



Harvard Bioscience, Inc.

**2022 Annual Report
Notice of Annual Meeting
Proxy Statement**

Annual Meeting to be held on May 15, 2023



HARVARD BIOSCIENCE, INC.
84 October Hill Road
Holliston, Massachusetts 01746-1371

April 5, 2023

Dear Stockholder:

You are cordially invited to attend the 2023 Annual Meeting of Stockholders of Harvard Bioscience, Inc. (the “Annual Meeting”) to be held on Monday, May 15, 2023 at 11:00 a.m. EDT. The Annual Meeting will be held by virtual meeting only. You will not be able to attend the Annual Meeting in person. To be admitted to the Annual Meeting at www.virtualshareholdermeeting.com/HBIO2023, you must enter the control number found on your proxy card, voting instruction form or notice you previously received. You may vote during the Annual Meeting by following the instructions available on the meeting website during the meeting. At the meeting, we will be voting on the matters described in the accompanying proxy statement.

We are using the Internet as our primary means of furnishing the proxy materials to our stockholders. This process expedites the delivery of proxy materials, ensures materials remain easily accessible to stockholders, and allows stockholders to receive clear instructions for receiving materials and voting.

We are mailing the Notice of Internet Availability of Proxy Materials to stockholders on or about April 5, 2023. The proxy statement and our Annual Report on Form 10-K for the year ended December 31, 2022, are available at www.proxyvote.com.

The Notice of Internet Availability of Proxy Materials contains instructions for our stockholders’ use of this process, including how to access or receive copies of our proxy statement and 2022 Annual Report and how to vote by Internet or mail. To the extent you receive a proxy card, such proxy card will also contain instructions on how to vote, including the option to vote by telephone.

If you are unable to attend the meeting virtually, it is still important that your shares be represented and voted. Therefore, regardless of the number of shares you own, **PLEASE VOTE THROUGH THE INTERNET, BY TELEPHONE OR BY MAIL**. Any stockholder who attends the meeting virtually may vote through the meeting website, even if he or she has already voted through the Internet, by telephone or by mail.

The Board of Directors has fixed the close of business on March 21, 2023 as the record date for determination of stockholders entitled to notice of, and to vote at, the Annual Meeting and any adjournments or postponements thereof.

YOUR VOTE IS IMPORTANT. OUR ANNUAL MEETING WILL BE HELD AS A VIRTUAL MEETING. WHETHER OR NOT YOU PLAN TO ATTEND THE ANNUAL MEETING VIRTUALLY, PLEASE CAST YOUR VOTE ONLINE, BY TELEPHONE OR BY COMPLETING, DATING, SIGNING AND PROMPTLY RETURNING YOUR PROXY CARD OR VOTING INSTRUCTION CARD IN THE POSTAGE-PAID ENVELOPE (WHICH WILL BE PROVIDED TO THOSE STOCKHOLDERS WHO REQUEST TO RECEIVE PAPER COPIES OF THESE MATERIALS BY MAIL) BEFORE THE ANNUAL MEETING SO THAT YOUR SHARES ARE REPRESENTED AT THE ANNUAL MEETING.

Sincerely,

A handwritten signature in dark ink, appearing to read 'J. Green', written over a light grey background.

James W. Green
*Chairman of the Board, President and
Chief Executive Officer*

HARVARD BIOSCIENCE, INC.
84 October Hill Road
Holliston, Massachusetts 01746-1371
(508) 893-8999

NOTICE OF ANNUAL MEETING OF STOCKHOLDERS
To Be Held on Monday, May 15, 2023

NOTICE IS HEREBY GIVEN that the 2023 Annual Meeting of Stockholders (the “Annual Meeting”) of Harvard Bioscience, Inc. (the “Company”) will be held on May 15, 2023 at 11:00 a.m. EDT. The Annual Meeting will be held by virtual meeting only. You will not be able to attend the Annual Meeting in person. To be admitted to the Annual Meeting at www.virtualshareholdermeeting.com/HBIO2023, you must enter the control number found on your proxy card, voting instruction form or notice you previously received. You may vote during the Annual Meeting by following the instructions available on the meeting website during the meeting. The Annual Meeting will be held for the following purposes:

1. The election of two Class II Directors named in the accompanying proxy statement, nominated by the Board of Directors for a three-year term, such term to continue until the annual meeting of stockholders in 2026 and until such Director’s successor is duly elected and qualified or until his or her earlier resignation or removal;
2. The ratification of the appointment of Grant Thornton LLP as the Company’s independent registered public accounting firm for the fiscal year ending December 31, 2023;
3. Approval, by a non-binding advisory vote, of the compensation of our named executive officers;
4. Recommendation, by a non-binding advisory vote, of the frequency (one, two or three years) of the shareholder vote to approve the compensation of the Company’s named executive officers; and
5. Such other business as may properly come before the Annual Meeting and any adjournments or postponements thereof.

The Board of Directors has fixed the close of business on March 21, 2023 as the record date for determination of stockholders entitled to notice of, and to vote at, the Annual Meeting and any adjournments or postponements thereof. Only holders of our Common Stock of record at the close of business on that date will be entitled to notice of, and to vote at, the Annual Meeting and any adjournments or postponements thereof. Each of the items of business listed above is more fully described in the proxy statement that accompanies this notice.

The Board of Directors of Harvard Bioscience, Inc. recommends that you vote:

- “FOR” the election of the nominees of the Board of Directors as Directors of the Company;
- “FOR” the proposal to ratify the appointment of Grant Thornton LLP as the Company’s independent registered public accounting firm for the fiscal year ending December 31, 2023;
- “FOR” the proposal to approve, by a non-binding advisory vote, of the compensation of our named executive officers; and
- “FOR” the proposal to recommend, by a non-binding advisory vote, 1 year as the frequency of the shareholder vote to approve the compensation of the Company’s named executive officers.

Important Notice Regarding the Availability of Proxy Materials for the Annual Meeting to be Held on May 15, 2023. The proxy statement and the Annual Report on Form 10-K for the year ended December 31, 2022 are available at www.proxyvote.com. The Annual Report, however, is not part of the proxy solicitation material.

By Order of the Board of Directors,



James W. Green
*Chairman of the Board, President and
Chief Executive Officer*

Holliston, Massachusetts
April 5, 2023

YOUR VOTE IS IMPORTANT. OUR ANNUAL MEETING WILL BE HELD AS A VIRTUAL MEETING. WHETHER OR NOT YOU PLAN TO ATTEND THE ANNUAL MEETING VIRTUALLY, PLEASE CAST YOUR VOTE ONLINE, BY TELEPHONE OR BY COMPLETING, DATING, SIGNING AND PROMPTLY RETURNING YOUR PROXY CARD OR VOTING INSTRUCTIONS CARD IN THE POSTAGE-PAID ENVELOPE (WHICH WILL BE PROVIDED TO THOSE STOCKHOLDERS WHO REQUEST TO RECEIVE PAPER COPIES OF THESE MATERIALS BY MAIL) BEFORE THE ANNUAL MEETING SO THAT YOUR SHARES ARE REPRESENTED AT THE ANNUAL MEETING.

Harvard Bioscience, Inc.
Proxy Statement

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HARVARD BIOSCIENCE, INC.
84 October Hill Road
Holliston, Massachusetts 01746-1371
(508) 893-8999

PROXY STATEMENT

Annual Meeting of Stockholders to Be Held on Monday, May 15, 2023

This proxy statement is furnished in connection with the solicitation of proxies by the Board of Directors (the “Board”) of Harvard Bioscience, Inc. (the “Company” or “we”) for use at the 2023 Annual Meeting of Stockholders of the Company (the “Annual Meeting”) to be held on May 15, 2023, at 11:00 a.m. EDT, and any adjournments or postponements thereof. The Annual Meeting will be held by virtual meeting only. You will not be able to attend the Annual Meeting in person.

To be admitted to the Annual Meeting at www.virtualshareholdermeeting.com/HBIO2023, you must enter the control number found on your proxy card, voting instruction form or notice you previously received. You may vote during the Annual Meeting by following the instructions available on the meeting website during the meeting.

At the Annual Meeting, the stockholders of the Company will be asked to consider and vote upon:

1. The election of two Class II Directors named in this proxy statement, nominated by the Board for a three-year term, such term to continue until the annual meeting of stockholders in 2026 and until such Director’s successor is duly elected and qualified or until his or her earlier resignation or removal;
2. The ratification of the appointment of Grant Thornton LLP as the Company’s independent registered public accounting firm for the fiscal year ending December 31, 2023;
3. Approval, by a non-binding advisory vote, of the compensation of our named executive officers;
4. Recommendation, by a non-binding advisory vote, of the frequency (one, two or three years) of the shareholder vote to approve the compensation of our named executive officers; and
5. Such other business as may properly come before the Annual Meeting and any adjournments or postponements thereof.

We are furnishing proxy materials, which include our proxy statement and our Annual Report on Form 10-K for the year ended December 31, 2022 (the “Annual Report”), to our stockholders over the Internet, and providing a Notice of Internet Availability of Proxy Materials (the “Notice”) by mail. We believe that this e-proxy process expedites stockholders’ receipt of proxy materials, including our proxy statement and Annual Report, while lowering the costs and reducing the environmental impact of our annual meeting. The Notice is first being mailed to stockholders of the Company on or about April 5, 2023, in connection with the solicitation of proxies for the Annual Meeting. The Board of Directors has fixed the close of business on March 21, 2023 as the record date for the determination of stockholders entitled to notice of, and to vote at, the Annual Meeting (the “Record Date”). Only holders of Common Stock, par value \$0.01 per share, of the Company (the “Common Stock”) of record at the close of business on the Record Date will be entitled to notice of, and to vote at, the Annual Meeting. As of the Record Date, there were 41,190,043 shares of Common Stock outstanding and entitled to vote at the Annual Meeting. Each holder of a share of Common Stock outstanding as of the close of business on the Record Date will be entitled to one vote for each share held of record with respect to each matter properly submitted at the Annual Meeting.

The presence, virtually online or by proxy, of holders of at least a majority of the total number of outstanding shares of Common Stock entitled to vote is necessary to constitute a quorum for the transaction of business at the Annual Meeting. Shares held of record by stockholders or their nominees who do not return a signed and dated proxy, properly deliver proxies via the Internet or telephone, or attend the Annual Meeting virtually will not be considered present or represented at the Annual Meeting and will not be counted in determining the presence of a quorum. Consistent with applicable law, we intend to count abstentions and broker non-votes only for the purpose of determining the presence or absence of a quorum for the transaction of business.

A broker “non-vote” refers to shares held by a broker or nominee that does not have the authority, either express or discretionary, to vote on a particular matter. If the beneficial owner does not provide voting instructions, the broker or nominee can still vote the shares with respect to matters that are considered to be “routine,” but not with respect to “non-routine” matters. Proposal No. 2, the ratification of the appointment of Grant Thornton LLP as our independent registered public accounting firm for the fiscal year ending December 31, 2023, is considered “routine” under applicable rules. A broker or other nominee may generally vote on routine matters without voting instructions from beneficial owners, and therefore no broker non-votes are expected to exist in connection with Proposal 2. The remaining proposals are considered “non-routine” under applicable rules. A broker or other nominee cannot vote without instructions on non-routine matters, and therefore there may be broker non-votes on those proposals. Accordingly, if you own shares in street name through a broker, bank or other nominee, please be sure to provide voting instructions to your nominee to ensure that your vote is counted on each of the proposals.

With respect to Proposal No. 1, the election of two Class II Directors, such Directors are elected by a plurality of the votes cast if a quorum is present. Votes may be cast for or withheld from the Directors. In a plurality election, votes may only be cast in favor of or withheld from each nominee; votes that are withheld will be excluded entirely from the vote and will have no effect. This means that the person receiving the highest number of “FOR” votes will be elected as Director.

Approval of Proposal Nos. 2 (the ratification of the appointment of Grant Thornton LLP as the Company’s independent registered public accounting firm for the fiscal year ending December 31, 2023) and 3 (approval, by a non-binding advisory vote, of the compensation of our named executive officers) require the affirmative vote of a majority of the votes cast at the Annual Meeting virtually online or by proxy.

With respect to Proposal No. 4, the advisory vote on the frequency of future advisory votes on the compensation for our named executive officers, the alternative (one year, two years or three years) receiving the highest number of votes cast at the Annual Meeting virtually online or by proxy, will be considered the frequency recommended by stockholders.

Any shares not voted (whether by abstention, broker non-vote or otherwise) will have no impact on the election of the Directors, except to the extent that the failure to vote for an individual results in another individual receiving a larger percentage of votes, and no impact on the voting results of each other matter expected to be voted on at the Annual Meeting.

You will not receive a printed copy of the proxy materials unless you request to receive these materials in hard copy by following the instructions provided in the Notice. Instead, the Notice will instruct you how you may access and review all of the important information contained in the proxy materials. The Notice also instructs you how you may submit your proxy via the Internet or mail. To the extent you receive a proxy card, such proxy card will also contain instructions on how you may also vote by telephone (in addition to voting by Internet or mail). If you received a Notice by mail and would like to receive a printed copy of our proxy materials, you should follow the instructions for requesting such materials included in the Notice.

We encourage you to vote either online, by telephone or by completing, signing, dating and returning a proxy card, or if you hold your shares through a broker or nominee, by completing and returning a voting instruction form. This ensures that your shares will be voted at the Annual Meeting and reduces the likelihood that we will be forced to incur additional expenses soliciting proxies for the Annual Meeting.

Voting over the Internet, by telephone or mailing a proxy card will not limit your right to vote virtually online or to attend the Annual Meeting virtually. Any record holder as of the Record Date may attend the Annual Meeting virtually and may revoke a previously provided proxy at any time by: (i) submitting a new vote on the Internet or by telephone or submitting a properly completed proxy card with a later date; (ii) sending written notice that you are revoking your proxy to the corporate secretary at Harvard Bioscience, Inc., 84 October Hill Road, Holliston, Massachusetts 01746-1371, with such notice received by May 12, 2023; or (iii) attend the Annual Meeting virtually online and vote through the Annual Meeting website. Attendance at the Annual Meeting will not, by itself, revoke a proxy. If your shares are held by your broker or nominee, you should follow the instructions provided by such broker or nominee to revoke an earlier vote.

Beneficial holders who wish to attend the Annual Meeting virtually and vote through the Annual Meeting website should contact their brokerage firm, bank or other financial institution holding shares of Common Stock on their behalf in order to obtain a “legal proxy”, which will allow them to vote through the Annual Meeting website.

You will be able to participate in the Annual Meeting online and submit your questions during the meeting by visiting www.virtualshareholdermeeting.com/HBIO2023. To be admitted to the Annual Meeting, you must enter the control number found on your proxy card, voting instruction form or notice you received. You also will be able to vote your shares electronically prior to or during the Annual Meeting. If you want to submit a question during the Annual Meeting, log into www.virtualshareholdermeeting.com/HBIO2023, type your question into the “Ask a Question” field, and click “Submit.” Questions pertinent to meeting matters will be read and answered during the meeting, subject to time constraints.

If you encounter any difficulties accessing the virtual meeting during the check-in or meeting time, please call the technical support number that will be posted on the Virtual Shareholder Meeting log in page.

Our Board of Directors recommends a vote “FOR” the nominees of the Board of Directors with respect to Proposal No. 1 and “FOR” on Proposal Nos. 2 and 3. With respect to Proposal No. 4, our Board recommends a vote “FOR” 1 year as the frequency of the shareholder vote to approve the compensation of our named executive officers. Proxies will be voted as specified. If your proxy is properly submitted, it will be voted in the manner you direct. **If you submit a properly executed proxy but do not specify instructions with respect to any particular matter to be acted upon at the meeting, proxies will be voted in favor of the Board of Directors’ recommendations.**

We will pay the entire expense of soliciting proxies for the Annual Meeting. In addition to solicitations by mail, certain of our Directors, officers and employees (who will receive no compensation for their services other than their regular compensation) may solicit proxies by telephone, in person, e-mail or other means of electronic communication. Banks, brokerage houses, custodians, nominees and other fiduciaries have been requested to forward proxy materials to the beneficial owners of shares of Common Stock held of record by them as of the Record Date, and such custodians will be reimbursed for their expenses.

Important Notice Regarding the Availability of Proxy Materials for the Annual Meeting to be Held on Monday, May 15, 2023: The proxy statement and Annual Report, are available at www.proxyvote.com. The Annual Report, however, is not part of the proxy solicitation material.

PROPOSAL 1 ELECTION OF DIRECTORS

The Board of Directors of the Company currently consists of five members and is divided into three classes of Directors, with two Directors in Class I, two Directors in Class II and one Director in Class III.

Once elected, Directors serve for three-year terms with one class of Directors being elected by our stockholders at each annual meeting to succeed the Directors of the same class whose terms are then expiring. Each nominee elected as a Director will continue in office until his or her successor has been duly elected and qualified or until his or her earlier resignation or removal.

At the Annual Meeting, two Class II Directors, nominated by the Board of Directors, will stand for election to serve until the 2026 annual meeting of stockholders. At the recommendation of the Governance Committee, the Board of Directors has nominated Ms. Katherine A. Eade and Mr. Thomas W. Loewald for election as the two Class II Directors of the Company. The nominees have agreed to stand for election and, if elected, to serve as Directors. However, if any person nominated by the Board of Directors is unable to serve or will not serve, the proxies will be voted for the election of such other person or persons as the Governance Committee and the Board of Directors may recommend.

Vote Required

The affirmative vote of a plurality of the votes cast by holders of shares of Common Stock present or represented by proxy and entitled to vote on the matter at the Annual Meeting is required for the election of the nominees as Class II Directors of the Company.

OUR BOARD OF DIRECTORS UNANIMOUSLY RECOMMENDS A VOTE “FOR” THE ELECTION OF THE FOLLOWING NOMINEES OF THE BOARD OF DIRECTORS: KATHERINE A. EADE AND THOMAS W. LOEWALD.

INFORMATION REGARDING DIRECTORS

Set forth below is certain information regarding the Directors of the Company, including the two Class II Directors who have been nominated for election at the Annual Meeting, based on information furnished to the Company by such Directors. The biographical descriptions below for the Directors include, as of the date hereof, their age, all positions they hold with the Company, their principal occupation and business experience over at least the past five years, and the names of other publicly-held companies for which they currently serve as Directors or have served as Directors during at least the past five years. The biographical descriptions below for the Directors also include the specific experience, qualifications, attributes and skills that led to the conclusion by the Board of Directors that such persons should serve as Directors of the Company. In addition to such specific information, we also believe that all of our Directors have a reputation for integrity, honesty and adherence to high ethical standards. Further, they have each demonstrated business acumen and an ability to exercise sound judgment as well as a commitment of service to the Company and our Board.

Independence

The Board of Directors has determined that the incumbent Directors listed below, other than our Chief Executive Officer, Mr. Green, are “independent” as such term is currently defined by applicable Nasdaq rules.

Directors of Harvard Bioscience, Inc.

<u>Name</u>	<u>Age</u>	<u>Principal Occupation</u>	<u>Director Since</u>
Class I Directors—Term expires 2025			
<i>James W. Green</i>	64	President, Chief Executive Officer and Chairman of the Board of Directors of the Company	2015
<i>Bertrand Loy (CC)(GC)</i>	57	President, CEO and a Director of Entegris, Inc., Lead Independent Director of the Board of the Directors of the Company	2014
Class II Directors—Term expires 2023; Nominated to Serve a Term Expiring 2026			
<i>Thomas W. Loewald (CC)(AC)(GC)</i>	60	President and CEO of Cambrex	2017
<i>Katherine A. Eade (AC)(GC)</i>	49	Member of the Board of Directors of Vaxxinity, Inc.	2017
Class III Director—Term expires 2024			
<i>Alan Edrick (AC)(CC)</i>	55	Executive Vice President and Chief Financial Officer of OSI Systems, Inc.	2019

(AC) Member of the Audit Committee

(CC) Member of the Compensation Committee

(GC) Member of the Governance Committee

Incumbent Class I Directors—Terms Expiring in 2025

James W. Green has served as a Director of the Company since April 2015 and was appointed Chairman on June 5, 2017. Mr. Green was appointed President and Chief Executive Officer on July 8, 2019. Immediately prior to becoming our President and Chief Executive Officer, Mr. Green served as President of Spacelabs Healthcare, a manufacturer of medical equipment, beginning in April 2018. Prior to that position, Mr. Green was General Partner of Grantchester Group, a private equity investment firm with experience in healthcare and technology. Mr. Green also previously served as President, Chief Executive Officer and a Director of Analogic Corporation, a leading publicly held advanced medical and security imaging company from 2007 until October 2016. From 2005 to 2007, Mr. Green worked as Regional Vice President of Unilab Corp., a California division of Quest Diagnostics Corporation. From 1983 to 2005, Mr. Green worked in various other leadership positions at Koninklijke Philips Electronics NV, St. Jude Medical Inc., Beckman Instruments, McDonnell Douglas Corporation and Northrop Advanced Systems. Mr. Green holds a B.S. from the University of Missouri at Columbia, an M.S. from the University of Southern California and is a graduate of the Stanford University Executive Program. We believe Mr. Green's qualifications to serve on our Board of Directors include his executive leadership experience and global experience in technology, healthcare and life science industries in a variety of executive positions.

Bertrand Loy has served as a Director of the Company since November 2014 and currently serves as the Lead Independent Director and is a member of the Governance Committee and the Compensation Committee. Mr. Loy has been Chief Executive Officer, President and a director of Entegris, Inc. since November 2012. From July 2008 to November 2012, he served as the Executive Vice President and Chief Operating Officer of Entegris, Inc. From August 2005 until July 2008, he served as the Executive Vice President of Entegris, Inc., in charge of its information technology, global supply chain and manufacturing operations. He served as the Vice President and Chief Financial Officer of Mykrolis, a company spun out of Millipore Corporation, a life science products company, from January 2001 until August 2005. Prior to that, Mr. Loy served as the Chief Information Officer of Millipore Corporation during 1999 and 2000, and previously served in various strategic planning, global supply chain and financial roles with Millipore and Sandoz Pharmaceuticals (now Novartis), a pharmaceutical company. Since July 2013, Mr. Loy has also been on the board of directors of SEMI, the global industry association representing the electronics manufacturing supply chain. Mr. Loy holds an M.B.A. from ESSEC Business School in France. We believe Mr. Loy's qualifications to serve on our Board of Directors include his extensive experience as a Chief Executive Officer, as well as his experience in operational management and his extensive international experience in Europe, Asia-Pacific and the Americas.

Nominees for Election as Class II Directors—Nominated to Serve Terms Expiring in 2026

Thomas W. Loewald has served as a Director of the Company since October 2017. Mr. Loewald currently serves as Chair of the Compensation Committee and is a member of the Governance Committee and Audit Committee. Since September 2020, Mr. Loewald has served as President and Chief Executive Officer of Cambrex, a leading private equity-owned Contract Development & Manufacturing Organization. Previously, Mr. Loewald served as President of the Flexible Packaging Division of ProAmpac, a private-equity owned flexible packaging company from September 2017 to September 2020. Prior to that, he served as Senior Vice President and Chief Commercial Officer of Thermo Fisher Scientific, a multinational biotechnology product development company. He previously worked in various roles of Thermo Fisher Scientific from 2002 to 2016. Prior to Thermo Fisher, Mr. Loewald led sales, marketing, and customer service for the adhesives division of Tyco International from 1998 to 2002. Prior to Tyco, Tom held a series of roles with General Electric's Plastics and Materials businesses. Mr. Loewald holds a B.A. in economics from Middlebury College and an M.B.A. in business administration from The Amos Tuck School at Dartmouth College. We believe Mr. Loewald's qualifications to serve on our Board of Directors include his broad global business experience in a wide range of industries from commodity to high growth, his strong strategic management and leadership skills, and his extensive record of success in leading business growth and excellence.

Katherine A. Eade has served as a Director of the Company since October 2017. Ms. Eade currently serves as Chair of the Governance Committee and is a member of the Audit Committee. Ms. Eade has more than 20 years of experience advising public companies on M&A and other significant corporate transactions, governance matters and capital markets. In February 2023, Ms. Eade joined the board of directors of Vaxxinity, Inc., a publicly traded biotechnology company committed to democratizing healthcare across the globe, where she also serves as a member of the audit committee. Ms. Eade has also served as Interim General Counsel and advisor to Standard Biotools Inc., a publicly-traded supplier of life science research tools focused on proteomic and genomic applications, since January 2023. She previously served as General Counsel of Checkmate Pharmaceuticals, Inc. and President of Checkmate Pharmaceuticals Security Corporation from September 2020 until their acquisition by Regeneron Pharmaceuticals in May 2022. Previously, Ms. Eade served as Vice President, Strategic Commercial Affairs at Align Technology, a position she held from 2019 to 2020, and prior to that was Deputy General Counsel of La-Z-Boy Incorporated from 2018 to 2019. Prior to joining La-Z-Boy, Ms. Eade was the Director, M&A Law and Transactions for Corning Incorporated and Division Counsel for Corning's Life Sciences and Pharmaceutical

Technologies divisions. Her life science acquisitions for Corning included the \$730 million purchase of BD's Discovery Labware business. Previous to her work at Corning, Ms. Eade was an attorney at Cleary Gottlieb Steen & Hamilton LLP, a leading international law firm, for over seven years. Earlier in her career, she served as a law clerk for Judge Morton I. Greenberg of the U.S. Court of Appeals for the Third Circuit. Ms. Eade earned a J.D., cum laude, from Harvard Law School and a B.A. in Government, summa cum laude, from Cornell University. We believe Ms. Eade's qualifications to serve on our Board of Directors include her significant experience in mergers and acquisitions, including in the life sciences industry, and her extensive experience in capital markets and corporate governance.

Incumbent Class III Director—Term Expiring in 2024

Alan Edrick has served as a Director of the Company since September 2019. Mr. Edrick currently serves as Chair of the Audit Committee and a member of the Compensation Committee. Mr. Edrick has over 30 years of financial management and public accounting experience, including mergers and acquisitions, capital markets, financial planning and analysis, and regulatory compliance. Mr. Edrick has been the Executive Vice President and Chief Financial Officer of OSI Systems, Inc., a publicly traded multinational company with leading market positions in homeland security, patient monitoring and optoelectronics, since 2006. Between 2004 and 2006, Mr. Edrick served as Executive Vice President and Chief Financial Officer of BioSource International, Inc. until its sale to Invitrogen Corporation. Between 1998 and 2004, Mr. Edrick served as Senior Vice President and Chief Financial Officer of North American Scientific, Inc., a medical device and specialty pharmaceutical company. Between 1989 and 1998, Mr. Edrick was employed by Price Waterhouse LLP in various positions including Senior Manager, Capital Markets. Mr. Edrick earned a Bachelor of Arts in economics/business from the University of California, Los Angeles (UCLA) and a Master of Business Administration from UCLA's Anderson School of Management. We believe Mr. Edrick's qualifications to serve on our Board of Directors include his executive leadership experience as a Chief Financial Officer, as well as his significant operating, accounting and financial management expertise, including in the life sciences industry.

INFORMATION REGARDING THE BOARD OF DIRECTORS AND ITS COMMITTEES

During the year ended December 31, 2022, our Board of Directors met or acted by written consent eleven times. Each of the Directors attended at least 75% of the total number of meetings of the Board of Directors held while he or she was a Director and of the committees of which he or she was a member. The Board of Directors generally encourages Directors to attend in person the Annual Meeting of Stockholders of the Company, or Special Meeting in lieu thereof, or, if unable to attend in person, to participate by other means, if practicable. The Board of Directors encourages Directors to participate virtually for the 2023 Annual Meeting. All of the Directors in office at the time attended the 2022 Annual Meeting of Stockholders held on May 17, 2022. The non-employee Directors meet regularly in executive sessions outside the presence of management.

Board Leadership Structure

Our Board of Directors does not have a fixed policy as to whether the roles of Board Chair and Chief Executive Officer should be separated or combined. The Board believes that it is in the best interests of our Company to make this determination periodically based on the then-current circumstances, including the then-current strategic and operating environment and the composition of our Board of Directors and our management team. If the Board Chair is not an independent director, a Lead Independent Director is appointed by the Board.

The Lead Independent Director coordinates the activities of the other independent directors and performs such other duties and responsibilities as the Board of Directors may determine. The duties of the Lead Independent Director include:

- presiding at all meetings of the Board at which the Chairman is not present, including executive sessions of the independent Directors;
- calling meetings of independent Directors;
- serving as the principal liaison between the Chairman and the independent Directors;
- approving meeting agendas for the Board;
- approving the frequency of Board meetings and meeting schedules;
- assuring there is sufficient time for discussion of all agenda items;
- previewing information provided to the Board of Directors, as appropriate;
- being available, when appropriate, for consultation and direct communication with stockholders;
- retaining outside advisors and consultants who report directly to the Board on Board-wide issues;
- leading, together with the Chair of the Governance Committee, the Board of Director's annual self-assessment; and
- leading, together with the Chair of the Compensation Committee, the Board of Directors' evaluation of the CEO.

Our Board of Directors believes that it is currently in the best interest of our Company to combine the roles of Board Chair and Chief Executive Officer under the leadership of Mr. Green. Mr. Loy currently serves as our Lead Independent Director. The Board believes that this structure allows us to capitalize on Mr. Green's knowledge and experience to more effectively carry out our operating activities, execute our strategic plans, and foster effective communications between the Board of Directors, our management team, and our external stakeholders. The effectiveness of this structure is further enhanced by Mr. Loy's extensive executive and board experience, which provides a valuable independent perspective to our Board and its leadership.

Board Diversity Matrix (As of March 21, 2023)

Total Number of Directors				5
Part I. Gender Identity	Female	Male	Non-Binary	Did Not Disclose Gender
Directors	1	4	-	-
Part II. Demographic Background				
African American or Black	-	-	-	-
Alaskan Native or Native American	-	-	-	-
Asian	-	-	-	-
Hispanic or Latinx	-	-	-	-
Native Hawaiian or Pacific Islander	-	-	-	-
White	1	4	-	-
Two or More Races or Ethnicities	-	-	-	-
LGBTQ+	-	-	-	-
Did Not Disclose Demographic Background	-	-	-	-

Board Committees

The Board of Directors has established an Audit Committee (the "Audit Committee"), a Compensation Committee (the "Compensation Committee") and a Governance Committee (the "Governance Committee"). The charters of each our committees are available on the Corporate Governance page in the Investor Relations section of our website at www.harvardbioscience.com. Please note that the information contained on the Company website is not incorporated by reference in, or considered to be a part of, this proxy statement.

Audit Committee

The Audit Committee currently consists of Mr. Edrick, Ms. Eade and Mr. Loewald. Mr. Edrick serves as the Chair. The Audit Committee is comprised entirely of independent Directors and operates under a Board-approved charter that sets forth its duties and responsibilities. The Audit Committee met or acted by written consent nine times during 2022.

Under its charter, the Audit Committee is responsible for, among other things:

- reviewing our financial statements and related disclosures included in quarterly and annual financial statements, as well as quarterly earnings releases;
- reviewing the adequacy of our internal controls, and financial systems and management practices;
- appointing, retaining and terminating, and determining compensation of, our independent auditors;
- overseeing our independent auditors and the evaluation of the independent auditors' qualifications, performance and independence;
- pre-approving audit and non-audit services to be provided by the independent auditors, which may include the delegation of the pre-approval of non-audit services to one or more members of the committee;
- assessing the independence of the independent auditors, including consideration of the auditors' provision of non-audit services to the Company;
- assuring the regular rotation of audit partners, including any lead and concurring partners, in accordance with applicable laws and regulations;
- reporting matters that arise relating to quality or integrity of our financial statements and other matters to the Board and reviewing such matters with the Board;
- establishing and overseeing procedures for (1) the receipt, retention and treatment of complaints received by the Company regarding accounting, internal accounting controls, or auditing matters and (2) the confidential, anonymous submission by employees of the Company of concerns regarding questionable accounting or auditing matters;
- reviewing and discussing with management our policies with respect to risk assessment and risk management; and
- discussing matters relating to risks that arise or may arise with the Board.

The Board of Directors has determined that Ms. Eade, Mr. Edrick and Mr. Loewald are "independent" as such term is currently defined by Nasdaq rules for purposes of service on the Audit Committee. The Board of Directors has also determined that Mr. Edrick qualifies as an "audit committee financial expert" as this term has been defined under the rules of the Securities and Exchange Commission (the "SEC").

Compensation Committee

The Compensation Committee currently consists of Mr. Edrick, Mr. Loewald, and Mr. Loy. Mr. Loewald serves as the Chair. The Compensation Committee is comprised entirely of independent Directors and operates under a Board approved charter that sets forth its duties and responsibilities. The Compensation Committee met or acted by written consent eight times in 2022.

Under its charter, the Compensation Committee is responsible for, among other things:

- determining and overseeing the execution of our compensation philosophy;
- overseeing the administration of our executive compensation program;
- overseeing the Company's compensation and benefit plans and policies;
- retaining or terminating committee advisors;
- evaluating the independence of compensation advisors;
- administering its stock plans (including reviewing and approving equity grants); and
- reviewing and approving annually all compensation decisions for the Company's executive officers, including the CEO and the other executive officers named in the 2022 Summary Compensation Table. See "Executive Compensation—Compensation Discussion and Analysis" later in this proxy statement for information concerning the Compensation Committee's role, processes and activities in overseeing executive compensation.

The Board of Directors has determined that Mr. Edrick, Mr. Loewald, and Mr. Loy are "independent" as such term is currently defined by Nasdaq rules for purposes of service on the Compensation Committee.

Governance Committee

The current members of the Governance Committee are Ms. Eade, Mr. Loewald, and Mr. Loy. Ms. Eade serves as the Chair. The Governance Committee is comprised entirely of independent Directors and operates under a Board approved charter that sets forth its duties and responsibilities. The Governance Committee met or acted by written consent two times in 2022.

Under its charter, the Governance Committee is responsible for, among other things:

- identifying individuals qualified to become Board members, consistent with criteria recommended by the Governance Committee and approved by the Board of Directors;
- recommending that the Board of Directors select the director candidates for election at each annual meeting of stockholders;
- recommending to the Board of Directors the criteria for membership on the committees; and
- assisting the Board of Directors with such corporate governance matters as the Board of Directors may request.

In identifying and evaluating nominees for the Board of Directors, the Governance Committee may solicit recommendations from any or all of the following sources: non-management Directors, the Chief Executive Officer, other executive officers, third-party search firms or any other source it deems appropriate.

The Governance Committee has established procedures for stockholders to recommend Director candidates. All stockholder recommendations for Director candidates must be submitted in writing to our Chief Financial Officer at 84 October Hill Road, Holliston, Massachusetts 01746, who will forward all recommendations to the Governance Committee. All stockholder recommendations for Director candidates must be submitted to the Company not less than 120 calendar days prior to the anniversary of the date on which our proxy statement was released to stockholders in connection with the previous year's annual meeting. All stockholder recommendations for Director candidates must include:

- the name and address of record of the stockholder;
- a representation that the stockholder is a record holder of our securities, or if the stockholder is not a record holder, evidence of ownership in accordance with Rule 14a-8(b)(2) of the Securities Exchange Act of 1934 (the "Exchange Act");
- the name, age, business and residential address, educational background, public company directorships, current principal occupation or employment, and principal occupation or employment for the preceding five full fiscal years of the proposed Director candidate;
- a description of the qualifications and background of the proposed director candidate which addresses the minimum qualifications and other criteria for Board membership approved by the Board of Directors and set forth in the Governance Committee Charter;
- a description of all arrangements or understandings between the stockholder and the proposed Director candidate;
- the consent of the proposed Director candidate to be named in the proxy statement, to have all required information regarding such Director candidate included in the proxy statement, and to serve as a Director if elected; and
- any other information regarding the proposed Director candidate that is required to be included in a proxy statement filed pursuant to the rules of the SEC.

The Governance Committee will evaluate all such proposed Director candidates, including those recommended by stockholders, in compliance with the procedures established by the Governance Committee, in the same manner, with no regard to the source of the initial recommendation of such proposed Director candidate. When considering a potential candidate for membership on the Board of Directors, the Governance Committee may consider, in addition to the minimum qualifications and other criteria for Board membership approved by the Board of Directors, all facts and circumstances that the Governance Committee deems appropriate or advisable, including, among other things, the skills of the proposed Director candidate, his or her availability, depth and breadth of business experience or other background characteristics, his or her independence and the needs of the Board of Directors. At a minimum, each candidate must have high personal and professional integrity, have demonstrated ability and judgment, and be effective, in conjunction with the other Directors and candidates, in collectively serving the long-term interests of the stockholders. In addition, the Governance Committee will recommend that the Board select candidates for nomination to help ensure that a majority of the Board shall be "independent" in accordance with Nasdaq rules and that each of its Audit, Compensation and Governance Committees shall be comprised entirely of independent Directors, subject to certain exceptions under the Nasdaq rules to such requirement. Although there is no specific policy regarding the consideration of diversity in identifying Director candidates, the Governance Committee may consider whether the candidate, if elected, assists in achieving a mix of Board members that represents a diversity of background and experience. The Governance Committee also may consider whether the candidate has direct experience in the biotechnology, pharmaceutical and/or life science research industries or in the markets in which the Company operates.

The Board's Role in Risk Oversight

Risks to the Company are discussed by the Board of Directors during the year. Management is responsible for the day-to-day management of risks we face, while the Board, as a whole and through its committees, oversees risk management. The Board reviews and discusses, including with management, the risks that arise or may arise, including in relation to legal, compliance and cyber-security matters, as well as novel risks that arise such as the impact of the COVID-19 global pandemic. The Board discusses with management, the Audit Committee, and our independent registered public accounting firm the financial risk, including with respect to financial reporting and internal controls, and the steps management has taken to address such risks. Our Board also administers its risk oversight function through the required approval by the Board (or a committee of the Board) of significant transactions and other material decisions.

Risk Considerations in our Compensation Programs

The Compensation Committee believes that risks arising from our policies and practices for compensating employees are not reasonably likely to have a material adverse effect on the Company.

Non-Employee Director Stock Ownership Guidelines

Our Board has implemented equity ownership guidelines with respect to our non-employee Directors. The ownership guidelines require each non-employee member of the Board of Directors, within five years from their initial election to the Board, to own shares of our Common Stock having a value of at least three times the annual retainer of the non-employee Directors. With respect to satisfying the guidelines, unvested awards of restricted stock units are included in the calculation while stock options are excluded. All of our Directors are currently in compliance with these equity ownership guidelines.

CODE OF BUSINESS CONDUCT AND ETHICS

The Board of Directors has adopted a Code of Business Conduct and Ethics, which applies to all Directors, officers and employees of the Company and its subsidiaries including the Chief Executive Officer, the Chief Financial Officer, principal accounting officer, controller and any person performing similar functions. The Code of Business Conduct and Ethics is available on the Corporate Governance page in the Investor Relations section of our website at www.harvardbioscience.com. We intend to post any amendments to or waivers from our Code of Business Conduct and Ethics at this location on our website.

ENVIRONMENTAL, SOCIAL, AND GOVERNANCE

At Harvard Bioscience, we are committed to enabling the discovery, safety and regulatory testing, and production of tomorrow's therapeutics. We strive to be a trusted partner to our customers by supplying products and services that enable advances in life science research and drug development across the continuum from fundamental research, therapy discovery, pre-clinical regulatory safety pharmacology and toxicology testing, to bioproduction.

We believe that conducting our business in a socially, environmentally, and ethically responsible manner is important to our long-term success and the well-being of our stakeholders.

Environmental. We strive to minimize our environmental impact, including through more efficient energy and water usage, minimizing waste and emissions, and encouraging recycling. Consistent with these goals, our product development teams strive to minimize the use of hazardous substances in our products through initiatives such as the European Union's directive on the Restriction of Hazardous Substances (RoHS). We also work closely with our suppliers to advance the responsible sourcing of materials such as conflict minerals and compliance with the European Union's Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) regulation to manage the use of chemical substances.

Social. We believe that providing our customers with products and services that enable the development, testing, and production of tomorrow's therapeutics plays a fundamental role in improving the health and well-being of the global community. We value our employees, customers, and communities and are committed to fostering a workplace that promotes fairness, respect, and opportunity for all. This commitment includes our participation in equal employment opportunity outreach programs and in the SkillBridge program, which provides valuable opportunities for armed service members to transition to civilian employment.

Governance. We are focused on sound corporate governance. This includes a commitment to ethics and integrity, foundational values that we believe are key to our continued success. We have established a Code of Business Conduct and Ethics that applies across all levels of our business, including our Board of Directors, senior executives, and all employees worldwide. We have also established a confidential ethics hotline that allows employees to report ethical or legal concerns. More information on our governance policies and procedures and our Code of Business Conduct and Ethics is available elsewhere in this proxy statement and the Investor Relations section of our website at www.harvardbioscience.com.

REPORT OF THE AUDIT COMMITTEE

Notwithstanding anything to the contrary set forth in any of the Company's previous or future filings under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended, that might incorporate this proxy statement or any future filing with the Securities and Exchange Commission, in whole or in part, the following report shall not be deemed incorporated by reference into any such filing.

The undersigned members of the Audit Committee of the Board of Directors of the Company submit this report in connection with the committee's review of the financial reports of the Company for the fiscal year ended December 31, 2022 as follows:

1. The Audit Committee has reviewed and discussed with management the audited financial statements of the Company for the fiscal year ended December 31, 2022.
2. The Audit Committee has discussed with representatives of Grant Thornton LLP the matters required to be discussed with them by applicable requirements of the Public Company Accounting Oversight Board and the SEC.
3. The Audit Committee has received the written disclosures and the letter from the independent accountant required by the Public Company Accounting Oversight Board regarding the independent accountant's communications with the Audit Committee concerning independence, and has discussed with the independent accountant the independent accountant's independence.

Based on the review and discussions referred to above, the Audit Committee recommended to the Board of Directors that the audited financial statements be included in the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2022 for filing with the Securities and Exchange Commission.

Audit Committee:

Alan Edrick, Chair
Katherine A. Eade
Thomas W. Loewald

DIRECTOR COMPENSATION

Our Board of Directors has the authority to approve all compensation payable to our Directors, although our Compensation Committee is responsible for making recommendations to our Board regarding Board compensation. Our Board of Directors and Compensation Committee periodically review our Board compensation to evaluate whether it remains competitive such that we are able to recruit and retain qualified Directors. We use a mix of cash and/or stock-based incentive compensation to attract and retain qualified candidates to serve on our Board. In setting Board compensation, the Board of Directors and the Compensation Committee consider the significant amount of time that Directors expend in fulfilling their duties to the Company as well as the skill-level required by the Company of members of the Board.

Directors who are also employees of the Company receive no additional compensation for service as a Director. Non-employee Directors receive the compensation described below.

Compensation of Non-Employee Directors Upon Initial Election to the Board

Each new non-employee Director, upon his or her initial election to the Board, is entitled to receive a restricted stock unit (“RSU”) award having a grant date fair value of \$150,000. Such RSU award will vest annually over three years and be granted on the fifth business day following his or her initial election to the Board.

Annual Compensation of Non-Employee Directors

Annual Board and Committee Retainers

Each non-employee Director is entitled to receive an annual retainer award, paid in RSUs, for such Director’s service on the Board of Directors. The annual retainer award is granted on the fifth business day following each annual meeting of stockholders and will vest in full on the earlier of (i) immediately prior to the Company’s next annual meeting and (ii) one year from the date of grant, subject to the Director’s continued service through the applicable vesting date. The Lead Independent Director receives an additional retainer paid in RSUs which has the same date of grant and vesting schedule as the annual Board retainers. Further, each non-employee Director is entitled to receive cash retainers for such Director’s service on committees of the Board of Directors. The Chairs of each committee also receive an additional cash retainer for service in such role. Committee retainers are paid quarterly in arrears.

The current annual retainers for service on the Board and its committees are as follows:

Role	Form of Retainer	Annual Retainer Value
Non-employee Director.....	RSUs	\$45,000
Lead Independent Director.....	RSUs	\$35,000
Audit Committee chair.....	Cash	\$17,500
Audit Committee member.....	Cash	\$10,000
Compensation Committee chair.....	Cash	\$7,000
Compensation Committee member.....	Cash	\$7,000
Governance Committee chair.....	Cash	\$5,000
Governance Committee member.....	Cash	\$5,000

Annual Equity Award

In addition, each non-employee Director is entitled to receive an annual equity award, paid in RSUs, for such Director’s service on the Board of Directors. The annual equity award is granted on the fifth business day following each annual meeting of stockholders and will vest in full on the earlier of (i) immediately prior to the Company’s next annual meeting of stockholders, and (ii) one year from the date of grant, subject to the Director’s continued service through the applicable vesting date.

The current annual equity award for service on the Board is as follows:

Role	Form of Retainer	Annual Equity Award Value
Non-employee Director.....	RSUs	\$100,000

Expenses

In addition, non-employee Directors shall be reimbursed for expenses incurred in connection with attending Board and committee meetings.

2022 Director Compensation Table

The following table presents the compensation provided to the non-employee Directors who served during the fiscal year ended December 31, 2022.

Name	Fees Earned or	Stock Awards (\$)	Option Awards	Total
	Paid	(1)	(2)	
	in Cash (\$)	(2)	(3)	
<i>Katherine Eade</i>	20,000	145,000	\$ -	165,000
<i>Alan Edrick</i>	34,500	145,000	-	179,500
<i>Thomas Loewald</i>	29,000	145,000	-	174,000
<i>Bertrand Loy</i>	12,000	180,000	-	192,000

- (1) Based on the aggregate grant date fair value computed awards in accordance with the provisions of FASB ASC 718, “Compensation—Stock Compensation.” Assumptions used in the calculation of this amount are included in Note 10 to the Company’s audited financial statements for the fiscal year ended December 31, 2022 included in the Company’s Annual Report on Form 10-K filed with the SEC on March 9, 2023.
- (2) The aggregate number of unvested RSU awards outstanding at December 31, 2022 and held by the non-employee Directors were as follows: 38,259 awards for Ms. Eade; 38,259 awards for Mr. Edrick; 38,259 awards for Mr. Loewald; 47,493 awards for Mr. Loy.
- (3) The aggregate number of stock options outstanding at December 31, 2022 and held by the non-employee Directors were as follows:

Name	Aggregate Number of Stock Options Outstanding
<i>Katherine A. Eade</i>	87,600
<i>Alan Edrick</i>	101,800
<i>Thomas W. Loewald</i>	87,600
<i>Bertrand Loy</i>	55,300

INFORMATION ABOUT OUR EXECUTIVE OFFICERS

Our current executive officers are:

Name	Age	Position
James W. Green.....	64	President, Chief Executive Officer and Chairman of the Board of Directors
Jennifer Cote	51	Interim Chief Financial Officer and Treasurer

Biographical information for Mr. Green is provided above under the heading “Directors of Harvard Bioscience, Inc.” above.

Jennifer Cote joined the Company as Vice President of Global Finance in May 2022 and was named Interim Chief Financial Officer and Treasurer as of January 1, 2023. Prior to joining the Company, Ms. Cote held various financial, strategy, and operating roles of increasing responsibility at Bose Corporation, a leading supplier of speakers, headphones, electronics and other related products for the consumer audio, automotive, health, and professional audio market from 1999 to March

2022. She served as Bose’s Head of Global Business Services – Strategy Enablement and Finance Services from September 2019 to March 2022 and Global Service Owner for Finance Services from December 2016 to September 2019. Ms. Cote’s previous roles at Bose included Head of Finance for Bose’s Headphones Business Unit, Head of Global Business Operations and Head of Finance for its Professional Systems Division. Earlier in her career, Ms. Cote held various positions of increasing responsibility, including Audit Manager, at Arthur Andersen LLP. A Certified Public Accountant and Chartered Global Management Accountant, Mr. Cote holds a Bachelor of Science in Accountancy from Villanova University.

COMPENSATION DISCUSSION AND ANALYSIS

This Compensation Discussion and Analysis, which should be read together with the executive compensation tables set forth below, provides information regarding our executive compensation program for our named executive officers. Our named executive officers for 2022 were:

<u>Name</u>	<u>Title</u>
James W. Green.....	President and Chief Executive Officer
Kenneth Olson ⁽¹⁾	Chief Operating Officer
Michael Rossi ⁽²⁾	Chief Financial Officer and Treasurer

(1) Mr. Olson resigned from his position as Chief Operating Officer effective January 31, 2022 and assisted on various projects and in the transition of the Chief Operating Officer role until his departure from the Company on December 31, 2022.

(2) Mr. Rossi resigned from his position as Chief Financial Officer and Treasurer effective December 31, 2022.

Objectives of Our Executive Compensation Programs

Our compensation programs for our executive officers are designed to achieve the following key objectives:

- attract and retain high performing and experienced executives;
- motivate and reward executives whose knowledge, skills and performance are deemed critical to our success;
- align the interests of our executives and stockholders by motivating executives to increase stockholder value and rewarding executives when stockholder value increases;
- foster a shared commitment among executives by coordinating their goals; and
- motivate our executives to manage our business to meet our short- and long-term objectives, and reward them for meeting these objectives, including growing our revenues, earnings per share, total market capitalization and share price.

Role and Authority of the Compensation Committee

The Compensation Committee oversees our executive compensation programs. In this role, the Compensation Committee reviews and approves the compensation of our executive officers. Additional information about the Compensation Committee, including its composition and responsibilities, can be found under the heading “Compensation Committee” above. The Compensation Committee’s practice has been to establish fiscal year base salaries, and to approve bonus programs and long-term incentive awards, on an annual basis. From time to time, the Compensation Committee makes other adjustments to individual compensation arrangements due to promotions, changes of responsibilities, or other appropriate circumstances.

Role of Independent Compensation Consultant

The Compensation Committee engages an independent compensation consultant to provide guidance with respect to the development and implementation of our compensation programs. The Compensation Committee utilizes input from its compensation consultant in determining the appropriate compensation, including base salary, bonus and equity grants, with respect to our named executive officers. The Compensation Committee engaged Frederic W. Cook & Co., Inc. (“FW Cook”) as its independent compensation consultant for 2022.

FW Cook provides no services to the Company other than those performed on behalf of the Compensation Committee. The Compensation Committee considers the independence of its compensation consultant on an annual basis.

Role of Management

The Compensation Committee receives input from our Chief Executive Officer and other members of our senior management team with respect to compensation programs for our executives. The Compensation Committee also receives input from our Chief Executive Officer on the performance of our other executives and on compensation decisions for those executives. The Compensation Committee considers, but is not bound by and does not always accept, the recommendations of our Chief Executive Officer or the other members of our management team with respect to compensation matters. While our Chief Executive Officer and other members of our senior management team typically attend Compensation Committee meetings, the Compensation Committee regularly meets in executive session without management present. Our Chief Executive Officer is not present during voting or deliberations on his compensation. The Compensation Committee also makes compensation decisions with respect to our other executives without them present.

Bases for Our Compensation Policies and Decisions

As a general guideline, the Compensation Committee seeks to establish the target compensation of our executive officers at approximately the median of similarly situated executives, assuming that our Company meets the performance targets established for incentive-based programs. An individual executive’s target compensation may be higher or lower than this guideline based on his or her particular background, experience and performance, market factors, and internal equity. These factors are weighed by the Compensation Committee in its judgment, and no one factor takes precedence over the others.

Given then-prevailing economic conditions and a desire that year-over-year compensation remain largely unchanged, the Compensation Committee did not obtain peer group data in establishing the 2022 compensation of our named executive officers.

Compensation Practices

Our executive compensation practices include the following, each of which the Compensation Committee believes reinforces our executive compensation objectives:

- market comparison of executive compensation against a relevant peer group, as appropriate;
- use of an independent compensation consultant reporting directly to the Compensation Committee and providing no other services to the Company;
- double-trigger vesting for equity awards in the event of a change in control;
- limited perquisites;
- executive stock ownership guidelines;
- clawback policy;
- anti-short selling, anti-margin and hedging policies; and
- annual say-on-pay vote.

Compensation Elements

The elements of executive compensation include base salary, annual cash incentive bonuses, long-term equity incentive compensation, employment agreements, and broad-based benefits programs. We have not adopted any formal guidelines for allocating total compensation between long-term and short-term compensation, cash compensation and non-cash compensation, or among different forms of non-cash compensation.

Base Salary

We pay our executive officers a base salary, which our Compensation Committee reviews and determines annually. We believe that a competitive base salary is a necessary element of any compensation program that is designed to attract and retain talented and experienced executives. We also believe that attractive base salaries can motivate and reward executives for their overall performance. The 2022 annualized base salary of each of our named executive officers was as follows:

Executive	2022 Base Salary	Increase over 2021
James Green	\$573,710	0%
Michael Rossi.....	\$340,000	0%

In view of Mr. Olson's resignation as the Company's Chief Operating Officer effective January 31, 2022, the Compensation Committee did not establish a 2022 base salary for Mr. Olson.

Annual Cash Incentive Bonuses

Our 2022 annual cash incentive bonus plan (the "2022 Annual Cash Incentive Plan"), as approved by the Compensation Committee, was designed to encourage our executives to achieve predetermined corporate financial performance objectives. The Annual Cash Incentive Plan emphasizes pay for performance and is intended to align executive compensation with the achievement of specified operating results.

The metrics and weightings of the 2022 Annual Cash Incentive Plan were as follows:

Metric	Weighting	Rationale for Metric
Revenue Growth	50%	Strategic goal to return the Company to organic growth
Adjusted Operating Income (1)	50%	Achievement of Adjusted Operating Income targets designed to significantly improve the core profitability of the business and invest in products and revenue growth activities.

- (1) Adjusted operating income is a non-GAAP measure and excludes certain expenses and income primarily resulting from purchase accounting or events that management does not believe are related to the underlying operations of the business such as amortization of intangibles related to acquisitions, costs related to acquisition, disposition and integration initiatives, impairment charges, severance, restructuring and other business transformation expenses, and stock-based compensation expense. The effect of the current year's annual cash incentive bonus is also excluded from adjusted operating income.

Target awards for our named executive officers under the 2022 Annual Cash Incentive Plan were established by the Compensation Committee as follows:

Executive	2022 Target Award (% of Base Salary)
James Green	100%
Michael Rossi.....	50%

The target awards for Messrs. Green and Rossi were unchanged from 2021. In view of Mr. Olson’s resignation as the Company’s Chief Operating Officer effective January 31, 2022, Mr. Olson did not receive a target award for fiscal 2022.

Under the terms of their awards, Messrs. Green and Rossi were each eligible to receive a cash payment between 0% and 150% of their respective target awards based on our performance with respect to the predetermined financial goals established in connection with the 2022 Annual Cash Incentive Plan.

The Compensation Committee evaluated our 2022 performance against these goals and determined that neither Mr. Green nor Mr. Rossi was eligible to receive a payment under the 2022 Annual Cash Incentive Plan.

Long-Term Equity Incentive Compensation

We grant long-term equity incentive awards in the form of time- and performance-based RSUs to executives as part of our total compensation package. These awards generally represent a significant portion of total executive compensation. We use long-term equity incentive awards in order to align the interests of our executives and our stockholders by providing our executives with strong incentives to increase stockholder value and a significant reward for doing so.

The Compensation Committee’s long-term incentive strategy allows for use of a portfolio approach when granting awards. Each element of the portfolio is intended to address a different aspect of long-term incentive compensation, as set forth below:

- Time-based RSUs serve as a retentive device and provide an interest in the value of the Company’s shares, because, even though they vest over time, they provide recipients with a certain equity interest, assuming continued employment. In addition to promoting retention, time-based RSUs further align executives’ interests with the interests of shareholders and provide a long-term ownership mentality as well as motivation to succeed in the long term.
- Performance-based RSUs provide an additional incentive for executive officers to create shareholder value, as the vesting of these awards is subject to the achievement of pre-defined performance goals. Vesting of performance-based RSUs awarded to our named executive officers in 2022 is based on the relative total shareholder return (“TSR”) of our Common Stock as compared to companies in the Russell 2000 stock index. The Committee believes that the Russell 2000 stock index is an appropriate measure of our performance as it consists of small market capitalization companies with whom the company competes for investment capital. Measuring TSR on a relative, rather than on an absolute, basis provides a more relevant measure of the performance of the Company’s stock. By mitigating the impact of macroeconomic factors (both positive and negative) that are beyond the control of the Company and its executives, we believe relative TSR provides rewards that are better aligned with relative performance through varying economic cycles.

Holders of RSUs do not have any rights of a stockholder until the RSUs vest and are converted to Common Stock.

The Compensation Committee’s decisions regarding the amount and type of long-term equity incentive compensation and relative weighting of these awards among total executive compensation have also been based on its understanding of market practices of our comparable companies and take into account additional factors such as level of individual responsibility, experience and performance. The vesting of our long-term equity incentive compensation is typically subject to continued employment with our Company, and in some instances, to acceleration in connection with certain termination events and a change-in-control.

The Compensation Committee approved 2022 long term equity incentive awards for our named executive officers as follows:

Executive	Award Value (\$)	Target Number of Performance-based RSUs	Number of Time-based RSUs
James Green	\$1,721,120	145,365	157,037
Michael Rossi	\$340,000	28,716	31,021

In view of Mr. Olson’s resignation as the Company’s Chief Operating Officer effective January 31, 2022, Mr. Olson did not receive a long term equity incentive award for fiscal 2022.

Performance-based RSUs will vest based on the relative TSR of our Common Stock during the period beginning on March 1, 2022 and ending on December 31, 2024. Performance is measured with respect to the companies in the Russell 2000 stock index, as follows:

Relative TSR Percentile Rank	Performance Factor
Below 25th percentile	0%
25th to 50th percentile	50%, plus an additional 1.923% for each whole percentile above 25th percentile
51st to 74th percentile	100%, plus an additional 2.083% for each whole percentile above 51 st percentile
75th percentile or higher	150%

The time-based RSUs vest in three equal installments on each of December 29, 2022, 2023 and 2024.

Vesting of both the performance-based RSUs and time-based RSUs is subject to the executive’s continued employment with the Company on the applicable vesting date.

Broad-Based Benefits Programs

All full-time employees in the United States, including our named executive officers, may participate in our Employee Stock Purchase Plan and in our health and welfare benefit programs, including medical coverage, dental coverage, disability insurance, life insurance and our 401(k) plan. The 401(k) plan provides for matching contributions equal to 100% of each dollar contributed up to 1% of eligible compensation plus 50% of each additional 1% of eligible compensation up to 6% for a maximum matching contribution of 3.5%. We offer similar plans in certain foreign countries.

Executive Stock Ownership Guidelines

At the recommendation of our Compensation Committee, our Board of Directors has implemented executive stock ownership guidelines with respect to our named executive officers. The ownership guidelines require that, within five years from their initial appointment or designation as named executive officers, our named executive officers own our Common Stock with a market value equal to at least three times their respective annual base salary. With respect to satisfying such guidelines, stock options are excluded in the calculation while shares owned outright or beneficially owned (as defined under Rule 13d-3 of the Exchange Act), restricted shares, including shares granted but not vested, shares issuable upon the settlement of RSUs and shares acquired pursuant to our Employee Stock Purchase Plan are all included. The Compensation Committee monitors compliance with the stock ownership guidelines.

Clawbacks

Awards under the Company’s 2021 Incentive Plan and any shares issued pursuant to such awards will be subject to recovery or “clawback” by the Company if and to the extent that the vesting of such awards was determined or calculated based on materially inaccurate financial statements or any other material inaccurate performance metric criteria; or if the Company or its subsidiaries terminate a grantee’s service relationship due to the grantee’s gross negligence or willful misconduct, or determine there are grounds for such a termination (whether or not such actions also constitute “cause” under an award agreement), any awards under the 2021 Incentive Plan, whether or not vested, as well as any shares of stock issued pursuant to awards under the 2021 Incentive Plan shall be subject to forfeiture, recovery and “clawback.” In addition, the 2021 Incentive Plan provides that if the Company is required to prepare an accounting restatement due to material noncompliance with the financial reporting requirements of the securities laws, in certain cases the Compensation Committee may require the repayment of amounts paid under the 2021 Incentive Plan in excess of what the employee would have received under the accounting restatement.

Further, if the Company is required to prepare an accounting restatement due to the material noncompliance with any financial reporting requirement under the securities laws as a result of misconduct, the Company’s Chief Executive Officer and Chief Financial Officer are required to reimburse the Company for any bonus or other incentive-based or equity-based compensation received by such officer from the Company during the twelve-month period following the first public issuance or filing with the SEC (whichever first occurs) of the financial document embodying such financial reporting requirement, and any profits realized from the sale of securities of Company during such twelve-month period.

Anti-Short Selling, Anti-Margin and Hedging Policies

The Company's Insider Trading Guidelines explicitly prohibit directors, officers, employees, contractors and part-time and temporary workers in possession of material non-public information from (i) buying, selling, or otherwise transacting in Company's securities, including common stock, options and any other securities that the Company may issue, such as preferred stock, notes, bonds and convertible securities, as well as derivative securities; and (ii) disclosing information to another individual for the purpose of enabling such individual to trade in the Company's securities on the basis of such information. The Insider Trading Guidelines also explicitly prohibit directors, officers, employees, contractors and part-time and temporary workers, whether or not in possession of material non-public information, from (i) engaging in transactions designed to hedge or offset economic risks of owning the Company's securities, including short sales of the Company's securities and selling security futures related to the Company's securities; (ii) trading in options or derivatives related to the Company's securities; and (iii) and purchasing the Company's securities on margin (i.e. borrowing money to fund the stock purchase) other than the cashless exercises of employee stock options.

2022 SUMMARY COMPENSATION TABLE

The table below summarizes the total compensation paid or earned during the years ending December 31, 2022 and 2021 by our (i) President and Chief Executive Officer; (ii) former Chief Financial Officer, who was the only other person serving in an executive officer capacity as of December 31, 2022; and (iii) former Chief Operating Officer, who would have been the next most highly compensated executive officer but for the fact that he was not an executive officer as of December 31, 2022. No other persons served as an executive officer of the Company during the year ended December 31, 2022.

<u>Name and Principal Position</u>	<u>Year</u>	<u>Salary</u> <u>(\$)</u>	<u>Stock</u> <u>Awards</u> <u>(\$)(1)</u>	<u>Non-Equity</u>		<u>Total</u> <u>(\$)</u>
				<u>Incentive Plan</u> <u>Compensation</u> <u>(\$)(2)</u>	<u>All Other</u> <u>Compensation</u> <u>(\$)</u>	
James W. Green..... Chairman, President & Chief Executive Officer	2022	573,710	1,721,120	-	33,640 ⁽³⁾	2,328,470
	2021	573,710	1,721,140	390,123	30,712	2,715,685
Michael A. Rossi..... Chief Financial Officer	2022	340,000	340,000	-	2,746 ⁽⁴⁾	682,746
	2021	340,000	340,000	115,600	1,381	796,981
Kenneth Olson (5)..... Chief Operating Officer	2022	290,000	-	-	17,940 ⁽⁶⁾	307,940
	2021	290,000	290,000	98,600	17,608	696,208

- (1) Based on the aggregate grant date fair value computed in accordance with the provisions of FASB ASC 718, "Compensation—Stock Compensation." Under FASB ASC 718, the vesting condition related to the performance-based RSUs is considered a market condition and not a financial performance condition. Accordingly, there is no grant date fair value below or in excess of the amount reflected in the table above for the named executive officers that could be calculated and disclosed based on achievement of the underlying market condition. Assumptions used in the calculation of this amount are set forth in Note 10 to the Company's audited financial statements for the fiscal year ended December 31, 2022, included in the Company's Annual Report on Form 10-K filed with the SEC on March 9, 2023.
- (2) Amounts shown represent amounts earned under the 2022 and 2021 annual cash incentive plans and paid in 2023 and 2022, respectively. No amounts were earned under the 2022 annual cash incentive plan.
- (3) Amount shown for 2022 includes \$12,000 for personal usage of Company leased automobile, \$11,490 in president's club travel, and \$10,150 in matching contributions made by the Company to Mr. Green's tax-qualified 401(k) Savings Plan account. Amount shown for 2021 includes Amounts shown for 2021 include \$12,000 for personal usage of Company leased automobile, \$8,562 in president's club travel, and \$10,150 in matching contributions made by the Company to Mr. Green's tax-qualified 401(k) Savings Plan account.
- (4) Amounts shown include matching contributions made by the Company to Mr. Rossi's tax-qualified 401(k) Savings Plan account in 2022 and 2021, respectively.
- (5) Mr. Olson resigned from his position as Chief Operating Officer effective January 31, 2022.
- (6) Amount shown for 2022 includes \$8,400 for personal usage of Company leased automobile, and \$9,540 in matching contributions made by the Company to Mr. Olson's tax-qualified 401(k) Savings Plan account. Amount shown for 2021 includes \$8,400 for personal usage of Company leased automobile and \$9,208 in matching contributions made by the Company to Mr. Olson's tax-qualified 401(k) Savings Plan account.

Employment Agreements

Chief Executive Officer

We have entered into an employment agreement with Mr. Green, dated July 2, 2019, which provides for a term of two years from his commencement date of July 8, 2019, which term shall automatically be extended for two additional years on each anniversary of the commencement date unless, not less than 90 days prior to each such date, either party shall have given written notice to the other that it does not wish to extend the agreement. In addition, the agreement provides for an annual base salary, which is subject to review annually by our Board of Directors or Compensation Committee. Furthermore, commencing with fiscal year 2020, Mr. Green is eligible to receive cash incentive compensation on an annual basis of up to one hundred fifty percent (150%) of his base salary upon meeting objectives as determined by the Board of Directors or the Compensation Committee from time to time. Mr. Green is also eligible to participate in other incentive compensation plans as the Board of Directors or Committee shall provide for the Company's senior executive officers.

Chief Financial Officer

We entered into an employment agreement with Mr. Rossi, dated July 18, 2019, which provided for a term of one year from such date, which term was subject to automatic extension for additional one-year periods on each anniversary of thereof unless, not less than 90 days prior to each such anniversary, either party shall have given written notice to the other that it does not wish to extend the agreement. In addition, the agreement provided for an annual base salary, which was subject to review annually by our Board of Directors or Compensation Committee. Furthermore, commencing with fiscal year 2020, Mr. Rossi was eligible to receive cash incentive compensation on an annual basis of up to fifty percent (50%) of his base salary upon meeting objectives as determined by the Board of Directors or the Compensation Committee from time to time. Mr. Rossi was also eligible to participate in other incentive compensation plans as the Board of Directors or Compensation Committee shall provide for the Company's senior executive officers.

Mr. Rossi resigned from his position as our Chief Financial Officer and Treasurer effective December 31, 2022. For information on Mr. Rossi's separation from the Company, please see the heading "Termination Arrangements with Named Executive Officers" below.

OUTSTANDING EQUITY AWARDS AT FISCAL YEAR-END—2022

The following table sets forth information concerning the number and value of exercisable and unexercisable options to purchase Common Stock, and the number of time-based and performance-based RSUs held by the applicable named executive officers noted below as of December 31, 2022.

	Option Awards				Stock Awards			
	Number of Securities Underlying Unexercised Options (#) Exercisable	Number of Securities Underlying Unexercised Options (#) Unexercisable	Option Exercise Price (\$)	Option Expiration Date	Number of Shares or Units of Stock That Have Not Vested (#)	Market Value of Shares or Units of Stock That Have Not Vested (\$)(1)	Equity Incentive Plan Awards: Number of Shares, Units or Rights That Have Not Vested (#)	Equity Incentive Plan Awards: Market or Payout Value of Unearned Shares, Units or Rights That Have Not Vested (\$)(1)
James W. Green.....	60,000	-	\$ 5.27	5/5/2025	104,590 ⁽²⁾	289,714	186,674 ⁽³⁾	517,087
	235,127	117,563 ⁽⁴⁾	2.63	6/11/2030	54,535 ⁽⁵⁾	151,062	145,365 ⁽⁶⁾	402,661
					64,899 ⁽⁷⁾	179,770		
					109,071 ⁽⁸⁾	302,127		
					104,691 ⁽⁹⁾	289,994		
Michael A. Rossi	83,881	27,961 ⁽¹⁰⁾	\$ 1.78	7/18/2029	10,773 ⁽⁵⁾	29,841	36,876 ⁽³⁾	102,147
	69,672	23,224 ⁽⁴⁾	2.63	6/11/2030	12,821 ⁽⁷⁾	35,514	28,716 ⁽⁶⁾	79,543
					21,546 ⁽¹¹⁾	59,682		
					20,681 ⁽⁹⁾	57,286		
Kenneth Olson ⁽¹³⁾ ...	27,777	9,260 ⁽¹²⁾	\$ 2.95	11/1/2029				
	59,426	19,809 ⁽⁴⁾	2.63	6/11/2030				

(1) Based on a closing stock price of \$2.77 per share on December 31, 2022.

(2) These RSUs were granted on July 8, 2019 and, assuming continued employment with the Company, the unvested shares vest on January 1, 2023.

(3) These performance-based RSUs were granted on March 1, 2021 subject to relative TSR vesting conditions. The RSUs vest in full on December 31, 2023, and are linked to the achievement of a relative total shareholder return of the Company's Common Stock from March 1, 2021 to the earlier of December 31, 2023 or the date of a change of control (measured relative to the Russell 2000 Index and based on the 20-day trading average beginning on the first day of the measurement period and ending on the last day of the measurement period). The target number of these RSUs that may be earned is noted above; the maximum amount is 150% of the amount reported.

(4) The option was granted on June 11, 2020 and, assuming continued employment with the Company, the unvested options would become exercisable on December 31, 2023. Pursuant to the terms of the Separation Agreement and Release entered into with Mr. Olson, all unvested stock options outstanding as of December 31, 2022 were cancelled on that date.

(5) These RSUs were granted on June 11, 2020 and, assuming continued employment with the Company, the unvested shares vest on December 29, 2023.

- (6) These performance-based RSUs were granted on March 1, 2022 subject to relative TSR vesting conditions. The RSUs vest in full on December 31, 2024, and are linked to the achievement of a relative total shareholder return of the Company's Common Stock from March 1, 2022 to the earlier of December 31, 2024 or the date of a change of control (measured relative to the Russell 2000 Index and based on the 20-day trading average beginning on the first day of the measurement period and ending on the last day of the measurement period). The target number of these RSUs that may be earned is noted above; the maximum amount is 150% of the amount reported.
- (7) These RSUs were granted on March 1, 2021 and, assuming continued employment with the Company, the unvested shares vest on December 29, 2023.
- (8) These performance-based RSUs were granted on June 11, 2020. The RSUs vest in three equal installments on June 11, 2021, June 11, 2022 and June 11, 2023, and are linked to the achievement of a relative total shareholder return of the Company's Common Stock from June 11, 2020 to the earlier of June 11, 2021 or upon a change of control (measured relative to the Nasdaq Biotechnology index and based on the 20-day trading average price before each such date, or for a change of control, the per share purchase price in such change of control). The maximum number of these RSUs was earned on June 11, 2021 and an additional 109,070 shares was added to the award.
- (9) These RSUs were granted on March 1, 2022 and, assuming continued employment with the Company, the unvested shares vest in equal installments on each of December 29, 2023 and December 29, 2024.
- (10) The option was granted on July 18, 2019 and, assuming continued employment with the Company, the unvested options become exercisable on July 18, 2023.
- (11) These performance-based RSUs were granted on June 11, 2020. The RSUs vest in three equal installments on June 11, 2021, June 11, 2022 and June 11, 2023, and are linked to the achievement of a relative total shareholder return of the Company's Common Stock from June 11, 2020 to the earlier of June 11, 2021 or upon a change of control (measured relative to the Nasdaq Biotechnology index and based on the 20-day trading average price before each such date, or for a change of control, the per share purchase price in such change of control). The maximum number of these RSUs was earned on June 11, 2021 and an additional 21,546 shares was added to the award.
- (12) The option was granted on November 1, 2019 and, assuming continued employment with the Company, the unvested options would have become exercisable on November 1, 2023. Pursuant to the terms of the Separation Agreement and Release entered into with Mr. Olson, all unvested stock options outstanding as of December 31, 2022 were cancelled on that date.
- (13) Pursuant to the terms of the Separation Agreement and Release entered into with Mr. Olson, all unvested RSUs outstanding as of December 31, 2022 were cancelled on that date.

Potential Payments upon Termination or Change-in-Control

Termination Arrangements with Messrs. Rossi and Green

The employment agreements with Mr. Green and Mr. Rossi also require the Company to provide certain payments and benefits in the event of a termination of the executive's employment by us without cause, by the executive for good reason, upon death or disability or in relation to a change-in-control. The events constituting cause, good reason and a change-in-control are specified in the respective agreement. Such benefits include, without limitation, accrued and unpaid base salary to the date of termination, accrued and unused vacation, and if to the extent required by law, any bonuses or other compensation actually earned for periods ended prior to the termination event. These employment agreements also provide change-in-control benefits, and have customary best net/modified economic cutback provisions in relation to Section 280G of the Internal Revenue Code. In some instances, the executive's receipt of such payments and other benefits in connection with such a termination is subject to the executive signing a general release of claims, as provided in the respective employment agreement.

With respect to termination due to death or disability, all equity awards of the named executive officers shall accelerate and fully vest and we shall also pay a cash lump sum equal to the value of COBRA premiums for a period of twelve (12) months following the termination that may be used by the executive or his spouse and dependents, as applicable, to pay for health insurance coverage that is substantially similar to the coverage executive and his eligible dependents received prior to the termination.

In the case of a termination by the executive for good reason, or by us without cause, and subject to the terms of the agreement, (i) we shall pay the executive an amount equal to eighteen (18) months for Mr. Green, and twelve (12) months for Mr. Rossi of his respective base salary rate in equal installments over the period of one year from the date of termination in accordance with our payroll procedures and (ii) any stock options or other stock based grants which would otherwise vest within 12 months of the date of termination shall become fully vested or non-forfeitable (provided that with respect to Mr. Green, as to the time-based RSUs granted in connection with his hiring, such period shall be 24 months, and with respect to the performance-based RSUs granted in connection with his hiring, the performance period would be measured as to the period from grant through the termination event). Further, following any such termination, we shall reasonably determine what annual bonus the executive would have received had he remained employed throughout the fiscal year in which the termination occurs, and if any such annual bonus would have been earned, we shall pay the executive a pro rata portion of such determined annual bonus by a lump-sum cash payment. In addition, following the termination we shall also pay a cash lump sum equal to the value of COBRA premiums for a period of eighteen (18) months for Mr. Green, and twelve (12) months for Mr. Rossi, following the termination that may be used by the respective executive to pay for health insurance coverage that is substantially similar to the coverage executive and his eligible dependents received prior to the termination.

In the event that the executive is terminated within three months prior to, or twelve months after, a change in control (as described in his employment agreement), we shall pay the executive a single lump sum in cash equal to twenty-four (24) months as to Mr. Green, and eighteen (18) months as to Mr. Rossi, of his respective base salary, and all stock options and other stock-based awards granted to the executive shall immediately accelerate and become exercisable or non-forfeitable as of the date of the change in control (and as to Mr. Green, with respect to the performance-based RSUs granted in connection with his hiring, the performance period would be measured as to the period from grant through the change of control event). In addition, following such termination we shall also pay a cash lump sum equal to the value of COBRA premiums for a period of twenty four (24) months for Mr. Green, and eighteen (18) months for Mr. Rossi, following the termination that may be used by the respective executive to pay for health insurance coverage that is substantially similar to the coverage executive and his eligible dependents received prior to the termination.

Separation Agreement with Mr. Rossi

In connection with Mr. Rossi's resignation as the Company's Chief Financial Officer and Treasurer effective December 31, 2022, the Company and Mr. Rossi entered into a Separation Agreement and Release dated January 18, 2023 (the "Rossi Separation Agreement"). Under the terms of the Rossi Separation Agreement, Mr. Rossi will be required to provide transition assistance and will remain an employee of the Company through May 10, 2023 (the "Rossi Separation Date"). Pursuant to the Rossi Separation Agreement, the Company will continue to pay Mr. Rossi's base salary for the period between January 1, 2023 and the Rossi Separation Date. Mr. Rossi is also eligible to participate in all applicable employee benefit plans through the Rossi Separation Date.

Separation Agreement with Mr. Olson

In connection with Mr. Olson's resignation as the Company's Chief Operating Officer effective January 31, 2022, the Company and Mr. Olson entered into a Separation Agreement and Release dated January 26, 2022 (the "Olson Separation Agreement"). Under the terms of the Olson Separation Agreement, Mr. Olson was required to provide transition assistance and remained an employee of the Company through December 31, 2022 (the "Olson Separation Date"). Pursuant to the Olson Separation Agreement, the Company continued to pay Mr. Olson's base salary for the period between February 1, 2022 and the Olson Separation Date. Mr. Olson was also eligible to participate in all applicable employee benefit plans through the Olson Separation Date.

PAY VERSUS PERFORMANCE

As required by Section 953(a) of the Dodd-Frank Wall Street Reform and Consumer Protection Act and Item 402(v) of Regulation S-K, we are providing the following information about the relationship between executive compensation actually paid (as defined by SEC rules) and certain financial performance of the Company. The Compensation Committee did not consider the pay versus performance disclosure when making its compensation decisions for the 2022 fiscal year. For further information about how we align executive compensation with the company's performance, please refer to the Compensation Discussion and Analysis, above. The amounts in the table below are calculated in accordance with SEC rules and do not represent amounts actually earned or realized by our NEOs, including with respect to RSUs and PSUs.

The following table sets forth the compensation for our principal executive officer and the average compensation for certain of our other named executive officers, each as reported in the Summary Compensation Table and with certain adjustments to reflect Compensation Actually Paid (“CAP”) as defined under the SEC rules. The table also provides information with respect to cumulative TSR and Net Income.

Pay Versus Performance						
(a)	(b)	(c)	(d)	(e)	(f)	(h)
Year	Summary compensation table total for PEO	Compensation actually paid to PEO	Average summary compensation table total for non-PEO named executives	Average compensation actually paid to non-PEO named executive officers	Value of initial fixed \$100 investment based on total shareholder return	Net Loss (in thousands)
2022	\$ 2,351,725	\$ (3,681,672)	\$ 511,197	\$ (1,014,026)	\$ 64.57	\$ (9,516)
2021	\$ 2,737,454	\$ 9,166,465	\$ 761,531	\$ 1,653,283	\$ 164.34	\$ (288)

(1) The dollar amounts reported in column (b) are the amounts of total compensation reported for Mr. Green (our Principal Executive Officer) for each corresponding year in the “Total” column of the Summary Compensation Table. Refer to “Executive Compensation – Summary Compensation Table.”

(2) The dollar amounts reported in column (c) represent the amount of “compensation actually paid” to Mr. Green, as computed in accordance with Item 402(v) of Regulation S-K. The dollar amounts do not reflect the actual amount of compensation earned by or paid to Mr. Green during the applicable year. In accordance with the requirements of Item 402(v) of Regulation S-K, the following adjustments were made to Mr. Green’s total compensation for each year to determine the compensation actually paid:

PEO Stock Award Adjustments					
Year	Subtract	Subtract	Add	Add	Add
Year	Amounts reported in “Stock Awards” column in SCT	Awards forfeited during year using prior year-end values	Year-end fair value of awards granted during covered fiscal year that were outstanding and unvested at year-end	Year-over-year change in fair value of awards granted in prior fiscal years that were outstanding and unvested at year-end	Change as of vesting date (from end of prior fiscal year) in fair value of awards granted in prior fiscal years for which all applicable vesting conditions were satisfied during covered fiscal year
2022	(1,721,120)	—	727,176	(3,176,423)	(1,863,029)
2021	(1,721,140)	—	2,429,009	2,930,672	2,790,470

(3) The dollar amounts reported in column (d) represent the average of the amounts reported for our named executive officers as a group (excluding Mr. Green) in the “Total” column of the Summary Compensation Table in each applicable year. The named executive officers included for purposes of calculating the average amounts in each applicable year were Messrs. Rossi and Olson (the “Other NEOs”).

(4) The dollar amounts reported in column (e) represent the average amount of “compensation actually paid” to the Other NEOs, as computed in accordance with Item 402(v) of Regulation S-K. The dollar amounts do not reflect the actual average

amount of compensation earned by or paid to the Other NEOs as a group (excluding Mr. Green) during the applicable year. In accordance with the requirements of Item 402(v) of Regulation S-K, the following adjustments were made to average total compensation for the Other NEOs for each year to determine the compensation actually paid, using the same methodology described above in Note 2.

Non-PEO Named Executive Officers Stock Award Adjustments					
	Subtract	Subtract	Add	Add	Add
			Year-end fair value of awards granted during covered fiscal year that were outstanding and unvested at year-end	Year-over-year change in fair value at year-end of awards granted in prior fiscal years that were outstanding and unvested at year-end	Change as of vesting date (from end of prior fiscal year) in fair value of awards granted in prior fiscal years for which all applicable vesting conditions were satisfied during covered fiscal year
Year	Amounts reported in “Stock Awards” column in SCT	Awards forfeited during year using prior year-end values			
2022	(169,997)	(334,572)	71,824	(744,216)	(348,262)
2021	(315,000)	—	444,550	459,942	302,260

(5) Total Shareholder Return assumes \$100 was invested in our Common Shares on December 31, 2020.

Analysis of the Information Presented in the Pay Versus Performance Table

As described in more detail under Compensation Discussion and Analysis, above, a significant portion of our executive compensation is linked directly to our Company’s financial and stock price performance. This linkage is reflected in the amounts shown in the Pay Versus Performance table above. As shown, the compensation actually paid to our Principal Executive Officer in 2021 and 2022 decreased from approximately \$9.2 million in 2021 to negative \$3.7 million in 2022, consistent with the year-over-year changes in net income and total shareholder return as shown in the table. The compensation actually paid to our Other NEOs follows a similar trend.

SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT

The following table sets forth information regarding the beneficial ownership of our outstanding Common Stock as of March 21, 2023 by: (i) all persons known by us to own beneficially more than 5% of our Common Stock; (ii) each of our Directors and nominees for Director; (iii) each of the named executive officers; and (iv) all of our Directors and executive officers as a group.

The number of shares beneficially owned by each stockholder is determined under rules issued by the SEC and includes voting or investment power with respect to securities. Under these rules, beneficial ownership includes any shares as to which the individual or entity has sole or shared voting power or investment power and includes any shares as to which the individual or entity has the right to acquire beneficial ownership within 60 days after March 21, 2023 through the exercise of any warrant, stock option or other right. The inclusion in this proxy statement of such shares, however, does not constitute an admission that the named stockholder is a direct or indirect beneficial owner of such shares. Common stock subject to options currently exercisable, or exercisable within 60 days after March 21, 2023, are deemed outstanding for the purpose of computing the percentage ownership of the person holding those options, but are not deemed outstanding for computing the percentage ownership of any other person.

Unless otherwise indicated below, to our knowledge, all persons named in the table have sole voting and investment power with respect to their shares of Common Stock, except to the extent spouses share authority under community property laws.

<u>Name and Address of Beneficial Owner⁽¹⁾</u>	<u>Common Stock Beneficially Owned</u>	
	<u>Shares</u>	<u>Percent (2)</u>
<i>Greater than 5% Holders</i>		
B. Riley Asset Management, LLC. 3811 Turtle Creek Blvd, Suite 2125 Dallas, TX 75219	3,264,796	7.74% ⁽³⁾
Harvey Partners, LLC..... 120 White Plains Road, Suite 430 Tarrytown, NY 10591	2,911,500	6.90% ⁽⁴⁾
Punch & Associates Investment Management, Inc. 7701 France Ave. So., Suite 300 Edina, MN 55435	2,764,039	6.6% ⁽⁵⁾
<i>Non-Employee Directors⁽¹⁾</i>		
Bertrand Loy	523,417	1.2% ⁽⁶⁾
Thomas Loewald.....	311,485	* ⁽⁷⁾
Katherine Eade.....	327,300	* ⁽⁷⁾
Alan Edrick	304,285	* ⁽⁸⁾
<i>Named Executive Officers⁽¹⁾</i>		
James Green	1,823,194	4.3% ⁽⁹⁾
Michael A. Rossi	282,680	* ⁽¹⁰⁾
Kenneth Olson.....	82,471	*
All Directors and Current Executive Officers, as a group (6 persons)	3,297,603	7.7% ⁽¹¹⁾

* Represents beneficial ownership of less than one percent (1%) of our outstanding Common Stock.

(1) The address for all non-employee directors and named executive officers is c/o Harvard Bioscience, Inc., 84 October Hill Road, Holliston, Massachusetts 01746.

(2) Based on 42,190,043 shares outstanding on March 21, 2023 together with the applicable options and restricted stock units for each stockholder.

- (3) This information is based solely upon a Schedule 13G/A filed by B. Riley Asset Management, LLC with the SEC on February 16, 2023, reporting shared voting power over 3,264,796 shares and shared dispositive power over 3,296,796 shares.
- (4) This information is based solely upon a Schedule 13G filed by Harvey Partners, LLC with the SEC on February 14, 2023, reporting sole voting power over 2,720,733 shares and sole dispositive power over 2,911,500 shares.
- (5) This information is based solely upon a Schedule 13G filed by Punch & Associates Investment Management, Inc. with the SEC on February 9, 2023, reporting sole voting power over 2,764,039 shares and sole dispositive power over 2,764,039 shares.
- (6) Includes options to acquire 55,300 shares that are exercisable within 60 days after March 21, 2023, as well as 47,493 restricted stock units that will fully vest within 60 days after March 21, 2023.
- (7) Includes options to acquire 87,600 shares that are exercisable within 60 days after March 21, 2023, as well as 38,259 restricted stock units that will fully vest within 60 days after March 21, 2023.
- (8) Includes options to acquire 101,800 shares that are exercisable within 60 days after March 21, 2023, as well as 38,259 restricted stock units that will fully vest within 60 days after March 21, 2023.
- (9) Includes options to acquire 295,127 shares that are exercisable within 60 days after March 21, 2023.
- (10) Includes options to acquire 153,553 shares that are exercisable within 60 days after March 21, 2023.
- (11) Group includes our non-employee directors, Mr. Green and Ms. Cote. Includes options to acquire 627,427 shares that are exercisable within 60 days after March 21, 2023 as well as 162,270 restricted stock units that will fully vest within 60 days after March 21, 2023.

EQUITY COMPENSATION PLAN INFORMATION

The following table sets forth information as of December 31, 2022 concerning the number of shares of Common Stock issuable under our existing equity compensation plans.

<u>Plan Category</u>	<u>Number of Securities to be Issued Upon Exercise of Outstanding Options, Restricted Stock Units, Warrants and Rights</u> (a)	<u>Weighted Average Exercise Price of Outstanding Options, Warrants, And Rights</u> (b)	<u>Number of Securities Remaining Available For Future Issuance Under Equity Compensation Plans (Excluding Securities Reflected In Column (a))</u> (c)
Equity compensation plans approved by security holders ⁽¹⁾	2,978,812	\$3.15	4,326,030 ⁽²⁾
Equity compensation plans not approved by security holders.....	-	\$0.00	-
Total	<u>2,978,812</u>		<u>4,326,030</u>

- (1) Consists of the Harvard Bioscience, Inc. Fourth Amended and Restated 2000 Stock Option and Incentive Plan, the Harvard Bioscience, Inc. 2021 Incentive Plan (the “2021 Plan”) and the Harvard Bioscience, Inc. Employee Stock Purchase Plan (as amended, the “ESPP”). The number of securities in column (a) for plans approved by security holders consists of 1,238,776 outstanding stock options and 1,740,036 RSUs.
- (2) Represents 3,904,861 shares available for future issuance under the 2021 Plan and 421,169 shares available for future issuance under the ESPP.

TRANSACTIONS WITH RELATED PERSONS

The Audit Committee charter sets forth the standards, policies and procedures that we follow for the review, approval or ratification of any related person transaction that we are required to report pursuant to Item 404(a) of Regulation S-K promulgated by the SEC. Pursuant to the Audit Committee charter, the Audit Committee reviews these related person transactions on an ongoing basis and the approval of the Audit Committee is required for all such transactions. The Audit Committee relies on management to identify related person transactions and bring them to the attention of the Audit Committee.

Aside from the indemnification agreements we have entered into with each of our Directors, each of which provides that we will indemnify our Directors for expenses incurred because of their status as a Director to the fullest extent permitted by Delaware law, our certificate of incorporation and our by-laws, during the 2021 and 2022 fiscal years, we were not a participant in any related person transactions that required disclosure under this heading.

DELINQUENT SECTION 16(A) REPORTS

Our executive officers, Directors and beneficial owners of more than 10% of our Common Stock are required under Section 16(a) of the Exchange Act to file reports of ownership and changes in ownership with the SEC. Copies of those reports must also be furnished to us.

Based solely on a review of the copies of the reports furnished to us, and written representations from certain reporting persons that no other reports were required, we believe that during the year ended December 31, 2022, the reporting persons complied on a timely basis with all Section 16(a) filing requirements applicable to them.

STOCKHOLDER COMMUNICATIONS WITH THE BOARD OF DIRECTORS

Stockholders and other interested parties wishing to communicate with the Board of Directors may do so by sending a written communication to any Director at the following address: Harvard Bioscience, Inc., 84 October Hill Road, Holliston, Massachusetts 01746. The mailing envelope should contain a notation indicating that the enclosed letter is a “Board Communication.” All such letters should clearly state whether the intended recipients are all members of the Board of

Directors or certain specified individual Directors. Our Secretary or his or her designee will make a copy of any such communication so received and promptly forward it to the Director or Directors to whom it is addressed.

INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

The following table presents fees for professional services provided by Grant Thornton LLP for the audits of the Company’s annual consolidated financial statements for the last two fiscal years, in each of the following categories is as set forth in the table below.

	2022	2021
Audit Fees (1).....	\$ 1,151,966	\$ 1,027,304
Audit-Related Fees.....	—	—
Tax Fees (2).....	7,426	7,218
Other.....	—	—
Total Fees.....	\$ 1,159,392	\$ 1,034,522

- (1) Audit Fees included fees billed or expected to be billed for professional services associated with the annual audit of our consolidated financial statements and internal controls over financial reporting and the reviews of our quarterly reports on Form 10-Q, and fees related to a registration statement on Form S-8 filed in 2022.
- (2) Tax Fees included domestic and international tax compliance, tax advice and tax planning.

All of the services performed in the year ended December 31, 2022 were pre-approved by the Audit Committee. It is the Audit Committee’s policy to pre-approve all audit and permitted non-audit services to be provided to us by the independent registered public accounting firm. The Audit Committee’s authority to pre-approve non-audit services may be delegated to one or more members of the Audit Committee, who shall present all decisions to pre-approve an activity to the full Audit Committee at its first meeting following such decision. The Audit Committee has delegated this pre-approval authority for non-audit services to the Audit Committee Chair. In addition, the Audit Committee has considered whether the provision of the non-audit services above is compatible with maintaining the independent registered public accounting firm’s independence.

PROPOSAL 2 RATIFICATION OF APPOINTMENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

The Audit Committee of the Board of Directors has appointed Grant Thornton LLP as our independent registered public accounting firm for the fiscal year ending December 31, 2023. Grant Thornton LLP has served as our independent registered public accounting firm since 2017. The Audit Committee is responsible for the appointment, retention, termination, compensation and oversight of the work of our independent registered public accounting firm. To execute this responsibility, the Audit Committee annually evaluates the independent auditor’s qualifications, performance and independence and whether the independent registered public accounting firm should be rotated, and considers the advisability and potential impact of selecting a different independent registered public accounting firm.

The Board is submitting the appointment of Grant Thornton LLP to our stockholders for ratification because we value the views of our stockholders. In the event that our stockholders fail to ratify the appointment of Grant Thornton LLP, the Audit Committee will reconsider the appointment of Grant Thornton LLP. Even if the appointment is ratified, the ratification is not binding and the Audit Committee may in its discretion select a different independent registered public accounting firm at any time during the year if it determines that such a change would be in the best interests of the Company and our stockholders.

A representative of Grant Thornton LLP is expected to be present virtually at the Annual Meeting. He or she will have an opportunity to make a statement, if he or she desires to do so, and will be available to respond to appropriate questions.

Vote Required

The affirmative vote of a majority of the votes cast by holders of shares of Common Stock present or represented by proxy and entitled to vote on the matter at the Annual Meeting is required for the ratification of the appointment of Grant Thornton LLP as our independent registered public accounting firm for the fiscal year ending December 31, 2023.

OUR BOARD OF DIRECTORS UNANIMOUSLY RECOMMENDS A VOTE “FOR” THE RATIFICATION OF THE APPOINTMENT OF GRANT THORNTON LLP AS OUR INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM FOR THE FISCAL YEAR ENDING DECEMBER 31, 2023.

PROPOSAL 3 ADVISORY VOTE ON THE COMPENSATION OF OUR NAMED EXECUTIVE OFFICERS

Background

We are seeking an advisory vote from our stockholders, as required under Section 951 of the Dodd-Frank Act, to approve our named executive officer compensation, as set forth below. The Compensation Committee and Board of Directors welcome our stockholders’ views on this subject, and will carefully consider the outcome of this vote consistent with the best interests of all stockholders. As an advisory vote, however, the outcome is not binding on us or the Compensation Committee or the Board of Directors.

As described in detail under the heading “Compensation Discussion and Analysis,” our executive compensation program is designed to attract and retain high performing and experienced executives; motivate and reward executives whose knowledge, skills and performance are critical to our success; align the interests of our executives and stockholders by motivating executives to increase stockholder value and rewarding executives when stockholder value increases; foster a shared commitment among executives by coordinating their goals; and motivate our executives to manage our business to meet our short and long-term objectives, and reward them for meeting these objectives. The elements of executive compensation include base salary, annual cash incentive bonuses, employment agreements, long-term equity incentive compensation and broad-based benefits programs. Please read the “Compensation Discussion and Analysis” for additional details about our executive compensation programs, including information about the fiscal year 2022 compensation of our named executive officers. Specifically, we are seeking a vote on the following resolution:

RESOLVED, that the stockholders approve, on a non-binding advisory basis, the compensation of our named executive officers as disclosed in this proxy statement pursuant to the compensation disclosure rules of the Securities and Exchange Commission, including the Compensation Discussion and Analysis, the compensation tables and related narrative discussion.

Vote Required

The affirmative vote of a majority of the votes cast by holders of shares of Common Stock present or represented by proxy and entitled to vote on the matter at the Annual Meeting is required for the approval of the resolution to approve the compensation of our named executive officers.

OUR BOARD OF DIRECTORS UNANIMOUSLY RECOMMENDS A VOTE “FOR” THE RESOLUTION TO APPROVE THE COMPENSATION OF OUR NAMED EXECUTIVE OFFICERS.

PROPOSAL 4
ADVISORY VOTE ON FREQUENCY OF FUTURE ADVISORY VOTES ON THE COMPENSATION OF OUR NAMED EXECUTIVE OFFICERS

Background

We are seeking your input with regard to the frequency of holding future stockholder advisory votes on the compensation of our named executive officers. In particular, we are asking whether the advisory vote on the compensation of our named executive officers (Proposal No. 3) should occur every year, every two years or every three years. Because your vote is advisory, it will not be binding on our Compensation Committee or our Board of Directors. However, the Compensation Committee and our Board of Directors will review the voting results and take them into consideration when making future decisions regarding how frequently it should present the advisory vote on the compensation of our named executive officers to our stockholders.

The Compensation Committee, Board of Directors and management believe that it is appropriate and in our best interests of our stockholders to vote in favor of an annual advisory vote on the compensation of our named executive officers. An advisory vote each year will permit our stockholders to provide annual feedback to us on our compensation policies, practices and compensation awards for our named executive officers. This is consistent with our policy of giving stockholders the opportunity to voice concerns with management or our Board of Directors. An annual advisory vote will give the Board of Directors, the Compensation Committee and management more timely feedback from the stockholders to allow us to evaluate and adjust, when we consider appropriate, the compensation of our named executive officers. If our stockholders approve the recommended frequency of holding the advisory vote once per year, we will implement that frequency without further action by the Board of Directors.

The proxy card provides stockholders with the opportunity to choose among four alternatives (holding the vote every one, two or three years, or abstaining) and, therefore, stockholders will not be voting to approve or disapprove our Board of Directors' recommendation. The alternative (one year, two years or three years) that received the highest number of votes casted at the Annual Meeting, virtually online or by proxy, will be the frequency approved on an advisory basis by our stockholders.

Recommendation

THE BOARD OF DIRECTORS RECOMMENDS THAT STOCKHOLDERS VOTE “FOR” “1 YEAR” AS THE FREQUENCY FOR WHICH STOCKHOLDERS SHALL HAVE AN ADVISORY VOTE ON THE COMPENSATION OF THE COMPANY’S NAMED EXECUTIVE OFFICERS.

SUBMISSION OF STOCKHOLDER PROPOSALS FOR THE 2024 ANNUAL MEETING

In order to be considered for inclusion in our proxy statement and form of proxy for our 2024 annual meeting, stockholder proposals intended to be presented at our 2024 annual meeting of stockholders must be received by us on or before December 7, 2023 and otherwise comply with the requirements set forth in Rule 14a-8 under the Exchange Act. These proposals must also comply with the rules of the Securities and Exchange Commission governing the form and content of proposals in order to be included in our proxy statement and form of proxy and should be mailed to: Secretary, Harvard Bioscience, Inc., 84 October Hill Road, Holliston, Massachusetts 01746.

To the extent a stockholder of record wishes to have a stockholder proposal or Director nomination considered at an annual meeting even though such proposal is not included in our proxy statement, our Bylaws provide that such stockholder of record must provide written notice of such proposal or nomination and appropriate supporting documentation, as set forth in the Bylaws, to our Secretary at our principal executive office not less than 90 days or not more than 120 days prior to the first anniversary of the date of the preceding year’s annual meeting. For the 2024 annual meeting of stockholders, such proposal or nomination must be received no earlier than January 16, 2024 and no later than February 15, 2024.

In addition to the notice and information requirements contained in our Bylaws, to comply with the universal proxy rules, stockholders who intend to solicit proxies in support of director nominees other than the Company’s nominees must provide notice that sets forth the information required by Rule 14a-19 under the Exchange Act no later than March 16, 2024.

MULTIPLE STOCKHOLDERS SHARING THE SAME ADDRESS

Owners of Common Stock in street name may receive a notice from their broker or bank stating that only one notice of internet availability of proxy materials, annual report or proxy statement will be delivered to multiple stockholders sharing an address. This practice, known as “householding,” is designed to reduce printing and postage costs. However, if any stockholder residing at such an address wishes to receive a separate notice of internet availability of proxy materials, annual report or proxy statement, we will promptly deliver a separate copy to any stockholder upon written or oral request to our investor relations department at Harvard Bioscience, Inc., 84 October Hill Road, Holliston, Massachusetts 01746-1371 or by telephone at (508) 893-3120 or by e-mail at investors@harvardbioscience.com. In addition, any stockholder who receives multiple copies at the same address can request delivery of a single copy by notifying our investor relations department pursuant to the contact information provided above.

OTHER MATTERS

The Board of Directors does not know of any matters, other than those described in this proxy statement that will be presented for action at the Annual Meeting. If other matters are duly presented, proxies will be voted in accordance with the best judgment of the proxy holders.

YOUR VOTE IS IMPORTANT. WHETHER OR NOT YOU PLAN TO ATTEND THE ANNUAL MEETING VIRTUALLY, PLEASE CAST YOUR VOTE ONLINE, BY TELEPHONE OR BY COMPLETING, DATING, SIGNING AND PROMPTLY RETURNING YOUR PROXY CARD OR VOTING INSTRUCTIONS CARD IN THE POSTAGE-PAID ENVELOPE (WHICH WILL BE PROVIDED TO THOSE STOCKHOLDERS WHO REQUEST PAPER COPIES OF THESE MATERIALS BY MAIL) BEFORE THE ANNUAL MEETING SO THAT YOUR SHARES ARE REPRESENTED AT THE ANNUAL MEETING.

THIS PROXY STATEMENT IS ACCOMPANIED BY THE COMPANY’S ANNUAL REPORT. THE COMPANY WILL FURNISH, WITHOUT CHARGE, A COPY OF ITS ANNUAL REPORT AND ANY EXHIBITS THERETO TO ANY STOCKHOLDER, UPON WRITTEN REQUEST TO HARVARD BIOSCIENCE, INC., 84 OCTOBER HILL ROAD, HOLLISTON, MASSACHUSETTS 01746-1371. A LIST OF STOCKHOLDERS ENTITLED TO VOTE AT THE ANNUAL MEETING WILL BE AVAILABLE FOR INSPECTION BY STOCKHOLDERS DURING REGULAR BUSINESS HOURS AT OUR OFFICES AND THE OFFICES OF OUR TRANSFER AGENT DURING THE TEN DAYS PRIOR TO THE ANNUAL MEETING AS WELL AS AT THE ANNUAL MEETING.

**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, 2022
- 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 001-33957

HARVARD BIOSCIENCE, INC.

(Exact Name of Registrant as Specified in Its Charter)

Delaware **04-3306140**
(State or other jurisdiction of Incorporation or organization) (I.R.S. Employer Identification No.)

84 October Hill Road, Holliston, Massachusetts 01746
(Address of Principal Executive Offices, including zip code)
(508) 893-8999

(Registrant's telephone number, including area code)
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, \$0.01 par value	HBIO	The Nasdaq Global 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 check mark 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. (Check one):

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.

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 Exchange Act). Yes No

The aggregate market value of shares of voting common equity held by non-affiliates of the registrant as of June 30, 2022 was approximately \$141.8 million based on the closing sales price of the registrant's common stock, par value \$0.01 per share on that date. At March 1, 2023, there were 42,190,043 shares of the registrant's common stock issued and outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the Company's definitive Proxy Statement in connection with the 2023 Annual Meeting of Stockholders (the “Proxy Statement”), to be filed within 120 days after the end of the Registrant's fiscal year, are incorporated by reference into Part III of this Form 10-K. Except with respect to information specifically incorporated by reference in this Form 10-K, the Proxy Statement is not deemed to be filed as part hereof.

HARVARD BIOSCIENCE, INC.
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For the Year Ended December 31, 2022
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This Annual Report on Form 10-K contains statements that are not statements of historical fact and are forward-looking statements within the meaning of Section 27A of the Securities Act of 1933 and Section 21E of the Securities Exchange Act of 1934 (the “Exchange Act”), each as amended. The forward-looking statements are principally, but not exclusively, contained in “Item 1: Business” and “Item 7: Management’s Discussion and Analysis of Financial Condition and Results of Operations.” These statements involve known and unknown risks, uncertainties and other factors that may cause our actual results, performance or achievements to be materially different from any future results, performance or achievements expressed or implied by the forward-looking statements. Forward-looking statements include, but are not limited to, statements about management’s confidence or expectations, our business strategy, our ability to raise capital or borrow funds to consummate acquisitions and the availability of attractive acquisition candidates, our expectations regarding future costs of product revenues, our anticipated compliance with the covenants contained in our credit facility, the adequacy of our financial resources and our plans, objectives, expectations and intentions that are not historical facts. In some cases, you can identify forward-looking statements by terms such as “may,” “will,” “should,” “could,” “would,” “seek,” “expects,” “plans,” “aim,” “anticipates,” “believes,” “estimates,” “projects,” “predicts,” “intends,” “think,” “strategy,” “potential,” “objectives,” “optimistic,” “new,” “goal” and similar expressions intended to identify forward-looking statements. These statements reflect our current views with respect to future events and are based on assumptions and subject to risks and uncertainties. Given these uncertainties, you should not place undue reliance on these forward-looking statements. We discuss many of these risks in detail under the heading “Item 1A. Risk Factors” beginning on page 7 of this Annual Report on Form 10-K. You should carefully review all of these factors, as well as other risks described in our public filings, and you should be aware that there may be other factors, including factors of which we are not currently aware, that could cause these differences. Also, these forward-looking statements represent our estimates and assumptions only as of the date of this report. We may not update these forward-looking statements, even though our situation may change in the future, unless we have obligations under the federal securities laws to update and disclose material developments related to previously disclosed information. Harvard Bioscience, Inc. is referred to herein as “we,” “our,” “us,” and “the Company.”

PART I

Item 1. Business.

Overview

Harvard Bioscience, Inc., a Delaware corporation, is a leading developer, manufacturer and seller of technologies, products and services that enable fundamental advances in life science applications, including research, pharmaceutical and therapy discovery, bio-production and preclinical testing for pharmaceutical and therapy development. Our products and services are sold globally to customers ranging from renowned academic institutions and government laboratories to the world’s leading pharmaceutical, biotechnology and contract research organizations. With operations in North America, Europe and China, we sell through a combination of direct and distribution channels to customers around the world.

Recent Developments

Global Supply Chain and Economic Environment

The global supply chain has experienced significant disruptions due to electronic component and labor shortages and other macroeconomic factors which have emerged since the onset of COVID-19, leading to increased cost of freight, purchased materials, and manufacturing labor costs, while also delaying customer shipments. We expect these supply chain trends to continue into 2023. These conditions, in addition to the overall impacts on the global economy, have negatively impacted our results of operations and cash flows.

Additionally, during 2022 the global economy has experienced high levels of inflation, rising interest rates, significant fluctuations in currency values, and increasing economic uncertainty, particularly in Europe. Our results of operations have been negatively impacted by higher costs of raw materials, labor and freight resulting from inflationary pressures. These factors and global events including the ongoing military conflict between Russia and Ukraine, a softening economy in Europe, and rising interest rates on our debt have had a negative impact on our results of operations.

COVID-19

The COVID-19 pandemic has had a negative impact on our operations to date and the future impacts of the pandemic and any resulting economic impact remain largely unknown and continue to evolve. Many countries worldwide continue to issue COVID-19 related restrictive orders in an attempt to control the effects of the pandemic. In particular, during the beginning of 2022, China implemented area-wide shutdowns in order to control the spread of COVID-19, which continued in different parts of China throughout 2022. Such shutdowns had an adverse impact on our financial results for fiscal 2022.

If business interruptions resulting from the current macroeconomic conditions or COVID-19 described above were to be prolonged or expanded in scope, the Company's business, financial condition, results of operations and cash flows would likely be negatively impacted. If the impacts of the supply chain disruptions are more severe than we expect, it could result in longer lead times and further increased costs, all of which could materially adversely affect our business, financial condition and results of operations.

Our History and Strategy

Our business began in 1901 under the name Harvard Apparatus. It was founded by Dr. William T. Porter, a Professor of Physiology at Harvard Medical School and a pioneer of physiology education. We have grown over the years with the development and evolution of modern life science research and education. Our early inventions included ventilators based on Dr. Porter's design, the mechanical syringe pump for drug infusion in the 1950s, and the microprocessor-controlled syringe pump in the 1980s.

In 1996, a group of investors acquired a majority of the then existing business of our predecessor, Harvard Apparatus, Inc. Following this acquisition, our focus was redirected to acquiring complementary companies with innovative technologies while continuing to grow the existing business through internal product development. Since 1996, we have completed multiple business or product line acquisitions related to our continuing operations. Harvard Bioscience, Inc. was incorporated in the State of Delaware in September 2000 and became the successor entity to Harvard Apparatus, Inc. by merger in November 2000.

In 2018, we acquired Data Sciences International, Inc. ("DSI"), a global leader in products, services and solutions focused on preclinical testing. The DSI product portfolio, which is largely complementary to our cellular and molecular technology ("CMT") product portfolio, expanded our product portfolio to address the continuum from research and discovery to preclinical testing with principal application in pharmaceutical and therapy testing.

In 2019, we initiated a restructuring program to improve operational efficiency and reduce costs which entailed consolidating and downsizing several sites and reducing headcount in Europe and North America. This program was completed in 2021.

During 2022, we completed a review of our business and product portfolio and identified opportunities to rationalize our product portfolio, improve our cost structure and optimize our sales organization. In connection with this review, we identified certain non-strategic products for discontinuation and further reduced our headcount in Europe and North America. We believe that these actions, which were completed in 2022, will allow us to focus on product opportunities that drive sustainable revenue growth with attractive gross margins and improved profitability.

Our Products

As noted above, our products and services enable fundamental advances in life science applications, including research, pharmaceutical and therapy discovery, bio-production and preclinical testing.

We have organized our product line activities into two product families, CMT and Preclinical.

Our CMT product family is primarily composed of products supporting research related to molecular, cellular organ and organoid technologies, with additional application in the emerging field of bio-production of pharmaceuticals and therapeutics. The principal customers for our CMT products include academic and government laboratories, biotechnology and pharmaceutical companies, and contract research organizations.

Our Preclinical product family includes four business lines that support the preclinical research and testing phase for drug development, and in particular testing related to data collection and analysis for safety and regulatory compliance. Preclinical products are primarily sold to pharmaceutical, biotechnology and contract research organizations, as well as larger academic labs.

We sell our products under several brand names, including Harvard Apparatus, DSI, Buxco, Biochrom, BTX, Heka, Hugo Sachs, Multichannel Systems MCS GmbH ("MCS"), and Panlab.

Our solutions range from simple to complex, and generally consist of hardware/firmware and software products, augmented with consumables, options, upgrades and post-sales (scientific, installation and data) services. Sales prices of these products and services range typically from \$1,000 to over \$100,000. Our products include spectrophotometers that

analyze light to detect and quantify a wide range of molecules as well as cell analysis and electroporation and electrofusion systems to influence and/or analyze cellular processes. Other products and services focus on tissue and organ responses to new drugs and encompass wireless monitors, and signal acquisition and analysis functionality. We also feature products that monitor physiological processes in living organisms to study behavior. Many of our proprietary products are leaders in their fields.

In addition to our proprietary manufactured products, we distribute products developed by other manufacturers. These distributed products accounted for approximately 15% and 14% of our revenues for the years ended December 31, 2022 and 2021, respectively. Resale of such products enables us to act as a single source for our customers' research needs. They consist of a large variety of complementing instruments or accessories as well as consumables used in experiments involving fluid handling, molecular and cell analysis and tissue, organ and animal research.

Below is a description of each product family.

Cellular and Molecular Technologies Product Family

Our CMT product family includes products designed primarily to support the discovery phase of new drug development. CMT products include:

- High precision syringe and peristaltic infusion pump product lines;
- electroporation and electrofusion instruments, amino acid analyzers, spectrophotometers, and other equipment which primarily support molecular level testing and research; and
- precision scientific measuring instrumentation and equipment in the field of electrophysiology such as: data acquisition systems with custom amplifier configurations for cellular analysis, complete micro electrode array solutions for in vivo recordings and in vitro systems for extracellular recordings.

Our CMT product family made up approximately 51% and 47% of our global revenues for the years ended December 31, 2022 and 2021, respectively.

Preclinical Product Family

Our Preclinical product family provides a complete platform to assess physiological data from organisms for research ranging from basic research to drug discovery, and drug development services. The Preclinical product family consists of the DSI and Buxco brands. It includes:

- implantable and externally worn telemetry systems, which are commonly used in research to collect cardiovascular, central nervous system, respiratory, metabolic data;
- behavioral products; isolated organ and surgical products, a broad range of instruments and accessories for tissue, organ-based lab research, including surgical products, infusion systems, and behavior research systems;
- turn-key respiratory system solutions encompassing plethysmograph chambers, data acquisition hardware, physiological signal analysis software, and final report generation;
- inhalation and exposure systems providing precise, homogenous aerosol delivery for up to 42 subjects, while integrating respiratory parameters for the ultimate delivered dose system; and
- powerful GLP-capable data acquisition and analysis systems, capable of integrating third party sensors for a more comprehensive study design.

Our Preclinical product family made up approximately 49% and 53% of our global revenues for the years ended December 31, 2022 and 2021, respectively.

Customers

Our end-user customers are primarily research scientists at pharmaceutical and biotechnology companies, universities, hospitals, government laboratories, including the United States National Institutes of Health (“NIH”), and contract research organizations (“CROs”). Our pharmaceutical and biotechnology customers have included pharmaceutical companies and research laboratories such as Pfizer, Amgen, Inc., AstraZeneca plc, Genentech, Inc. and Johnson & Johnson. Our academic customers include major colleges and universities including Harvard University, Cambridge University, Johns Hopkins University, Massachusetts Institute of Technology, Yale University, the University of California system, Baylor College of Medicine, and the University of Texas and Imperial College London. Our CRO customers include Labcorp, Charles River Laboratories and Wuxi AppTec. We have a wide range of diverse customers worldwide and no customer accounted for more than 10% of our revenues in 2022.

Sales

We conduct direct sales in the United States, China and major European markets. We sell primarily through distributors in other countries. For the year ended December 31, 2022, revenues from direct sales to end-users represented approximately 63% of our revenues; and revenues from sales of our products through distributors represented approximately 37% of our revenues.

Direct Sales

We have a global sales organization managing both direct sales and distributors. Our websites and marketing collateral serve as the primary sales tool for our product lines, which includes both proprietary manufactured products and complementary products from various suppliers.

Sales through Distributors

We engage distributors for the sales of our own branded and private label products in certain areas of the world and for certain product lines.

Marketing

We have a centralized marketing group, which encompasses product management, and market communications. Marketing maintains value-proposition based product roadmaps, collaborates with research and development on timing and investment for new products, supports direct and distributor sales activities, sets the global pricing of our products and conceives the storylines on how to sell our products. Marketing also maintains digital presence across the web and social media platforms, creates electronic leads and analyzes opportunities for new product portfolio extensions.

Research and Development

Our principal research and development mission is to develop products that address growth opportunities within the life science research process as well as to maintain and optimize our existing product portfolios. We maintain development staff in many of our manufacturing facilities to design and develop new products and to re-engineer existing products to bring them to the next generation. Our research and development expenses were approximately \$12.3 million and \$10.8 million for the years ended December 31, 2022 and 2021, respectively. We anticipate that we will continue to make investments in research and development activities to advance our position in the industry as a provider of life science equipment, software and services. We plan to continue to pursue a balanced development portfolio strategy of originating new products from internal research and acquiring products and technologies through business and technology acquisitions or collaborations, as appropriate.

Manufacturing

We manufacture and test the majority of our products in our principal manufacturing facilities located in the United States, Sweden, Spain and Germany. We have considerable manufacturing flexibility at our various facilities, and each facility can manufacture multiple products at the same time. We maintain in-house manufacturing expertise, technologies and resources. We seek to maintain multiple suppliers for key components that are not manufactured in-house, and while some of our products are dependent on sole-source suppliers, we have made investments in new talent in procurement and other functions to reduce exposures related to sole-source suppliers, and are accelerating these efforts given the dynamics of the global supply chain in 2022. Our manufacturing operations primarily involve assembly and testing activities along with some

machine-based processes. Going forward we will continue to evaluate our manufacturing facilities and operations in order to optimize our manufacturing footprint.

See “Part I, Item 2. Properties” of this report for additional information regarding our manufacturing facilities.

Competition

The markets into which we sell our products are highly competitive, and we expect the intensity of competition to continue or increase. We compete with many companies engaged in developing and selling tools for life science research. Many of our competitors have greater financial, operational, sales and marketing resources and more experience in research and development and commercialization than we have. Moreover, our competitors may have greater name recognition than we do, and many offer discounts as a competitive tactic. These competitors and other companies may have developed or could in the future develop new technologies that compete with our products, which could render our products obsolete. We cannot provide assurance that we will be able to make the enhancements to our technologies necessary to compete successfully with newly emerging technologies. We believe that we offer one of the broadest selections of products to organizations engaged in life science research. We have numerous competitors on a product line basis. We believe that we compete favorably with our competitors on the basis of product performance, including quality, reliability, speed, technical support, price and delivery time.

We compete with several companies that provide instruments for life science research including, Lonza Group Ltd., Becton Dickinson, Eppendorf AG, Kent Scientific Corporation, Danaher Corporation, Bio-Rad Laboratories, Inc., PerkinElmer, Inc., Thermo Fisher Scientific, Inc. Instem plc, Emka Technologies and TSE Systems.

We cannot forecast if or when these or other companies may develop competitive products. We expect that other products will compete with our products and potential products based on efficacy, safety, cost and intellectual property positions. While we believe that these will be the primary competitive factors, other factors include, in certain instances, availability of supply, manufacturing, marketing and sales expertise and capability.

Seasonality

Sales and earnings in our third quarter are usually flat or down from the second quarter primarily because there are a large number of holidays and vacations during such quarter, especially in Europe. Our fourth quarter revenues and earnings are often the highest in any fiscal year compared to the other three quarters, primarily because many of our customers tend to spend budgeted money before their own fiscal year ends.

Intellectual Property

To establish and protect our proprietary technologies and products, we rely on a combination of patent, copyright, trademark and trade secret laws, as well as confidentiality provisions in our contracts. Patents or patent applications cover certain of our new technologies. Most of our more mature product lines are protected by trade names and trade secrets only.

We have implemented a patent strategy designed to provide us with freedom to operate and facilitate commercialization of our current and future products. Our success depends, to a significant degree, upon our ability to develop proprietary products and technologies. We intend to continue to file patent applications covering new products and technologies where it is appropriate to do so taking into account factors such as the likely scope of coverage, strategic value, and cost.

Patents provide some degree of protection for our intellectual property. However, the assertion of patent protection involves complex legal and factual determinations and is therefore uncertain. The scope of any of our issued patents may not be sufficiently broad to offer meaningful protection. In addition, our issued patents or patents licensed to us may be successfully challenged, invalidated, circumvented or unenforceable so that our patent rights would not create an effective competitive barrier. Moreover, the laws of some foreign countries may protect our proprietary rights to a greater or lesser extent than the laws of the United States. In addition, the laws governing patentability and the scope of patent coverage continue to evolve, particularly in areas of interest to us. As a result, there can be no assurance that patents will be issued from any of our patent applications or from applications licensed to us. As a result of these factors, our intellectual property positions bear some degree of uncertainty.

We also rely in part on trade secret protection of our intellectual property. We attempt to protect our trade secrets by entering into confidentiality agreements with third parties, employees and consultants. Our employees and consultants also

sign agreements requiring that they assign to us their interests in patents and copyrights arising from their work for us. Although many of our United States employees have signed agreements not to compete unfairly with us during their employment and after termination of their employment, through the misuse of confidential information, soliciting employees, soliciting customers and the like, the enforceability of these provisions varies from jurisdiction to jurisdiction and, in some circumstances, they may not be enforceable. In addition, it is possible that these agreements may be breached or invalidated and if so, there may not be an adequate corrective remedy available. Despite the measures we have taken to protect our intellectual property, we cannot provide assurance that third parties will not independently discover or invent competing technologies or reverse engineer our trade secrets or other technologies. Therefore, the measures we are taking to protect our proprietary rights may not be adequate.

We do not believe that our products infringe on the intellectual property rights of any third party. We cannot assure, however, that third parties will not claim such infringement by us or our licensors with respect to current or future products. We expect that product developers in our market will increasingly be subject to such claims as the number of products and competitors in our market segment grows and the product functionality in different market segments overlaps. In addition, patents on production and business methods are becoming more common and we expect that more patents will be issued in our technical field. Any such claims, with or without merit, could be time-consuming, result in costly litigation and diversion of management’s attention and resources, cause product shipment delays or require us to enter into royalty or licensing agreements. Moreover, such royalty or licensing agreements, if required, may not be on terms advantageous to us, or acceptable at all, which could seriously harm our business or financial condition.

“Harvard” is a registered trademark of Harvard University. The marks “Harvard Apparatus” and “Harvard Bioscience” are being used pursuant to a license agreement entered into in December 2002 between us and Harvard University.

Government Regulation

We are generally not subject to direct governmental regulation other than the laws and regulations generally applicable to businesses in the domestic and foreign jurisdictions in which we operate. In particular, other than our amino asset analyzer product, our current products are not subject to pre-market approval by the United States Food and Drug Administration for use on human clinical patients. In addition, we believe we are materially in compliance with all relevant environmental laws.

Employees

As of December 31, 2022, we employed 455 employees, which included 436 full-time employees. Some of our employees in Europe have statutory collective bargaining rights. We have never experienced a general work stoppage or strike, and management believes that our relations with our employees are good. Additional information about our employees follows:

Employees by country:

Country	Full time	Part time
United States	271	10
Germany	73	9
United Kingdom.....	32	-
Spain	28	-
China	15	-
Rest of World	17	-
Total	<u>436</u>	<u>19</u>

Employees by business function:

Function	Full time	Part time
Manufacturing	178	6
Sales and marketing	141	4
Research and development.....	61	2
General and administrative.....	56	7
Total	<u>436</u>	<u>19</u>

We make employment decisions without regard to age, color, national origin, citizenship status, physical or mental disability, race, religion, creed, gender, sex, sexual orientation, gender identity and/or expression, genetic information, marital status, status with regard to public assistance, veteran and military status or any other characteristic protected by federal, state or local law. We take steps to employ and advance in employment qualified protected veterans and qualified individuals with disabilities.

Geographic Area

Financial information regarding geographic areas in which we operate is provided in Note 16 to the Consolidated Financial Statements included in “Part IV, Item 15. Exhibits, Financial Statement Schedules” of this report.

Available Information and Website

Our website address is www.harvardbioscience.com. Our Annual Report on Form 10-K, Quarterly Reports on Form 10-Q, Current Reports on Form 8-K, and exhibits and amendments to those reports filed or furnished with the Securities and Exchange Commission pursuant to Section 13(a) of the Exchange Act are available for review on our website and the Securities and Exchange Commission’s website at www.sec.gov. Any such materials that we file with, or furnish to, the SEC in the future will be available on our website as soon as reasonably practicable after they are electronically filed with, or furnished to, the SEC. The information on our website is not incorporated by reference into this Annual Report on Form 10-K.

Item 1A. Risk Factors.

The following factors should be reviewed carefully, in conjunction with the other information contained in this Annual Report on Form 10-K. As previously discussed, our actual results could differ materially from our forward-looking statements. Our business faces a variety of risks. These risks include those described below and may include additional risks and uncertainties not presently known to us or that we currently deem immaterial. If any of the events or circumstances described in the following risk factors occur, our business operations, performance and financial condition could be adversely affected, and the trading price of our common stock could decline.

Risks Related to Our Industry

The life sciences industry is very competitive.

We expect to encounter increased competition from both established and development-stage companies that continually enter the market. These include companies developing and marketing life science instruments, systems and lab consumables, health care companies that manufacture laboratory-based tests and analyzers, diagnostic and pharmaceutical companies, analytical instrument companies, and companies developing life science or drug discovery technologies. Currently, our principal competition comes from established companies that provide products that perform many of the same functions for which we market our products. Many of our competitors have substantially greater financial, operational, marketing and technical resources than we do. Moreover, these competitors may offer broader product lines and tactical discounts and may have greater name recognition. In addition, we may face competition from new entrants into the field. We may not have the financial resources, technical expertise or marketing, distribution or support capabilities to compete successfully in the future. In addition, we face changing customer preferences and requirements, including increased customer demand for more environmentally friendly products.

The life sciences industry is also subject to rapid technological change and discovery. The development of new or improved products, processes or technologies by other companies may render our products or proposed products obsolete or less competitive. In some instances, our competitors may develop or market products that are more effective or commercially attractive than our current or future products. To meet the evolving needs of customers, we must continually enhance our current products and develop and introduce new products. However, we may experience difficulties that may delay or prevent the successful development, introduction and marketing of new products or product enhancements. In addition, our product lines are based on complex technologies that are subject to change as new technologies are developed and introduced in the marketplace. We may have difficulty in keeping abreast of the changes affecting each of the different markets we serve or intend to serve. Our failure to develop and introduce products in a timely manner in response to changing technology, market demands, or the requirements of our customers could cause our product sales to decline, and we could experience significant losses.

We offer, and plan to continue to offer, a broad range of products and have incurred, and expect to continue to incur, substantial expenses for the development of new products and enhancements to our existing products. The speed of technological change in our market may prevent us from being able to successfully market some or all of our products for the length of time required to recover development costs. Failure to recover the development costs of one or more products or product lines could decrease our profitability or cause us to experience significant losses.

A portion of our revenues are derived from customers from the pharmaceutical and biotechnology industries and are subject to the risks faced by those industries. Such risks may adversely affect our financial results.

We derive a significant portion of our revenues from pharmaceutical and biotechnology companies. We expect that pharmaceutical and biotechnology companies will continue to be a significant source of our revenues for the foreseeable future, including in our Cellular and Molecular Technologies and Preclinical product families. As a result, we are subject to risks and uncertainties that affect the pharmaceutical and biotechnology industries, such as government regulation, ongoing consolidation, uncertainty of technological change, and reductions and delays in research and development expenditures by companies in these industries.

In particular, the biotechnology industry is largely dependent on raising capital to fund its operations. If biotechnology companies that are our customers are unable to obtain the financing necessary to purchase our products, our business and results of operations could be adversely affected. In addition, we are dependent, both directly and indirectly, upon general health care spending patterns, particularly in the research and development budgets of the pharmaceutical and biotechnology industries, as well as upon the financial condition and purchasing patterns of various governments and government agencies. As it relates to both the biotechnology and pharmaceutical industries, many companies have significant patents that have expired or are about to expire, which could result in reduced revenues for those companies. If pharmaceutical or biotechnology companies that are our customers suffer reduced revenues as a result of these patent expirations, they may be unable to purchase our products, and our business and results of operations could be adversely affected.

Changes in governmental regulations may reduce demand for our products, adversely impact our revenues, or increase our expenses.

We operate in many markets in which we and our customers must comply with federal, state, local and international regulations. We develop, configure and market our products to meet customer needs created by, and in compliance with, those regulations. These requirements include, among other things, regulations regarding manufacturing practices, product labeling, and advertising and post marketing reporting. We must incur expense and spend time and effort to ensure compliance with these complex regulations. Possible regulatory actions for non-compliance could include warning letters, fines, damages, injunctions, civil penalties, recalls, seizures of our products, and criminal prosecution. These actions could result in, among other things, substantial modifications to our business practices and operations; refunds, recalls, or seizures of our products; a total or partial shutdown of production in one or more of our facilities while we or our suppliers remedy the alleged violation; and withdrawals or suspensions of current products from the market. Any of these events could disrupt our business and have a material adverse effect on our revenues, profitability and financial condition.

Risks Related to Our Business

Reductions in customers' research budgets or government funding may adversely affect our business.

Many of our customers are universities, government research laboratories, private foundations and other institutions who are dependent on grants from government agencies, such as the NIH, for funding. These customers represent a significant source of our revenue. Research and development spending by our customers may fluctuate based on spending priorities and general economic conditions. The level of government funding for research and development is unpredictable. In the past, NIH grants have been frozen or otherwise made unavailable for extended periods or directed to certain products. Reductions or delays in governmental spending could cause customers to delay or forego purchases of our products. If government funding necessary for the purchase of our products were to decrease, our business and results of operations could be materially, adversely affected. Spending by some of these customers fluctuates based on budget allocations and the timely passage of the annual federal budget. An impasse in federal government budget decisions could lead to substantial delays or reductions in federal spending.

Our business is subject to economic, political and other risks associated with international revenues and operations.

We manufacture and sell our products worldwide and as a result, our business is subject to risks associated with doing business internationally. A substantial amount of our revenues is derived from international operations, and we

anticipate that a significant portion of our sales will continue to come from outside the United States in the future. We anticipate that revenues from international operations will likely continue to increase as a result of our efforts to expand our business in markets abroad. In addition, a number of our manufacturing facilities and suppliers are located outside the United States.

Our foreign operations subject us to certain risks, including: effects of fluctuations in foreign currency exchange rates; the impact of local economic conditions; local product preferences and seasonality and product requirements; local difficulty to effectively establish and expand our business and operations in international markets; disruptions of capital and trading markets; restrictions and potentially negative tax implications of transfer of capital across borders; differing labor regulations; other factors beyond our control, including potential political instability, terrorism, acts of war, natural disasters and diseases, including COVID-19 discussed below; unexpected changes and increased enforcement of regulatory requirements and various state, federal and international, intellectual property, environmental, antitrust, anti-corruption, fraud and abuse (including anti-kickback and false claims laws) and employment laws; interruption to transportation flows for delivery of parts to us and finished goods to our customers; and laws and regulations on foreign investment in the United States under the jurisdiction of the Committee on Foreign Investment in the United States, or CFIUS, and other agencies, including the Foreign Investment Risk Review Modernization Act, or FIRRMA, adopted in August 2018.

A small percentage of our products are subject to export control regulations administered by the U.S. Department of the Treasury's Office of Foreign Assets Control ("OFAC") and by the Export Administration Regulations administered by the U.S. Department of Commerce's Bureau of Industry and Security ("BIS"). Based on the nature of the product, its ultimate end use and country of destination, we are sometimes subject to foreign assets control and economic sanctions regulations administered by OFAC, which restrict or prohibit our ability to transact with certain foreign countries, certain individuals and entities identified on the Treasury Department's "Denied Parties List." Under the OFAC regulations, the sale or transfer of certain equipment to a location outside the United States may require prior approval in the form of an export license issued by the BIS or the U.S. Department of State's Directorate of Defense Trade Controls. Some potential international transactions may also be restricted or prohibited based on the location, nationality or identity of the potential end user, customer or other parties to the transaction or may require prior authorization in the form of an OFAC license. Any delay in obtaining required governmental approvals could affect our ability to conclude a sale or timely commence a project, and the failure to comply with all such controls could result in criminal and/or civil penalties. These international transactions may otherwise be subject to tariffs and import/export restrictions from the United States or other governments.

Our overall success as a global business depends, in part, upon our ability to succeed in differing economic, social and political conditions. In order to continue to succeed in our international sales strategy, we must continue developing and implementing policies and strategies that are effective in each location where we do business, which could negatively affect our profitability.

Rising inflation and interest rates could negatively impact our revenues, profitability and borrowing costs. In addition, if our costs increase and we are not able to correspondingly adjust our commercial relationships to account for this increase, our net income would be adversely affected, and the adverse impact may be material.

Inflation rates, particularly in the U.S., have increased recently to levels not seen in years. Increased inflation may result in decreased demand for our products, increased operating costs (including our labor costs), reduced liquidity, and limitations on our ability to access credit or otherwise raise debt and equity capital. In addition, the United States Federal Reserve has raised, and may again raise, interest rates in response to concerns about inflation. Increases in interest rates have had, and could continue to have, a material impact on our borrowing costs. In an inflationary environment, we may be unable to raise the sales prices of our products at or above the rate at which our costs increase, which could reduce our profit margins and have a material adverse effect on our financial results and net income. We also may experience lower than expected sales if there is a decrease in spending on products in our industry in general or a negative reaction to our pricing. A reduction in our revenue would be detrimental to our profitability and financial condition and could also have an adverse impact on our future growth.

We have substantial debt and other financial obligations, and we may incur even more debt. Any failure to meet our debt and other financial obligations or maintain compliance with related covenants could harm our business, financial condition and results of operations.

Our credit agreement provides for a term loan of \$40.0 million and a \$25.0 million senior revolving credit facility (collectively, the "Credit Agreement") and will mature on December 22, 2025. As of December 31, 2022, we had outstanding borrowings of \$47.7 million under the Credit Agreement.

Pursuant to the terms of the Credit Agreement, we are subject to various covenants, including negative covenants that restrict our ability to engage in certain transactions, which may limit our ability to respond to changing business and economic conditions. Such negative covenants include, among other things, limitations on our ability and the ability of our subsidiaries to:

- incur debt,
- incur liens,
- make investments (including acquisitions),
- sell assets, and
- pay dividends on our capital stock.

In addition, the Credit Agreement contains certain financial covenants, including a maximum consolidated net leverage ratio and a minimum consolidated fixed charge coverage ratio, each of which will be tested at the end of each fiscal quarter of the Company.

We were not in compliance with certain financial covenants under the Credit Agreement as of September 30, 2022 but we were able to cure such noncompliance by entering into an amendment to the Credit Agreement, dated November 8, 2022. If we are not able to maintain compliance with the covenants under the Credit Agreement, as amended, or are unsuccessful in obtaining waivers or amendments for any covenant defaults in the future, in addition to other actions our lenders may require, the amounts outstanding under the Credit Agreement may become immediately due and payable. This immediate payment may negatively impact our financial condition. In addition, any failure to make scheduled payments of interest and principal on our outstanding indebtedness would likely harm our ability to incur additional indebtedness on acceptable terms. Our cash flow and capital resources may be insufficient to pay interest and principal on our debt in the future. If that should occur, our capital raising or debt restructuring measures may be unsuccessful or inadequate to meet our scheduled debt service obligations, which could cause us to default on our obligations and further impair our liquidity.

Further, based upon our actual performance levels, our covenants relating to leverage and fixed charges could limit our ability to incur additional debt, which could hinder our ability to execute our current business strategy.

Our ability to make scheduled payments on our debt and other financial obligations and comply with financial covenants depends on our financial and operating performance. Our financial and operating performance will continue to be subject to prevailing economic conditions and to financial, business and other factors, some of which are beyond our control. Failure within any applicable grace or cure periods to make such payments, comply with the financial covenants, or any other non-financial or restrictive covenant, would create a default under our Credit Agreement. Our cash flow and existing capital resources may be insufficient to repay our debt at maturity, in which such case prior thereto we would have to extend such maturity date, or otherwise repay, refinance and or restructure the obligations under the Credit Agreement, including with proceeds from the sale of assets, and additional equity or debt capital. If we are unsuccessful in obtaining such extension, or entering into such repayment, refinance or restructure prior to maturity, or any other default existed under the Credit Agreement, our lenders could accelerate the indebtedness under the Credit Agreement, foreclose against their collateral or seek other remedies, which would jeopardize our ability to continue our current operations.

Ethical concerns surrounding the use of our products and misunderstanding of the nature of our business could adversely affect our ability to develop and sell our existing products and new products.

Some of our products may be used in areas of research involving animal research and other techniques presently being explored in the life science industry. These techniques have drawn negative attention in the public forum. Government authorities may regulate or prohibit any of these activities. Additionally, the public may disfavor or reject these activities.

Foreign currency exchange rate fluctuations may have a negative impact on our reported earnings.

We are subject to the risks of fluctuating foreign currency exchange rates, which could have an adverse effect on the sales price of our products in foreign markets, as well as the costs and expenses of our foreign subsidiaries. A substantial amount of our revenues is derived from international operations, and we anticipate that a significant portion of revenues will continue to come from outside the United States in the future. As a result, currency fluctuations among the United States dollar, British pound, euro and the other currencies in which we do business have caused and will continue to cause foreign

currency translation and transaction gains and losses. We have not used forward exchange contracts to hedge our foreign currency exposures. We attempt to manage foreign currency risk through the matching of assets and liabilities. In the future, we may undertake to manage foreign currency risk through hedging methods, including foreign currency contracts. We recognize foreign currency gains or losses arising from our operations in the period incurred. We cannot guarantee that we will be successful in managing foreign currency risk or in predicting the effects of exchange rate fluctuations upon our future operating results because of the number of currencies involved, the variability of currency exposure and the potential volatility of currency exchange rates. We cannot predict with any certainty changes in foreign currency exchange rates or the degree to which we can address these risks.

Failure or inadequacy of our information technology infrastructure or software could adversely affect our day-to-day operations and decision-making processes and have an adverse effect on our performance.

We depend on accurate and timely information and numerical data from key software applications to aid our day-to-day business, financial reporting and decision-making and, in many cases, proprietary and custom-designed software is necessary to operate our business.

Disruption caused by the failure of these systems, the underlying equipment, or communication networks could delay or otherwise adversely impact day-to-day business and decision making, could make it impossible for us to operate critical equipment, and could have an adverse effect on our performance. Although we maintain disaster recovery procedures for our critical systems, our disaster recovery plans may not fully mitigate the effect of any such disruption. Disruptions could be caused by a variety of factors, such as catastrophic events or weather, power outages, or cyber-attacks on our systems by outside parties.

We review our information technology (“IT”) systems regularly to assess and implement opportunities to improve or upgrade our enterprise resource planning (“ERP”) or other information systems required to operate our business effectively. Our ERP systems are critical to our ability to accurately maintain books and records, record transactions, provide important information to our management and prepare our financial statements. The implementation of any IT systems, including ERP systems, has required in the past, and may continue to require, the investment of significant financial and human resources. In addition, we may not be able to successfully complete the implementation of the ERP systems without experiencing difficulties. Any disruptions, delays or deficiencies in the design and implementation of any IT system, including ERP systems could adversely affect our ability to process orders, ship products, provide services and customer support, send invoices and track payments, fulfill contractual obligations or otherwise operate our business.

An information security incident, including a cybersecurity breach, could have a negative impact to our business or reputation.

To meet business objectives, we rely on both internal IT systems and networks, and those of third parties and their vendors, to process and store sensitive data, including confidential research, business plans, financial information, intellectual property, and personal data that may be subject to legal protection. The extensive information security and cybersecurity threats, which affect companies globally, pose a risk to the security and availability of these IT systems and networks, and the confidentiality, integrity, and availability of our sensitive data. We continually assess these threats and make investments to increase internal protection, detection, and response capabilities, as well as ensure our third-party providers have the required capabilities and controls, to address this risk. To date, we have not experienced any material impact to the business or operations resulting from information or cybersecurity attacks; however, because of the frequently changing attack techniques, along with the increased volume and sophistication of the attacks, there is the potential for us to be adversely impacted. This impact could result in reputational, competitive, operational or other business harm as well as financial costs and regulatory action. Additionally, the California Consumer Privacy Act of 2018 (the “CCPA”), which became effective on January 1, 2020, provides private rights of action for data breaches and requires companies that process information on California residents to make new disclosures to consumers about their data collection, use and sharing practices and allow consumers to opt out of certain data sharing with third parties. Compliance with the CCPA and other current and future applicable privacy, cybersecurity and related laws can be costly and time-consuming. Significant capital investments and other expenditures could also be required to remedy cybersecurity problems and prevent future breaches, including costs associated with additional security technologies, personnel, experts and credit monitoring services for those whose data has been breached. These costs, which could be material, could adversely impact our results of operations in the period in which they are incurred and may not meaningfully limit the success of future attempts to breach our information technology systems.

We may incur additional restructuring costs or not realize the expected benefits of our initiatives to reduce operating expenses in the future.

We may not be able to implement all of the actions that we intend to take in the restructuring of our operations, and we may not be able to fully realize the expected benefits from such realignment and restructuring plans or other similar restructurings in the future. In addition, we may incur additional restructuring costs in implementing such realignment and restructuring plans or other similar future plans in excess of our expectations. The implementation of our restructuring efforts, including the reduction of our workforce, may not improve our operational and cost structure or result in greater efficiency of our organization; and we may not be able to support sustainable revenue growth and profitability following such restructurings.

If we are not able to manage our growth, our operating profits may be adversely impacted.

Our success will depend on the expansion of our operations through organic growth, and we may execute acquisitions in the future to augment this growth. Effective growth management will place increased demands on our management team, operational and financial resources and expertise. To manage growth, we must optimize our operational, financial and management processes and systems, and information technology infrastructure and hire and train additional qualified personnel. While we are currently in the process of evaluating potential improvements to and consolidation of many of our processes and systems, we may not be able to implement these changes in an efficient or timely manner. Failure to manage our growth effectively, including failure to improve our systems and processes timely or efficiently, could impair our ability to generate revenues or could cause our expenses to increase more rapidly than revenues, resulting in operating losses or reduced profitability.

We may incur a variety of costs in connection with acquisitions we may seek to consummate in the future, and we may never realize the anticipated benefits of our acquisitions due in part to difficulties integrating the businesses, operations and product lines.

Our business strategy has historically included the acquisition of businesses, technologies, services or products that we believe are a strategic fit with our business. If we were to undertake future acquisitions, the process of integrating the acquired business, technology, service and/or product(s) may result in unforeseen operating difficulties and expenditures and potentially absorb significant management attention that would otherwise be available for ongoing development of our business. Moreover, we may fail to realize the anticipated benefits of an acquisition as rapidly as expected, or at all. Such transactions are inherently risky, and any such recent or future acquisitions could reduce stockholders' ownership, cause us to incur debt, expose us to future liabilities and result in amortization expenses related to intangible assets with definite lives, which may adversely impact our ability to undertake future acquisitions on substantially similar terms. We may also incur significant expenditures in anticipation of an acquisition that is never realized.

Our ability to achieve the benefits of acquisitions depends in part on the integration and leveraging of technology, operations, sales and marketing channels and personnel. Integration is a complex, time-consuming and expensive process and may disrupt our business if not completed in a timely and efficient manner. We may have difficulty successfully integrating acquired businesses, and their domestic and foreign operations or product lines, and as a result, we may not realize any of the anticipated benefits of the acquisitions we make. We cannot assure that our growth rate will equal the growth rates that have been experienced by us, and these other acquired companies, respectively, operating as separate companies in the past.

Failure to raise additional capital or generate the significant capital necessary to expand our operations, invest in new products, or pursue acquisitions or other business development opportunities could reduce our ability to compete and result in less revenues.

We anticipate that our financial resources, which include available cash, cash generated from operations, and debt and equity capacity, will be sufficient to finance operations and capital expenditures for at least the next twelve months. However, this expectation is premised on the current operating plan, which may change as a result of many factors, including market acceptance of new products and future opportunities with collaborators. Consequently, we may need additional funding sooner than anticipated. In addition, our borrowings under the Credit Agreement may not be sufficient to support our pursuit of potential acquisitions or other business development opportunities. In such case, our inability to raise sufficient capital on favorable terms and in a timely manner (if at all) could seriously harm our business, product development, and acquisition efforts. In addition, our Credit Agreement contains various negative covenants that, among other things, restrict our ability to incur additional indebtedness and make acquisitions for aggregate consideration in excess of \$5.0 million. If future financing is not available or is not available on acceptable terms, we may have to alter our operations or change our

business strategy. We cannot assure you that the capital required to fund operations, or our acquisition strategy will be available in the future.

If we fail to retain key personnel and hire, train and retain qualified employees, we may not be able to compete effectively, which could result in reduced revenue or increased costs.

Our success is highly dependent on the continued services of key management, technical and scientific personnel. Our management and other employees may voluntarily terminate their employment at any time upon short notice. The loss of the services of any member of the senior management team, including the Chief Executive Officer or Interim Chief Financial Officer or any of our managerial, technical or scientific staff may significantly delay or prevent the achievement of product development, our growth strategies and other business objectives. Our future success will also depend on our ability to identify, recruit and retain additional qualified scientific, technical and managerial personnel. We operate in several geographic locations where labor markets are particularly competitive, including the Boston, Massachusetts and Minneapolis, Minnesota metropolitan areas, England, and Germany where demand for personnel with these skills is extremely high and is likely to remain high. Additionally, the COVID-19 pandemic and other macroeconomic factors have exacerbated these challenges, contributed to a sustained labor shortage, and increased turnover rates. As a result, competition for qualified personnel is intense, particularly in the areas of general management, finance, information technology, engineering and science, and the process of hiring suitably qualified personnel is often lengthy and expensive, and may become more expensive in the future. If we are unable to hire and retain a sufficient number of qualified employees, our ability to conduct and expand our business could be seriously reduced.

Our success will depend partly on our ability to operate without infringing on or misappropriating the intellectual property rights of others.

We may be sued for infringing on the intellectual property rights of others, including the patent rights, trademarks and trade names of third parties. Intellectual property litigation is costly, and the outcome is uncertain. If we do not prevail in any intellectual property litigation, in addition to any damages we might have to pay, we could be required to stop the infringing activity, or obtain a license to or design around the intellectual property in question. If we are unable to obtain a required license on acceptable terms, or are unable to design around any third-party patent, we may be unable to sell some of our products and services, which could result in reduced revenue.

The shares of Series E Preferred Stock of Biostage held by the Company could fluctuate considerably in value and could become worthless.

In connection with the Biostage Settlement, Biostage issued shares of its Series E Convertible Preferred Stock (the “Series E Preferred Stock”) to the Company on June 10, 2022 in satisfaction of \$4.0 million of Biostage’s total indemnification obligations to the Company. The Series E Preferred Stock is convertible at any time at the option of the Company into such number of shares of Biostage common stock determined by dividing (a) the \$1,000 face value of the Series E Preferred Stock plus all accrued and unpaid dividends thereon by (b) the average of the volume weighted average trading prices of Biostage’s common stock, which is currently quoted on the OTCQB Marketplace, for the 60 consecutive trading days prior to the conversion. In the event Biostage has a subsequent qualified offering of its common stock, (which is defined as an offering of Biostage common stock that coincides with its uplisting onto Nasdaq, the first subsequent public offering by Biostage, or the first subsequent private placement by Biostage resulting in gross proceeds to Biostage of at least \$4,000,000), the Series E Preferred Stock is mandatorily converted into Biostage common stock at the applicable qualified offering price.

Due to Biostage’s limited operating history, their overall financial condition, (including whether it can continue as a going concern without additional capital) and the limited trading volume and liquidity of Biostage’s common stock, the value of the Series E Preferred Stock could fluctuate considerably or become worthless.

Biostage third parties may seek to hold us responsible for Biostage’s liabilities, including liabilities that Biostage has assumed from us.

Third parties may continue to seek to hold us responsible for Biostage’s liabilities, including any of the liabilities that Biostage agreed to retain or assume in connection with the separation of the Biostage business from our businesses, and related spin-off distribution. On April 14, 2017, representatives for the estate of an individual plaintiff filed a wrongful death complaint with the Suffolk Superior Court, in the County of Suffolk, Massachusetts (the “Court”), against us and other defendants, including Biostage, as well as another third party (the “Biostage Litigation”). The complaint sought payment for an unspecified amount of damages and alleges that the plaintiff sustained terminal injuries allegedly caused by products,

including one synthetic trachea scaffold and two bioreactors, provided by certain of the named defendants and utilized in connection with surgeries performed by third parties in Europe in 2012 and 2013.

On September 15, 2021, Biostage's products liability insurance carrier, which insures us as an additional insured and which had appointed defense counsel and had been defending both Biostage and us on this case, notified us and Biostage that it was denying coverage under the applicable policy for the lawsuit and would no longer be providing a defense to us or Biostage with respect thereto, or covering related legal expenses incurred after September 30, 2021. The insurance carrier also filed a corresponding complaint for declaratory judgment with the Court asking the Court to declare that said insurance provider is not required to defend, indemnify or provide coverage to us or Biostage with respect to the lawsuit.

On January 24, 2022, the Court granted our and Biostage's jointly filed motion for a preliminary injunction against the insurance carrier requiring that it continue to pay legal expenses incurred by Biostage and us in connection with the underlying lawsuit during the pendency of the insurance coverage lawsuit, as well as awarding reasonable attorneys' fees and costs incurred by the parties in connection with seeking the preliminary injunction. The insurance carrier has filed a notice of appeal of the preliminary injunction.

On April 27, 2022, the Company and Biostage executed a settlement with the plaintiffs of the Biostage Litigation and Biostage's products liability insurance carriers (the "Biostage Settlement"), which resolved all claims by and between the parties and Biostage's product liability insurance carriers and resulted in the dismissal with prejudice of the wrongful death claim and all claims between the Company, Biostage and the insurance carriers. The Biostage Settlement was entered into solely by way of compromise and settlement and is not in any way an admission of liability or fault by the Company or Biostage. Biostage has indemnified the Company for all losses and expenses, including legal expenses that the Company incurred in connection with the Biostage Litigation and the Biostage Settlement.

Risks Related to Our Common Stock

Our stock price has fluctuated in the past and could experience substantial declines in the future.

The market price of our common stock has experienced significant fluctuations and may become volatile and could decline in the future, perhaps substantially, in response to various factors including, but not limited to:

- volatility of the financial markets;
- uncertainty regarding the prospects of the domestic and foreign economies;
- technological innovations by competitors or in competing technologies;
- revenues and operating results fluctuating or failing to meet the expectations of management, securities analysts, or investors in any quarter;
- comments of securities analysts and mistakes by or misinterpretation of comments from analysts, downward revisions in securities analysts' estimates or management guidance;
- investment banks and securities analysts becoming subject to lawsuits that may adversely affect the perception of the market;
- conditions or trends in the biotechnology and pharmaceutical industries;
- announcements of significant acquisitions or financings or strategic partnerships;
- non-compliance with the internal control standards pursuant to the Sarbanes-Oxley Act of 2002; and
- a decrease in the demand for our common stock.

In addition, public stock markets have experienced extreme price and trading volatility. The stock market and the Nasdaq Global Market in general, and the biotechnology industry and small cap markets in particular, have experienced significant price and volume fluctuations that at times may have been unrelated or disproportionate to the operating performance of those companies. These broad market and industry factors may further harm the market price of our common

stock, regardless of our operating performance. In the past, securities class action litigation has often been instituted following periods of volatility in the market price of a company's securities. A securities class action suit against us could result in substantial costs, potential liabilities and the diversion of management's attention and resources.

If we raise additional funds through the sale of equity or convertible debt or equity-linked securities, existing percentages of ownership in our common stock will be reduced and these transactions may dilute the value of our outstanding common stock.

We may raise additional funds through the sale of equity or convertible debt or equity-linked securities to repay our existing indebtedness, implement our acquisition strategy, expand our operations and/or invest in new products. If we raise additional funds through such sales, existing percentages of ownership in our common stock will be reduced and these transactions may dilute the value of our outstanding common stock. We may issue securities that have rights, preferences and privileges senior to our common stock. If we raise additional funds through collaborations or licensing arrangements, we may relinquish rights to certain of our technologies or products, or grant licenses to third parties on terms that are unfavorable

General Risks

We are currently operating in a period of economic uncertainty and capital markets disruption, which has been significantly impacted by geopolitical instability due to the ongoing military conflict between Russia and Ukraine. Our business, financial condition and results of operations may be materially adversely affected by any negative impact on the global economy and capital markets resulting from the conflict in Ukraine or any other geopolitical tensions.

U.S. and global markets are experiencing volatility and disruption following the escalation of geopolitical tensions and the start of the military conflict between Russia and Ukraine. On February 24, 2022, a full-scale military invasion of Ukraine by Russian troops was reported. Although the length and impact of the ongoing military conflict is highly unpredictable, the conflict in Ukraine could lead to market disruptions, including significant volatility in commodity prices, credit and capital markets, as well as supply chain interruptions. We are continuing to monitor the situation in Ukraine and globally and assessing its potential impact on our business.

Additionally, Russia's prior annexation of Crimea, recent recognition of two separatist republics in the Donetsk and Luhansk regions of Ukraine and subsequent military interventions in Ukraine have led to sanctions and other penalties being levied by the United States, European Union and other countries against Russia, Belarus, the Crimea Region of Ukraine, the so-called Donetsk People's Republic, and the so-called Luhansk People's Republic, including agreement to remove certain Russian financial institutions from the Society for Worldwide Interbank Financial Telecommunication payment system. Additional potential sanctions and penalties have also been proposed and/or threatened. Russian military actions and the resulting sanctions could adversely affect the global economy and financial markets and lead to instability and lack of liquidity in capital markets, potentially making it more difficult for us to obtain additional funds.

Any of the abovementioned factors could affect our business, prospects, financial condition, and operating results. The extent and duration of the military action, sanctions and resulting market disruptions are impossible to predict, but could be substantial. Any such disruptions may also magnify the impact of other risks described in this Annual Report on Form 10-K.

The COVID-19 outbreak has significantly impacted worldwide economic conditions and has negatively impacted our business, financial condition and results of operations.

The COVID-19 pandemic has had a negative impact on our operations to date and the future impacts of the pandemic and any resulting economic impact remain largely unknown and continue to evolve. Many countries worldwide continue to issue COVID-19 related restrictive orders in an attempt to control the effects of the pandemic. In particular, during the beginning of 2022, China implemented area-wide shutdowns in order to control the spread of COVID-19, which continued for different parts of China throughout 2022. Such shutdowns have had an adverse impact on our financial results for fiscal 2022 and if they continue could have an adverse impact on our future financial results.

Disruptions to the global supply chain and the economic environment have adversely affected our financial results and cash flows.

The global supply chain has experienced significant disruptions due to electronic component and labor shortages and other macroeconomic factors which have emerged since the onset of COVID-19, leading to increased cost of freight, purchased materials and manufacturing labor costs, while also delaying customer shipments. We believe these supply chain

trends will continue into 2023. These conditions, in addition to the overall impacts on the global economy, have negatively impacted our results of operations and cash flows.

Additionally, during 2022 the global economy has experienced high levels of inflation, rising interest rates, significant fluctuations in currency values, and increasing economic uncertainty, particularly in Europe. Our results of operations have been negatively impacted by higher costs of raw materials, labor and freight resulting from inflationary pressures. These factors and global events including the ongoing military conflict between Russia and Ukraine, a softening economy in Europe, and rising interest rates on our debt have had a negative impact on our results of operations.

If business interruptions resulting from COVID-19 or the current macroeconomic conditions described above were to be prolonged or expanded in scope, our business, financial condition, results of operations and cash flows would likely be negatively impacted. If the impacts of the supply chain disruptions are more severe than we expect, it could result in longer lead times and further increased costs, all of which could materially adversely affect our business, financial condition and results of operations.

If we incur higher costs as a result of trade policies, treaties, government regulations or tariffs, we may become less profitable.

There continues to be uncertainty about the relationship between the United States and foreign countries, including with respect to trade policies, treaties, government regulations and tariffs. We are unable to predict whether or when tariffs will be imposed or the impact of any such future tariff increases.

We may be the subject of lawsuits from counterparties to acquisitions and divestitures, including an acquiring company or its stockholders, an acquired company's previous stockholders, a divested company's stockholders or our current stockholders.

We may be the subject of lawsuits from either an acquiring company or its stockholders, an acquired company's previous stockholders, a divested company's stockholders or our current stockholders. Such lawsuits could result from the actions of the acquisition or divestiture target prior to the date of the acquisition or divestiture, from the acquisition or divestiture transaction itself or from actions after the acquisition or divestiture. Defending potential lawsuits could cost us significant expense and detract management's attention from the operation of the business. Additionally, these lawsuits could result in the cancellation of or the inability to renew certain insurance coverage that would be necessary to protect our assets.

Rising commodity and precious metals costs could adversely impact our profitability.

Raw material commodities such as resins, and precious metal commodities such as platinum are subject to wide price variations. Increases in the costs of these commodities and the costs of energy, transportation and other necessary services may adversely affect our profit margins if we are unable to pass along any higher costs in the form of price increases or otherwise achieve cost efficiencies such as in manufacturing and distribution.

Provisions of Delaware law, or of our charter and bylaws may make a takeover more difficult, which could cause our stock price to decline.

Provisions in our certificate of incorporation and bylaws and in the Delaware corporate law may make it difficult and expensive for a third party to pursue a tender offer, change in control or takeover attempt, which is opposed by management and the board of directors. Public stockholders who might desire to participate in such a transaction may not have an opportunity to do so. We have a staggered board of directors that makes it difficult for stockholders to change the composition of the board of directors in any one year. These anti-takeover provisions could substantially impede the ability of public stockholders to change our management and board of directors. Such provisions may also limit the price that investors might be willing to pay for shares of our common stock in the future.

Item 1B. *Unresolved Staff Comments.*

None.

Item 2. Properties.

Our facilities perform manufacturing, research and development, sales and marketing, and administration functions. As of December 31, 2022, we leased the following principal facilities:

Location	Description of Facility	Approximate Square Footage	Expiration
Holliston, Massachusetts	Manufacturing facility and corporate headquarters	83,000	2024
New Brighton, Minnesota	Manufacturing facility	75,000	2030
Reutlingen, Germany.....	Manufacturing facility	23,000	2024
Barcelona, Spain.....	Manufacturing facility	16,000	2023
March-Hugstetten, Germany	Manufacturing facility	11,000	2024

We also lease facilities in Cambridge, England; Kista, Sweden; Beijing, China; and Shanghai, China. We believe our current facilities are adequate for our needs for the foreseeable future.

Item 3. Legal Proceedings.

For information related to legal proceedings, see the discussion in Note 14 to the Consolidated Financial Statements included in “Part IV, Item 15. Exhibits, Financial Statement Schedules” of this report, which information is incorporated by reference into this Item 3.

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

Our common stock has been quoted on the Nasdaq Global Market since our initial public offering on December 7, 2000, and trades under the symbol “HBIO.”

Stockholders

There were 93 holders of record of our common stock as of March 1, 2023. The number of record holders was determined from the records of our transfer agent and does not include beneficial owners of our common stock whose shares are held in the names of various security brokers, dealers, and registered clearing agencies.

Dividend Policy

We have never declared or paid cash dividends on our common stock in the past and do not intend to pay cash dividends on our common stock in the foreseeable future. Any future determination to pay cash dividends will be at the discretion of our Board of Directors and will depend on our financial condition, results of operations, capital requirements and other factors our Board of Directors deems relevant.

Item 6. *[Reserved]*

Item 7. *Management’s Discussion and Analysis of Financial Condition and Results of Operations.*

Forward-Looking Statements

The following section of this Annual Report on Form 10-K contains statements that are not statements of historical fact and are forward-looking statements within the meaning of federal securities laws. These statements involve known and unknown risks, uncertainties and other factors that may cause our actual results, performance or achievements to be materially different from any future results, performance or achievements expressed or implied by the forward-looking statements. These statements reflect our current views with respect to future events and are based on assumptions and subject to risks and uncertainties. Factors that may cause our actual results to differ materially from those in the forward-looking statements include those factors described in “Item 1A. Risk Factors” in this Annual Report on Form 10-K. You should carefully review all of these factors, as well as the comprehensive discussion of forward-looking statements on page 1 of this Annual Report on Form 10-K.

Overview

Harvard Bioscience is a leading developer, manufacturer and seller of technologies, products and services that enable fundamental advances in life science applications, including research, pharmaceutical and therapy discovery, bio-production and preclinical testing for pharmaceutical and therapy development. Our products and services are sold globally to customers ranging from renowned academic institutions and government laboratories to the world’s leading pharmaceutical, biotechnology and contract research organizations. With operations in North America, Europe and China, we sell through a combination of direct and distribution channels to customers around the world.

Recent Developments

Global Supply Chain and Economic Environment

The global supply chain has experienced significant disruptions due to electronic component and labor shortages and other macroeconomic factors which have emerged since the onset of COVID-19, leading to increased cost of freight, purchased materials, and manufacturing labor costs, while also delaying customer shipments. We believe these supply chain trends will continue into 2023. These conditions, in addition to the overall impacts on the global economy, have negatively impacted our results of operations and cash flows.

Additionally, during 2022 the global economy has experienced high levels of inflation, rising interest rates, significant fluctuations in currency values, and increasing economic uncertainty, particularly in Europe. Our results of operations have been negatively impacted by higher costs of raw materials, labor and freight resulting from inflationary pressures. These factors and global events including the ongoing military conflict between Russia and Ukraine, a softening economy in Europe, and rising interest rates on our debt have had a negative impact on our results of operations.

If business interruptions resulting from the current macroeconomic conditions described above were to be prolonged or expanded in scope, the Company's business, financial condition, results of operations and cash flows would likely be negatively impacted. If the impacts of the supply chain disruptions are more severe than we expect, it could result in longer lead times and further increased costs, all of which could materially adversely affect our business, financial condition and results of operations.

COVID-19

The COVID-19 pandemic has had a negative impact on our operations to date and the future impacts of the pandemic and any resulting economic impact remain largely unknown and continue to evolve. Many countries worldwide continue to issue COVID-19 related restrictive orders in an attempt to control the effects of the pandemic. In particular, during the beginning of 2022, China implemented area-wide shutdowns in order to control the spread of COVID-19, which continued in different parts of China throughout 2022. Such shutdowns had an adverse impact on our financial results for fiscal 2022 and if they continue could have an adverse impact on our future financial results.

See Part I, Item 1. "Business—Our History and Strategy" of this report for a discussion of recent significant developments.

Restructuring Activities

On an ongoing basis, we review our business, the global economy, the healthcare industry, and the markets in which we compete to identify operational efficiencies, enhance commercial capabilities and align our cost base and infrastructure with customer needs and our strategic plans.

During 2019, we initiated a restructuring program to improve operational efficiency and reduce costs which entailed consolidating and downsizing several sites and reducing headcount in Europe and North America. This program was completed in 2021. Restructuring costs under this program were \$1.3 million for the year ended December 31, 2021. Substantially all of these costs have been included as a component of general and administrative expenses.

During 2022, we completed a review of our business and product portfolio and identified opportunities to rationalize our product portfolio, improve our cost structure, optimize our sales organization. In connection with this review, we identified certain non-strategic products for discontinuation and recorded charges of \$1.6 million in cost of revenue. We also incurred \$0.9 million in severance expenses in connection with headcount reductions in Europe and North America.

Selected Results of Operations

Year ended December 31, 2022 compared to year ended December 31, 2021

In the table below, we provide an overview of selected operating metrics.

(dollars in thousands)	Year Ended December 31,			
	2022	% of revenue	2021	% of revenue
Revenues.....	\$ 113,335		\$ 118,904	
Gross profit	60,819	53.7%	67,652	56.9%
Sales and marketing expenses.....	25,041	22.1%	24,642	20.7%
General and administrative expenses	24,493	21.6%	24,305	20.4%
Research and development expenses	12,329	10.9%	10,799	9.1%
Amortization of intangible assets.....	6,122	5.4%	5,840	4.9%
Settlement of litigation, net.....	(233)	-0.2%	-	-
Interest expense.....	2,548	2.2%	1,540	1.3%
Income tax expense.....	337	0.3%	148	0.1%

Revenues

Revenues decreased \$5.6 million, or 4.7%, to \$113.3 million for the year ended December 31, 2022, compared to \$118.9 million for the year ended December 31, 2021. The decrease in revenues was due primarily to a decrease in sales of our preclinical products, lower revenue in Europe and an unfavorable currency impact of \$3.4 million.

Gross profit

Gross profit decreased \$6.8 million, or 10.1%, to \$60.8 million for the year ended December 31, 2022, compared with \$67.7 million for the year ended December 31, 2021. Gross profit in 2022 was negatively impacted by charges of \$1.6 million related to the discontinuation of certain non-strategic products. Our gross profit was also negatively impacted by the decrease in revenue noted above, as well as higher costs of labor, material and freight. Gross margin decreased 3.2% to 53.7% for the year ended December 31, 2022 as compared to 56.9% for the year ended December 31, 2021. Of the reduction of gross margin, 1.4% was driven by the previously mentioned inventory charges, with the remaining impact due to reduced overhead absorption from lower revenue, offset by pricing increases during 2022.

The global supply chain has experienced significant disruptions due to electronic components and labor shortages and other macroeconomic factors, leading to increased costs as noted above. We expect these supply chain trends to continue into 2023.

Sales and marketing expenses

Sales and marketing expenses increased \$0.4 million, or 1.6%, to \$25.0 million for the year ended December 31, 2022, compared to \$24.6 million for the year ended December 31, 2021. The increase was primarily due to increases in travel and attendance at in-person trade shows offset by lower variable compensation. Travel and trade show costs were lower in the prior year due to COVID-19 related restrictions.

General and administrative expenses

General and administrative expenses increased slightly by \$0.2 million, or 0.8%, to \$24.5 million for the year ended December 31, 2022, compared with \$24.3 million for the year ended December 31, 2021. The increase was primarily due to external costs related to our product portfolio review and legal expenses mostly offset by lower variable compensation.

Research and development expenses

Research and development expenses increased \$1.5 million, or 14.2%, to \$12.3 million for the year ended December 31, 2022, compared with \$10.8 million for the year ended December 31, 2021. The increase was primarily due to increased spending associated with new product development in our preclinical product lines.

Amortization of intangible assets

Amortization of intangible assets was \$6.1 million for the year ended December 31, 2022, compared to \$5.8 million for the year ended December 31, 2021. Amortization expense in 2022 was higher due to a change in the estimated remaining economic life of certain intangible assets related to products we decided to discontinue in 2022.

Settlement of litigation

During the year ended December 31, 2022, we recorded a net credit of \$0.2 million related to the Biostage Settlement consisting of \$5.2 million in settlement and legal expenses accrued during the three months ended March 31, 2022, offset by credits of \$4.9 million and \$0.5 million during the three months ended June 30, 2022 and September 30, 2022, respectively. The credits consisted of adjustments to the reserve against an indemnification receivable from Biostage to reflect: i) the issuance by Biostage of Series E Convertible Preferred Stock to us on June 10, 2022, in satisfaction of \$4.0 million of Biostage's total indemnification obligations, ii) the payment by Biostage of legal fees associated with the Biostage Settlement, and iii) other accrual adjustments.

Interest expense

Interest expense increased \$1.0 million, or 65.5%, to \$2.5 million for the year ended December 31, 2022, compared with \$1.5 million for the year ended December 31, 2021. The increase was primarily the result of higher interest rates under

our Credit Agreement as well as slightly higher average borrowing balances. Subsequent to year-end, the Company entered into an interest rate swap contract that is expected to mitigate further interest rate fluctuation on a majority of our debt (see Note 18 to the Consolidated Financial Statements included in “Part IV, Item 15. Exhibits, Financial Statement Schedules” of this report).

Income tax expense

Income tax expense for the year ended December 31, 2022 was \$0.3 million compared to \$0.1 million for the year ended December 31, 2021. The effective tax rates for the years ended December 31, 2022 and 2021 were (3.7)% and (105.7)%, respectively. The difference between our effective tax rates compared to the U.S. statutory tax rate of 21% is primarily due to changes in reserves for uncertain tax positions in 2022, and changes in valuation allowances associated with our assessment of the likelihood of the recoverability of our deferred tax assets in 2021. We currently have valuation allowances against substantially all of our net operating loss carryforwards and tax credit carryforwards.

Liquidity and Capital Resources

Our primary sources of liquidity are cash and cash equivalents, internally generated cash flow from operations and our revolving credit facility. Our expected cash outlays relate primarily to cash payments due under our Credit Agreement described below as well as capital expenditures and payments associated with ongoing business improvement initiatives.

As of December 31, 2022, we held cash and cash equivalents of \$4.5 million, compared with \$7.8 million at December 31, 2021. Borrowings outstanding under our Credit Agreement were \$47.7 million and \$49.5 million as of December 31, 2022 and December 31, 2021, respectively.

On December 22, 2020, we entered into a Credit Agreement which provides for a term loan of \$40.0 million and a \$25.0 million senior revolving credit facility both maturing on December 22, 2025 (See Note 11 to the Consolidated Financial Statements included in “Part IV, Item 15. Exhibits, Financial Statement Schedules” of this report). As of December 31, 2022, the weighted average interest rate on our borrowings was 7.6%, and the available and unused borrowing capacity under the Credit Agreement, as amended, was \$2.9 million. Total revolver borrowing capacity is limited by our consolidated net leverage ratio as defined under the Credit Agreement, as amended.

On April 28, 2022, and November 8, 2022, we entered into amendments to the Credit Agreement and Pledge and Security Agreement (respectively, the “April 2022 Amendment” and the “November 2022 Amendment”) (see Note 11 to the Consolidated Financial Statements included in “Part IV, Item 15. Exhibits, Financial Statements Schedules” of this report). The April 2022 Amendment, among other things modified the financial covenant relating to the consolidated net leverage ratio, and consented to the Biostage Settlement, including without limitation the receipt by the Company of convertible preferred stock in Biostage, and the securities issuable upon conversion thereof, as partial payment for Biostage’s indemnification obligations in connection with the Biostage Settlement. (See Note 15 to the Consolidated Financial Statements included in “Part IV, Item 15. Exhibits, Financial Statements Schedules” of this report). In consideration for the April 2022 Amendment, the Company paid fees of \$0.2 million to the lenders and administrative agent. The November 2022 Amendment, among other things, modified the financial covenant relating to the consolidated net leverage ratio and the definition of Consolidated EBITDA used in the calculation of certain financial covenants, including to exclude non-cash inventory charges related to the Company’s decision to discontinue non-strategic products. In consideration for the November 2022 Amendment, the Company paid fees of \$0.2 million to the lenders and administrative agent. As of December 31, 2022, we are in compliance with the financial covenants of the Credit Agreement, as amended.

Based on our current operating plans, we expect that our available cash, cash generated from current operations and debt capacity will be sufficient to finance current operations, any costs associated with restructuring activities, debt financing costs and capital expenditures for at least the next 12 months. This assessment includes consideration of our best estimates of the impact of the macroeconomic conditions and COVID-19 on our financial results described above. Our forecast of the period of time through which our financial resources will be adequate to support our operations is a forward-looking statement that involves risks and uncertainties, and actual results could vary as a result of a number of factors.

Condensed Consolidated Cash Flow Statements

(in thousands)	Year Ended December 31,	
	2022	2021
Cash provided by operating activities	\$ 1,152	\$ 1,262
Cash used in investing activities.....	(1,590)	(1,345)
Cash used in financing activities	(2,837)	(252)
Effect of exchange rate changes on cash.....	(38)	(161)
Decrease in cash and cash equivalents	<u>\$ (3,313)</u>	<u>\$ (496)</u>

Cash provided by operations was \$1.2 million and \$1.3 million for the years ended December 31, 2022 and 2021, respectively. Cash flow from operations for the year ended December 31, 2022, was lower than the comparable period in the prior year due to increased operating losses as noted and payments related to the Biostage Litigation, offset by the positive impact of improved accounts receivable collections and accounts payable management activities. During the year ended December 31, 2022, we paid approximately \$4.0 million in connection with the Biostage Settlement.

Cash used in investing activities was \$1.6 million and \$1.3 million for the years ended December 31, 2022 and 2021, respectively, and consisted primarily of capital expenditures in manufacturing and information technology infrastructure.

Cash used in financing activities was \$2.8 million for the year ended December 31, 2022. During this period, we made term loan payments under the Credit Agreement of \$3.2 million, with net borrowings of \$1.4 million under the revolving facility. We also received proceeds of \$0.6 million from the exercise of stock options and employee stock purchase plan purchases and paid \$1.6 million for taxes related to net share settlement of equity awards.

Cash used in financing activities was \$0.3 million for the year ended December 31, 2021. During this period, we made term loan installments payments under the Credit Agreement of \$2.0 million, with net borrowings of \$2.0 million under the revolving credit facility. We also received proceeds of \$3.3 million from the exercise of stock options and employee stock purchases and paid \$3.5 million for taxes related to net share settlement of equity awards.

Impact of Foreign Currencies

Our international operations in some instances operate in a natural hedge as we sell our products in many countries and a substantial portion of our revenues, costs and expenses are denominated in foreign currencies, primarily the euro and the British pound.

During the year ended December 31, 2022, changes in foreign currency exchange rates resulted in an unfavorable effect on revenues of approximately \$3.4 million and a favorable effect on expenses of approximately \$3.3 million.

The translation of foreign currency into U.S. dollars included as a component of comprehensive income during the year ended December 31, 2022 resulted in a loss of approximately \$3.0 million, compared to a loss of \$2.4 million for the year ended December 31, 2021.

In addition, the currency exchange rate fluctuations included as a component of net loss resulted in currency losses of \$(0.4) million and \$(0.1) million during the years ended December 31, 2022 and 2021, respectively.

Recent Accounting Pronouncements

For information on recent accounting pronouncements impacting our business, see “Recent Accounting Pronouncements” included in Note 2 to the Consolidated Financial Statements included in “Part IV, Item 15. Exhibits, Financial Statement Schedules” of this report.

Critical Accounting Policies and Estimates

The discussion and analysis of our financial condition and results of operations are based upon our consolidated financial statements, which have been prepared in accordance with accounting principles generally accepted in the United States. The preparation of these financial statements requires us to make estimates and judgments that affect the reported amounts of assets, liabilities, revenue and expenses, and related disclosure of contingent assets and liabilities. On an ongoing basis, we evaluate our estimates, including those related to revenue recognition, investments, income taxes, litigation and other contingencies. We base our estimates on historical experience and on various other assumptions that are believed to be

reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates under different assumptions or conditions.

We believe the following are the more significant judgments and estimates used in the preparation of our consolidated financial statements.

Valuation of Biostage Series E Preferred Stock

During 2022, we received 4,000 shares of the Series E Preferred Stock in connection with the Biostage Settlement. The Series E Preferred Stock was initially recorded at an estimated fair value of \$3.9 million and has a carrying value at December 31, 2022, of \$4.1 million, inclusive of accrued dividends. We estimated the initial fair value of the Series E Preferred Stock using an income approach which considered a discount rate and an estimated time until conversion into Biostage's common stock.

We have elected the provisions within ASC 321 Investment Securities to subsequently measure the Series E Preferred Stock at its original cost minus impairment, if any, plus or minus changes resulting from observable price changes in orderly transactions for the identical or a similar investment of Biostage. As of December 31, 2022, there have been no observable price changes or indicators of impairment and therefore there have been no measurement adjustments to the carrying value of the Series E Preferred Stock.

Due to Biostage's limited operating history, their overall financial condition which includes the requirement to raise additional capital in order to continue as a going concern and the limited trading volume and liquidity of Biostage's common stock, the value of the Series E Preferred Stock could fluctuate considerably or become worthless.

Income Taxes and Valuation Allowance

We are subject to income taxes in the U.S. and numerous foreign jurisdictions. Our annual tax rate is based on income, statutory tax rates, tax reserve changes and tax planning opportunities available to us in the various jurisdictions in which we operate. We regularly assess the likelihood of tax adjustments in each of the tax jurisdictions in which we have operations and account for the related financial statement implications. We have established tax reserves that we believe are appropriate given the possibility of tax adjustments. Determining the appropriate level of tax reserves requires significant judgment regarding the uncertain application of tax laws. Reserves are adjusted when information becomes available or when an event occurs indicating a change in the reserve is appropriate. Changes in tax reserves could have a material impact on our financial condition or results of operations.

Significant judgment is also required in determining the amount of deferred tax assets that will ultimately be realized and corresponding deferred tax asset valuation allowance. When estimating the necessary valuation allowance, we consider all available evidence for each jurisdiction including historical operating results, estimates of future taxable income and the feasibility of ongoing tax planning strategies. If new information becomes available that would alter our estimate of the amount of deferred tax assets that will ultimately be realized, we adjust the valuation allowance through income tax expense. Changes in the deferred tax asset valuation allowance could have a material impact on our financial condition or results of operations.

Item 7A. Quantitative and Qualitative Disclosures about Market Risk.

Not Applicable.

Item 8. Financial Statements and Supplementary Data.

The information required by this item is contained in the financial statements referenced in "Part IV, Item 15. Exhibits, Financial Statement Schedules" of this report, which financial statements are appended to this report. An index of those financial statements is found on page F-1.

Item 9. Changes in and Disagreements with Accountants on Accounting and Financial Disclosure.

None.

Item 9A. Controls and Procedures.

This Report includes the certifications of our Chief Executive Officer and Interim Chief Financial Officer required by Rule 13a-14 of the Securities Exchange Act of 1934, as amended (the “Exchange Act”). See Exhibits 31.1 and 31.2. This Item 9A includes information concerning the controls and control evaluations referred to in those certifications.

(a) Evaluation of Disclosure Controls and Procedures

Disclosure controls and procedures refer to controls and other procedures designed to ensure that information required to be disclosed in the reports we file or submit under the Exchange Act is recorded, processed, summarized and reported, within the time periods specified in the rules and forms of the U.S. Securities and Exchange Commission. Disclosure controls and procedures include, without limitation, controls and procedures designed to ensure that information required to be disclosed by us in our reports that we file or submit under the Exchange Act is accumulated and communicated to our management, including our Chief Executive Officer and Interim Chief Financial Officer, as appropriate to allow timely decisions regarding our required disclosure. In designing and evaluating our disclosure controls and procedures, our management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving the desired control objectives, and management was required to apply its judgment in evaluating and implementing possible controls and procedures.

We carried out an evaluation, under the supervision and with the participation our Chief Executive Officer and Interim Chief Financial Officer, of the effectiveness of the design and operation of our disclosure controls and procedures (as defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act) as of the end of the period covered in this Report. Based upon the evaluation described above, our Chief Executive Officer and Interim Chief Financial Officer have concluded that they believe that our disclosure controls and procedures were effective, as of December 31, 2022, in providing reasonable assurance that information required to be disclosed by us in the reports that we file or submit under the Exchange Act is accumulated and communicated to our management, including our Chief Executive Officer and Interim Chief Financial Officer, to allow timely decisions regarding required disclosures, and is recorded, processed, summarized and reported within the time periods specified in the Securities and Exchange Commission’s rules and forms.

(b) Management’s Report on Internal Control Over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting (as defined in Rules 13a-15(f) and 15d-15(f) under the Exchange Act). Our internal control over financial reporting is a process designed by and under the supervision of our Chief Executive Officer and Interim Chief Financial Officer and effected by our management and other personnel, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of consolidated financial statements for external purposes in accordance with generally accepted accounting principles. Our 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 transactions and dispositions of assets, (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of consolidated financial statements for external purposes in accordance with generally accepted accounting principles, (3) provide reasonable assurance that receipts and expenditures are being made only in accordance with authorizations of management and directors, and (4) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use or disposition of assets that could have a material effect on the consolidated financial statements.

Because of inherent limitations, internal control over financial reporting may not prevent or detect misstatements. It is a process that involves human diligence and compliance and is therefore subject to human error and misjudgment. In general, evaluations of effectiveness for future periods are subject to risk as controls may become inadequate due to changes in conditions or the degree of compliance with key processes or procedures could deteriorate.

Our management evaluated the effectiveness of our internal control over financial reporting as of December 31, 2022 using the criteria set forth in Internal Control – Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission. As a result of that evaluation, management has concluded that our internal control over financial reporting was effective as of December 31, 2022.

The effectiveness of our internal control over financial reporting as of December 31, 2022 has also been audited by Grant Thornton LLP, our independent registered public accounting firm, as stated in their report, which is included below in Item 9A(e).

(c) Changes in Internal Controls Over Financial Reporting

There has been no change in the Company's internal control over financial reporting as of December 31, 2022, that has materially affected, or is reasonably likely to materially affect, the Company's internal control over financial reporting. We continue to monitor the impact of the COVID-19 pandemic and, despite many of our employees working remotely, have not experienced any changes that materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

(d) Inherent Limitations on Effectiveness of Controls

The design of any system of control is based upon certain assumptions about the likelihood of future events, and there can be no assurance that any design will succeed in achieving its stated objectives under all future events, no matter how remote, that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may not deteriorate. Because of their inherent limitations, systems of control may not prevent or detect all misstatements. Accordingly, even effective systems of control can provide only reasonable assurance of achieving their control objectives.

(e) **Report of Independent Registered Public Accounting Firm**

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

Board of Directors and Shareholders
Harvard Bioscience, Inc.

Opinion on internal control over financial reporting

We have audited the internal control over financial reporting of Harvard Bioscience, Inc. (a Delaware corporation) and subsidiaries (the “Company”) as of December 31, 2022, based on criteria established in the 2013 *Internal Control—Integrated Framework* issued by the Committee of Sponsoring Organizations of the Treadway Commission (“COSO”). In our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2022, based on criteria established in the 2013 Internal Control—Integrated Framework issued by COSO.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (“PCAOB”), the consolidated financial statements of the Company as of and for the year ended December 31, 2022, and our report dated March 9, 2023 expressed an unqualified opinion on those financial statements.

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 Management’s report on Internal Control over Financial Reporting (“Management’s Report”). 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/ GRANT THORNTON LLP

Hartford, Connecticut
March 9, 2023

Item 9B. *Other Information.*

None.

Item 9C. *Disclosure Regarding Foreign Jurisdictions that Prevent Inspections.*

Not applicable.

PART III

Item 10. *Directors, Executive Officers and Corporate Governance.*

Incorporated by reference to our definitive Proxy Statement to be filed pursuant to Regulation 14A under the Exchange Act in connection with our 2023 Annual Meeting of Stockholders.

Item 11. *Executive Compensation.*

Incorporated by reference to our definitive Proxy Statement to be filed pursuant to Regulation 14A under the Exchange Act in connection with our 2023 Annual Meeting of Stockholders.

Item 12. *Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters.*

Incorporated by reference to our definitive Proxy Statement to be filed pursuant to Regulation 14A under the Exchange Act in connection with our 2023 Annual Meeting of Stockholders.

Item 13. *Certain Relationships and Related Transactions, and Director Independence.*

Incorporated by reference to our definitive Proxy Statement to be filed pursuant to Regulation 14A under the Exchange Act in connection with our 2023 Annual Meeting of Stockholders.

Item 14. *Principal Accounting Fees and Services.*

Incorporated by reference to our definitive Proxy Statement to be filed pursuant to Regulation 14A under the Exchange Act in connection with our 2023 Annual Meeting of Stockholders.

PART IV

Item 15. Exhibits, Financial Statement Schedules.

The following documents are filed as part of this Annual Report on Form 10-K or incorporated by reference as indicated:

(a) *Financial Statements, Schedules, and Exhibits.* We have listed our consolidated financial statements filed as part of this annual report in the index to consolidated financial statements on page F-1.

(b) *Exhibits.* We have listed the exhibits filed as part of this annual report in the accompanying exhibit index, which follows the signature page to this annual report.

(c) *Financial Statement Schedules.* We have omitted all financial statement schedules because they are not applicable or not required or because we have included the necessary information in our consolidated financial statements or related notes.

Item 16. Form 10-K Summary.

None.

INDEX TO CONSOLIDATED FINANCIAL STATEMENTS
HARVARD BIOSCIENCE, INC.

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REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

Board of Directors and Shareholders
Harvard Bioscience, Inc.

Opinion on the financial statements

We have audited the accompanying consolidated balance sheets of Harvard Bioscience, Inc. (a Delaware corporation) and subsidiaries (the “Company”) as of December 31, 2022 and 2021, the related consolidated statements of operations, comprehensive income (loss), stockholders’ equity, and cash flows for each of the two years in the period ended December 31, 2022, and the related notes (collectively referred to as the “financial statements”). In our opinion, the financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2022 and 2021, and the results of its operations and its cash flows for each of the two years in the period ended December 31, 2022, in conformity with accounting principles generally accepted in the United States of America.

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, 2022, based on criteria established in the 2013 *Internal Control—Integrated Framework* issued by the Committee of Sponsoring Organizations of the Treadway Commission (“COSO”), and our report dated March 9, 2023 expressed an unqualified opinion.

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 matter

The critical audit matter communicated below is a matter arising from the current period audit of the financial statements that was communicated or required to be communicated to the audit committee and that: (1) relates 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 financial statements, taken as a whole, and we are not, by communicating the critical audit matter below, providing a separate opinion on the critical audit matter or on the accounts or disclosures to which it relates.

Preferred shares received in settlement of indemnification obligation

As described further in note 2 to the financial statements, the Company received 4,000 shares of Series E Convertible Preferred Stock from Biostage, Inc. (a former subsidiary of the Company) in connection with the settlement of an indemnification obligation to the Company. We identified the valuation and accounting for the receipt of these shares as a critical audit matter.

The principal considerations for our determination that the valuation and accounting for the receipt of these shares is a critical audit matter are (1) applying the accounting guidance for the initial recording of the shares requires judgement (2) estimating the fair value of the shares is complex and requires specialized skills and knowledge. These considerations heightened the complexity surrounding the design and execution of audit procedures to respond to this risk.

Our audit procedures related to the valuation and accounting for the receipt of these shares include the following, among others.

- We consulted with our national office resources regarding management's accounting conclusion that the shares should be initially recorded at fair value.
- We utilized personnel with specialized skill and knowledge to assist in evaluating the appropriateness of management's conclusions around the fair value methodology, inputs and key assumptions used by management in the valuation of the Series E Convertible Preferred Stock.
- We obtained an understanding, evaluated the design, and tested the operating effectiveness of controls related to the valuation and accounting for the receipt of the Series E Convertible Preferred Stock from Biostage.

/s/ GRANT THORNTON LLP

We have served as the Company's auditor since 2017.

Hartford, Connecticut
March 9, 2023

HARVARD BIOSCIENCE, INC.
CONSOLIDATED BALANCE SHEETS
(Unaudited, in thousands, except share and per share data)

	December 31,	
	2022	2021
<u>Assets</u>		
Current assets:		
Cash and cash equivalents	\$ 4,508	\$ 7,821
Accounts receivable, net.....	16,705	21,834
Inventories	26,439	27,587
Other current assets.....	3,472	4,341
Total current assets.....	51,124	61,583
Property, plant and equipment, net.....	3,366	3,415
Operating lease right-of-use assets.....	5,816	6,897
Goodwill.....	56,260	57,689
Intangible assets, net	21,014	27,385
Other long-term assets.....	7,780	5,375
Total assets.....	<u>\$ 145,360</u>	<u>\$ 162,344</u>
<u>Liabilities and Stockholders' Equity</u>		
Current liabilities:		
Current portion of long-term debt.....	\$ 3,811	\$ 3,235
Current portion of operating lease liabilities.....	2,135	2,142
Accounts payable.....	6,447	4,911
Deferred revenue	3,370	4,266
Other current liabilities	7,486	10,762
Total current liabilities	23,249	25,316
Long-term debt, net.....	43,013	45,095
Deferred tax liability	590	1,558
Operating lease liabilities	5,282	6,488
Other long-term liabilities	1,006	486
Total liabilities	73,140	78,943
Commitments and contingencies - Note 14		
Stockholders' equity:		
Preferred stock, par value \$0.01 per share, 5,000,000 shares authorized	-	-
Common stock, par value \$0.01 per share, 80,000,000 shares authorized: 42,081,707 shares issued and outstanding at December 31, 2022; 41,142,876 shares issued and outstanding at December 31, 2021	454	452
Additional paid-in-capital	229,008	225,650
Accumulated deficit.....	(142,190)	(132,674)
Accumulated other comprehensive loss.....	(15,052)	(10,027)
Total stockholders' equity	72,220	83,401
Total liabilities and stockholders' equity	<u>\$ 145,360</u>	<u>\$ 162,344</u>

See accompanying notes to condensed consolidated financial statements.

HARVARD BIOSCIENCE, INC.
CONSOLIDATED STATEMENTS OF OPERATIONS
(Unaudited, in thousands, except per share data)

	Year Ended December 31,	
	2022	2021
Revenues	\$ 113,335	\$ 118,904
Cost of revenues	52,516	51,252
Gross profit	60,819	67,652
Sales and marketing expenses.....	25,041	24,642
General and administrative expenses.....	24,493	24,305
Research and development expenses	12,329	10,799
Amortization of intangible assets.....	6,122	5,840
Settlement of litigation, net - Note 15.....	(233)	-
Total operating expenses	67,752	65,586
Operating (loss) income	(6,933)	2,066
Other (expense) income:		
Interest expense	(2,548)	(1,540)
Other income (expense), net	302	(666)
Total other expense	(2,246)	(2,206)
Loss before income taxes	(9,179)	(140)
Income tax expense	337	148
Net loss.....	\$ (9,516)	\$ (288)
Loss per share:		
Basic and diluted.....	\$ (0.23)	\$ (0.01)
Weighted-average common shares:		
Basic and diluted.....	41,413	40,343

See accompanying notes to condensed consolidated financial statements.

HARVARD BIOSCIENCE, INC.
CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME (LOSS)
(Unaudited, in thousands)

	Year Ended December 31,	
	2022	2021
Net loss.....	\$ (9,516)	\$ (288)
Other comprehensive (loss) income:		
Foreign currency translation adjustments	(2,960)	(2,353)
Defined benefit pension plans, net of tax.....		
Net (loss) gain, net of tax expense of \$(695) and \$ 1,160, respectively.....	(2,085)	4,946
Amounts reclassified from accumulated other comprehensive loss to net loss, net of tax expense of \$7 and \$105, respectively	20	446
Defined benefit pension plans, net of tax	(2,065)	5,392
Other comprehensive (loss) income	(5,025)	3,039
Comprehensive (loss) income	\$ (14,541)	\$ 2,751

See accompanying notes to consolidated financial statements.

HARVARD BIOSCIENCE, INC.
CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY
(Unaudited, in thousands)

	Number of Shares Issued	Common Stock	Additional Paid-in Capital	Accumulated Deficit	Accumulated Other Comprehensive Loss	Treasury Stock	Total Stockholders' Equity
Balance at December 31,							
2020	47,153	\$ 444	\$ 232,357	\$ (132,386)	\$ (13,066)	\$ (10,668)	\$ 76,681
Retirement of treasury stock	(7,746)	-	(10,668)	-	-	\$ 10,668	-
Stock option exercises	580	8	2,869	-	-	-	2,877
Employee stock purchase plan	96	-	437	-	-	-	437
Vesting of restricted stock units	1,571	-	-	-	-	-	-
Shares withheld for taxes.	(511)	-	(3,514)	-	-	-	(3,514)
Stock-based compensation expense	-	-	4,169	-	-	-	4,169
Net loss	-	-	-	(288)	-	-	(288)
Other comprehensive income	-	-	-	-	3,039	-	3,039
Balance at December 31,							
2021	41,143	\$ 452	\$ 225,650	\$ (132,674)	\$ (10,027)	\$ -	\$ 83,401
Stock option exercises	40	2	106	-	-	-	108
Employee stock purchase plan	176	-	469	-	-	-	469
Vesting of restricted stock units	1,135	-	-	-	-	-	-
Shares withheld for taxes.	(412)	-	(1,628)	-	-	-	(1,628)
Stock-based compensation expense	-	-	4,411	-	-	-	4,411
Net loss	-	-	-	(9,516)	-	-	(9,516)
Other comprehensive loss	-	-	-	-	(5,025)	-	(5,025)
Balance at December 31,							
2022	42,082	\$ 454	\$ 229,008	\$ (142,190)	\$ (15,052)	\$ -	\$ 72,220

See accompanying notes to consolidated financial statements.

HARVARD BIOSCIENCE, INC.
CONSOLIDATED STATEMENTS OF CASH FLOWS
(Unaudited, in thousands)

	Year Ended December 31,	
	2022	2021
Cash flows from operating activities:		
Net loss.....	\$ (9,516)	\$ (288)
Adjustments to reconcile net loss to net cash provided by operating activities:		
Depreciation.....	1,453	1,781
Amortization of intangible assets.....	6,122	5,840
Amortization of deferred financing costs.....	280	280
Stock-based compensation expense.....	4,411	4,169
Deferred income taxes and other	(414)	(330)
Convertible Preferred Stock received in Biostage Settlement - Note 15	(3,900)	-
Changes in operating assets and liabilities:		
Accounts receivable.....	4,780	(4,294)
Inventories	252	(5,861)
Other assets.....	474	(439)
Accounts payable and accrued expenses	(1,399)	2,454
Deferred revenue	(851)	505
Other liabilities	(540)	(2,555)
Net cash provided by operating activities	<u>1,152</u>	<u>1,262</u>
Cash flows from investing activities:		
Additions to property, plant and equipment.....	(1,590)	(1,195)
Additions to intangible assets	-	(150)
Net cash used in investing activities.....	<u>(1,590)</u>	<u>(1,345)</u>
Cash flows from financing activities:		
Borrowing on bank line of credit.....	7,800	4,250
Repayment on bank line of credit	(6,400)	(2,200)
Repayment of term debt.....	(3,186)	(2,000)
Debt issuance costs	-	(102)
Proceeds from exercise of stock options and employee stock purchase plan	577	3,314
Taxes paid related to net share settlement of equity awards.....	(1,628)	(3,514)
Net cash used in financing activities	<u>(2,837)</u>	<u>(252)</u>
Effect of exchange rate changes on cash.....	(38)	(161)
Decrease in cash and cash equivalents	(3,313)	(496)
Cash and cash equivalents at beginning of period.....	7,821	8,317
Cash and cash equivalents at end of period.....	<u>\$ 4,508</u>	<u>\$ 7,821</u>
Supplemental disclosures of cash flow information:		
Cash paid for interest.....	\$ 2,314	\$ 1,577
Cash paid for income taxes, net of refunds.....	\$ 534	\$ 577

See accompanying notes to consolidated financial statements.

HARVARD BIOSCIENCE, INC.
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

1. Organization

Harvard Bioscience, Inc., a Delaware corporation (the “Company”), is a leading developer, manufacturer and seller of technologies, products and services that enable fundamental advances in life science applications, including research, pharmaceutical and therapy discovery, bio-production and preclinical testing for pharmaceutical and therapy development. The Company’s products and services are sold globally to customers ranging from renowned academic institutions and government laboratories to the world’s leading pharmaceutical, biotechnology and contract research organizations. With operations in North America, Europe and China, the Company sells through a combination of direct and distribution channels to customers around the world.

Risks and Uncertainties

The global supply chain has experienced significant disruptions due to electronic component and labor shortages and other macroeconomic factors which have emerged since the onset of COVID-19, leading to increased cost of freight, purchased materials, and manufacturing labor costs, while also delaying customer shipments. The Company believes these supply chain trends will continue into 2023. These conditions, in addition to the overall impact on the global economy, have negatively impacted the Company’s results of operations and cash flows.

Additionally, during 2022 the global economy has experienced high levels of inflation, rising interest rates, significant fluctuations in currency values, and increasing economic uncertainty, particularly in Europe. The Company’s results of operations have been negatively impacted by higher costs of raw materials, labor and freight resulting from inflationary pressures. These factors and global events including the ongoing military conflict between Russia and Ukraine, a softening economy in Europe, and rising interest rates on the Company’s debt have had a negative impact on the Company’s results of operations.

The COVID-19 pandemic has had a negative impact on the Company’s operations to date and the future impacts of the pandemic and any resulting economic impact are continuously evolving. During the beginning of 2022, China implemented area-wide shutdowns in order to control the spread of COVID-19, which continued in different parts of China throughout 2022. Such shutdowns had an adverse impact on the Company’s financial results for fiscal 2022.

If business interruptions resulting from the current macroeconomic conditions described above or from COVID-19 were to be prolonged or expanded in scope, the Company’s business, financial condition, results of operations and cash flows would likely be negatively impacted. If the impacts of the supply chain disruptions are more severe than the Company expect, it could result in longer lead times and further increased costs, all of which could materially adversely affect the Company’s business, financial condition and results of operations

2. Summary of Significant Accounting Policies

Principles of Consolidation

The consolidated financial statements include the accounts of Harvard Bioscience, Inc. and its wholly-owned subsidiaries. All intercompany balances and transactions have been eliminated in consolidation.

Use of Estimates

The preparation of financial statements in conformity with generally accepted accounting principles in the United States requires the use of management estimates. Such estimates include the determination and establishment of certain accruals and provisions, including those for inventory excess and obsolescence, income tax and reserves for bad debts as well as the defined benefit pension obligations. Estimates are also required to evaluate the value and recoverability of existing long-lived and intangible assets, including goodwill and the convertible preferred stock of Biostage held by the Company. On an ongoing basis, the Company reviews its estimates based upon currently available information. Actual results could differ materially from those estimates.

Cash and Cash Equivalents

The Company considers all highly liquid instruments with original maturities of three months or less to be cash equivalents. Cash and cash equivalents include cash on hand and amounts due from banks. Cash and cash equivalents totaled \$4.5 million at December 31, 2022, of which approximately 56% was held by the Company's foreign subsidiaries and subject to repatriation tax considerations. These foreign funds were held primarily by subsidiaries in the United Kingdom, Germany, and Spain. The Company has cash holdings in financial institutions that exceed insured limits for such financial institutions. The Company mitigate this risk by utilizing international financial institutions of high credit quality.

Allowance for Doubtful Accounts

The allowance for doubtful accounts reflects the Company's best estimate of probable losses inherent in the accounts receivable balance. The Company determines the allowance based on considering factors such as historical experience, credit quality, known troubled accounts, historical experience, factors that may affect a customer's ability to pay and other currently available evidence.

Inventories

The Company values its inventories at the lower of the actual cost to purchase (first-in, first-out method) and/or manufacture the inventories or the net realizable value of the inventories. The Company regularly reviews inventory quantities on hand and records a provision to write down excess and obsolete inventories to its estimated net realizable value if less than cost, based primarily on historical inventory usage and estimated forecast of product demand.

Property, Plant and Equipment

Property, plant and equipment are stated at cost and depreciated using the straight-line method over the estimated useful lives of the assets as follows:

Machinery and equipment (years).....	3 - 10
Computer equipment and software (years)	3 - 7
Furniture and fixtures (years).....	5 - 10

Leasehold improvements are amortized using the straight-line method over the shorter of the lease term or estimated useful life of the asset.

Leases

The Company leases office space, manufacturing facilities, automobiles and equipment. The Company concludes on whether an arrangement is a lease at inception. This determination as to whether an arrangement contains a lease is based on an assessment as to whether a contract conveys the right to the Company to control the use of identified property, plant or equipment for period of time in exchange for consideration. Leases with an initial term of 12 months or less are not recorded on the balance sheet. The Company recognizes these lease expenses on a straight-line basis over the lease term.

The Company has assessed its contracts and concluded that its leases consist of operating leases. Operating leases are included in operating lease right-of-use ("ROU") assets, current portion of operating lease liabilities, and operating lease liabilities in the Company's consolidated balance sheets.

ROU 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 ROU assets and liabilities are recognized at commencement date based on the present value of lease payments over the lease term. As most of the Company's leases do not provide an implicit rate, the Company determines an incremental borrowing rate based on the information available at commencement date in determining the present value of lease payments. The incremental borrowing rate represents a significant judgment that is based on an analysis of the Company's credit rating, country risk, treasury and corporate bond yields, as well as comparison to the Company's borrowing rate on its most recent loan. The Company uses the implicit rate when readily determinable. The Company has lease agreements with lease and non-lease components, which are generally accounted for separately.

Income Taxes

Income taxes are accounted for under the asset and liability method. Deferred tax assets and liabilities are recognized for the future tax consequences attributable to differences between the financial statement carrying amounts of existing assets and liabilities and their respective tax bases. Deferred tax assets and liabilities are measured using enacted tax rates expected to be applied to taxable income in the years in which those temporary differences are expected to be recovered or settled. The effect on deferred tax assets and liabilities of a change in tax rates is recognized in income in the period that includes the enactment date.

The Company recognizes the effect of income tax positions only if those positions are more likely than not of being sustained. Recognized income tax positions are measured at the largest amount that is more than 50% likely of being realized. Changes in recognition are reflected in the period in which the judgement occurs.

The Company's policy is to account for Global Intangible Low-Taxed income as a period cost.

Foreign Currency Translation

The functional currency of the Company's foreign subsidiaries is generally their local currency. All assets and liabilities of its foreign subsidiaries are translated at exchange rates in effect at period-end. Income and expenses are translated at rates which approximate those in effect on the transaction dates. The resulting translation adjustment is recorded as a separate component of stockholders' equity in accumulated other comprehensive (loss) income ("AOCI") in the consolidated balance sheets. Gains and losses resulting from foreign currency transactions are included in net (loss) income.

Earnings per Share

Basic earnings per share is computed by dividing net income by the weighted average number of shares of common stock outstanding during the periods presented. The computation of diluted earnings per share is similar to the computation of basic earnings per share, except that the denominator is increased for the assumed exercise of dilutive options and other potentially dilutive securities using the treasury stock method unless the effect is antidilutive.

Comprehensive Income (Loss)

The Company reports all changes in equity during a period, resulting from net income (loss) and transactions from non-owner sources, in a financial statement in the period in which they are recognized. The Company discloses comprehensive income (loss), which encompasses net income (loss), foreign currency translation adjustments, gains and losses on derivatives, the underfunded status of its pension plans, and pension minimum additional liability adjustments, net of tax, in the consolidated statements of comprehensive income (loss).

Revenue Recognition

Nature of contracts and customers

The Company's contracts are primarily of short duration and are mostly based on the receipt and fulfillment of purchase orders. The purchase orders are binding and include pricing and all other relevant terms and conditions.

The Company's customers are primarily research scientists at pharmaceutical and biotechnology companies, universities, hospitals, government laboratories, including the United States National Institutes of Health and contract research organizations. The Company also has global and regional distribution partners, and original equipment manufacturer customers who incorporate its products into their products under their own brands.

Performance obligations

The Company's performance obligations under its revenue contracts consist of its instruments, equipment, accessories, services, maintenance and extended warranties. Equipment also includes software that functions together with the tangible equipment to deliver its essential functionality. Contracts with customers may contain multiple promises such as delivery of hardware, software, professional services or post-contract support services. These promises are accounted for as separate performance obligations if they are distinct. For contracts with customers that contain multiple performance obligations, the transaction price is allocated to the separate performance obligations based on estimated relative standalone

selling price, which does not materially differ from the stated price in the contract. In general, the Company's list prices are indicative of standalone selling price.

Instruments, equipment and accessories consist of a range of products that are used in life sciences research. Revenues from the sales of these items are recognized when transfer of control of these products to the customer occurs. Transfer of control occurs when the Company has a right to payment, and the customer has legal title to the asset and the customer or their selected carrier has possession, which is typically upon shipment. Sales on these items are therefore generally recognized at a point in time.

The Company's equipment revenue also includes the sale of wireless implantable monitors that are used for life science research purposes. The Company sells these wireless implantable monitors to pharmaceutical companies, contract research organizations and academic laboratories. In addition to sales generated from new and existing customers, these implantable devices are also sold under a program called the "exchange program." Under this program, customers may return an implantable monitor to the Company after use, and if the returned monitor can be reprocessed and resold, they may, in exchange, purchase a replacement implantable monitor of the same model at a lower price than a new monitor. The implantable monitors that are returned by customers are reprocessed and made available for future sale. The initial sale of implantable monitors and subsequent sale of replacement implantable monitors are independent transactions. The Company has no obligation in connection with the initial sale to sell replacement implantable monitors at any future date under any fixed terms and may refuse returned implantable monitors that cannot be recovered or are obsolete. The Company has concluded that the offer to its customers that they may purchase a discounted product in the future is not a material right.

Service revenue consists of installation, training, data analysis, and surgeries performed on research animals. Maintenance revenue consists of post-contract support provided in relation to software that is embedded within the equipment that is sold to the customer. The Company provides standard warranties that promise the customer that the product will work as promised. These standard warranties are not a separate performance obligation. Extended warranties relate to warranties that are separately priced, and purchased in addition to a standard warranty, and are therefore a separate performance obligation. The Company has made the judgment that the customer benefits as the Company performs over the period of the contract, and therefore revenues from service, maintenance and warranty contracts are recognized over time. The Company uses the input method to recognize revenue over time, based on time elapsed, which is generally on a straight-line basis over the service period. The period over which maintenance and warranty contracts is recognized is typically one year. The period over which service revenue is recognized is generally less than one month.

For sales for which transfer of control occurs upon shipment, the Company accounts for shipping and handling costs as fulfillment costs. As such, the Company records the amounts billed to the customer for shipping costs as revenue and the costs within cost of revenues upon shipment. For sales, for which control transfers to customers after shipment, the Company has elected to account for shipping and handling as activities to fulfill the promise to transfer the goods to the customer. The Company therefore accrues for the costs of shipping undelivered items in the period of shipment.

Revenues expected to be recognized related to remaining performance obligations are generally expected to be recognized in one year or less, as the majority of the Company's contracts have a term of less than one year.

Variable Consideration

The nature of the Company's contracts gives rise to certain types of variable consideration, including in limited cases volume and payment discounts. The Company analyzes sales that could include variable consideration and estimates the expected or most likely amount of revenue after returns, trade-ins, discounts, rebates, credits, and incentives. Product returns are estimated and accrued for, based on historical information. In making these estimates, the Company considers whether the amount of variable consideration is constrained and is included in revenue only to the extent that it is probable that a significant reversal of the revenue recognized will not occur when the uncertainty associated with the variable consideration is subsequently resolved. Variable consideration, and its impact on the Company's revenue recognition, was not material in any of the periods presented.

The Company's payment terms are generally from zero to sixty days from the time of invoicing, which generally occurs at the time of shipment or prior to services being performed. Payment terms vary by the type of customers and the products or services offered.

Sales taxes, value added taxes, and certain excise taxes collected from customers and remitted to governmental authorities are accounted for on a net basis and are therefore excluded from revenues.

Deferred revenue

The Company records deferred revenue when cash is collected from customers prior to satisfaction of the Company's performance obligation to the customer. Deferred revenue consists of amounts deferred related to service contracts and revenue deferred as a result of payments received in advance from customers. Deferred revenue is generally expected to be recognized within one year.

The amounts included in deferred revenue from advanced payments relate to amounts that are prepaid for wireless implantable monitors under the exchange program. The Company has made the judgment that these payments do not represent a significant financing component as the customer can exercise their discretion as to when they can obtain the products that they have made a prepayment for.

Advanced payments received from customers are recorded as a liability, and revenue is recognized when the Company's performance obligations are completed. Performance obligations are completed when the product is shipped or delivered to the customer, or at the end of the exchange program if goods are not acquired prior to the termination of the contract period.

Disaggregation of revenue

Refer to Note 12 for revenue disaggregated by type as well as further information about the deferred revenue balances and to Note 16 for revenue disaggregated by geographic region.

Definite-lived Intangible Assets

Definite-lived Intangible assets are comprised of existing technology, customer contracts and contractual relationships, and other definite-lived intangible assets. Identifiable intangible assets resulting from the acquisitions of entities accounted for using the purchase method of accounting are estimated by the Company based on the fair value of assets received. Identifiable definite-lived intangible assets are being amortized over the period of estimated benefit using the straight-line method and estimated useful lives ranging from four to fifteen years.

The Company amortizes definite-lived intangible assets over their estimated useful lives and evaluates definite-lived assets for impairment whenever events or changes in circumstances indicate the carrying value of an asset may not be recoverable. The carrying value is not recoverable if it exceeds the undiscounted cash flows resulting from the use of the asset and its eventual disposition. The Company's estimate of future cash flows attributable to intangible assets requires significant judgment based on historical and anticipated results and are subject to many factors. Factors which could trigger an impairment review include significant negative industry or economic trends, significant loss of clients, and significant changes in the manner of the Company's use of the acquired assets or the strategy for its overall business.

When the Company determines that the carrying value of the assets may not be recoverable based upon the existence of one or more of the above indicators of impairment, the Company measures the potential impairment based on a projected discounted cash flow method using a discount rate determined by management to be commensurate with the risk inherent in its current business model. An impairment loss is recognized only if the carrying amount of the asset is not recoverable and exceeds its fair value. Different assumptions and judgments could materially affect the calculation of the fair value of our assets.

Goodwill

Goodwill acquired in a business combination and determined to have an indefinite useful life is not amortized, but instead is tested for impairment annually or more frequently if events or changes in circumstances indicate that the asset might be impaired.

For the purpose of its goodwill analysis, the Company has one reporting unit. The Company conducts its annual impairment analysis in the fourth quarter of the fiscal year and more frequently if there is an indicator of impairment. The Company assesses qualitative factors of the reporting unit to determine whether it is more likely than not that the fair value of the reporting unit is less than its carrying value. If the qualitative assessment indicates a potential impairment, a quantitative analysis is performed. The Company compares the fair value of the reporting unit with its carrying amount. The Company typically estimates fair value using the income approach but will also consider market approaches when appropriate. Under the income approach, the Company uses a discounted cash flows model, which indicates the fair value of the reporting unit based on the present value of the cash flows that the Company expects the reporting unit to generate in the future. The

Company's significant estimates in the discounted cash flows model include weighted average cost of capital, long-term rate of growth and profitability of the reporting unit's business, expected income tax rates, and working capital effects. If the carrying amount of a reporting unit exceeds its fair value, goodwill is impaired, and the Company would recognize a loss equal to the excess.

The Company evaluated its goodwill for impairment as of October 1, 2022 using a quantitative analysis under which a discounted cash flow analysis was prepared to determine whether the fair value of the reporting unit is less than its carrying value. Based on these analyses, we have determined that as of October 1, 2022, the fair value of our reporting unit exceeded the carrying value.

Impairment of Long-Lived Assets

The Company assesses recoverability of its long-lived assets that are held for use, such as property, plant and equipment and amortizable intangible assets in accordance with ASC 360, "Property, Plant and Equipment" when events or changes in circumstances indicate that the carrying amount of an asset or asset group may not be recoverable. Recoverability of assets or an asset group to be held and used is measured by a comparison of the carrying amount of an asset or asset group to estimated undiscounted future cash flows expected to be generated by the asset or the asset group. Cash flow projections are based on trends of historical performance and management's estimate of future performance. If the carrying amount of the asset or asset group exceeds the estimated future cash flows, an impairment charge is recognized by the amount by which the carrying amount of the asset or asset group exceeds its estimated fair value. For the year ended December 31, 2022, the Company concluded that none of its long-lived assets were impaired.

Derivatives

The Company monitors interest rate risk attributable to both its outstanding and forecasted debt obligations and may use interest-rate-related derivative instruments to manage its exposure related to changes in interest rates on its variable-rate debt instruments. The Company does not enter into derivative instruments for any purpose other than cash flow hedging. The Company does not speculate using derivative instruments. The Company recognizes all derivative instruments as either assets or liabilities in the balance sheet at their respective fair values. For derivatives designated in hedging relationships, changes in the fair value are either offset through earnings against the change in fair value of the hedged item attributable to the risk being hedged or recognized in AOCI, to the extent the derivative is effective at offsetting the changes in cash flows being hedged until the hedged item affects earnings.

Valuation of Investment in Preferred Stock

On June 10, 2022, Biostage, Inc., issued 4,000 shares of its Series E Convertible Preferred Stock (the "Series E Preferred Stock") to the Company in satisfaction of \$4.0 million of Biostage's indemnification obligation to the Company in connection with the settlement of litigation involving Biostage, Inc. and other third parties. (See Note 15 – Litigation Settlement)

The Company recorded the Series E Preferred Stock at an initial estimated fair value of \$3.9 million using an income approach which considered a discount rate and an estimated time until conversion into Biostage Inc. common stock. The Company has elected the provisions within ASC 321 *Investment Securities* to subsequently measure its investment at cost minus impairment, if any, plus or minus observable price changes. As of December 31, 2022, there have been no measurement adjustments to the carrying value of the Series E Preferred Stock.

Fair Value of Financial Instruments

Financial reporting standards define a fair value hierarchy that consists of three levels:

- § Level 1 includes instruments for which quoted prices in active markets for identical assets or liabilities accessible to the Company at the measurement date.
- § Level 2 includes instruments for which the valuations are based on quoted prices for similar assets or liabilities, quoted prices in markets that are not active, or other inputs that are observable or can be corroborated by observable data for substantially the full term of the assets or liabilities.
- § Level 3 includes valuations based on inputs that are unobservable and significant to the overall fair value measurement.

The carrying values of the Company’s cash and cash equivalents, trade accounts receivable and trade accounts payable and short-term debt approximate their fair values because of the short maturities of those instruments. The fair value of the Company’s long-term debt approximates its carrying value and is based on the amount of future cash flows associated with the debt discounted using current borrowing rates for similar debt instruments of comparable maturity (Level 2).

Stock-based Compensation

The Company accounts for stock-based payment awards in accordance with the provisions of ASC 718, “Compensation—Stock Compensation”, which requires it to recognize compensation expense for all stock-based payment awards made to employees and directors including stock options, restricted stock units, and restricted stock units with a market condition issued under the Company’s 2021 Incentive Plan (the “2021 Incentive Plan”) and the Fourth Amended and Restated 2000 Stock Option and Incentive Plan (the “2000 Incentive Plan” and together with 2021 Incentive Plan, the “Incentive Plans”) as well as employee stock purchases (“employee stock purchases”) related to its Employee Stock Purchase Plan (as amended, the “ESPP”). The Company issues new shares from its registered but unissued stock pool to satisfy stock option exercises and vesting of the restricted stock units.

Stock-based compensation expense recognized is based on the value of the portion of stock-based payment awards that is ultimately expected to vest. The Company values stock-based payment awards, except restricted stock units at grant date using the Black-Scholes option-pricing model. The Company values restricted stock units with a market condition using a Monte-Carlo valuation simulation. The determination of fair value of stock-based payment awards on the date of grant using an option-pricing model or Monte-Carlo valuation simulation is affected by the Company’s stock price as well as assumptions regarding certain variables. These variables include, but are not limited to, the Company’s expected stock price volatility over the term of the awards and actual and projected stock option exercise behaviors.

The fair value of restricted stock units is based on the market price of the Company’s stock on the date of grant and are recorded as compensation expense on a straight-line basis over the applicable service period, which ranges from one to four years.

Recent Accounting Pronouncements

Accounting Pronouncements Adopted

In November 2021, the Financial Accounting Standards Board (“FASB”) issued Accounting standards Update (“ASU”) 2021-10, *Government Assistance (Topic 832), Disclosures by Business Entities About Government Assistance* (ASU 2021-10), which requires entities to provide disclosures on material government assistance transactions for annual reporting periods. The disclosures include information around the nature of the assistance, the related accounting policies used to account for government assistance, the effect of government assistance on the entity’s financial statements, and any significant terms and conditions of the agreements, including commitments and contingencies. The Company has adopted ASU 2021-10 effective January 1, 2022 and has elected to adopt the disclosure provisions of this ASU prospectively to all transactions that are reflected in the financial statements at the date of initial application and new transactions that are entered into after that date. The disclosures required by ASU 2021-10 is provided in Note 17.

Accounting Pronouncements to be Adopted

In January 2017, the FASB issued ASU 2017-04, *Intangibles—Goodwill and Other (Topic 350): Simplifying the Test for Goodwill Impairment* (ASU 2017-04), which eliminates the performance of Step 2 from the goodwill impairment test. In performing its annual or interim impairment testing, an entity will instead compare the fair value of the reporting unit with its carrying amount and recognize any impairment charge for the amount by which the carrying amount exceeds the reporting unit’s fair value. Additionally, an entity should consider income tax effects from any tax-deductible goodwill on the carrying amount of the reporting unit when measuring the goodwill impairment loss. ASU 2017-04 is effective for the Company for fiscal years beginning after December 15, 2022. The Company has determined that the adoption of ASU 2017-04 will not have a significant impact on its consolidated financial statements.

In September 2016, the FASB issued ASU No. 2016-13, *Financial Instruments—Credit Losses (Topic 326): Measurement of Credit Losses on Financial Instruments* (ASU 2016-13), which amends the impairment model by requiring entities to use a forward-looking approach based on expected losses rather than incurred losses to estimate credit losses on certain types of financial instruments, including trade receivables. This may result in the earlier recognition of allowances for losses. The FASB issued several ASUs after ASU 2016-13 to clarify implementation guidance and to provide transition relief for certain entities. ASU 2016-13 is effective for the Company for fiscal years beginning after December 15, 2022, with early

adoption permitted. The Company has determined that the adoption of ASU 2016-13 will not have a significant impact on its consolidated financial statements.

3. Accumulated Other Comprehensive Loss

Changes in the components of accumulated other comprehensive loss, net of tax, for the years ended December 31, 2022 and 2021, respectively, are as follows:

(in thousands)	Foreign currency translation adjustments	Defined benefit pension plans	Total
Balance at December 31, 2020	\$ (11,473)	\$ (1,593)	\$ (13,066)
Other comprehensive income (loss) before reclassifications	(2,353)	4,946	2,593
Amounts reclassified from AOCI	-	446	446
Net other comprehensive (loss) income	(2,353)	5,392	3,039
Balance at December 31, 2021	(13,826)	3,799	(10,027)
Other comprehensive income (loss) before reclassifications	(2,960)	(2,085)	(5,046)
Amounts reclassified from AOCI	-	20	20
Net other comprehensive (loss) income	(2,960)	(2,065)	(5,025)
Balance at December 31, 2022	<u>\$ (16,786)</u>	<u>\$ 1,734</u>	<u>\$ (15,052)</u>

4. Goodwill and Intangible Assets

The change in the carrying amount of goodwill is as follows:

(in thousands)	December 31,	
	2022	2021
Carrying amount at beginning of period	\$ 57,689	\$ 58,590
Effect of change in currency translation	(1,429)	(901)
Carrying amount at end of period	<u>\$ 56,260</u>	<u>\$ 57,689</u>

Identifiable intangible assets at December 31, 2022 and 2021 consist of the following:

(in thousands)		December 31, 2022			December 31, 2021		
Amortizable intangible assets:	Average Life*	Gross	Accumulated Amortization	Net	Gross	Accumulated Amortization	Net
Distribution agreements/customer relationships.....	7.2	\$ 16,124	\$ (8,727)	\$ 7,397	\$ 17,689	\$ (8,675)	\$ 9,014
Existing technology.....	3.2	37,549	(26,482)	11,067	38,707	(23,962)	14,745
Trade names and patents ..	3.7	7,523	(5,197)	2,326	8,496	(5,108)	3,388
Total amortizable intangible assets		<u>\$ 61,196</u>	<u>\$ (40,406)</u>	<u>\$ 20,790</u>	<u>\$ 64,892</u>	<u>\$ (37,745)</u>	<u>\$ 27,147</u>
Indefinite-lived intangible assets:.....				224			238
Total intangible assets.....				<u>\$ 21,014</u>			<u>\$ 27,385</u>

* Weighted average life in years as of December 31, 2022

During the year ended December 31, 2022, the Company wrote off approximately \$2.5 million of fully amortized intangible assets of certain customer relationships and other intangibles related to discontinued product lines.

Intangible asset amortization expense was \$6.1 million and \$5.8 million of the years ended December 31, 2022 and 2021, respectively. Estimated amortization expense of existing amortizable intangible assets for each of the five succeeding years and thereafter is as follows:

(in thousands)		
2023	\$	5,546
2024		5,248
2025		4,020
2026		2,359
2027		1,262
Thereafter.....		2,355
Total.....	\$	<u>20,790</u>

5. Balance Sheet Information

The following tables provide details of selected balance sheet items as of the periods indicated:

<i>Inventories:</i>	December 31,	
(in thousands)	2022	2021
Finished goods.....	\$ 5,223	\$ 5,646
Work in process	3,776	3,410
Raw materials	17,440	18,531
Total.....	<u>\$ 26,439</u>	<u>\$ 27,587</u>

<i>Property, Plant and Equipment:</i>	December 31,	
(in thousands)	2022	2021
Machinery and equipment	\$ 7,500	\$ 7,698
Computer equipment and software.....	6,781	6,269
Leasehold improvements.....	2,507	2,560
Furniture and fixtures	1,386	1,296
Automobiles	38	41
	<u>18,212</u>	<u>17,864</u>
Less: accumulated depreciation.....	(14,846)	(14,449)
Property, plant and equipment, net.....	<u>\$ 3,366</u>	<u>\$ 3,415</u>

During the year ended December 31, 2022, the Company wrote off approximately \$0.7 million of fully depreciated property and equipment from its fixed asset records.

<i>Other Current Liabilities:</i>	December 31,	
(in thousands)	2022	2021
Compensation	\$ 3,476	\$ 6,048
Professional fees.....	392	480
Warranty costs	268	240
Customer advances.....	2,368	2,265
Accrued income taxes.....	-	224
Other.....	982	1,505
Total.....	<u>\$ 7,486</u>	<u>\$ 10,762</u>

6. Restructuring and Other Exit Costs

On an ongoing basis, the Company reviews the global economy, the healthcare industry, and the markets in which it competes to identify operational efficiencies, enhance commercial capabilities and align its cost base and infrastructure with customer needs and its strategic plans. In order to realize these opportunities, the Company undertakes activities from time to time to transform its business. A portion of these transformation activities are considered restructuring costs under ASC 420 – *Exit or Disposal Cost Obligations* and are discussed below.

The Company initiated a restructuring plan in 2019 to improve operational efficiency and reduce costs which entailed consolidating and downsizing several sites and headcount reductions in Europe and North America. During the year ended December 31, 2021, the Company incurred \$1.3 million in expenses under this plan which was completed in 2021.

During the year ended December 31, 2022, the Company completed a review of its product portfolio and identified certain non-strategic products for discontinuation and recorded charges of \$1.5 million in cost of revenue. The Company also incurred \$0.9 million in severance expenses in connection with headcount reductions in Europe and North America.

The following table summarizes the restructuring activity for the years ended December 31, 2022 and 2021:

(in thousands)	Cost of			Total
	Revenues	Severance	Other	
Balance at December 31, 2020.....	\$ -	\$ 270	\$ 18	\$ 288
Restructuring and other exit costs ..	-	1,174	101	1,275
Non-cash charges	-	-	(46)	(46)
Cash payments	-	(1,444)	(73)	(1,517)
Balance at December 31, 2021.....	\$ -	\$ -	\$ -	\$ -
Restructuring and other exit costs ..	1,471	877	46	2,394
Non-cash charges	(1,471)	-	-	(1,471)
Cash payments	-	(241)	(46)	(287)
Balance at December 31, 2022.....	\$ -	\$ 636	\$ -	\$ 636

Substantially all of the severance and other costs detailed above have been included as a component of general and administrative expenses.

7. Related Party Transactions

In connection with the 2014 acquisitions of Multi Channel Systems MCS GmbH (“MCS”), the Company entered into a facility lease agreement with the former principal owner of this company who became an employee of the Company and subsequently retired in 2021. The MCS lease agreement expires on December 31, 2024. Pursuant to this lease agreement, the Company made rent payments of approximately \$0.3 million for each of the years ended December 31, 2022 and 2021.

8. Employee Benefit Plans

Employee Retirement Savings Plans

The Company sponsors various qualified employee retirement savings plans and makes discretionary contributions to match a certain portion of employee contributions. For the years ended December 31, 2022 and 2021, the Company contributed \$1.1 million and \$1.0 million, respectively, to these plans.

Employee Pension Plans

The Company’s subsidiary in the United Kingdom, Biochrom Limited maintains contributory, defined benefit pension plans for its employees. In 2014, these defined benefit pension plans were closed to new employees, as well as closed to the future accrual of benefits for existing employees. The provisions of ASC 715-20 require that the funded status of the pension plans be recognized in Company’s balance sheet. ASC 715-20 does not change the measurement or income statement recognition of these plans, although it does require that plan assets and benefit obligations be measured as of the balance

sheet date. The Company has historically measured the plan assets and benefit obligations as of the balance sheet date. The Company records net period benefit expense (credit) as a component of other expense in the Consolidated Statement of Operations.

The components of the Company's net period benefit (credit) expense were as follows:

(in thousands)	Year Ended December 31,	
	2022	2021
Interest cost.....	\$ 371	\$ 358
Expected return on plan assets.....	(818)	(675)
Net amortization loss.....	27	551
Recognition of net loss due to settlements	-	115
Net periodic benefit (credit) cost.....	<u>\$ (420)</u>	<u>\$ 349</u>

The following provides a reconciliation of the changes in the plans' benefit obligations and fair value of assets for the years ended December 31, 2022 and 2021, and a statement of the funded status as of December 31, 2022 and 2021:

(in thousands)	December 31,	
	2022	2021
Change in benefit obligation:		
Balance at beginning of year.....	\$ 22,562	\$ 25,519
Interest cost.....	371	358
Actuarial (gain) loss.....	(6,912)	(2,440)
Settlements due to transfers paid	-	(198)
Benefits paid	(592)	(498)
Currency translation adjustment	(2,166)	(179)
Balance at end of year.....	<u>\$ 13,263</u>	<u>\$ 22,562</u>

Changes in the actuarial gain disclosed above are primarily the result of changes in the discount rate and inflation assumptions due to underlying market conditions.

(in thousands)	December 31,	
	2022	2021
Change in fair value of plan assets:		
Balance at beginning of year.....	\$ 27,252	\$ 23,926
Actual return on plan assets	(9,098)	3,354
Employer contributions.....	619	1,042
Settlement due to transfers paid.....	-	(270)
Benefits paid	(592)	(498)
Currency translation adjustment	(2,605)	(302)
Balance at end of year.....	<u>\$ 15,576</u>	<u>\$ 27,252</u>

(in thousands)	December 31,	
	2022	2021
Benefit obligation.....	\$ 13,263	\$ 22,562
Fair value of plan assets	15,576	27,252
Net funded status	<u>\$ 2,313</u>	<u>\$ 4,690</u>

The amounts recognized in the consolidated balance sheets consist of:

(in thousands)	December 31,	
	2022	2021
Other long-term assets.....	\$ 2,313	\$ 4,690
Deferred income tax liabilities	(579)	(891)
Recognized in accumulated other comprehensive loss...	<u>\$ 1,734</u>	<u>\$ 3,799</u>

The weighted average assumptions used in determining the net pension cost for these plans follows:

	Year Ended December 31,	
	2022	2021
Discount rate.....	5.0%	1.8%
Expected return on assets	5.0%	2.8%

The discount rate assumptions used for pension accounting reflect the prevailing rates available on high-quality, fixed-income debt instruments with terms that match the average expected duration of the Company's defined benefit pension plan obligations.

The Company's mix of pension plan investments among asset classes also affects the long-term expected rate of return on plan assets. As of December 31, 2022, the Company's actual asset mix approximated its target mix. Differences between actual and expected returns are recognized in the calculation of net periodic pension cost over the average remaining expected future working lifetime, which is approximately 8 years of active plan participants.

The fair value and asset allocations of the Company's pension benefits as of December 31, 2022 and 2021 measurement dates were as follows:

(in thousands)	December 31,			
	2022		2021	
Asset category:				
Equity securities	\$ 3,507	23 %	\$ 14,295	52 %
Debt securities	11,714	75 %	4,720	17 %
Liability driven investment funds.....	-	-	5,722	21 %
Cash and cash equivalents	185	1 %	1,907	7 %
Other.....	170	1 %	608	2 %
Total	<u>\$ 15,576</u>	<u>100 %</u>	<u>\$ 27,252</u>	<u>100 %</u>

Financial reporting standards define a fair value hierarchy that consists of three levels. The fair values of the plan assets by fair value hierarchy level as of December 31, 2022 and 2021, is as follows:

(in thousands)	December 31,	
	2022	2021
Quoted Prices in Active Markets for Identical Assets (Level 1)	\$ 185	\$ 1,907
Significant Other Observable Inputs (Level 2).....	15,391	25,345
Significant Other Unobservable Inputs (Level 3).....	-	-
Total.....	<u>\$ 15,576</u>	<u>\$ 27,252</u>

Level 1 assets consist of cash and cash equivalents held in the pension plans. The Level 2 assets primarily consist of investments in private investment funds that are valued using the net asset values provided by the trust or fund, including an insurance contract. Although these funds are not traded in an active market with quoted prices, the investments underlying the net asset value are based on quoted prices.

The Company expects to contribute approximately \$0.6 million to its pension plans during 2023. The benefits expected to be paid from the pension plans are \$0.7 million in 2023, \$0.7 million in 2024, \$0.8 million in 2025, \$0.9 million in 2026 and \$0.7 million in 2027. The expected benefits to be paid in the five years from 2028 to 2032 are \$4.5 million. The expected benefits are based on the same assumptions used to measure the Company's benefit obligations at December 31, 2022.

9. Leases

The Company has noncancelable operating leases for office space, manufacturing facilities, warehouse space, automobiles and equipment expiring at various dates through 2030.

The components of lease expense for the years ended December 31, 2022 and 2021 are as follows:

(in thousands)	Year Ended December 31,	
	2022	2021
Operating lease cost.....	\$ 1,971	\$ 2,041
Short-term lease cost.....	233	196
Sublease income	(102)	(102)
Total lease cost.....	<u>\$ 2,102</u>	<u>\$ 2,135</u>

Supplemental cash flow information related to the Company's operating leases was as follows:

(in thousands)	Year Ended December 31,	
	2022	2021
Cash paid for amounts included in the measurement of lease liabilities:....	\$ 2,347	\$ 2,365
Right-of-use assets obtained in exchange for lease obligations:.....	\$ 295	\$ 524

Supplemental balance sheet information related to the Company's operating leases was as follows:

(in thousands)	December 31,	
	2022	2021
Operating lease right-of-use assets	\$ 5,816	\$ 6,897
Current portion, operating lease liabilities.....	\$ 2,135	\$ 2,142
Operating lease liabilities, long-term.....	5,282	6,488
Total operating lease liabilities	<u>\$ 7,417</u>	<u>\$ 8,630</u>
Weighted average remaining lease term (years).....	6.2	6.7
Weighted average discount rate	9.4%	9.3%

Future minimum lease payments for operating leases, with initial terms in excess of one year at December 31, 2022, are as follows:

(in thousands)	
2023.....	\$ 2,135
2024.....	1,794
2025.....	1,064
2026.....	1,022
2027.....	1,004
Thereafter	2,995
Total lease payments	<u>10,014</u>
Less imputed interest.....	<u>(2,597)</u>
Total operating lease liabilities.....	<u>\$ 7,417</u>

10. Capital Stock and Stock-Based Compensation

Retirement of Treasury Stock

In May 2021, the Company retired the 7.8 million shares of common stock held by the Company as treasury shares and returned these shares to the status of authorized and unissued shares of common stock.

Preferred Stock

The Company's Board of Directors has the authority to issue up to 5.0 million shares of preferred stock and to determine the price privileges and other terms of the shares. The Board of Directors may exercise this authority without any further approval of stockholders. As of December 31, 2022 and 2021, the Company had no preferred stock issued or outstanding.

Employee Stock Purchase Plan ("ESPP")

Under the ESPP, participating employees can authorize the Company to withhold a portion of their base pay during consecutive six-month payment periods for the purchase of shares of the Company's common stock. At the conclusion of the period, participating employees can purchase shares of the Company's common stock at 85% of the lower of the fair market value of the Company's common stock at the beginning or end of the period. Shares are issued under the ESPP for the six-month periods ending June 30 and December 31. There were 0.2 million and 0.1 million shares issued under the ESPP during the years ended December 31, 2022 and 2021, respectively. As of December 31, 2022, there were 0.4 million shares available for issuance under the ESPP.

Equity Incentive Plans

During 2021, the Company's Board of Directors and stockholders adopted the 2021 Incentive Plan which authorizes approximately 2.2 million additional shares available for grants to officers, employees, non-employee directors and other key persons of the Company and its subsidiaries. Approximately 2.1 million shares available under the prior plan were also made available for issuance under the 2021 Incentive Plan. As of December 31, 2022, there were approximately 3.9 million shares available for issuance under the 2021 Incentive Plan.

Performance Restricted Stock Units

The Company grants awards of Performance Market Condition RSUs (the "PRSUs") to certain members of the Company's management team. The vesting of the PRSUs is linked to the achievement of a relative total shareholder return of the Company's common stock measured from the earlier of (i) the measurement period as set out in the award agreement or (ii) upon a change of control (measured relative to the Nasdaq Biotechnology or Russell 2000 index and based on a 20-day trading average price).

For PRSUs granted during the year ended December 31, 2020, the total shareholder return of the Company's common stock relative to the applicable index resulted in a positive performance factor adjustment and the issuance of 163,216 of additional awards during the year ended December 31, 2021. PRSUs subject to vesting as of December 31, 2022 include 0.4 million awards which remain subject to a relative total shareholder return measurement which can result in vesting rates ranging from -0% to 150% of the target number.

Stock-Based Payment Awards

The Company accounts for stock-based payment awards in accordance with the provisions of FASB ASC 718, which requires it to recognize compensation expense for all stock-based payment awards made to employees and directors including stock options, restricted stock units, Market Condition RSUs and employee stock purchases related to the ESPP. The Company has elected as an accounting policy to account for forfeitures for service-based awards as they occur, with no adjustment for estimated forfeitures.

Stock option and restricted stock unit activity under the Company's Incentive Plans for the years ended December 31, 2022 and 2021 were as follows:

	Stock Options Outstanding	Weighted Average Exercise Price	Time-Based RSUs Outstanding	Grant Date Fair Value	Performance- Based RSUs Outstanding	Grant Date Fair Value
Balance at December 31, 2020	2,637,339	\$ 3.51	1,560,461	\$ 2.44	813,031	\$ 2.12
Granted	-	-	820,831	4.74	293,509	4.61
Exercised	(579,968)	3.77	-	-	-	-
Vested (RSUs)	-	-	(1,167,473)	2.88	(403,422)	2.11
Cancelled/Forfeited	(652,555)	4.24	(72,655)	3.67	(6,179)	2.98
Performance Factor Adjustment	-	-	-	-	163,216	2.98
Balance at December 31, 2021	1,404,816	\$ 3.10	1,141,164	\$ 3.57	860,155	\$ 3.13
Granted	-	-	918,870	4.64	320,272	5.08
Exercised	(40,267)	2.64	-	-	-	-
Vested (RSUs)	-	-	(733,611)	4.08	(401,308)	2.11
Cancelled/Forfeited	(125,773)	2.77	(232,622)	4.44	(132,884)	4.21
Balance at December 31, 2022	<u>1,238,776</u>	\$ 3.15	<u>1,093,801</u>	\$ 3.94	<u>646,235</u>	\$ 4.51

Earnings per share

Basic earnings per share is based upon net income divided by the number of weighted average common shares outstanding during the period. The calculation of diluted earnings per share assumes conversion of stock options, restricted stock units and Market Condition RSUs into common stock using the treasury method. The weighted average number of shares used to compute basic and diluted earnings per share consists of the following:

(in thousands)	Year Ended December 31,	
	2022	2021
Weighted average shares outstanding - basic	41,413	40,343
Dilutive effect of equity awards	-	-
Weighted average shares outstanding - diluted	<u>41,413</u>	<u>40,343</u>
Shares excluded from diluted loss per share due to their anti-dilutive effect....	<u>3,661</u>	<u>4,274</u>

The following table summarizes outstanding and exercisable options as of December 31, 2022 (Aggregate Intrinsic Value, in thousands):

Range of Exercise Price	Options Outstanding				Options Exercisable			
	Number Outstanding	Weighted Average Remaining Contractual Life in Years	Weighted Average Exercise Price	Aggregate Intrinsic Value	Shares Exercisable	Weighted Average Remaining Contractual Life in Years	Weighted Average Exercise Price	Aggregate Intrinsic Value
\$ 1.78 - 2.62	135,342	6.3	\$ 1.89	\$ 119	102,381	6.2	\$ 1.91	\$ 88
2.63 - 2.78	505,423	4.4	2.63	71	357,192	4.4	2.63	50
2.79 - 3.24	135,077	6.6	2.93	-	135,077	6.6	2.93	-
3.25 - 3.72	206,808	4.2	3.38	-	206,808	4.2	3.38	-
3.73 - 5.51	256,126	3.2	4.76	-	238,222	3.0	4.83	-
\$ 1.78 - 5.51	<u>1,238,776</u>	4.6	\$ 3.15	<u>\$ 190</u>	<u>1,039,680</u>	4.5	\$ 3.25	<u>\$ 138</u>

The aggregate intrinsic value in the preceding table represents the total pre-tax intrinsic value, based on the Company's closing stock price of \$2.77 as of December 31, 2022, which would have been received by the option holders had all option holders exercised their options as of that date. The aggregate intrinsic value of options exercised was \$0.1 million and \$1.3 million for the years ended December 31, 2022 and 2021, respectively.

As of December 31, 2022, the total compensation costs related to unvested awards not yet recognized is \$5.1 million and the weighted average period over which it is expected to be recognized is approximately 1.6 years. During the years ended December 31, 2022 and 2021, the Company did not capitalize any stock-based compensation.

Valuation and Expense Information under Stock-Based-Payment Accounting

Stock-based compensation expenses related to stock options, restricted stock units, Market Condition RSU's and the ESPP for the years ended December 31, 2022 and 2021 was allocated as follows:

(in thousands)	Year Ended December 31,	
	2022	2021
Cost of revenues.....	\$ 121	\$ 118
Sales and marketing expenses.....	557	507
General and administrative expenses.....	3,487	3,416
Research and development expenses.....	246	128
Total stock-based compensation expenses.....	<u>\$ 4,411</u>	<u>\$ 4,169</u>

The weighted average estimated fair value per share of the Market Condition RSUs granted during the years ended December 31, 2022 and 2021 was \$5.08 and \$4.61, respectively, using a Monte-Carlo valuation simulation, with the following weighted-average assumptions:

	2022	2021
Volatility.....	62.6%	65.1%
Risk-free interest rate.....	2.1%	0.3%
Correlation coefficient.....	41.5%	35.7%
Dividend yield.....	-%	-%

The Company used historical volatility to calculate the expected volatility. Historical volatility was determined by calculating the mean reversion of the daily adjusted closing stock price. The risk-free interest rate assumption is based upon observed U.S. Treasury bill interest rates (risk-free) appropriate for the term of the Company's stock options. The expected holding period of stock options represents the period of time options are expected to be outstanding and were based on historical experience. The vesting period ranges from one to four years and the contractual life is ten years.

11. Long-Term Debt

As of December 31, 2022 and December 31, 2021, the Company's borrowings were comprised of the following:

(in thousands)	December 31, 2022	December 31, 2021
Long-term debt:		
Term loan.....	\$ 34,814	\$ 38,000
Revolving line.....	12,850	11,450
Less: unamortized deferred financing costs.....	(840)	(1,120)
Total debt.....	<u>46,824</u>	<u>48,330</u>
Less: current installments.....	(4,091)	(3,515)
Current unamortized deferred financing costs.....	280	280
Long-term debt.....	<u>\$ 43,013</u>	<u>\$ 45,095</u>

The aggregate amounts of debt maturing during the next five years are as follows:

(in thousands)	
2023	\$ 4,091
2024	4,000
2025	39,573
	<u>\$ 47,664</u>

On December 22, 2020, the Company entered into a Credit Agreement (the “Credit Agreement”) with Citizens Bank, N.A., Wells Fargo Bank, National Association, and Silicon Valley Bank, (together, the “Lenders”). The Credit Agreement provides for a term loan of \$40.0 million and a \$25.0 million senior revolving credit facility (including a \$10.0 million sub-facility for the issuance of letters of credit and a \$10.0 million swingline loan sub-facility) (collectively, the “Credit Facility”). The Company’s obligations under the Credit Agreement are guaranteed by certain of the Company’s direct, domestic wholly-owned subsidiaries; none of the Company’s direct or indirect foreign subsidiaries has guaranteed the Credit Facility. The Company’s obligations under the Credit Agreement are secured by substantially all of the assets of Harvard Bioscience, Inc. and each guarantor (including all or a portion of the equity interests in certain of the Company’s domestic and foreign subsidiaries). The Credit Facility matures on December 22, 2025. Issuance costs of \$1.4 million are amortized over the contractual term to maturity date on a straight-line basis, which approximates the effective interest method. Available and unused borrowing capacity under the revolving line of credit was \$2.9 million as of December 31, 2022 based on the Credit Agreement, as amended pursuant to the April 2022 Amendment and November 2022 Amendment as described below. Total revolver borrowing capacity is limited by the consolidated net leverage ratio as defined under the amended Credit Agreement.

As part of the November 2022 Amendment, the Credit Facility’s LIBOR rate option was replaced with the Secured Overnight Financing Rate (“SOFR”). All references in this footnote to the LIBOR rate were changed to SOFR in connection with the November 2022 Amendment. Borrowings under the amended Credit Facility will, at the option of the Company, bear interest at either (i) a rate per annum based on SOFR for an interest period of one, two, three or six months, plus an applicable interest rate margin determined as provided in the Credit Agreement, as amended (a “SOFR Loan”), or (ii) an alternative base rate plus an applicable interest rate margin, each as determined as provided in the Credit Agreement (an “ABR Loan”). SOFR interest under the Credit Agreement is subject to applicable market rates and a floor of 0.50%. The alternative base rate is based on the Citizens Bank prime rate or the federal funds effective rate of the Federal Reserve Bank of New York and is subject to a floor of 1.0%. The applicable interest rate margin varies from 2.0% per annum to 3.25% per annum for SOFR Loans, and from 1.5% per annum to 3.0% per annum for ABR Loans, in each case depending on the Company’s consolidated leverage ratio and is determined in accordance with a pricing grid set forth in the Credit Agreement. Interest on SOFR Loans is payable in arrears on the last day of each applicable interest period, and interest on ABR Loans is payable in arrears at the end of each calendar quarter. There are no prepayment penalties in the event the Company elects to prepay and terminate the Credit Facility prior to its scheduled maturity date, subject to SOFR Loan breakage and redeployment costs in certain circumstances.

The effective interest rate on the Company’s borrowings for the years ended December 31, 2022 and 2021, was 5.0% and 3.3%, respectively, and the weighted average interest rate as of December 31, 2022 was 7.6%. The carrying value of the debt approximates fair value because the interest rate under the obligation approximates market rates of interest available to the Company for similar instruments.

Commencing on March 31, 2021, the outstanding term loans amortizes in equal quarterly installments equal to \$0.5 million per quarter on such date and during each of the next three quarters thereafter, \$0.75 million per quarter during the next eight quarters thereafter and \$1.0 million per quarter thereafter, with a balloon payment at maturity. Furthermore, within ninety days after the end of the Company’s fiscal year, the term loans may be permanently reduced pursuant to certain mandatory prepayment events including an annual “excess cash flow sweep” of 50% of the consolidated excess cash flow, as defined in the agreement; provided that, in any fiscal year, any voluntary prepayments of the term loans shall be credited against the Company’s “excess cash flow” prepayment obligations on a dollar-for-dollar basis for such fiscal year. As of December 31, 2022, the current portion of long-term debt includes an excess cash flow sweep of \$1.1 million to be paid by March 31, 2023. Amounts outstanding under the revolving credit facility can be repaid at any time but are due in full at maturity.

The Credit Agreement, as amended, includes customary affirmative, negative, and financial covenants binding on the Company. The negative covenants limit the ability of the Company, among other things, to incur debt, incur liens, make investments, sell assets and pay dividends on its capital stock. The financial covenants include a maximum consolidated net

leverage ratio and a minimum consolidated fixed charge coverage ratio. The Credit Agreement, as amended, also includes customary events of default.

The April 28, 2022 Amendment, among other things modified the financial covenant relating to the consolidated net leverage ratio, and consented to the Biostage Settlement, including without limitation the receipt by the Company of convertible preferred stock in Biostage, and the securities issuable upon conversion thereof, as partial payment for Biostage's indemnification obligations in connection with the Biostage Settlement. (See Note 15). In consideration for the April 28, 2022 Amendment, the Company paid fees of \$0.2 million to the Lenders and Administrative Agent.

The November 8, 2022 Amendment, among other things, modified the financial covenant relating to the consolidated net leverage ratio, and the definition of Consolidated EBITDA used in the calculation of certain financial covenants, including to exclude non-cash inventory charges related to the Company's decision to discontinue non-strategic products. In consideration for the November 2022 Amendment, the Company paid fees of \$0.2 million to the Lenders and Administrative Agent.

The Company was in compliance with the covenants of the Credit Agreement, as amended, as of December 31, 2022.

The Company monitors interest rate risk attributable to both its outstanding and forecasted debt obligations by the use of cash flow sensitivity analysis which estimates the expected impact of changes in interest rates on the Company's future cash flows.

12. Revenues

The following table represents a disaggregation of revenue from contracts with customers for the years ended December 31, 2022 and 2021:

(in thousands)	Year Ended December 31,	
	2022	2021
Instruments, equipment, software and accessories.....	\$ 108,165	\$ 114,115
Service, maintenance and warranty contracts	5,170	4,789
Total revenues	<u>\$ 113,335</u>	<u>\$ 118,904</u>

Deferred revenue

The following tables provide details of deferred revenue as of the periods indicated:

(in thousands)	December 31,	
	2022	2021
Service contracts	\$ 1,530	\$ 1,976
Customer advances.....	1,840	2,290
Total deferred revenue	<u>\$ 3,370</u>	<u>\$ 4,266</u>

During the years ended December 31, 2022 and 2021, the Company recognized revenue of \$2.5 million and \$2.0 million from contract liabilities existing at December 31, 2021 and 2020, respectively.

Allowance for Doubtful Accounts

Allowance for doubtful accounts is based on the Company's assessment of the collectability of customer accounts. A rollforward of allowance for doubtful accounts is as follows:

(in thousands)	December 31,	
	2022	2021
Balance, beginning of period	\$ 136	\$ 227
Bad debt expense (credit)	62	(4)
Charge-offs and other	(7)	(87)
Balance, end of period.....	<u>\$ 191</u>	<u>\$ 136</u>

Concentrations

No customer accounted for more than 10% of the revenues for the years ended December 31, 2022, and 2021, or for more than 10% of net accounts receivable at December 31, 2022 and 2021.

Warranties

Warranties are estimated and accrued at the time revenues are recorded. A rollforward of the Company's product warranty accrual is as follows:

(in thousands)	December 31,	
	2022	2021
Balance, beginning of period	\$ 240	\$ 186
Expense	408	319
(Charges)/Credits	(380)	(265)
Balance, end of period.....	<u>\$ 268</u>	<u>\$ 240</u>

13. Income Tax

Income tax expense for years ended December 31, 2022 and 2021 consisted of:

(in thousands)	Year Ended December 31,	
	2022	2021
Current income tax expense:		
Federal and state.....	\$ 641	\$ 363
Foreign	194	156
	<u>835</u>	<u>519</u>
Deferred income tax (benefit) expense:		
Federal and state.....	(468)	22
Foreign	(30)	(393)
	<u>(498)</u>	<u>(371)</u>
Total income tax expense.....	<u>\$ 337</u>	<u>\$ 148</u>

The effective tax rate for the year ended December 31, 2022 was (3.7)% as compared with (105.7)% for the same period in 2021. The difference between the Company's effective tax rate year over year was primarily attributable to changes in the mix of pre-tax income and losses at individual subsidiaries, the impact of different tax rates in certain foreign jurisdictions, and the impact of changes in uncertain tax positions, Global Intangible Low-Taxed Income (GILTI), and valuation allowances.

Income tax expense for the years ended December 31, 2022 and 2021 differed from the amount computed by applying the U.S. federal income tax rate of 21% to pre-tax operations income as a result of the following:

(in thousands)	Year Ended December 31,	
	2022	2021
Provision for income taxes at federal statutory rates.....	\$ (1,927)	\$ (29)
Increase (decrease) in income taxes resulting from:		
Permanent differences, net.....	375	(362)
Non-deductible executive compensation	346	412
Global Intangible Low-Taxed Income (GILTI).....	552	-
Foreign tax rate differential	(103)	(217)
State income taxes, net of federal income tax benefit.....	(295)	(16)
Non-deductible stock compensation expense	69	280
Tax credits	492	455
Net operating loss true-ups and expirations.....	431	195
Change in reserve for uncertain tax position.....	688	(118)
Impact of change to prior year tax accruals	(232)	269
Change in valuation allowance allocated to income tax	(102)	(961)
Other	43	240
Total income tax expense.....	<u>\$ 337</u>	<u>\$ 148</u>

Income tax expense is based on the following pre-tax income (loss) from operations:

(in thousands)	Year Ended December 31,	
	2022	2021
Domestic	\$ (9,099)	\$ 2,364
Foreign	(80)	(2,504)
Total	<u>\$ (9,179)</u>	<u>\$ (140)</u>

The tax effects of temporary differences that give rise to significant components of the deferred tax assets and deferred tax liabilities at December 31, 2022 and 2021 are as follows:

(in thousands)	Year Ended December 31,	
	2022	2021
Deferred income tax assets:		
Inventory.....	\$ 1,696	\$ 1,280
Operating loss and credit carryforwards	14,883	18,046
Accrued expenses	621	835
Deferred interest expense	881	1,191
Stock compensation	675	580
Lease liability	1,538	1,693
Research and development	2,000	-
Other assets.....	726	386
Total gross deferred assets	<u>23,020</u>	<u>24,011</u>
Less: valuation allowance.....	(14,506)	(14,700)
Deferred tax assets	<u>\$ 8,514</u>	<u>\$ 9,311</u>
Deferred income tax liabilities:		
Indefinite-lived intangible assets	\$ 1,914	\$ 1,882
Definite-lived intangible assets.....	4,875	6,277
Right-of-use asset	1,148	1,277
Other liabilities	834	1,228
Total deferred tax liabilities	<u>8,771</u>	<u>10,664</u>
Deferred income tax liability, net.....	<u>\$ (257)</u>	<u>\$ (1,353)</u>

Deferred income tax assets and liabilities by classification on the consolidated balance sheets were as follows:

(in thousands)	Year Ended December 31,	
	2022	2021
Deferred tax assets (included in other long-term assets).....	\$ 333	\$ 205
Deferred income tax liabilities	(590)	(1,558)
Deferred income tax liability, net.....	<u>\$ (257)</u>	<u>\$ (1,353)</u>

As of December 31, 2022 and 2021, the Company maintained a total valuation allowance of \$14.5 million and \$14.7 million, respectively, which relates to foreign, federal, and state deferred tax assets in both years. The valuation allowance is based on estimates of taxable income in each of the jurisdictions in which the Company operates and the period over which deferred tax assets will be recoverable. The net change in total valuation allowance for each of the years ended December 31, 2022 and December 31, 2021 was a decrease of \$0.2 million and a decrease of \$2.0 million, respectively. The decrease in the valuation allowance in 2022 is primarily due to the utilization and expiration of certain U.S. net operating losses and the expiration of certain U.S. credits. The movement in the valuation allowance in 2021 is primarily due to a change in estimate of the realizability of UK deferred tax assets and the utilization and expiration of certain U.S. net operating losses and the expiration of certain U.S. credits. A valuation allowance decrease of \$0.9 million was recorded to equity during the year ended December 31, 2021 related to the UK pension liability.

At December 31, 2022, the Company had U.S. federal net operating loss carryforwards of \$13.4 million, of which \$13.3 million expire between 2029 and 2038. The remaining \$0.1 million of U.S. federal net operating loss carryforwards can be carried forward indefinitely. The Company's state net operating loss carryforwards of \$9.6 million expire between 2023 and 2042. The Company has net operating loss carryforwards of \$8.0 million in certain foreign jurisdictions which may be carried forward indefinitely, partially offset by valuation allowances. The Company has \$8.1 million of research and development tax credit carryforwards and foreign tax credits of \$0.1 million which begin to expire in 2023. Approximately \$0.8 million of the research and development tax credit carryforwards are offset by a reserve for uncertain tax positions. The Company had a total of \$2.7 million of state investment tax credit carryforwards, research and development tax credit carryforwards, and enterprise zone credit carryforwards, which begin to expire in 2023. In addition, the Company had a total of \$0.2 million international R&D credits which begin to expire in 2036. The Internal Revenue Code ("IRC") limits the amounts of net operating loss carryforwards or credits that a company may use in any one year in the event of a change in ownership under IRC Sections 382 or 383. As a result of the DSI acquisition as well as other acquisitions in prior years, certain losses and credit carryforwards are subject to these limitations. The Company has provided a full or partial valuation allowance for the portion of state NOLs and federal and state credit carryforwards the Company expects will expire before use.

As of December 31, 2022 and December 31, 2021, cash and cash equivalents held by the Company's foreign subsidiaries was \$2.6 million and \$2.8 million, respectively. As of December 31, 2022, the Company has determined the potential income tax and withholding liability related to available cash balances at foreign subsidiaries to be immaterial.

At December 31, 2022 and 2021 the amount of unrecognized tax benefits that would affect the Company's effective tax rate are shown in the table below:

	(in thousands)
Balance at December 31, 2020.....	\$ 1,673
Decreases based on tax positions of prior years	(208)
Additions based on tax positions of current years	176
Decreases based on expiration of statutes of limitation.....	(42)
Settlements and other.....	<u>(267)</u>
Balance at December 31, 2021	<u>1,332</u>
Additions based on tax positions of prior years.....	534
Decreases based on tax positions of prior years	(34)
Additions based on tax positions of current years	237
Decreases based on expiration of statutes of limitation.....	<u>(86)</u>
Balance at December 31, 2022.....	<u>\$ 1,983</u>

The Company does not anticipate that any portion of the total unrecognized tax benefits will be reduced within the next 12 months. The total amount of unrecognized tax benefits that, if recognized, would impact the effective tax rate is \$2.0 million. The Company classifies interest and penalties related to unrecognized tax benefits as a component of income tax expense, which has not been significant during the years ended December 31, 2022 and 2021, respectively.

The Company or one of its subsidiaries files income tax returns in the U.S. federal jurisdiction, and various states and foreign jurisdictions. With few exceptions, the Company is no longer subject to income tax examinations by tax authorities in foreign jurisdictions for years before 2018. In the U.S., the Company's net operating loss and tax credit carryforward amounts remain subject to federal and state examination for tax years starting in 2003 as a result of tax losses incurred in prior years. There are currently no pending federal or state tax examinations.

On August 16, 2022, the Inflation Reduction Act of 2022 (“IRA”) was signed into law. Among other changes, the IRA imposes a 15% corporate alternative minimum tax on certain corporations and a 1% excise tax on public company stock buybacks for tax years beginning after December 31, 2022. The Company does not expect the provisions of this new law to have a material impact on its consolidated financial statements and related disclosures.

14. Commitments and Contingent Liabilities

On April 27, 2022, the Company and Biostage, Inc. (f/k/a Harvard Apparatus Regenerative Technology, Inc.) (“Biostage”) executed a settlement with the plaintiffs in the Biostage Litigation (as defined below) which resolves all claims relating to the litigation as described in Note 15 – Litigation Settlement.

The Company is involved in various other claims and legal proceedings arising in the ordinary course of business. After consultation with legal counsel, the Company has determined that the ultimate disposition of such proceedings is not likely to have a material adverse effect on its business, financial condition, results of operations or cash flow. Although unfavorable outcomes in the proceedings are possible, the Company has not accrued loss contingencies relating to any such matters as they are not considered to be probable and reasonably estimable. If one or more of these matters are resolved in a manner adverse to the Company, the impact on the Company’s business, financial condition, results of operations and cash flows could be material.

In addition, the Company has entered into indemnification agreements with its directors. It is not possible to determine the maximum potential liability amount under these indemnification agreements due to the limited history of prior indemnification claims and the unique facts and circumstances involved in each particular agreement. The company has not recorded any liability for costs related to contingent indemnification obligations as of December 31, 2022.

15. Litigation Settlement

On April 14, 2017, representatives for the estate of an individual plaintiff filed a wrongful death complaint with the Court against the Company and other defendants, including Biostage, a former subsidiary of the Company that was spun off in 2013, as well as another third party (the “Biostage Litigation”). The complaint sought payment for an unspecified amount of damages and alleges that the plaintiff sustained terminal injuries allegedly caused by products, including one synthetic trachea scaffold and two bioreactors, provided by certain of the named defendants and utilized in connection with surgeries performed by third parties in Europe in 2012 and 2013.

On April 27, 2022, the Company and Biostage executed a settlement with the plaintiffs of the Biostage Litigation and Biostage’s products liability insurance carriers (the “Biostage Settlement”), which resolved all claims by and between the parties and Biostage’s product liability insurance carriers and resulted in the dismissal with prejudice of the wrongful death claim and all claims between the Company, Biostage and the insurance carriers. The Biostage Settlement was entered into solely by way of compromise and settlement and is not in any way an admission of liability or fault by the Company or Biostage. Biostage has indemnified the Company for all losses and expenses, including legal expenses that the Company incurred in connection with the litigation and the Settlement.

During the three months ended March 31, 2022, the Company accrued \$5.2 million of costs related to legal fees and the Biostage Settlement. Additionally, during the year ended December 31, 2021, the Company had incurred \$0.3 million in legal fees in connection with the litigation. Due to the financial condition of Biostage, the Company determined that it was uncertain as to whether Biostage would be able to meet its indemnification obligation and had fully reserved any receivable from Biostage.

During the three months ended June 30, 2022 and September 30, 2022, the Company recorded adjustments of \$4.9 million and \$0.5 million, respectively, to the reserve against the indemnification receivable from Biostage. These adjustments reflected: i) the issuance by Biostage of 4,000 shares of its Series E Convertible Preferred Stock (the “Series E Preferred Stock”) to the Company on June 10, 2022, in satisfaction of \$4.0 million of Biostage’s total indemnification obligation, ii)

the payment by Biostage of the legal fees associated with the Settlement, and iii) other accrual adjustments. The Series E Preferred Stock was initially recorded at an estimated fair value of \$3.9 million using a Monte Carlo valuation simulation incorporating information from selected guideline companies.

The Series E Preferred Stock ranks senior to all classes of common stock of Biostage and all classes of preferred stock of Biostage (unless the Company consents to Biostage's issuance of other preferred stock that is senior to or pari passu with the Series E Preferred Stock) and accrues dividends at a rate of 8% per annum that are payable in additional shares of Series E Preferred Stock. Each share of Series E Preferred Stock is convertible at any time at the option of the Company into such number of shares of Biostage common stock determined by dividing (a) the \$1,000 face value of the Series E Preferred Stock plus all accrued and unpaid dividends thereon by (b) the average of the volume weighted average trading prices of Biostage's common stock, which is currently quoted on the OTCQB Marketplace, for the 60 consecutive trading days prior to the conversion. In the event Biostage has a subsequent qualified offering of its common stock, (which is defined as an offering of Biostage common stock that coincides with its uplisting onto Nasdaq, the first subsequent public offering by Biostage, or the first subsequent private placement by Biostage resulting in gross proceeds to Biostage of at least \$4,000,000), the Series E Preferred Stock is mandatorily converted into Biostage common stock at the applicable qualified offering price. Due to Biostage's limited operating history, their overall financial condition which includes the requirement to raise additional capital in order to continue as a going concern and the limited trading volume and liquidity of Biostage's common stock, the value of the Series E Preferred Stock could fluctuate considerably or become worthless.

The book value of the Series E Preferred Stock, inclusive of accrued dividends, is \$4.1 million and is included in the December 31, 2022 Consolidated Balance Sheet as a component of Other Long-Term Assets. The Company has elected the provisions within ASC 321 *Investment Securities* to subsequently measure the Series E Preferred Stock at its original cost minus impairment, if any, plus or minus changes resulting from observable price changes in orderly transactions for the identical or a similar investment of Biostage. As of December 31, 2022, there have been no observable price changes or indicators of impairment and therefore there have been no measurement adjustments to the carrying value of the Series E Preferred Stock.

16. Segment and Related Information

Operating segments are determined by products and services provided by each segment, internal organization structure, the manner in which operations are managed, criteria used by the Chief Operating Decision Maker, or CODM, to assess the segment performance, as well as resource allocation and the availability of discrete financial information. The Company has one operating segment and therefore segment results and consolidated results are the same.

The following tables summarize additional selected financial information of the Company's operations by geographic location.

Revenues by geographic destination are as follows:

(in thousands)	Year Ended December 31,	
	2022	2021
United States	\$ 49,912	\$ 49,831
Europe	30,687	35,767
Greater China	16,393	13,496
Rest of the world	16,343	19,810
Total revenues	<u>\$ 113,335</u>	<u>\$ 118,904</u>

Long-lived assets by geographic area include operating lease right-of-use assets, property, plant and equipment, and amortizable intangible assets, are as follows:

(in thousands)	December 31,	
	2022	2021
United States	\$ 26,051	\$ 31,512
Germany	2,432	3,501
Rest of the world	1,489	2,446
Total long-lived assets	<u>\$ 29,972</u>	<u>\$ 37,459</u>

Net assets by geographic area are as follows:

(in thousands)	December 31,	
	2022	2021
United States	\$ 34,408	\$ 38,641
Germany.....	14,761	15,501
United Kingdom.....	10,116	13,999
Rest of the world.....	12,935	15,260
Total net assets.....	<u>\$ 72,220</u>	<u>\$ 83,401</u>

17. Government Assistance

For the year ended December 31, 2022, the Company received \$0.7 million under government assistance programs. The majority of the assistance was a result of the Company's German subsidiaries participating in programs established to offset the negative impact of COVID-19 on profitability, to support employment during the COVID-19 pandemic, and to offset the costs of qualifying research and development activities. Government assistance that is related to profitability is recorded as other income, and government assistance that supplements salaries or research activities are recorded as a reduction of the related operating expense.

18. Subsequent Event - Derivatives

On February 28, 2023, the Company entered into an interest rate swap contract to improve the predictability of cash flows from interest payments related to our variable, SOFR based debt. The swap contract has initial notional amount of \$33.4 million and matures on December 22, 2025. This swap contract converts the SOFR-based variable portion of the interest payable under the Credit Agreement into fixed-rate debt at an annual rate of 4.75%. The swap contract does not impact the additional interest related to the applicable interest rate margin as discussed above in Note 11 Long-Term Debt. The interest rate swap is considered an effective cash flow hedge, and as a result, the net gains or losses on such instrument are reported as a component of other comprehensive income (loss) in the consolidated financial statements and are reclassified as net income when the underlying hedged interest impacts earnings. A qualitative and quantitative assessment over the hedge effectiveness is performed on a quarterly basis unless facts and circumstances indicate that the hedge may no longer be highly effective.

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.

HARVARD BIOSCIENCE, INC.

Date: March 9, 2023

By: /s/ JAMES GREEN

James Green
Chief Executive Officer

Pursuant to the requirements of Section 13 or 15(d) 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.

<u>Signature</u>	<u>Title</u>	<u>Date</u>
<u>/s/ JAMES GREEN</u> James Green	Chief Executive Officer and Director (Principal Executive Officer)	March 9, 2023
<u>/s/ JENNIFER COTE</u> Jennifer Cote	Interim Chief Financial Officer (Principal Financial Officer and Principal Accounting Officer)	March 9, 2023
<u>/s/ KATHERINE A. EADE</u> Katherine A. Eade	Director	March 9, 2023
<u>/s/ ALAN EDRIK</u> Alan Edrick	Director	March 9, 2023
<u>/s/ THOMAS W. LOEWALD</u> Thomas W. Loewald	Director	March 9, 2023
<u>/s/ BERTRAND LOY</u> Bertrand Loy	Director	March 9, 2023

EXHIBIT INDEX

The following exhibits are filed as part of this Annual Report on Form 10-K. Where such filing is made by incorporation by reference to a previously filed document, such document is identified.

<u>Exhibit</u>	<u>Description</u>	<u>Method of Filing</u>
2.1§	Separation and Distribution Agreement between Harvard Bioscience, Inc. and Biostage, Inc. (f/k/a Harvard Apparatus Regenerative Technology, Inc.) dated as of October 31, 2013.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed November 6, 2013) and incorporated by reference thereto.
3.1	Second Amended and Restated Certificate of Incorporation of Harvard Bioscience, Inc.	Previously filed as an exhibit to the Company's Registration Statement on Form S-1/A (File No. 333-45996) (filed on November 9, 2000) and incorporated by reference thereto.
3.2	Amended and Restated By-laws of Harvard Bioscience, Inc.	Previously filed as an exhibit to the Company's Registration Statement on Form S-1/A (File No. 333-45996) (filed on November 9, 2000) and incorporated by reference thereto.
3.3	Amendment No. 1 to Amended and Restated Bylaws of Harvard Bioscience, Inc. (as adopted October 30, 2007).	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed on November 1, 2007) and incorporated by reference thereto.
4.1	Specimen certificate for shares of Common Stock, \$0.01 par value, of Harvard Bioscience, Inc.	Previously filed as an exhibit to the Company's Registration Statement on Form S-1/A (File No. 333-45996) (filed on November 9, 2000) and incorporated by reference thereto.
4.2	Description of Securities.	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 16, 2020) and incorporated by reference thereto.
10.1 #	Harvard Bioscience, Inc. Fourth Amended and Restated 2000 Stock Option and Incentive Plan.	Previously filed as an exhibit to the Company's Quarterly Report on Form 10-Q (filed August 10, 2020) and incorporated by reference thereto.
10.2	Harvard Bioscience, Inc. Employee Stock Purchase Plan, as amended.	Previously disclosed as Appendix A to the Company's Current Report on Form 8-K (filed May 17, 2022) and incorporated by reference thereto.
10.3	Form of Director Indemnification Agreement.	Previously filed as an exhibit to the Company's Quarterly Report on Form 10-Q (filed May 8, 2020) and incorporated by reference thereto.
10.4 +	Trademark License Agreement, dated December 19, 2002, by and between Harvard Bioscience, Inc. and President and Fellows of Harvard College.	Filed with this report.
10.5 #	Form of Incentive Stock Option Agreement (Executive Officers).	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 16, 2006) and incorporated by reference thereto.
10.6 #	Form of Non-Qualified Stock Option Agreement (Executive Officers).	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 16, 2006) and incorporated by reference thereto.
10.7 #	Form of Non-Qualified Stock Option Agreement (Non-Employee Directors).	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 16, 2006) and incorporated by reference thereto.
10.8 #	Form of Deferred Stock Award Agreement.	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 16, 2011) and incorporated by reference thereto.
10.9 #	Form of Market Condition Deferred Stock Award Agreement.	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 16, 2020) and incorporated by reference thereto.
10.10 #	Employment Agreement between Harvard Bioscience, Inc. and James Green.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed July 8, 2019) and incorporated by reference thereto.

10.11 #	Employment Agreement between Harvard Bioscience, Inc. and Michael Rossi.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed July 19, 2019) and incorporated by reference thereto.
10.12 #	Letter Agreement between Harvard Bioscience, Inc. and Jennifer Cote.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed January 3, 2023) and incorporated by reference thereto.
10.13 #	Offer Letter between Harvard Bioscience Inc., and Jennifer Cote.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed January 3, 2023) and incorporated by reference thereto.
10.14	Consulting Agreement, dated as of March 2, 2020, by and between Harvard Bioscience, Inc. and Chane Graziano.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed March 6, 2020) and incorporated by reference thereto.
10.15	Credit Agreement dated as of December 22, 2020 among Harvard Bioscience, Inc., as borrower, the lenders party thereto, and Citizens Bank, N.A., as administrative agent.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed December 23, 2020) and incorporated by reference thereto.
10.16	Pledge and Security Agreement dated as of December 22, 2020 among Harvard Bioscience, Inc., certain of Harvard Bioscience's direct and indirect subsidiaries and Citizens Bank, N.A., as administrative agent.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed December 23, 2020) and incorporated by reference thereto.
10.17	First Amendment to Credit Agreement and Amendment to Pledge and Security Agreement, dated April 28, 2022, among Harvard Bioscience, Inc., Citizens Bank, N.A., as the administrative agent, and the lenders party thereto.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed April 28, 2022) and incorporated by reference thereto.
10.18	Second Amendment to Credit Agreement and Amendment to Pledge and Security Agreement, dated November 8, 2022, among Harvard Bioscience, Inc., Citizens Bank, N.A., as the administrative agent, and the lenders party thereto.	Previously filed as an exhibit to the Company's Form 10-Q (filed November 9, 2022) and incorporated by reference thereto.
10.19	Guarantee Agreement dated as of December 22, 2020 among Harvard Bioscience, Inc., certain of Harvard Bioscience's direct and indirect subsidiaries and Citizens Bank, N.A., as administrative agent.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed December 23, 2020) and incorporated by reference thereto.
10.20#	Harvard Bioscience, Inc. 2021 Incentive Plan.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed May 19, 2021) and incorporated by reference thereto.
10.21#	Form of Performance RSU Award Agreement - 2021 Incentive Plan.	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 11, 2022) and incorporated by reference thereto.
10.22#	Form of Time-Based RSU Awards Agreement – 2021 Incentive Plan.	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 11, 2022) and incorporated by reference thereto.
10.23#	Form of RSU Award for Directors – 2021 Incentive Plan.	Previously filed as an exhibit to the Company's Annual Report on Form 10-K (filed March 11, 2022) and incorporated by reference thereto.
10.24#	Separation Agreement and Release between Harvard Bioscience, Inc. and Ken Olson, dated as of January 26, 2022.	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed January 28, 2022) and incorporated by reference thereto.
10.25#	Separation Agreement and Release between Harvard Bioscience, Inc. and Michael Rossi, dated January 18, 2023	Previously filed as an exhibit to the Company's Current Report on Form 8-K (filed January 19, 2023) and incorporated by reference thereto.

21.1	Subsidiaries of the Registrant	Filed with this report
23.1	Consent of Grant Thornton LLP	Filed with this report
31.1	Certification of Chief Financial Officer of Harvard Bioscience, Inc., pursuant to Rules 13a-15(e) and 15d-15(e), as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002	Filed with this report
31.2	Certification of Chief Executive Officer of Harvard Bioscience, Inc., pursuant to Rules 13a-15(e) and 15d-15(e), as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002	Filed with this report
32.1	Certification of Chief Financial Officer of Harvard Bioscience, Inc., pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002	*
32.2	Certification of Chief Executive Officer of Harvard Bioscience, Inc., pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002	*
101.INS	Inline XBRL Instance Document	Filed with this report
101.SCH	Inline XBRL Taxonomy Extension Schema Document	Filed with this report
101.CAL	Inline XBRL Taxonomy Extension Calculation Linkbase Document	Filed with this report
101.DEF	Inline XBRL Taxonomy Extension Definition Linkbase Document	Filed with this report
101.LAB	Inline XBRL Taxonomy Extension Label Linkbase Document	Filed with this report
101.PRE	Inline XBRL Taxonomy Extension Presentation Linkbase Document	Filed with this report
104	Cover Page Interactive Data File (formatted as Inline XBRL with applicable taxonomy extension information contained in Exhibits 101)	

+ Portions of this exhibit have been redacted in compliance with Item 601(b)(10) of Regulation S-K.

* This certification shall not be deemed “filed” for purposes of Section 18 of the Securities Exchange Act of 1934, or otherwise subject to the liability of that section, nor shall it be deemed to be incorporated by reference into any filing under the Securities Act of 1933 or the Securities Exchange Act of 1934

Management contract or compensatory plan or arrangement.

§ The schedules and exhibits have been omitted. A copy of any omitted schedule or exhibit will be furnished to the SEC supplementally upon request.

The Company will furnish to stockholders a copy of any exhibit without charge upon written request.