stated in the terms of the 2019 Notes. These conditions have been met each quarter since the third quarter of 2020. As a result, as of the date of this filing and prior to the Exchange Transaction mentioned above, the Company received requests to convert $0.2 million aggregate principal amount of the 2019 Notes and all but $0.1 million of the requests have been settled as of December 31, 2023. The remaining outstanding requests for conversions will settle in the first quarter of 2024. The conversions resulted in the issuance of a nominal number of shares of the Company's common stock to the note holders. Because the 2019 Notes mature within one year of the report date, the Company classifies the carrying value of the 2019 Notes of $69.5 million as current liabilities on the Company's consolidated balance sheets at December 31, 2023.

Prior to the adoption of ASU 2020-06, the Company accounted for the 2019 Notes as a liability and equity component where the carrying value of the liability component was valued based on a similar debt instrument. In accounting for the issuance of the 2019 Notes, the Company separated the 2019 Notes into liability and equity components. The carrying value of the liability component was calculated as the present value of its cash flows using a discount rate of 4.5% based on comparative convertible transactions for similar companies. The carrying value of the equity component representing the conversion option was determined by deducting the fair value of the liability component from the par value of the 2019 Notes as a whole. The excess of the principal amount of the liability component over its carrying value amount, referred to as the debt discount, was amortized to interest expense on our consolidated statements of comprehensive income over the five-year term of the 2019 Notes. The equity component was not re-measured as long as it continued to meet the conditions for equity classification. The equity component related to the 2019 Notes recorded at issuance was $52.1 million, which was recorded in additional paid-in capital on the Company's consolidated balance sheets.

In accounting for the transaction costs related to the issuance of the 2019 Notes, the Company allocated the total costs incurred to the liability and equity components of the 2019 Notes using the same proportions as the initial carrying value of the 2019 Notes. Transaction costs related to the liability component were $7.4 million and are amortized to interest expense using the effective interest method over the five-year term of the 2019 Notes. Transaction costs attributable to the equity component were $1.6 million and are netted with the equity component of the 2019 Notes in stockholders' equity of the Company's consolidated balance sheets. Additionally, the Company recorded a net deferred tax liability of $11.4 million.

Effective January 1, 2022, the Company adopted ASU 2020-06. After adoption, the Company now accounts for the 2019 Notes, and any convertible debt issued going forward, as a single liability measured at amortized cost. As the equity component is no longer required to be split into a separate component, the Company recorded a net adjustment for the initial $50.4 million that was allocated to additional paid-in capital and $22.9 million of life-to-date interest expense recorded as amortization of debt discount. Additionally, the net deferred tax liability recorded for the 2019 Notes was reversed. The principal amount of the liability over its carrying amount is amortized to interest expense over the five-year term of the 2019 Notes. Since the 2019 Notes are classified as a single liability, there is no debt discount required to be amortized in 2022.

Contractual coupon interest expense related to the 2019 Notes was $1.0 million in 2023 and the Company recorded $1.8 million of amortization of the debt issuance costs related to the 2019 Notes as well. The effective interest rate on the 2019 Notes is 1.02%, which included the interest on the 2019 Notes and amortization of the debt issuance costs. As of December 31, 2023, the carrying value of the 2019 Notes was $69.5 million and the fair value of the principal was $109.8 million. The fair value of the 2019 Notes was determined based on the most recent trade activity of the 2019 Notes as of December 31, 2023.

The indenture governing the 2019 Notes contains customary terms and events of default. If an event of default (other than certain events of bankruptcy, insolvency or reorganization involving the Company) occurs and is continuing, the holders of at least 25% in aggregate principal amount of the outstanding 2019 Notes may declare 100% of the principal of, and any accrued and unpaid interest on, all of the 2019 Notes to be due and payable. Upon the occurrence of certain events of bankruptcy, insolvency or reorganization involving the Company, 100% of the principal of and accrued and unpaid interest, if any, on all of the 2019 Notes will become due and payable automatically. Notwithstanding the foregoing, the 2019 Notes provide that, to the extent the Company elects and for up to 360 days, the sole remedy for an event of default relating to certain failures by the Company to comply with certain reporting covenants consist exclusively of the right to receive additional interest on the 2019 Notes. The Company is not aware of any events of default, current events or market conditions that would allow holders to declare the principal of, and any accrued and unpaid interest on, all of 2019 Notes to be due and payable.

15. Employee Benefit Plans

In the United States, the Repligen Corporation 401(k) Savings and Retirement Plan (the "401(k) Plan") is a qualified defined contribution plan in accordance with Section 401(k) of the Internal Revenue Code. All U.S. employees over the age of 21 are eligible to make pre-tax contributions up to a specified percentage of their compensation. Under the 401(k) Plan, the Company may, but is not obligated to match a portion of the employees' contributions up to a defined maximum. The match is calculated on a calendar year basis. The Company matched $3.0 million, $2.7 million and $1.8 million in the years ended December 31, 2023, 2022 and 2021, respectively.

In Sweden, the Company contributes to a government-mandated occupational pension plan that is a qualified defined contribution plan. All employees in Sweden are eligible for this pension plan. The Company pays premiums to a third-party occupational pension specialist who administers the pension plan. These premiums are based on various factors including each employee's age, salary, employment history and selected benefits in the pension plan. When an employee terminates or retires, these premium payments cease for that employee and the Company has no further pension-related obligations for that employee. The Company contributed $1.0 million, $1.1 million and $1.0 million, respectively to the defined contribution plan for the years ended December 31, 2023, 2022 and 2021.

16. Related Party Transactions

Certain facilities leased by Spectrum LifeSciences LLC ("Spectrum") are owned by the Roy Eddleman Living Trust (the "Trust"). As of December 31, 2023, the Trust owned greater than 5% of the Company's outstanding shares. Therefore, the Company considers the Trust to be a related party. The lease amounts paid to the Trust prior to the public offering were negotiated in connection with the acquisition of Spectrum. The Company incurred rent expense related to these leases totaling $0.7 million for the years ended December 31, 2023, 2022 and 2021.

Exhibit 10.5

REPLIGEN CORPORATION

AMENDED AND RESTATED
NON-EMPLOYEE DIRECTORS' COMPENSATION POLICY

Cash Fees

Annual Retainer:

		Annual Retainer
Board of Directors (the "*Board*")		
Each Non-Employee Member of the Board	$	60,000
Additional Retainer for the Chairperson	$	95,000
Audit Committee		
Committee Chairperson	$	30,000
Other Committee Members	$	10,000
Compensation Committee		
Committee Chairperson	$	20,000
Other Committee Members	$	10,000
Nominating and Corporate Governance Committee		
Committee Chairperson	$	16,000
Other Committee Members	$	5,000
Transaction Committee		
Committee Members	$	5,000

The Annual Retainer will be paid quarterly, in arrears, or upon the earlier resignation or removal of the non-employee director. Amounts owing to non-employee directors as Annual Retainer shall be annualized, meaning that for non-employee directors who join the Board during the calendar year, such amounts shall be pro-rated based on the number of calendar days served by such director.

Per Meeting fees:

None, unless otherwise specifically duly approved by the Board or any committee thereof hereafter.

Equity

Annual Equity Grant for each Continuing Non-Employee Director:

Each non-employee director reelected to the Board at any annual meeting of stockholders (excluding any directors who are initially appointed or elected to the Board on the date of such annual meeting of stockholders) shall receive an award of a stock option to purchase shares of Common Stock and an award of restricted stock units on such date (collectively, the "***Annual Award***").

The stock option to be granted as part of the Annual Award (i) to the Chairperson of the Board shall have a Value of $125,000 and (ii) to all other non-employee directors shall each have a Value of $107,500. The exercise price of each stock option granted as part of the Annual Award shall be equal to the Closing Price.

The restricted stock unit award to be granted as part of the Annual Award (i) to the Chairperson of the Board shall have a Value of $125,000 and (ii) to all other non-employee directors shall have a Value of $107,500.

Each Annual Award shall be fully vested on the first anniversary of the date of grant or the date of the next annual meeting of stockholders, whichever is earlier, subject to the director's continued service on the Board through such date.

Initial Equity Grants for a Non-Employee Director:

On the effective date of a new director's initial appointment or election to the Board (including any directors who are initially appointed or elected to the Board on the date of an annual meeting of stockholders), such new director shall receive an award of an option to purchase shares of Common Stock, which shall have a Value equal to the aggregate Value of the stock option and restricted stock units comprising the then-current Annual Award (the "***Initial Award***"). The Initial Award shall vest annually in three equal installments on the first, second and third anniversary of the date of grant, provided that if a new director is first elected to the Board at an annual meeting of stockholders, then each vesting date in respect of such Initial Award shall be on the relevant anniversary of the date of grant or the date of the annual meeting of stockholders during such year, whichever is earlier, subject in all cases to the director's continued service on the Board through such date. The exercise price of each stock option granted as part of the Initial Award shall be equal to the Closing Price.

Additionally, on the effective date of a new director's initial appointment or election to the Board, such new director shall receive an additional award of (i) a stock option to purchase shares of Common Stock and (ii) restricted stock units, each of which shall have a Value equal to the Value of the stock option and restricted stock units, respectively, comprising the then-current Annual Award, pro-rated based on the number of months from such effective date until the Company's next annual meeting of stockholders (the "***Pro-Rata Award***"). For the avoidance of doubt, for any new director initially appointed or elected to the Board on the date of an annual meeting of stockholders, the Pro-Rata Award shall have a Value equal to the full aggregate Value of the stock option and restricted stock units comprising the then-current Annual Award. Each Pro-Rata Award shall fully vest on the date of the next annual meeting of stockholders, subject to service the director's continued service on the Board through such date. The exercise price of each stock option granted as part of the Pro-Rata Award shall be equal to the Closing Price.

Sale Event Acceleration

In the event of a Sale Event (as defined in the Company's 2018 Stock Option and Incentive Plan), the equity retainer awards, including the Initial Award, Pro-Rata Award and each Annual Award, granted to non-employee directors pursuant to this policy shall become 100% vested and exercisable or nonforfeitable immediately prior to such Sale Event.

Definitions

"***Closing Price***" shall mean the reported closing price of Repligen Corporation's Common Stock on the Nasdaq Global Market on any grant date, or the preceding business date if there are no market quotations on such date.

"***Common Stock***" shall mean the common stock of Repligen Corporation, par value $0.01 per share.

"***Value***" shall mean with respect to (i) any stock option award, the grant date fair value of the option (i.e., Black-Scholes Value) determined in accordance with the reasonable assumptions and methodologies employed by the Company for calculating the fair value of options under Financial Accounting Standard Board Accounting Standards Codification Topic 718; and (ii) any award of restricted stock units, the product of (A) the Closing Price and (B) the aggregate number of shares of Common Stock underlying such award.

* * *

ADOPTED BY THE BOARD OF DIRECTORS on March 2, 2023.

EXHIBIT 19.1

REPLIGEN CORPORATION

AMENDED AND RESTATED STATEMENT OF COMPANY POLICY ON INSIDER TRADING AND DISCLOSURE & TRADING PROCEDURES FOR INSIDERS

December 12, 2023

Repligen Corporation

Amended and Restated Statement of Company Policy on Insider Trading and Disclosure & Trading Procedures for Insiders

SECTION I

This memorandum sets forth the policy of Repligen Corporation (the "Company" or "Repligen") regarding trading in the Company's securities and the disclosure of confidential information concerning the Company or its customers/collaborators.

Background. Federal securities laws prohibit insiders of a public company (directors, officers and employees) from trading in the securities of that company or its customers or collaborators on the basis of "inside" (i.e., material and nonpublic) information, or sharing that information with others who may trade in that company's securities based on inside information. Violations of insider trading laws can result in severe sanctions, including significant prison sentences and monetary fines. Thus, it is important that you understand your obligations.

In addition to potential direct liability for insider trading violations, potential liability exists for a company's directors and officers for failure to prevent such violations. In order to prevent insider trading or the appearance of impropriety, and to ensure compliance with federal securities laws, Repligen has adopted this Amended and Restated Statement of Company Policy on Insider Trading and Disclosure & Trading Procedures for Insiders (the "Insider Trading Policy" or "Policy"), and has adopted Trading Procedures ("Trading Procedures") for Insiders (as defined below) set forth in Section II of this Policy.

Please read this statement carefully since you will be asked to certify that you have read, understood and agreed to comply with this Policy and, if applicable, the Trading Procedures set forth herein. Please note that this Company policy does not replace your independent responsibility to understand and comply with the prohibitions on insider trading and selective disclosure under the federal securities laws.

Please contact the Chief Financial Officer if you have any questions regarding the Policy.

A. To whom does this Insider Trading Policy Apply?

Section I of this Insider Trading Policy is applicable to all members of the Company's board of directors (the "Board of Directors"), and all officers and employees of the Company, as well as their respective Affiliated Persons (defined and discussed below). In addition, all members of the Board of Directors, all employees with titles at or above director-level, employees who, in the ordinary course of the performance of their duties, participate in the preparation or review of the Company's quarterly or annual consolidated financial statements and/or the Company's periodic filings with the SEC pursuant to the Exchange Act, and certain other designated employees (collectively, and solely for the purposes of this Insider Trading Policy, these persons are referred to as "Insiders") also must comply with the Trading Procedures. Individuals designated as Insiders will be notified in writing by the Chief Financial Officer that they are Insiders and, thus, required to comply with the Trading Procedures.

This Insider Trading Policy continues to apply following the termination of any such individual's service to or employment with the Company until the later of: (i) the first trading day following the public release of earnings for the fiscal quarter in which such individual leaves the Company, and (ii) the first trading day after any material, nonpublic information possessed by such individual has become public or is no longer material. This Insider Trading Policy, including, if applicable, the Trading Procedures contained herein, also apply to the following persons and entities, collectively referred to as "Affiliated Persons":

- Your spouse, child, parent, significant other or other family member, in each case living in the same household;

- All persons who execute trades on your behalf; and

- Any trust, partnership or other entity over which you have the ability to influence or direct investment decisions for the benefit of you or your family members, including venture capital partnerships.

Note that the timing of Affiliated Persons' trading in the Company's securities can carry risk, since trading by an Affiliated Person during a restricted period for the Company insider may give an appearance of impropriety that could subject such insider and the Company to a charge of insider trading. Accordingly, Company insiders are responsible for ensuring compliance with this Policy, including the Trading Procedures, by all of their Affiliated Persons. Unless the context otherwise requires, references to "Insiders" in this Policy refer collectively to Insiders and their Affiliated Persons.

B. What is prohibited by this Insider Trading Policy?

It is generally illegal for any covered person to trade in securities of the Company while in the possession of material, nonpublic information about the Company. It is also generally illegal for any director, officer or employee of the Company to disclose material, nonpublic information about the Company to others who may trade on the basis of that information. These illegal activities are commonly referred to as "insider trading."

Please note that the same trading and disclosure restrictions apply to trading in the securities of customers/collaborators, and it is generally illegal to trade in the securities of any other public company while in the possession of material, nonpublic information about that company.

Prohibited Activities. When you know or are in possession of material, nonpublic information about the Company, whether positive or negative, you generally are prohibited from the following activities:

- Trading in the Company's securities, which includes common stock, options to purchase common stock, any other type of securities that the Company may issue (such as preferred stock, convertible debentures, warrants, exchange-traded options or other derivative securities) and any derivative securities that provide the economic equivalent of ownership of any of the Company's securities or an opportunity, direct or indirect, to profit from any change in the value of the Company's securities;

- Having others trade for you in the Company's securities;

- Giving trading advice of any kind about the Company except that you should, when appropriate, advise others not to trade if doing so might violate the law or this Insider Trading Policy;

- Disclosing material, nonpublic information about the Company to anyone who might then trade in the Company's securities, or recommending to anyone that they purchase or sell the Company's securities when you are aware of material, nonpublic information (these practices are known as "tipping"); and

- Discussing material, nonpublic information about the Company with anyone, including other employees, except when clearly authorized in connection with the Company's business and the performance of your duties.

If, while in the course of working for the Company, you learn of any material, nonpublic information about another publicly traded company with which the Company does business (e.g., a customer, supplier or other party with which the Company is negotiating a transaction, such as an acquisition, investment or sale), this Insider Trading Policy also prohibits you from trading in that company's securities until the information becomes public or is no longer material.

Even when you are not in possession of material, nonpublic information about the Company, it is the Company's policy that you:

- Do not under any circumstances provide information or discuss matters involving the Company with the news media, any broker-dealer, analyst, investment banker, investment advisor, institutional investment manager, investment company or stockholder, even if you are contacted directly by such persons, without express prior authorization from an authorized Company Spokesperson. You should refer all such contact or inquiries to a Company Spokesperson, as defined in Section I, Part F of this Policy.

Relationships that Carry a Duty of Trust or Confidence. As noted above, these prohibitions under this Insider Trading Policy also apply to your Affiliated Persons as defined, and generally to individuals where a "duty of trust or confidence" exists. It is important to understand that violation of a "duty of trust or confidence" can support a claim of insider trading.

Rule 10b5-2 of the Securities Exchange Act of 1934 (the "Exchange Act") provides a nonexclusive list of the types of family and non-business relationships that give rise a "duty of trust or confidence" including those:

- Where the person receiving material, nonpublic information about the Company agrees to maintain the information in confidence;

- Where the person receiving and the person disclosing the information have a history, pattern or practice of sharing confidences, such that the person receiving the information knows or reasonably should know that the person communicating the information expects that the recipient will maintain its confidentiality; or

- Where the person receiving the information does so from a spouse, parent, child or sibling (unless he or she can show that, under the facts and circumstances of the relationship, no duty of trust or confidence exists).

Obligations Post-Employment. The Policy continues to apply to a covered person following the termination of such covered person's service to or employment with the Company until the later of: (i) the first trading day following the public release of earnings for the fiscal quarter in which such individual leaves the Company, and (ii) the first trading day after any material, nonpublic information possessed by such individual has become public or is no longer material. Covered persons are encouraged to consult with their counsel prior to any trading in the Company's securities after their business relationship with the Company ceases, particularly if the Company is in a Trading Blackout Period at the time of or immediately following such covered person's departure.

The prohibitions described above continue whenever and for as long as you know or are in possession of material, nonpublic information. Remember, anyone scrutinizing your transactions will be doing so after the fact, with the benefit of hindsight. As a practical matter, before engaging in any transaction, you should carefully consider how enforcement authorities and others might view the transaction in hindsight.

C. Are there exceptions to these Prohibited Activities?

Yes, the Trading Procedures section of this Policy outlines in detail the types of transaction that are exceptions to the foregoing trading prohibitions. There are two main areas of exception: preapproved Rule 10b5-1 Plans (as defined below) and Employee Benefit Plans, particularly the Exercise of Company Stock Options. Keep in mind that (i) the establishment of a trading plan, arrangement or instruction that meets the requirements of the SEC's Rule 10b5-1 (a "Rule 10b5-1 Plan") enables Insiders to trade in Company securities outside of our trading windows, even when in possession of material nonpublic information and (ii) the exercise of an option to purchase securities of the Company is subject to the current reporting requirements of Section 16 of the Exchange Act and, therefore, certain Insiders must comply with the post-trade reporting requirement described in Section II for any such transaction.

D. How is "Material, Nonpublic Information" Defined?

Material Information. Information about the Company is "material" if it could reasonably be expected to affect the investment or voting decisions of a stockholder or investor, or if the disclosure of the information could reasonably be expected to significantly alter the total mix of information in the marketplace about the Company. In simple terms, material information is any type of information that could reasonably be expected to affect the market price of the Company's securities. Both positive and negative information may be material. While it is not possible to identify all information that would be deemed "material," the following items are types of information that should be considered carefully to determine materiality:

- Projections of future earnings or losses, or other earnings guidance or changes therein;
- Actual earnings, revenue or other financial measures that are inconsistent with the consensus expectations of the investment community;
- Potential restatements of the Company's financial statements, changes in auditors or auditor notification that the Company may no longer rely on an auditor's audit report;

- Pending or proposed mergers, acquisitions, tender offers, joint ventures or dispositions of significant assets;
- Changes in senior management or the Board of Directors;
- Actual or threatened litigation or governmental investigations, or major developments in or resolution of such matters;
- Production or manufacturing issues or delays;
- Research and/or product development breakthroughs;
- New product launches;
- Developments regarding products, customers, suppliers, orders, contracts or financing sources (e.g., the award or loss of a substantial contract or the gain or loss of a substantial customer or supplier);
- Declarations of stock splits;
- Public or private sales of additional securities;
- Changes in dividend policies;
- Potential defaults under the Company's credit agreements or indentures, or the existence of material liquidity deficiencies; and
- Bankruptcies or receiverships.

The Securities and Exchange Commission (the "SEC") has stated that there is no fixed quantitative threshold amount for determining materiality, and that even very small quantitative changes can be qualitatively material if they would result in a movement in the price of the Company's securities.

Nonpublic Information. Material information is "nonpublic" if it has not been disseminated in a manner making it available to investors generally. To show that information is "public", it is necessary to point to some fact that establishes that the information has become broadly available, such as the filing of a report with the SEC, the distribution of a Company press release through a widely disseminated news or wire service, or by other means that are reasonably designed to provide broad public access.

The restrictions on purchases or sales of Company securities based on material information applies not only to nonpublic information, but also applies for a limited time after such information has been released to the public. The Company's shareholders and the investing public must be afforded time to receive and digest material information before it can be considered in the public domain. As a general rule, you should consider material information to be nonpublic from the time you become aware of material information until one (1) full trading day (on the NASDAQ market) after it has been released by the Company to the public and, accordingly, you should not engage in any stock transactions until after that time.

For example, if the Company announces material information of which you are aware before trading begins on a Tuesday, the first time you would be able to buy or sell Company securities would be at the opening of the market on Wednesday. However, if the Company announces this material information after trading begins on that Tuesday, the first time that you would be able to buy or sell Company securities would be the opening of the market on Thursday.

E. Fair Disclosure of Material Information

The SEC's Regulation Fair Disclosure ("Reg FD") generally requires that any intentional disclosure of material nonpublic information about the Company to market participants and holders of the Company's securities must by simultaneously disclosed to the public. Reg FD also requires that where material nonpublic information has been *inadvertently* disclosed to market participants and holders of the Company's securities on a selective basis, the Company must promptly disclose that same information to the public. Rule 101(d) defines "promptly" to mean "as soon as reasonably practical" but no later than 24 hours.

Monetary penalties and other sanctions may be imposed on both the Company and its senior officials if material nonpublic information is either intentionally disclosed on a selective basis, or is inadvertently disclosed on a selective basis and not subsequently and promptly disclosed publicly, where (a) at the time of disclosure the senior official either knew or was reckless in not knowing that the information was both material and nonpublic, or (b) after the inadvertent disclosure the senior official learns of the disclosure and knows or was reckless in not knowing that the information was both material and nonpublic.

Senior officials of the Company hold primary responsibility for Reg FD compliance. Senior officials include any member of the Board of Directors, executive officers and investor relations or public relations officers.

In light of the risks and penalties associated with non-compliance with Reg FD, the Company is committed to preventing inadvertent disclosures of material, nonpublic information and avoiding the appearance of impropriety by persons associated with the Company. As such, the Company has designated certain members of management as Company Spokespersons to respond to inquiries regarding the Company's business and prospects. This centralization of communication is designed to ensure that the information the Company discloses is accurate and considered in light of previous disclosures.

It is the Company's policy to disclose material information by a means of dissemination designed to provide broad, non-exclusionary distribution of the information to the public in accordance with SEC rules and regulations; for example Form 8-K filings with the SEC, newswire distributed press releases and corporate website postings. Communications made in connection with most registered securities offerings are excluded from Reg. FD.

If you feel that you or another Company insider may have disclosed material nonpublic information, it is very important to bring this to the attention of a Company Spokesperson, as described below, the Chief Financial Officer, Chief Compliance Officer or Global Head of Legal as rapidly as possible. This will allow the Company to evaluate the information and make a decision as to whether a press release, 8-K or other means of disclosure is required.

Currently, the Chief Financial Officer and Chief Compliance Officer is Jason Garland and the company's Global Head of Legal is Kimberly Cornwell.

F. Who are the Company Spokespersons?

The Company has authorized the Chief Executive Officer and certain other employees designated by him (the "Company Spokespersons") to speak on behalf of the Company with any market participant (broker-dealer, investment advisor, institutional investment manager or investment company including venture capital funds), shareholder or media representative. Requests for any information about the Company should in all cases be directed promptly to a Company Spokesperson.

The Company has a general policy that it will not comment on rumors concerning Company developments, including, without limitation, rumors concerning public offerings of its securities, acquisitions or dispositions, restructurings, product developments, financial performance or any similar and/or material matters except as approved by a Company Spokesperson (or a designee of such Spokesperson).

Currently, the designated Company Spokespersons are: Tony Hunt, Chief Executive Officer; Jason Garland, Chief Financial Officer and Chief Compliance Officer; and Sondra Newman, Global Head of Investor Relations.

G. Are there any Restrictions on the Use of Internet Communications?

With the prevalence of the Internet and social media sites, blogs, electronic bulletin boards, chat rooms, stock-picker newsletters, and so on, electronic discussions about companies and their business prospects have become common.

Inappropriate communications disseminated on the Internet may pose an inherently greater risk due to the size of the audience they can reach. These forums have the potential to move a stock price significantly, and very rapidly - yet the information disseminated through Internet vehicles may be unreliable, and in some cases, deliberately false. You may encounter information about the Company on the Internet that you believe is harmful or inaccurate, or other information that you believe is true or beneficial for the Company. Although you may have a natural tendency to deny or confirm such information, any sort of response, even if it presents accurate information, could be considered improper disclosure and could result in legal liability to you and/or to the Company.

Due to the risk of inadvertent disclosure of material nonpublic information, no Company director, officer or employee shall engage in online discussions concerning the Company (i.e., company financial performance, business activities or dealings, as listed in Section I, Part D) on any internet site or forum, including social media sites (Facebook, Twitter, LinkedIn, etc.), internet chat rooms, message boards, blogs, e-newsletters, etc. This restriction applies whether or not you identify yourself as being associated with the Company - even completely anonymous online postings are prohibited. In addition, the Company strongly discourages employees from participating in such forums relating to competitors of the Company or entities with which the Company has a significant business relationship.

If you have concern about potential internet fraud or misinformation you find on the internet about the Company, please notify the Chief Financial Officer, Chief Compliance Officer, Global Head of Legal or a Company Spokesperson.

H. What are the Penalties for Insider Trading?

Both the SEC and the national securities exchanges, through the Financial Industry Regulatory Authority (FINRA), investigate and are very effective at detecting insider trading. The SEC, together with the U.S. Attorney's Office, pursues insider trading violations vigorously. The penalties for violating insider trading or tipping rules via The Insider Trading and Securities Fraud Enforcement Act of 1988 ("The Insider Trading Act") can be severe and include:

- Criminal penalties of up to $5,000,000;
- Civil penalties of up to three times the profit made or loss avoided; and
- Imprisonment for up to 20 years.

The Company and/or the supervisors of the person engaged in insider trading may also be required to pay civil penalties of up to the greater of $1,275,000 or three times the profit made or loss avoided, as well as criminal penalties of up to $25,000,000, and could under certain circumstances be subject to private lawsuits.

Violation of this Insider Trading Policy or any federal or state insider trading laws may subject the person violating such policy or laws to disciplinary action by the Company up to and including termination. The Company reserves the right to determine, in its own discretion and on the basis of the information available to it, whether this Insider Trading Policy has been violated. The Company may determine that specific conduct violates this Insider Trading Policy, whether or not the conduct also violates the law. It is not necessary for the Company to await the filing or conclusion of a civil or criminal action against the alleged violator before taking disciplinary action.

I. How Do I Report a Violation of this Insider Trading Policy?

If you are aware of a violation of this Insider Trading Policy or of any federal or state laws governing insider trading, you should report the violation as immediately as possible to the Chief Financial Officer, Chief Compliance Officer or Global Head of Legal. If you would prefer for any reason, including that you do not feel you can discuss the matter with the Chief Financial Officer, Chief Compliance Officer or Global Head of Legal, or you have reported a violation that you do not believe has been dealt with properly, you may anonymously register your concern by our phone- and internet- based Compliance Hotline. These avenues are independently managed by a company called NAVEX Global.

Compliance Hotline Access by Phone:

- US Based employees: Dial 844-945-0213
- International employees: First dial codes required for dialing to the United States, then dial 844-945-0213

Compliance Hotline Access by Internet:

- All employees: Follow directions at https://iwf.tnwgrc.com/repligen

J. Is This Insider Trading Policy Subject to Modification?

The Company may at any time change this Insider Trading Policy or adopt such other policies or procedures which it considers appropriate to carry out the purposes of its policies regarding insider trading and the disclosure of Company information. Notice of any such change will be delivered to you by regular or electronic mail (or other delivery option used by the Company) by the Company.

You will be deemed to have received, be bound by and agree to revisions of this Insider Trading Policy when such revisions have been delivered to you, unless you object to any revision in a written statement received by the Chief Financial Officer within two (2) business days of such delivery.

* * * * *

Your failure to observe this Insider Trading Policy could lead to significant legal problems, including fines and/or imprisonment, and could have other serious consequences, including the termination of your employment or service relationship with the Company.

SECTION II

TRADING PROCEDURES FOR INSIDERS

To comply with federal and state securities laws governing insider trading, the Company has adopted these Trading Procedures for Insiders as a supplement to (and part of) the Insider Trading Policy. For purposes of these Trading Procedures, Insiders are classified into two tiers:

- Tier I Insiders: (i) members of the Board of Directors; executive officers of the Company; (ii) employees of the Company with titles at or above the Vice President-level; and (iii) any employees who have been notified in writing by the Chief Financial Officer that they are Tier I Insiders.

- Tier II Insiders: (i) employees of the Company with titles at or above director-level but below the Vice President-level; (ii) employees who, in the ordinary course of the performance of their duties, participate in the preparation or review of the Company's quarterly or annual consolidated financial statements and/or the Company's periodic filings with the SEC pursuant to the Exchange Act; and (iii) any employees who have been notified in writing by the Chief Financial Officer that they are Tier II Insiders.

A. To What Activities Do These Trading Procedures Apply?

These Trading Procedures regulate securities trades by all Insiders and their Affiliated Persons.

These Trading Procedures apply to any and all transactions in the Company's securities, including its common stock, options to purchase common stock, any other type of securities that the Company may issue (such as preferred stock, convertible debentures, warrants, exchange-traded options or other derivative securities), and any derivative securities that provide the economic equivalent of ownership of any of the Company's securities or an opportunity, direct or indirect, to profit from any change in the value of the Company's securities.

As set forth in the Trading Policy, the trading restrictions set forth in these Trading Procedures continue to apply to Insiders following the termination of such person's service to or employment with the Company until the later of: (i) the first trading day following the public release of earnings for the fiscal quarter in which such person leaves the Company, and (ii) the first trading day after any material, nonpublic information possessed by such person has become public or is no longer material.

B. Who is the Chief Financial Officer?

Currently, the Chief Financial Officer is Jason Garland.

In the event that the Chief Financial Officer is incapacitated or otherwise unable to perform his or her duties hereunder, Tony Hunt, Chief Executive Officer, is designated as the alternate to perform such duties.

The Chief Financial Officer will review and either approve or prohibit all proposed trades by Insiders in accordance with the procedures set forth in Section C below. The Chief Financial Officer may consult with outside legal counsel to make an approval decision. The Chief Financial Officer will receive approval for his/her own trades from the Company's Chief Executive Officer. In the event that the Chief Executive Officer is incapacitated or otherwise unable perform his or her duties, the Chief Financial Officer will receive approval for his/her own trades from the current Chairperson of the Board of Directors.

C. What are the Trading Procedures for Insiders?

In addition to the restrictions on trading in company securities when in possession of material, nonpublic information as forth above, Insiders are subject to the following trading rules and procedures. No Trading Outside of "Open" trading windows.

Announcements by the Company of quarterly financial results or material news have the potential to significantly affect the market for the Company's securities. Although an Insider may not have knowledge of the Company's financial results prior to a public announcement, or be privy to a pending Company announcement of material news, if an Insider engages in a trade before such information is disclosed to the public, such trades may give an appearance of impropriety that could subject the Insider and the Company to a charge of insider trading.

Therefore, it is the Company's policy that Insiders may trade in Company securities only during "open" trading windows. Periods outside of trading windows are referred to as Trading Blackout Periods.

All Tier I Insiders and Tier II Insiders are generally prohibited from buying or selling Company securities during Trading Blackout Periods.

- The Company's "Quarterly Blackout Period" begins on the close of business on the fifteenth (15th) day before the end of the Company's then-current fiscal quarter and ends one (1) full trading day after the public announcement of that quarter's results. *Company Insiders will receive a reminder e-mail notification prior to the start of a Quarterly Blackout Periods and again when the trading window opens.*

- The Chief Financial Officer may, on a case-by-case basis, subject certain Insiders to "Special Blackout Periods", which may be instituted at any time, at the discretion of the Company. Reasons for being subject to a Special Blackout Period include having possession of material nonpublic information and/or knowledge of a pending significant announcement by the Company (e.g. an acquisition or a gain or loss of a major customer or supplier). In the event of a Special Blackout Period the Chief Financial Officer or other Company Spokesperson will facilitate notification to any Insider who is subject to the trading restriction, and NO exemptions will be allowed.

Exceptions. See Trading Procedures Part E for exceptions related to Employee Benefit Plans and Rule 10b5-1 Plans.

1. **All Trades by Tier I Insiders Must be Pre-cleared by the Chief Financial Officer (or his/her designated alternate as described in Section II (B) above).**

ALL purchases and sales of Company securities by Tier I Insiders must be preapproved in writing by the Chief Financial Officer, whether or not such Insider is in possession of material, nonpublic information about the Company, and regardless of trading window status. See Part D (below) for Preclearance Procedures. Tier II Insiders do not need to pre-clear trades with the Chief Financial Officer outside of a Trading Blackout Period.

2. **No Short Sales.**

No Insider may at any time sell any securities of the Company that are not owned by such Insider at the time of the sale (a "short sale").

3. **No Purchases or Sales of Derivative Securities or Hedging Transactions.**

No Insider may buy or sell puts, calls, other derivative securities of the Company or any derivative securities that provide the economic equivalent of ownership of any of the Company's securities or an opportunity, direct or indirect, to profit from any change in the value of the Company's securities or engage in any other hedging transaction with respect to the Company's securities.

4. **No Company Securities Subject to Margin Calls.**

No Insider may use the Company's securities as collateral in a margin account.

5. **No Pledges of Company Securities.**

No Insider may pledge Company securities as collateral for a loan.

6. **Gifts Subject to Same Restrictions as All Other Securities Trades.**

No Insider may give or make any other transfer of Company securities without consideration (e.g., a gift) during a period when the Insider is not permitted to trade.

D. Preclearance Procedures

Insomuch as preapproval is required for an Insider to trade in the Company's securities as described above (including all trades by Tier I Insiders), that Insider must:

1. Notify the Chief Financial Officer of the amount, timing and nature of the proposed trade(s) using the Stock Transaction Request form attached to these Trading Procedures. For Section 16 reporting persons in particular, in order to provide adequate time for the preparation of any required filings under Section 16 of the Securities Exchange Act of 1934, as amended (the "Exchange Act"), a Stock Transaction Request Form must be received by the Chief Financial Officer for review at least two (2) full business days prior to the intended trade date. For all other Insiders, a Stock Transaction Request Form must be received by the Chief Financial Officer for review at least one (1) full business day prior to the intended trade date.

2. Certify to the Chief Financial Officer in writing (via the Stock Transaction Request form) prior to the proposed trade(s) that the Insider is not in possession of material, nonpublic information concerning the Company;

3. Receive written approval for the proposed trade(s) from the Chief Financial Officer or his or her designee via the Stock Transaction Request form.

   Certification and approval may be made via digitally-signed electronic mail.

The Chief Financial Officer does not assume the responsibility for, and approval from the Chief Financial Officer does not protect the Insider from, the consequences of prohibited insider trading.

No Obligation to Approve Trades. The existence of the foregoing approval procedures does not in any way obligate the Chief Financial Officer to approve any trade requested by an Insider. The Chief Financial Officer may reject any trading request at his or her sole reasonable discretion. From time to time, an event may occur that is material to the Company and is known by only a few Insiders. So long as the event remains material and nonpublic, the Chief Financial Officer may determine not to approve any transactions by an Insider in the Company's securities. If an Insider requests clearance to trade in the Company's securities during the pendency of such an event, the Chief Financial Officer may reject the trading request without disclosing the reason.

Completion of Trades. After receiving written clearance to engage in a trade signed by the Chief Financial Officer, an Insider must complete the proposed trade within five (5) business days or make a new trading request.

E. Exceptions to Trading Prohibitions

Employee Benefit Plans

1. **Exercise of Stock Options**. The trading prohibitions and restrictions set forth in these Trading Procedures do not apply to the exercise of an option to purchase securities of the Company when payment of the exercise price is made in cash. *Note, however, that a sale of securities received upon the cash exercise of an option, is prohibited. Also prohibited is the use of outstanding Company securities to constitute part or all of the exercise price of an option, any sale of stock as part of a broker-assisted "cashless exercise" of an option, or any other market sale for the purpose of generating the cash needed to pay the exercise price of an option.* The Company securities acquired upon the exercise of an option are immediately subject to all of the requirements of these Trading Procedures and the Insider Trading Policy. For directors and officers, the exercise of an option to purchase securities of the Company is subject to the current reporting requirements of Section 16 of the Exchange Act and is therefore subject to the Post-Trade Reporting obligations described above.

2. **Tax Withholding on Restricted Stock/Units**. The trading prohibitions and restrictions set forth in these Trading Procedures do not apply to the withholding by the Company of shares of stock upon vesting of restricted stock or upon any settlement of restricted stock units to satisfy applicable tax withholding requirements if (a) such withholding or settlement of restricted stock units is required by the applicable plan or award agreement or (b) the election to exercise such tax withholding right was made by the Insider in compliance with these Trading Procedures.

Pre-Approved Rule 10b5-1 Plan.

Transactions made pursuant to an approved Rule 10b5-1 Plan will not be subject to our trading windows or pre-clearance procedures, and Insiders are not required to complete a Stock Transaction Request form for such transactions. Rule 10b5-1 of the Exchange Act provides an affirmative defense from insider trading liability under the federal securities laws for trading plans, arrangements or instructions that meet specified requirements. A Rule 10b5-1 Plan enables Insiders to trade in Company securities outside of its trading windows, even when in possession of material nonpublic information.

Certain Insiders may be under more scrutiny and at higher risk for insider trading violations by more often being aware of material, nonpublic information about the Company. Rule 10b5-1 allows an Insider to pre-establish a plan or pattern for future trades in the Company's securities.

For more information about establishing a Rule 10b5-1 Plan, please contact the Chief Compliance Officer.

The Company has adopted a separate "Rule 10b5-1 Trading Plan Policy" that sets forth the requirements for putting in place a Rule 10b5-1 Plan with respect to Company securities. As further detailed in the Rule 10b5-1 Trading Plan Policy, Insiders who set up a Rule 10b5-1 Plan that meets the Rule 10b5-1 and Company-imposed requirements set forth in the Rule 10b5-1 Trading Plan Policy will be allowed to execute sales and purchases under a Rule 10b5-1 Plan, even if at the time the trades take effect the Insider may be aware of material nonpublic information or may be subject to a Trading Blackout Period.

As further detailed in the Rule 10b5-1 Trading Plan Policy, if an Insider intends to trade pursuant to a Rule 10b5-1 Plan, such plan, arrangement or instruction must:

1. Satisfy the requirements of Rule 10b5-1 and the Company's policies related to Rule 10b5-1 Trading Plan Policy;

2. Be documented in writing;

3. Be established during a trading window when such Insider does not possess material, nonpublic information; and

4. Be approved by the Chief Compliance Officer.

Prior to approving a Rule 10b5-1 Plan, the Chief Compliance Officer may require that the plan exclude or include certain provisions (e.g., cooling off period, minimum number of trades requirement, limited term) that ensure compliance with SEC regulations, the Rule 10b5-1 Trading Plan Policy and practices the Chief Compliance Officer deems to be in the best interests of the Company. Any proposed deviation from the specifications of an approved Rule 10b5-1 Plan (including, without limitation, the amount, price or timing of a purchase or sale) must be reported immediately to, and be approved by, the Chief Compliance Officer. All transactions pursuant to a Rule 10b5-1 Plan must be timely reported in accordance with the procedures set forth above and in the Rule 10b5-1 Trading Plan Policy. Any modification or termination of a Rule 10b5-1 Plan previously approved by the Chief Compliance Officer requires a new approval by the Chief Compliance Officer. The Chief Compliance Officer may require as a condition to such approval that the modification or termination occur during a trading window and that the Insider be not aware of material nonpublic information.

F. WAIVERS

A waiver of any provision of these Trading Procedures in a specific instance may be authorized in writing by the Chief Financial Officer and any such waiver involving a Section 16 reporting person shall be reported to the Company's Chief Executive Officer and Board of Directors. Notwithstanding the foregoing, any waiver of Subsection 3 of Part II, Section C or Subsection 5 of Part II, Section C in a specific instance may be authorized solely by preapproval of the Company's Audit Committee.

SUMMARY

Repligen Corporation's Amended and Restated Statement of Company Policy on Insider Trading and Disclosure and Trading Procedures for Insiders is intended to present the Company's policies and procedures with respect to the trading of securities by employees, officers and directors and the disclosure of material nonpublic information to market participants. The policies and procedures set forth in this policy statement present only a general framework within which you may purchase and sell securities of the Company without violating the insider trading laws. You have the ultimate responsibility for complying with the insider trading laws. Your obligations under the insider trading laws may extend beyond the procedures and policies set forth herein, and you should obtain additional guidance whenever possible.

ADOPTED by the Board of Directors: December 12, 2023

Exhibit 21.1

SUBSIDIARIES OF THE REGISTRANT

Subsidiary Name	Subsidiary Jurisdiction
Repligen Sweden AB	Sweden
Repligen GmbH	Germany
Repligen Singapore Pte. Ltd.	Singapore
Repligen Europe B.V.	Netherlands
Repligen (Shanghai) Biotechnology Co. Ltd.	China
Repligen Japan LLC	Japan
Repligen India Private Limited	India
Repligen Korea Co., Ltd.	South Korea
ARTeSYN Biosolutions Holdings Ireland Ltd.	Ireland
ARTeSYN Biosolutions Ireland Limited	Ireland
Repligen Estonia OÜ	Estonia
Repligen Ireland Limited	Ireland
ARTeSYN Biosolutions USA, LLC	United States
Spectrum Life Sciences, LLC	United States
C Technologies, Inc.	United States
Polymem S.A.	France
Avitide LLC	United States
Newton T&M Corp.	United States
Bio-Flex Solutions, L.L.C.	United States
Repligen UK Limited	United Kingdom
FlexBiosys Inc.	United States
Metenova Holding AB	Sweden
Metenova AB	Sweden
Metenova America	United States

Exhibit 23.1

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

We consent to the incorporation by reference in the following Registration Statements:

(1) Registration Statement (Form S-8 No. 333-224978) pertaining to the 2018 Stock Option and Incentive Plan of Repligen Corporation, and
(2) Registration Statement (Form S-8 No. 333-196456) pertaining to the Repligen Corporation Amended and Restated 2012 Stock Option and Incentive Plan;

of our reports dated February 22, 2024, with respect to the consolidated financial statements of Repligen Corporation and the effectiveness of internal control over financial reporting of Repligen Corporation, included in this Annual Report (Form 10-K) of Repligen Corporation for the year ended December 31, 2023.

/s/ Ernst & Young LLP

Boston, Massachusetts
February 22, 2024

Exhibit 31.1

CERTIFICATION

I, Tony Hunt, certify that:

1. I have reviewed this Annual Report on Form 10-K of Repligen Corporation;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

   (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

   (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

   (c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

   (d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

   (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

   (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: February 22, 2024

/S/ TONY J. HUNT

Tony J. Hunt
Chief Executive Officer
(Principal executive officer)

Exhibit 31.2

CERTIFICATION

I, Jason K. Garland, certify that:

1. I have reviewed this Annual Report on Form 10-K of Repligen Corporation;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

   (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

   (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

   (c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

   (d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

   (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

   (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: February 22, 2024

/S/ JASON K. GARLAND

Jason K. Garland
Chief Financial Officer
(Principal financial officer)

Exhibit 32.1

CERTIFICATION PURSUANT TO
18 U.S.C. SECTION 1350,
AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

In connection with the Annual Report on Form 10-K of Repligen Corporation (the "Company") for the fiscal year ending December 31, 2023 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), the undersigned officers of the Company hereby certify, pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that to their knowledge:

(1) The Report fully complies with the requirements of section 13(a) or 15(d) of the Securities Exchange Act of 1934; and

(2) The information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

This certification is being provided pursuant to 18 U.S.C. 1350 and is not to be deemed a part of the Report, nor is it to be deemed to be "filed" for any purpose whatsoever.

Date: February 22, 2024

By: /S/ TONY J. HUNT

Tony J. Hunt
Chief Executive Officer
(Principal executive officer)

Date: February 22, 2024

By: /S/ JASON K. GARLAND

Jason K. Garland
Chief Financial Officer
(Principal financial officer)

EXHIBIT 97.1

REPLIGEN CORPORATION

COMPENSATION RECOVERY POLICY

Adopted as of October 11, 2023

Repligen Corporation, a Delaware corporation (the "Company"), has adopted a Compensation Recovery Policy (this "Policy") as described below. This Policy supersedes and replaces the Company's Policy for Recoupment of Incentive Compensation, dated as of September 28, 2019, with respect to Incentive Compensation received after the Effective Date (as defined below).

1. Overview

The Policy sets forth the circumstances and procedures under which the Company shall recover Erroneously Awarded Compensation from Covered Persons (as defined below) in accordance with rules issued by the United States Securities and Exchange Commission (the "SEC") under the Securities Exchange Act of 1934, as amended (the "Exchange Act"), and the Nasdaq Stock Market. Capitalized terms used and not otherwise defined herein shall have the meanings given to such terms in Section 3 below.

2. Compensation Recovery Requirement

In the event the Company is required to prepare a Financial Restatement, the Company shall recover reasonably promptly all Erroneously Awarded Compensation with respect to such Financial Restatement.

3. Definitions

a. "Applicable Recovery Period" means the three completed fiscal years immediately preceding the Restatement Date for a Financial Restatement. In addition, in the event the Company has changed its fiscal year: (i) any transition period of less than nine months occurring within or immediately following such three completed fiscal years shall also be part of such Applicable Recovery Period and (ii) any transition period of nine to 12 months will be deemed to be a completed fiscal year.

b. "Applicable Rules" means any rules or regulations adopted by the Exchange pursuant to Rule 10D-1 under the Exchange Act and any applicable rules or regulations adopted by the SEC pursuant to Section 10D of the Exchange Act.

c. "Board" means the Board of Directors of the Company.

d. "Committee" means the Compensation Committee of the Board or, in the absence of such committee, a majority of independent directors serving on the Board.

e. "Covered Person" means any Executive Officer and any other person designated by the Board or the Committee as being subject to this Policy. A person's status as a Covered Person with respect to Erroneously Awarded Compensation shall be determined as of the time of receipt of such Erroneously Awarded Compensation regardless of such person's current role or status with the Company (e.g., if a person began service as an Executive Officer after the beginning of an Applicable Recovery Period, that person would not be considered a Covered Person with respect to Erroneously Awarded Compensation received before the person began service as an Executive Officer, but would be considered a Covered Person with respect to Erroneously Awarded Compensation received after the person began service as an Executive Officer where such person served as an Executive Officer at any time during the performance period for such Erroneously Awarded Compensation).

f. "Effective Date" means October 2, 2023.

g. "Erroneously Awarded Compensation" means the amount of any Incentive-Based Compensation received by a Covered Person on or after the Effective Date and during the Applicable Recovery Period that exceeds the amount that otherwise would have been received by the Covered Person had such compensation been determined based on the restated amounts in a Financial Restatement, computed without regard to any taxes paid. Calculation of Erroneously Awarded Compensation with respect to Incentive-Based Compensation based on stock price or total shareholder return, where the amount of Erroneously Awarded Compensation is not subject to mathematical recalculation directly from the information in a Financial Restatement, shall be based on a reasonable estimate of the effect of the Financial Restatement on the stock price or total shareholder return upon which the Incentive-Based Compensation was based, and the Company shall maintain documentation of the determination of such reasonable estimate and provide such documentation to the Exchange in accordance with the Applicable Rules. Incentive-Based Compensation is deemed received when the Financial Reporting Measure is attained, not when the actual payment, grant, or vesting occurs.

h. "Exchange" means the Nasdaq Stock Market LLC.

i. "Executive Officer" means any person who served the Company in any of the following roles at any time during the performance period applicable to Incentive-Based Compensation and received Incentive-Based Compensation after beginning service in any such role (regardless of whether such Incentive-Based Compensation was received during or after such person's service in such role): the president, principal financial officer, principal accounting officer (or if there is no such accounting officer, the controller), any vice president in charge of a principal business unit, division, or function (such as sales, administration, or finance), any other officer who performs a policy making function, or any other person who performs similar policy making functions for the Company. Executive officers of parents or subsidiaries of the Company may be deemed Executive Officers if they perform such policy making functions for the Company.

j. "Financial Reporting Measures" mean measures that are determined and presented in accordance with the accounting principles used in preparing the Company's financial statements, any measures that are derived wholly or in part from such measures (including, for example, a non-GAAP financial measure), and stock price and total shareholder return.

k. "GAAP" means generally accepted accounting principles in the United States of America.

l. "Incentive-Based Compensation" means any compensation provided, directly or indirectly, by the Company or any of its subsidiaries that is granted, earned, or vested based, in whole or in part, upon the attainment of a Financial Reporting Measure and any other equity-based compensation provided by the Company or any of its subsidiaries, including, without limitation, stock options, restricted stock awards, restricted stock units, and stock appreciation rights, regardless of whether such equity-based compensation is granted, earned, or vested based, in whole or in part, upon the attainment of a Financial Reporting Measure.

m. "Financial Restatement" means a restatement of previously issued financial statements of the Company due to the material noncompliance of the Company with any financial reporting requirement under the securities laws, including any required restatement to correct an error in previously-issued financial statements that is material to the previously-issued financial statements or that would result in a material misstatement if the error were corrected in the current period or left uncorrected in the current period.

n. "Restatement Date" means, with respect to a Financial Restatement, the earlier to occur of: (i) the date the Board concludes, or reasonably should have concluded, that the Company is required to prepare the Financial Restatement or (ii) the date a court, regulator, or other legally authorized body directs the Company to prepare the Financial Restatement.

4. Exception to Compensation Recovery Requirement

The Company may elect not to recover Erroneously Awarded Compensation pursuant to this Policy if the Committee determines that recovery would be impracticable, and one or more of the following conditions, together with any further requirements set forth in the Applicable Rules, are met: (i) the direct expense paid to a third party, including outside legal counsel, to assist in enforcing this Policy would exceed the amount to be recovered, and the Company has made a reasonable attempt to recover such Erroneously Awarded Compensation; or (ii) recovery would likely cause an otherwise tax-qualified retirement plan to fail to be so qualified under applicable regulations.

5. Recovery from Participating Employees

In addition to (and without limiting) the provisions of paragraph 2 above, in the event the Company is required to prepare a Financial Restatement after the Effective Date, the Company may recover from any current or former employee of the Company who is not a Covered Person (each a "Participating Employee") and who received Incentive-Based Compensation from the Company during the three completed fiscal years immediately preceding the date on which the Board determines that the Company is required to prepare a Financial Restatement, the amount that exceeds what would have been paid to the Participating Employee under the Financial Restatement; provided that, this paragraph

5 will apply only to the extent the Board (or a duly established committee thereof), in its sole discretion, determines that the Participating Employee committed any act or omission that materially contributed to the circumstances requiring the Financial Restatement and such act or omission involved any of the following: (i) misconduct, wrongdoing, or a violation of any of the Company's rules or of any applicable legal or regulatory requirements in the course of the Participating Employee's employment by the Company or (ii) a breach of a fiduciary duty to the Company or its stockholders by the Participating Employee.

6. Recovery Where Intentional Misconduct

In addition to (and without limiting) the provisions of paragraphs 2 and 5 above, in the event the Company is required to prepare a Financial Restatement after the Effective Date and the Board (or a duly established committee thereof), in its sole discretion, determines that a Covered Person's or a Participating Employee's act or omission contributed to the circumstances requiring the Financial Restatement and such act or omission involved any of the following: (i) willful, knowing or intentional misconduct or a willful, knowing or intentional violation of any of the Company's rules or any applicable legal or regulatory requirements in the course of the Covered Person's or the Participating Employee's employment by the Company or (ii) fraud in the course of the Covered Person's or the Participating Employee's employment by the Company, the Company may recover from such Covered Person or Participating Employee up to 100% (as determined by the Board or a duly established committee thereof in its sole discretion) of the Incentive-Based Compensation received by such Covered Person or Participating Employee from the Company during the three fiscal years preceding the date on which the Board determines that the Company is required to prepare a Financial Restatement.

7. Tax Considerations

To the extent that, pursuant to this Policy, the Company is entitled to recover any Erroneously Awarded Compensation that is received by a Covered Person, the gross amount received (i.e., the amount the Covered Person received, or was entitled to receive, before any deductions for tax withholding or other payments) shall be returned by the Covered Person.

8. Method of Compensation Recovery

The Committee shall determine, in its sole discretion, the method for recovering Erroneously Awarded Compensation hereunder, which may include, without limitation, any one or more of the following:

a. requiring reimbursement of cash Incentive-Based Compensation previously paid;

b. seeking recovery of any gain realized on the vesting, exercise, settlement, sale, transfer, or other disposition of any equity-based awards;

c. cancelling or rescinding some or all outstanding vested or unvested equity-based awards;

d. adjusting or withholding from unpaid compensation or other offset;

e. cancelling or offsetting against planned future grants of equity-based awards; and/or

f. any other method permitted by applicable law or contract.

Notwithstanding the foregoing, a Covered Person will be deemed to have satisfied such person's obligation to return Erroneously Awarded Compensation to the Company if such Erroneously Awarded Compensation is returned in the exact same form in which it was received; provided that equity withheld to satisfy tax obligations will be deemed to have been received in cash in an amount equal to the tax withholding payment made.

9. Policy Interpretation

This Policy shall be interpreted in a manner that is consistent with the Applicable Rules and any other applicable law. The Committee shall take into consideration any applicable interpretations and guidance of the SEC in interpreting this Policy, including, for example, in determining whether a financial restatement qualifies as a Financial Restatement hereunder. To the extent the Applicable Rules require recovery of Incentive-Based Compensation in additional circumstances besides those specified above, nothing in this Policy shall be deemed to limit or restrict the right or obligation of the Company to recover Incentive-Based Compensation to the fullest extent required by the Applicable Rules.

10. Policy Administration

This Policy shall be administered by the Committee; provided, however, that the Board shall have exclusive authority to authorize the Company to prepare a Financial Restatement. In doing so, the Board may rely on a recommendation of the Audit Committee of the Board. The Committee shall have such powers and authorities related to the administration of this Policy as are consistent with the governing documents of the Company and applicable law. The Committee shall have full power and authority to take, or direct the taking of, all actions and to make all determinations required or provided for under this Policy and shall have full power and authority to take, or direct the taking of, all such other actions and make all such other determinations not inconsistent with the specific terms and provisions of this Policy that the Committee deems to be necessary or appropriate to the administration of this Policy. The interpretation and construction by the Committee of any provision of this Policy and all determinations made by the Committee under this policy shall be final, binding and conclusive.

11. Compensation Recovery Repayments not Subject to Indemnification

Notwithstanding anything to the contrary set forth in any agreement with, or the organizational documents of, the Company or any of its subsidiaries, Covered Persons are not entitled to indemnification for Erroneously Awarded Compensation or for any losses arising out of or in any way related to Erroneously Awarded Compensation recovered under this Policy.

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REPLIGEN

INSPIRING ADVANCES IN BIOPROCESSING

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Chairperson
President, Knowledgeable Decisions, LLC

Nicolas M. Barthelemy
Former President and Chief Executive Officer, bioTheranostics

Carrie Eglinton Manner
President and Chief Executive Officer, OraSure Technologies, Inc.

Tony J. Hunt
Chief Executive Officer, Repligen Corporation

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Executive Vice President and Chief Technical Operations Officer, Fog Pharmaceuticals, Inc.

Glenn P. Muir
Former Chief Financial Officer and Executive Vice President, Hologic, Inc.

Margaret A. Pax
Former Vice President, Strategy and Innovation, Thermo Fisher Scientific

External Corporate Counsel

Goodwin Procter LLP
100 Northern Avenue
Boston, MA 02210

Independent Accountants

Ernst & Young LLP
200 Clarendon Street
Boston, MA 02116

Executive Management

Executive Officers:

Tony J. Hunt
Chief Executive Officer

Olivier Loeillot
President and Chief Commercial Officer

Jason K. Garland
Chief Financial Officer

James R. Bylund
Chief Operating Officer

Christine Gebski
Senior Vice President, Filtration and Chromatography

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Senior Management:

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Keith Lee Robinson
Chief Information Officer

Mark Salerno
Vice President and Global Head of Analytics

Greg Titus
Senior Vice President, Commercial Development

Neil Whitfield
Vice President, Global Head of Sales

Market for Repligen Stock

NASDAQ Global Select Market: RGEN

Transfer Agent and Registrar

Equiniti Trust Company
PO Box 500
Newark, NJ 07101
helpast@equiniti.com

The Transfer Agent is responsible for handling shareholder questions regarding lost certificates, address changes and change of ownership or name in which shares are held.

Investor Information

Copies of our annual reports on Form 10-K, proxy statements, quarterly reports on Form 10-Q and current reports on Form 8-K are available to shareholders upon request without charge.

Please visit our website at www.repligen.com or direct requests to:

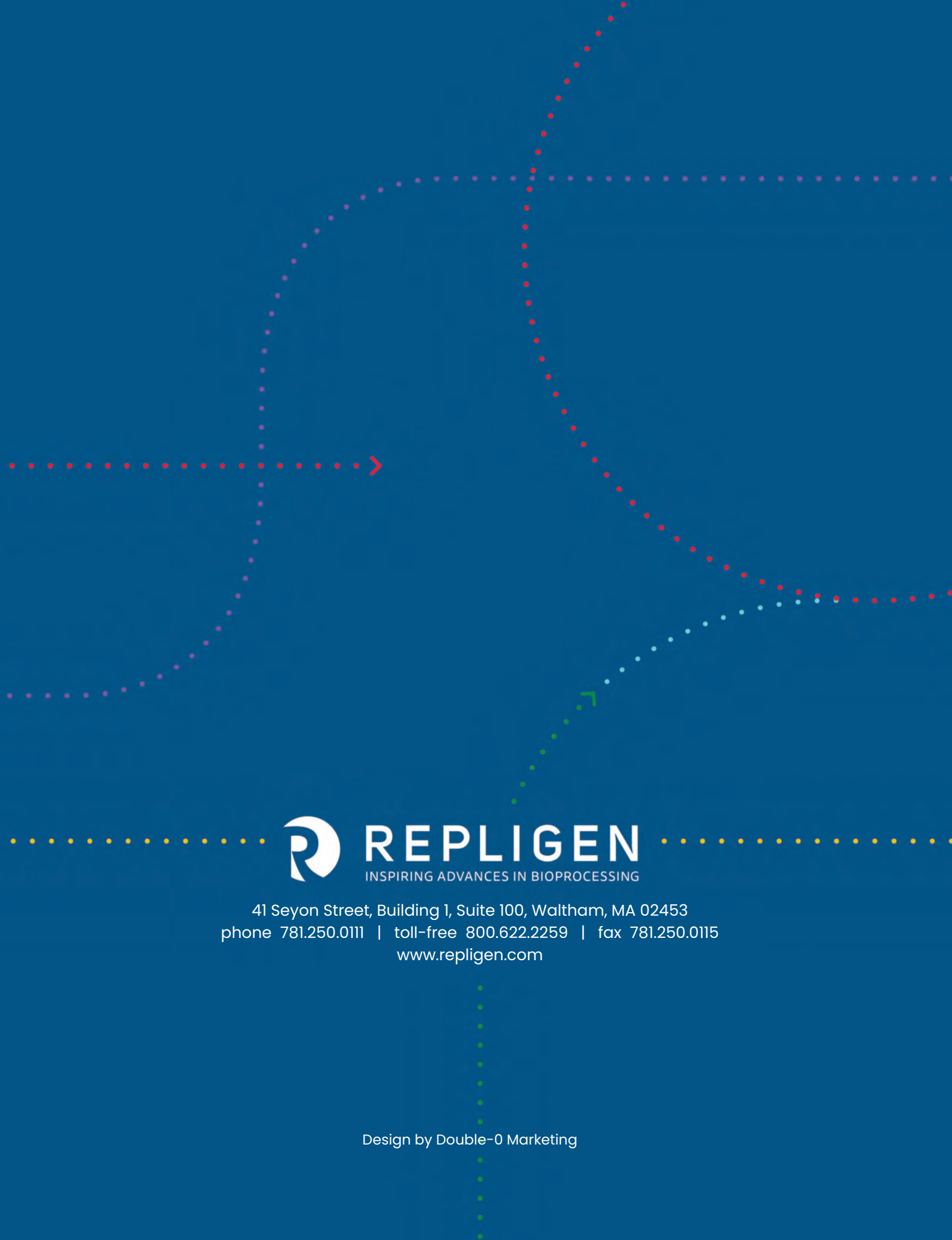
Repligen Corporation
41 Seyon Street, Building #1, Suite 100
Waltham, MA 02453
ATTN: Investor Relations
Phone: 781.250.0111
investors@repligen.com

Virtual Annual Meeting

The Annual Meeting of Shareholders will be held at 8:00 a.m. EDT, Thursday, May 16, 2024.

Location
Our 2024 Annual Meeting will be held online (only) at http://www.virtualshareholdermeeting.com/RGEN2024

You can vote your shares if you were a shareholder of record at the close of business on March 18, 2024 (the "Record Date").



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