Filed pursuant to Rule 424(b)(3)
Registration No. 333-278801

PROSPECTUS

Enliven Therapeutics, Inc.

6,428,649 Shares of Common Stock

This prospectus relates to the offer and resale from time to time of up to 6,428,649 shares (the "Shares") of our common stock, par value $0.001 per share, by the selling stockholders identified in this prospectus, including their transferees, pledgees or donees or their respective successors (the "selling stockholders"), which consist of (i) 5,357,144 outstanding shares of our common stock held by the selling stockholders and (ii) 1,071,505 shares of our common stock issuable upon the exercise of outstanding pre-funded warrants to purchase shares of our common stock. The shares of common stock and pre-funded warrants to purchase common stock were issued and sold to the selling stockholders in a private placement (the "Private Placement") pursuant to a securities purchase agreement among us and such selling stockholders dated March 19, 2024 (the "Purchase Agreement"). We are registering the Shares being offered hereunder pursuant to such Purchase Agreement on behalf of the selling stockholders, to be offered and sold by them from time to time.

The registration of the shares of our common stock covered by this prospectus does not mean that the selling stockholders will offer or sell any of the shares. Sales of the shares by the selling stockholders may occur at fixed prices, at market prices prevailing at the time of sale, at prices related to prevailing market prices or at negotiated prices. The selling stockholders may sell shares to or through underwriters, broker-dealers or agents, who may receive compensation in the form of discounts, concessions or commissions from the selling stockholders, the purchasers of the shares, or both. We are paying the cost of registering the shares of common stock covered by this prospectus as well as various related expenses. The selling stockholders will bear all fees, discounts, concessions or commissions of broker-dealers or agents, and any other expenses incurred in connection with the offering of the shares by the selling stockholders. See "*Plan of Distribution*" beginning on page 15 of this prospectus for more information about how the selling stockholders may sell their shares of common stock. Our common stock is listed on the Nasdaq Global Select Market under the symbol "ELVN."

We are an "emerging growth company" and a "smaller reporting company" as defined under the federal securities laws, and, as such, may elect to comply with certain reduced public company reporting requirements for this and future filings.

Investing in our securities involves risks. Please carefully read the information under the headings "RISK FACTORS" beginning on page 6 of this prospectus and "Item 1A – Risk Factors" of our most recent report on Form 10-K or 10-Q that is incorporated by reference in this prospectus before you invest in our securities.

Neither the Securities and Exchange Commission nor any state securities commission has approved or disapproved of these securities or passed upon the adequacy or accuracy of this prospectus. Any representation to the contrary is a criminal offense.

The date of this prospectus is April 30, 2024.

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ABOUT THIS PROSPECTUS

This prospectus is part of a registration statement on Form S-3 that we filed with the United States Securities and Exchange Commission (the "SEC") using a "shelf" registration process. Under this shelf registration process, the selling stockholders may, from time to time, offer and sell shares of our common stock described in this prospectus in one or more offerings.

You should only rely on the information contained in or incorporated by reference into this prospectus (as supplemented and amended), along with the information contained in any free writing prospectuses we have authorized for use in connection with a specific offering. No person has been authorized to give any information or make any representations other than those contained in or incorporated by reference into this prospectus (as supplemented and amended) and, if given or made, such information or representations must not be relied upon as having been authorized by us. Your reliance on any unauthorized information or representation is at your own risk. This prospectus (as supplemented and amended) shall not constitute an offer to sell or a solicitation of an offer to buy offered securities in any jurisdiction in which it is unlawful for such person to make such an offering or solicitation.

You should read the entire prospectus (as supplemented and amended) and any related free writing prospectus, as well as the documents incorporated by reference into this prospectus, before making an investment decision. The information contained in this prospectus, and in any supplement or amendment to this prospectus or any related free writing prospectus, or the documents incorporated by reference herein and therein, are accurate only as of their respective dates, regardless of the time of delivery of this prospectus, any supplement or amendment to this prospectus or any related free writing prospectus, or any sale of a security. Our business, financial condition, results of operations and prospects may have changed since that date.

PROSPECTUS SUMMARY

This summary highlights selected information that is presented in greater detail elsewhere, or incorporated by reference, in this prospectus. It does not contain all of the information that may be important to you and your investment decision. Before investing in our securities, you should carefully read this entire prospectus, including the matters set forth in the section titled "Risk Factors" and the financial statements and related notes and other information that we incorporate by reference herein, including our Annual Report on Form 10-K and our Quarterly Reports on Form 10-Q. Unless the context indicates otherwise, references in this prospectus to "Enliven Therapeutics, Inc.," "we," "Registrant", "our" and "us" refer, collectively, to Enliven Therapeutics, Inc., a Delaware corporation.

Company Overview

We are a clinical-stage biopharmaceutical company focused on the discovery and development of small molecule inhibitors to help people with cancer not only live longer, but live better. We aim to address existing and emerging unmet needs with a precision oncology approach that improves survival and enhances overall well-being. Our discovery process combines deep insights in clinically validated biological targets and differentiated chemistry with the goal of designing therapies for unmet needs. By combining clinically validated targets and specific target product profiles with disciplined clinical trial design and regulatory strategy, we aim to develop drugs with an increased probability of clinical and commercial success. "Clinically validated targets" refers to biological targets that have demonstrated statistical significance on efficacy endpoints in published third-party clinical trials. We have assembled a team of seasoned drug hunters with significant expertise in discovery and development of small molecule kinase inhibitors. Our team includes leading chemists who have been the primary or co-inventor of over 20 product candidates that have been advanced to clinical trials, including four U.S. Food and Drug Administration ("FDA") approved products: Koselugo (selumetinib), Mektovi (binimetinib), Tukysa (tucatinib), and Retevmo (selpercatinib). We are currently advancing two parallel lead product candidates, ELVN-001 and ELVN-002, as well as pursuing several additional research stage opportunities that align with our development approach.

The following table summarizes our parallel lead product candidates:

Program	Target	Differentiation	Disease	Regimen	Discovery	IND-Enabling	Phase 1	Phase 2	Phase 3	Next Milestone	Milestone Expected
ELVN-001	BCR-ABL	Highly selective active site inhibitor w/activity against asciminib emergent mutations	CML	Monotherapy	monotherapy					Phase 1 Safety/Efficacy	2025
ELVN-002	HER2 & HER2 mutants	Irreversible, highly selective, CNS penetrant	NSCLC, other solid tumors	Monotherapy	monotherapy					Phase 1 Safety/Efficacy	2025
			HER2+ MBC and CRC	Combination	+ trastuzumab +/- chemotherapy					Phase 1a Safety/Efficacy	

Our first product candidate, ELVN-001, is a potent, highly selective, small molecule kinase inhibitor designed to specifically target the breakpoint cluster region – Abelson ("BCR-ABL") gene fusion, the oncogenic driver for patients with chronic myeloid leukemia ("CML"). Although the approval of BCR-ABL tyrosine kinase inhibitors ("TKIs") has significantly improved the life expectancy of patients with CML, tolerability, safety, resistance and patient convenience concerns have become more prominent as patients can now expect to live on therapy for decades. Achieving this survival benefit requires continuous daily therapy, and all available active-site TKIs have off-target activity resulting in treatment-related adverse events ("AEs") and drug discontinuation due to intolerance or resistance. These issues can result in the loss of molecular response and disease progression for many patients and drive approximately 20% of patients to switch therapy within the first year of therapy and

approximately 40% to switch in the first 5 years of therapy. These factors, prolonged treatment course, off-target toxicities, and acquired resistance, explain why the global market for CML supports multiple blockbuster products, exceeding $6.0 billion of sales in 2022, and why there remains significant unmet need for an effective and more tolerable treatment. In our preclinical studies, ELVN-001 has demonstrated improved kinome selectivity, tolerability and robust tumor growth inhibition when compared to certain leading and investigational therapies. In addition, ELVN-001 was highly active against the T315I mutation, which confers resistance to nearly all approved TKIs. As a selective active site inhibitor, ELVN-001's mechanism of action potentially represents a complementary option to allosteric BCR-ABL inhibitors (e.g., Scemblix), which may play an increasingly important role in the standard of care for CML. Specifically, ELVN-001 was also designed to have activity against mutations known to confer resistance to Scemblix. ELVN-001 was designed to be a more attractive option for patients with comorbidities, on concomitant medications or desiring more freedom from stringent administration requirements. ELVN-001 is currently being evaluated in a Phase 1 clinical trial in adults with CML.

In April 2024, we announced positive proof of concept data from the Phase 1 clinical trial evaluating ELVN-001 in patients with CML who are relapsed, refractory, or intolerant to available TKIs. As of the cutoff date, March 18, 2024, 27 patients had enrolled in the ongoing Phase 1 clinical trial across five dose levels of ELVN-001, ranging from 10mg once daily ("QD") to 120mg QD. Of the enrolled patients, 16 were evaluable for molecular response by 12 weeks. Patients enrolled were heavily pretreated. ELVN-001 achieved a cumulative major molecular response ("MMR") rate of 44% (7/16) by 12 weeks and demonstrated responses in patients with prior exposure to asciminib and/or who were TKI-resistant. Among post-asciminib patients, ELVN-001 achieved a cumulative MMR rate of 44% (4/9) by 12 weeks. Among TKI-resistant patients, ELVN-001 achieved a cumulative MMR rate of 40% (4/10) by 12 weeks. ELVN-001 has been well tolerated, consistent with its selective kinase profile, had no Grade 3 or higher non-hematologic treatment-related adverse events ("TRAE"), and had no specific non-hematologic TRAE of any grade occurred in more than 11% of patients. Hematologic AEs observed are consistent with the approved BCR::ABL 1 TKIs.

Our second product candidate, ELVN-002, is a potent, highly selective, central nervous system ("CNS") penetrant and irreversible human epidermal growth factor receptor 2 ("HER2") inhibitor with activity against wild type HER2 and various HER2 mutations. The majority of the TKIs targeting this population are dual epidermal growth factor receptor ("EGFR") and HER2 inhibitors and are dose limited by EGFR-related toxicities. ELVN-002 is designed to inhibit wild type HER2 and key mutations of HER2, while sparing wild-type EGFR and avoiding EGFR-related toxicities. We believe that if ELVN-002 achieves this profile, it will be able to achieve an improved therapeutic index compared to current approved and investigational TKIs as well as provide a meaningful therapeutic option to patients with brain metastases, a key mechanism of resistance to current therapies in patients with non-small cell lung cancer ("NSCLC"), breast cancer ("BRC"), and other HER2 driven diseases. ELVN-002 was specifically designed to enable rational combination therapies, which, we believe, will be important for the treatment of patients with metastatic HER2 overexpressing and amplified cancers. In particular, we believe there is an attractive opportunity to address HER2+ colorectal cancer ("CRC"), BRC and NSCLC, in combination with standard of care. Additionally, due to the success of Enhertu, an antibody drug conjugate that targets HER2 expressing cancers, the HER2 treatment paradigm is changing rapidly. With Enhertu moving up in the treatment paradigm to earlier lines of therapy across HER2-altered cancers, a new unmet need is emerging for patients who cannot tolerate or progress on this new treatment option. On April 5, 2024, the FDA granted accelerated approval to Enhertu for the treatment of adult patients with unresectable or metastatic HER2-poistivie (IHC 3+) solid tumors who have received prior systemic treatment and have no satisfactory alternative treatment options. We believe there will be an increasing need for therapies for these patients. ELVN-002 has demonstrated robust activity in preclinical models against wild type HER2 and various HER2 mutations, including an intracranial model, at well-tolerated doses. Our focus for this program is in NSCLC, BRC, and CRC as a single agent and/or in combination with standard of care.

We have nearly completed our monotherapy Phase 1a dose escalation for ELVN-002 in HER2 altered tumors. This patient population includes patients with any HER2 mutant and HER2 amplified or overexpressed tumors, including patients who have received prior therapies, such as TKIs and antibody-drug conjugates ("ADCs"). Initial findings from the monotherapy trial include, investigator reported responses (including unconfirmed) in both HER2+ and HER2 mutant tumors, including in patients who have progressed on Enhertu and patients with brain metastases, at doses that have been well tolerated. Additionally, at the clinically predicted optimal monotherapy dose (n=30), the most common reported (>10%) TRAEs were headache, nausea, vomiting and diarrhea. Of note, there was no Grade 3 diarrhea (0%) and only Grade 1/2 AST/ALT (3%/0%) and rash (3%). Compared to tucatinib, ELVN-002 had >10x target coverage based on pharmacokinetics in cancer patients and preclinical HER2+ efficacy. Additionally, we filed an investigational new drug application ("IND") and received FDA clearance in the first quarter of 2024 for an additional Phase 1 trial evaluating the combination of ELVN-002 with trastuzumab in HER2+ solid tumors, and ELVN-002 with trastuzumab and chemotherapy in patients with HER2+ CRC and BRC. The combination trial in patients with HER2+ cancers is supported by the initial data from the ongoing monotherapy trial. We expect to begin enrolling patients in this trial in the second quarter of 2024. Phase 1 data from the monotherapy trial and initial proof of concept combination data in HER2+ cancers are expected in 2025.

Over the last several years, it has become increasingly clear that cancers developing in various sites throughout the body often share the same genomic alterations. More specifically, research and clinical data suggest that some tumors are primarily or exclusively dependent on aberrantly activated enzymes, including kinases for their proliferation and survival. Kinases are cellular enzymes that regulate the biological activity of proteins through a process known as phosphorylation and represent one of the largest classes of oncogenic drivers when aberrantly mutated or expressed in the cell. Kinase inhibition is a proven approach to fighting cancer and for nearly two decades has effectively addressed an increasing number of oncology indications. However, despite the advancement of precision medicine in oncology, a significant unmet need remains for the majority of cancer patients for whom no targeted therapies exist or whose cancer has developed resistance to currently available targeted treatments.

We believe that the fundamental change in the development of targeted kinase inhibitor therapies together with our development approach, which is rooted in validated biology and differentiated chemistry, represents a unique opportunity to provide cancer patients with medicines offering improved therapeutic profiles. To capitalize on this opportunity, we continue to advance our research pipeline. We have completed IND enabling studies for our third program, have an additional program in lead optimization and have multiple efforts ongoing in target validation and lead identification. In the near-term, we plan to remain focused on progressing ELVN-001 and ELVN-002 and will prioritize taking full advantage of the development opportunities related to these programs before initiating a potential clinical trial for a third program.

Corporate Information

Enliven Inc. (formerly, Enliven Therapeutics, Inc.) ("Former Enliven") was incorporated in the State of Delaware in June 2019. On February 23, 2023, we completed our business combination with Former Enliven in accordance with the terms of the Agreement and Plan of Merger, dated October 13, 2022 (the "Merger Agreement"), by and among us, Former Enliven, and Iguana Merger Sub, Inc., a Delaware corporation and our wholly owned subsidiary ("Merger Sub"), pursuant to which, among other matters, Merger Sub merged with and into Former Enliven (the "Merger"), with Former Enliven continuing as a wholly owned subsidiary of us and the surviving corporation of the Merger. In connection with the closing of the Merger, we effected a 1-for-4 reverse stock split (the "Reverse Stock Split") and changed our name to Enliven Therapeutics, Inc. Following the completion of the Merger, the business conducted by Former Enliven became the primary business conducted by us.

Our principal executive offices are located at 6200 Lookout Road, Boulder, Colorado 80301. Our telephone number is 720-647-8519. Our website address is www.enliventherapeutics.com. Information contained on, or

that can be accessed through, our website or any website is not incorporated by reference into this prospectus and should not be considered to be part of this prospectus unless expressly noted.

We may announce material information to the public through filings with the SEC, our website (www.enliventherapeutics.com), press releases, public conference calls, and public webcasts. We use these channels, as well as social media, to communicate with the public about us, our product candidates and other matters. We also make available on or through our website certain reports and amendments to those reports that we file with or furnish to the SEC in accordance with the Securities Exchange Act of 1934, as amended (the "Exchange Act"). These include our Annual Reports on Form 10-K, our quarterly reports on Form 10-Q, and our current reports on Form 8-K, and amendments to those reports filed or furnished pursuant to Section 13(a) or 15(d) of the Exchange Act. We make this information available on or through our website free of charge as soon as reasonably practicable after we electronically file the information with, or furnish it to, the SEC. The SEC also maintains a website that contains our SEC filings. The address for the SEC website is www.sec.gov.

Private Placement

On March 19, 2024, in connection with the Private Placement, we entered into the Purchase Agreement with the selling stockholders named in this prospectus. Under the terms of the Purchase Agreement, we agreed to prepare and file a registration statement for purposes of registering the resale of the Shares, to use our commercially reasonable efforts to have such registration statement declared effective within the time period set forth in the Purchase Agreement and keep such registration statement effective until the earliest of (i) the third anniversary of the effective date of such registration statement, (ii) such time as all of the Shares purchased by the selling stockholders pursuant to the terms of the Purchase Agreement have been sold pursuant to such registration statement, or (iii) such time as the Shares become eligible for resale by non-affiliates without any volume limitations or other restrictions pursuant to Rule 144(b)(1)(i) under the Securities Act of 1933, as amended (the "Securities Act").

At the closing of the Private Placement, on March 21, 2024, we sold and issued to certain of the selling stockholders (i) 5,357,144 shares of our common stock at a purchase price of $14.00 per share and (ii) 1,071,505 shares of our common stock issuable upon the exercise of outstanding pre-funded warrants to purchase shares of our common stock at a purchase price of $13.999 per share and an exercise price of $0.001 per share. The total purchase price paid by the selling stockholders in the Private Placement was approximately $90 million.

The offer and sale of the securities in the Private Placement were not registered under the Securities Act, or any state securities laws. We relied on an exemption from the registration requirements of the Securities Act provided by Section 4(a)(2) thereof and Rule 506(b) of Regulation D promulgated thereunder. Each of the selling stockholders has represented to us that such selling stockholder is an "accredited investor," as defined in Regulation D of the Securities Act, and that the securities purchased by such selling stockholder were being acquired solely for such selling stockholder's own account and for investment purposes and not with a view to its future sale or distribution.

The description of the Purchase Agreement is not complete and is qualified in its entirety by reference to the Purchase Agreement, which was filed as an exhibit to our Current Report on Form 8-K, filed on March 19, 2024. See "*Where You Can Find More Information*" and "*Incorporation by Reference*." The representations, warranties and covenants made by us in the Purchase Agreement were made solely for the benefit of the parties to such agreement, including, in some cases, for the purpose of allocating risk among the parties thereto, and should not be deemed to be a representation, warranty or covenant to you. Moreover, such representations, warranties or covenants were made as of an earlier date. Accordingly, such representations, warranties and covenants should not be relied on as accurately representing the current state of our affairs.

THE OFFERING	
Common stock registered for sale by selling stockholders	6,428,649 Shares, consisting of 5,357,144 outstanding shares of our common stock held by the selling stockholders and 1,071,505 shares of our common stock issuable upon the exercise of outstanding pre-funded warrants to purchase shares of our common stock.
Use of proceeds	We will not receive any proceeds from the sale of shares of common stock by the selling stockholders. Upon any exercise of the pre-funded warrants by payment of cash, however, we will receive the exercise price of such pre-funded warrants. See "*Use of Proceeds*" for additional information.
Offering Price	The selling stockholders may sell all or a portion of their shares through public or private transactions at prevailing market prices or at privately negotiated prices. See "*Plan of Distribution*" for additional information.
Risk factors	You should read the "*Risk Factors*" section included in or incorporated by reference in this prospectus for a discussion of factors to consider carefully before deciding to invest in shares of our common stock.
Nasdaq Global Select Market symbol	"ELVN"

RISK FACTORS

An investment in our common stock involves a high degree of risk. Prior to making a decision about investing in our common stock, you should carefully consider the specific risks, uncertainties and assumptions discussed in Part I, Item 1A "Risk Factors" in our most recent Annual Report on Form 10-K and Part II, Item 1A "Risk Factors" in our Quarterly Reports on Form 10-Q, each as may be amended, supplemented or superseded from time to time by other reports we file with the SEC in the future, all of which are incorporated by reference into this prospectus in their entirety, together with other information in this prospectus, including any information incorporated or deemed to be incorporated by reference herein. The risks and uncertainties we have described are not the only ones we face. Additional risks and uncertainties not presently known to us or that we currently deem immaterial may also affect our operations. See the sections titled "*Where You Can Find More Information*" and "*Incorporation by Reference*."

FORWARD-LOOKING STATEMENTS

This prospectus, any prospectus supplement and the information incorporated by reference herein may contain certain statements that constitute "forward-looking statements" within the meaning of Section 27A of the Securities Act and Section 21E of the Exchange Act. The words "believe," "may," "will," "estimate," "continue," "anticipate," "intend," "expect," "could," "would," "project," "plan," "potentially," "likely," and similar expressions and variations thereof are intended to identify forward-looking statements, but are not the exclusive means of identifying such statements. Such forward-looking statements include statements regarding the intent, belief or current expectations of our management that are subject to known and unknown risks, uncertainties and assumptions. You are cautioned that any such forward-looking statements are not guarantees of future performance and involve risks and uncertainties, and that actual results may differ materially from those projected in the forward-looking statements as a result of various factors. Forward-looking statements contained in this prospectus, any prospectus supplement and the information incorporated by reference herein include, but are not limited to, statements about:

- the ability of our clinical trials to demonstrate safety and efficacy of our product candidates, and other positive results;
- the timing, progress and results of clinical trials for ELVN-001 from our BCR-ABL program and ELVN-002 from our HER2 program, and other product candidates we have and may in the future develop, including statements regarding the timing of initiation and completion of studies or trials and related preparatory work, the period during which the results of the studies or trials will become available, and research and development programs;
- the timing, scope and likelihood of regulatory filings and approvals, including timing of INDs and final FDA approval of ELVN-001 from our BCR-ABL program and ELVN-002 from our HER2 program and any other future product candidates;
- the timing, scope or likelihood of foreign regulatory filings and approvals;
- our ability to develop and advance current product candidates and programs into, and successfully complete, clinical trials;
- our manufacturing, commercialization, and marketing capabilities and strategy;
- plans relating to commercializing our product candidates, if approved, including the geographic areas of focus and sales strategy;
- the need to hire additional personnel and our ability to attract and retain such personnel;
- the size of the market opportunity for our product candidates, including estimates of the number of patients who suffer from the diseases we are targeting;
- expectations regarding the approval and use of our product candidates in combination with other drugs;
- our ability to secure drug product for combination studies;
- expectations regarding potential for accelerated approval or other expedited regulatory designation;
- our competitive position and the success of competing therapies that are or may become available;
- estimates of the number of patients that we will enroll in our clinical trials;
- the beneficial characteristics, and the potential safety, efficacy and therapeutic effects of our product candidates;
- our ability to obtain and maintain regulatory approval of our product candidates and our expectations regarding particular lines of therapy;
- plans relating to the further development of our product candidates, including additional indications we may pursue;

- existing regulations and regulatory developments in the United States, Europe and other jurisdictions;
- expectations regarding the impact of health epidemics or other outbreaks, including the COVID-19 pandemic, on our business;
- our expectations regarding the impact of instability in the banking and financial services sector and other macroeconomic trends;
- our intellectual property position, including the scope of protection we are able to establish and maintain for intellectual property rights covering ELVN-001 from our BCR-ABL program and ELVN-002 from our HER2 program, and other product candidates we may develop, including the extensions of existing patent terms where available, the validity of intellectual property rights held by third parties, and our ability not to infringe, misappropriate or otherwise violate any third-party intellectual property rights;
- our continued reliance on third parties to conduct additional clinical trials of our product candidates, and for the manufacture of our product candidates for clinical trials;
- our relationships with patient advocacy groups, key opinion leaders, regulators, the research community and payors;
- our ability to obtain, and negotiate favorable terms of, any collaboration, licensing or other arrangements that may be necessary or desirable to develop, manufacture or commercialize our product candidates;
- the pricing and reimbursement of ELVN-001 in our BCR-ABL program and ELVN-002 from our HER2 program, and other product candidates we may develop, if approved;
- the rate and degree of market acceptance and clinical utility of ELVN-001 from our BCR-ABL program and ELVN-002 from our HER2 program, and other product candidates we may develop;
- our estimates regarding expenses, future revenue, capital requirements and needs for additional financing;
- our expectations regarding sales of our common stock made pursuant to the Open Market Sale Agreement[SM], dated June 23, 2023, by and between us and Jefferies LLC;
- our financial performance;
- the period over which we estimate our existing cash, cash equivalents and marketable securities will be sufficient to fund our planned operating expenses and capital expenditure requirements;
- our ability to utilize our net operating loss carryforwards and tax credit carryforwards;
- the impact of laws and regulations; and
- expectations regarding the period during which we will qualify as an emerging growth company under the Jumpstart Our Business Startups Act of 2012 and a smaller reporting company under the Exchange Act.

Because forward-looking statements are inherently subject to risks and uncertainties, some of which cannot be predicted or quantified, you should not rely upon forward-looking statements as predictions of future events. The events and circumstances reflected in the forward-looking statements may not be achieved or occur and actual results could differ materially from those projected in the forward-looking statements. Except as required by applicable law, including the securities laws of the United States and the rules and regulations of the SEC, we do not plan to publicly update or revise any forward-looking statements contained herein after we distribute this prospectus, whether as a result of any new information, future events or otherwise.

In addition, statements that “we believe” and similar statements reflect our beliefs and opinions on the relevant subject. These statements are based upon information available to us as of the date of this prospectus, and

although we believe such information forms a reasonable basis for such statements, such information may be limited or incomplete, and our statements should not be read to indicate that we have conducted a thorough inquiry into, or review of, all potentially available relevant information. These statements are inherently uncertain and investors are cautioned not to unduly rely upon these statements.

This prospectus and the documents incorporated by reference in this prospectus may contain market data that we obtain from industry sources. These sources do not guarantee the accuracy or completeness of the information. Although we believe that our industry sources are reliable, we do not independently verify the information. The market data may include projections that are based on a number of other projections. While we believe these assumptions to be reasonable and sound as of the date of this prospectus, actual results may differ from the projections.

USE OF PROCEEDS

We are filing the registration statement of which this prospectus is a part to permit holders of the shares of our common stock described in the section entitled "*Selling Stockholders*" to resell such shares. We are not selling any securities under this prospectus and we will not receive any proceeds from the sale or other disposition of shares of our common stock held by the selling stockholders. Upon any exercise of the pre-funded warrants by payment of cash, however, we will receive the exercise price of such pre-funded warrants. The selling stockholders will receive all of the proceeds from this offering.

The selling stockholders will pay any discounts, commissions, fees of underwriters, selling brokers or dealer managers and expenses incurred by the selling stockholders for brokerage, accounting, tax or legal services or any other expenses incurred by the selling stockholders in disposing of the shares. We will bear all other costs, fees and expenses incurred in effecting the registration of the shares covered by this prospectus, including, without limitation, all registration and filing fees, printing fees, Nasdaq listing fees and fees and expenses of our counsel and our accountants.

SELLING STOCKHOLDERS

This prospectus relates to the possible resale by certain of our stockholders, whom we refer to in this prospectus as the "selling stockholders," of up to 6,428,649 Shares, which consist of (i) 5,357,144 outstanding shares of our common stock held by the selling stockholders and (ii) 1,071,505 shares of our common stock issuable upon the exercise of outstanding pre-funded warrants to purchase shares of our common stock that are held by the selling stockholders. The pre-funded warrants are exercisable at any time after their original issuance and will not expire. We cannot predict when or whether any of the selling stockholders will exercise their pre-funded warrants. See "*Prospectus Summary—Private Placement*."

The pre-funded warrants provide that a holder of pre-funded warrants does not have the right to exercise pre-funded warrants if such holder, together with its affiliates, would beneficially own in excess of 4.99% of the number of shares of our common stock outstanding immediately before or after giving effect to such exercise (the "Beneficial Ownership Limitation"); provided, however, that each holder may increase the Beneficial Ownership Limitation by giving notice to the Company, but not in excess of 19.99%. Throughout this prospectus, when we refer to the shares of common stock being registered on behalf of the selling stockholders, we are referring to the outstanding shares of our common stock and the shares issuable upon the exercise of outstanding pre-funded warrants without giving effect to the Beneficial Ownership Limitation.

The following table provides the names of the selling stockholders and the number of shares of our common stock offered by such selling stockholders under this prospectus. The selling stockholders listed below have previously been granted registration rights with respect to the shares offered hereby pursuant to the Purchase Agreement. The shares offered by this prospectus may be offered from time to time by the selling stockholders listed below. The selling stockholders are not obligated to sell any of their shares offered by this prospectus, and reserve the right to accept or reject, in whole or in part, any proposed sale of shares. The selling stockholders listed below may also offer and sell less than the number of shares indicated. The selling stockholders are not making any representation that any shares covered by this prospectus will or will not be offered for sale.

The number of shares and percentages of beneficial ownership set forth below are based on 46,805,377 shares of our common stock outstanding as of April 8, 2024. Beneficial ownership is determined under the SEC rules and regulations and generally includes voting or investment power over securities. We have prepared the table based on information given to us by, or on behalf of, the selling stockholders. The selling stockholders may sell all, some or none of the shares of common stock subject to this prospectus. See "*Plan of Distribution*" as may be supplemented and amended from time to time.

The number of shares of common stock set forth below for each selling stockholder includes (i) all shares of our common stock beneficially held by such selling stockholder as of April 8, 2024, excluding shares issuable upon the exercise of outstanding pre-funded warrants above the Beneficial Ownership Limitation, (ii) the number of shares of our common stock that may be offered under this prospectus, and (iii) the number and percentage of our common stock beneficially owned by the selling stockholders assuming all of the shares of our common stock registered hereunder are sold. The table below and footnotes assume that the selling stockholders will sell all of the shares listed. However, because the selling stockholders may sell all or some of their shares under this prospectus from time to time, or in another permitted manner, we cannot assure you as to the actual number of shares that will be sold by the selling stockholders or that will be held by the selling stockholders after completion of any sales.

Name of Selling Stockholder	Shares of Common Stock Beneficially Owned Prior to Offering		Shares of Common Stock Being Offered (1)	Shares of Common Stock to be Beneficially Owned After Offering (2)	
	Number	Percentage	Number	Number	Percentage
Fairmount Healthcare Fund II L.P. (3)	3,202,798	6.8%	1,071,429	2,131,369	4.6%
Commodore Capital Master LP (4)	3,973,245	8.5%	1,071,429	2,901,816	6.2%
Entities affiliated with Venrock Healthcare Capital Partners (5)	4,026,331	8.6%	1,071,429	2,954,902	6.3%
Logos Opportunities Fund IV LP (6)	357,144	*	357,144	0	*
Entities affiliated with Baker Bros. Advisors LP (7)	1,186,338	2.5%	1,071,505	114,833	*
Woodline Master Fund LP (8)	285,714	*	285,714	0	*
Rock Springs Capital Master Fund LP (9)	370,714	*	370,714	0	*
Four Pines Master Fund LP (10)	57,857	*	57,857	0	*
Entities affiliated with Acuta Capital Partners (11)	396,099	*	285,714	110,385	*
Fidelity Advisor Series VII: Fidelity Advisor Biotechnology Fund (12)	749,313	1.6%	73,200	676,113	1.4%
Fidelity Capital Trust: Fidelity Stock Selector Small Cap Fund (12)	509,328	1.1%	120,720	388,608	*
Fidelity Securities Fund: Fidelity Series Small Cap Opportunities Fund (12)	972,607	2.1%	224,300	748,307	1.6%
Fidelity Securities Fund: Fidelity Small Cap Growth Fund (12)	831,266	1.8%	255,972	575,294	1.2%
Fidelity Securities Fund: Fidelity Small Cap Growth Fund (12)	42,779	*	10,935	31,844	*
Fidelity Securities Fund: Fidelity Small Cap Growth K6 Fund (12)	301,005	*	95,900	205,105	*
Fidelity Securities Fund: Fidelity Small Cap Growth K6 Fund (12)	15,794	*	4,687	11,107	*

* Indicates beneficial ownership of less than 1% of the total outstanding common stock.

(1) The number of shares of our common stock in the column "Number of Shares of Common Stock Being Offered" represents all of the shares of our common stock that a selling stockholder may offer and sell from time to time under this prospectus.

(2) We do not know when or in what amounts a selling stockholder may offer Shares for sale. The selling stockholders might not sell any or might sell all of the shares offered by this prospectus. Because the selling stockholders may offer all or some of the Shares pursuant to this offering, and because, except as set forth elsewhere in this prospectus, there are currently no agreements, arrangements or understandings with respect to the sale of any of the Shares, we cannot estimate the number of the Shares that will be held by the selling stockholders after completion of the offering. However, for purposes of this table, we have assumed

that, after completion of the offering, none of the shares covered by this prospectus will be held by the selling stockholders.

(3) Consists of 1,071,429 shares of common stock purchased by Fairmount Healthcare Fund II L.P. in the Private Placement and 2,131,369 shares of common stock held by Fairmount Healthcare Fund II L.P. prior to the Private Placement. Fairmount Funds Management LLC ("Fairmount") is the investment manager of Fairmount Healthcare Fund II L.P. ("Fund II"). Peter Harwin and Tomas Kiselak are the managing members of Fairmount. Fairmount, Peter Harwin and Tomas Kiselak may be deemed to have voting and investment power over the shares held by Fund II. Fairmount, Peter Harwin and Tomas Kiselak disclaim beneficial ownership of such shares, except to the extent of any pecuniary interest therein. The address of the entities listed is 200 Barr Harbor Drive, Suite 400, West Conshohocken, PA 19428.

(4) Consists of 1,071,429 shares of common stock purchased by Commodore Capital Master LP in the Private Placement and 2,901,816 shares of common stock held by Commodore Capital Master LP prior to the Private Placement. Commodore Capital LP is the investment manager to Commodore Capital Master LP and may be deemed to beneficially own the shares held by Commodore Capital Master LP. Michael Kramarz and Robert Egen Atkinson are the managing partners of Commodore Capital LP and exercise investment discretion with respect to these shares. The principal business address of Commodore Capital LP is 444 Madison Avenue, 35th Floor, New York, NY 10022.

(5) Consists of (i) 233,464 shares of common stock purchased by Venrock Healthcare Capital Partners III, L.P. in the Private Placement and 645,518 shares of common stock held by Venrock Healthcare Capital Partners III, L.P. prior to the Private Placement, (ii) 23,357 shares of common stock purchased by VHCP Co-Investment Holdings III, LLC in the Private Placement and 64,573 shares of common stock held by VHCP Co-Investment Holdings III, LLC prior to the Private Placement and (iii) 814,608 shares of common stock purchased by Venrock Healthcare Capital Partners EG, L.P. in the Private Placement and 2,244,811 shares of common stock held by Venrock Healthcare Capital Partners EG, L.P. prior to the Private Placement. VHCP Management III, LLC ("VHCPM") is the sole general partner of Venrock Healthcare Capital Partners III, L.P. and the sole manager of VHCP Co-Investment Holdings III, LLC. VHCP Management EG, LLC ("VHCPM EG") is the sole general partner of Venrock Healthcare Capital Partners EG, L.P. Dr. Bong Koh and Nimish Shah are the voting members of VHCPM and VHCPM EG. The address of each of these persons and entities is 7 Bryant Park, 23rd Floor, New York, NY 10018.

(6) Logos Opportunities IV GP LLC ("GP IV") is the general partner of Logos Opportunities Fund IV LP ("LOF IV") and may be deemed to have beneficial ownership of these shares. Arsani William and Graham Walmsley are the members of GP IV. Mr. William and Mr. Walmsley each disclaim beneficial ownership of these shares, except to the extent of each's pecuniary interest in such shares, if any. The principal address of LOF IV is 1 Letterman Drive, Building C, Suite C3-350, San Francisco, CA 94129.

(7) Includes (i) 9,892 shares of common stock and 87,874 shares of common stock issuable upon the exercise of pre-funded warrants to purchase common stock for $0.001 per share held directly by 667, L.P. ("667") and (ii) 104,941 shares of common stock and 983,631 shares of common stock issuable upon the exercise of pre-funded warrants to purchase common stock for $0.001 per share held directly by Baker Brothers Life Sciences, L.P. ("Life Sciences", and together with 667, the "Funds"). The pre-funded warrants are only exercisable to the extent that after giving effect or immediately prior to such exercise the holders thereof, their affiliate and any person who are members of a Section 13(d) group with the holders or one of their affiliates would beneficially own in the aggregate, for purposes of Rule 13d-3 under the Exchange Act, no more than the Beneficial Ownership Limitation. By written notice to us, the Funds may from time to time increase or decrease the Beneficial Ownership Limitation applicable to that Fund to any other percentage not in excess of 19.99%. Any such increase will not be effective until the 61st day after such notice is delivered to us. Baker Bros. Advisors LP (the "Adviser") is the investment adviser to the Funds and has the sole voting and investment power with respect to the securities held by the Funds and thus may be deemed to beneficially own the securities held by the Funds. Baker Bros. Advisors (GP) LLC (the "Adviser GP") is the sole general partner of the Adviser and thus may be deemed to beneficially own the securities held by the Funds. The managing members of the Adviser GP are Julian C. Baker and Felix J. Baker, who may be deemed to beneficially own the securities held by the Funds. Julian C. Baker, Felix J. Baker, the Adviser and the Adviser GP disclaim beneficial ownership of all shares held by the Funds, except to the extent of

their indirect pecuniary interest therein. The business address of the Adviser, the Adviser GP, Julian C. Baker and Felix J. Baker is 860 Washington Street, 3rd Floor, New York, NY 10014.

(8) Consists of 285,714 shares of common stock purchased by Woodline Master Fund LP in the Private Placement. Woodline Partners LP serves as the investment manager of Woodline Master Fund LP and may be deemed to be the beneficial owner of the shares. Woodline Partners LP disclaims any beneficial ownership of these shares. The address of Woodline Master Fund LP is 4 Embarcadero Center, Suite 3450, San Francisco, CA 94111.

(9) Consists of 370,714 shares of common stock purchased by Rock Springs Capital Master Fund LP. The address of Rock Springs Capital Master Fund LP is 650 South Exeter Street, Suite 1070, Baltimore, MD 21202.

(10) Consists of 57,857 shares of common stock purchased by Four Pines Master Fund LP. The address of Four Pines Master Fund LP is 650 South Exeter Street, Suite 1070, Baltimore, MD 21202.

(11) Consists of (i) 51,429 shares of common stock purchased by Acuta Opportunity Fund, LP in the Private Placement, (ii) 19,716 shares of common stock held by Acuta Opportunity Fund, LP prior to the Private Placement, (iii) 234,285 shares of common stock purchased by Acuta Capital Fund, LP in the Private Placement and (iv) 90,669 shares of common stock held by Acuta Capital Fund LP prior to the Private Placement. Acuta Capital Partners, LLC is the investment advisor and general partner of Acuta Capital Fund, LP and Acuta Opportunity Fund L.P. Anupam Dalal is the Managing Member of Acuta Capital Partners, LLC. Mr. Dalal has voting and investment authority over all of the shares held by Acuta Capital Fund, LP and Acuta Opportunity Fund, L.P. Each of Acuta Capital Partners, LLC and Mr. Dalal disclaim beneficial ownership of the shares held by Acuta Capital Fund, LP and Acuta Opportunity Fund, L.P. except to the extent of their pecuniary interest therein. The address of the above referenced entities and persons is 255 Shoreline Dr., Suite 515g, Redwood City, CA 94065.

(12) These funds and accounts are managed by direct or indirect subsidiaries of FMR LLC. Abigail P. Johnson is a Director, the Chairman and the Chief Executive Officer of FMR LLC. Members of the Johnson family, including Abigail P. Johnson, are the predominant owners, directly or through trusts, of Series B voting common shares of FMR LLC, representing 49% of the voting power of FMR LLC. The Johnson family group and all other Series B shareholders have entered into a shareholders' voting agreement under which all Series B voting common shares will be voted in accordance with the majority vote of Series B voting common shares. Accordingly, through their ownership of voting common shares and the execution of the shareholders' voting agreement, members of the Johnson family may be deemed, under the Investment Company Act of 1940, to form a controlling group with respect to FMR LLC. The address of these funds and accounts is 245 Summer Street, Boston, MA 02210.

PLAN OF DISTRIBUTION

The selling stockholders may sell securities:

- through underwriters;
- through dealers;
- through agents;
- directly to purchasers; or
- through a combination of any of these methods of sale.

The selling stockholders, including their transferees, pledgees or donees or their respective successors, may, from time to time, sell, transfer or otherwise dispose of any or all of their shares of common stock or interests in shares of common stock on any stock exchange, market or trading facility on which the shares are traded or in private transactions. These dispositions may be at fixed prices, at prevailing market prices at the time of sale, at prices related to the prevailing market price, at varying prices determined at the time of sale, or at negotiated prices.

The selling stockholders may use any one or more of the following methods when disposing of shares or interests therein:

- ordinary brokerage transactions and transactions in which the broker-dealer solicits purchasers;
- block trades in which the broker-dealer will attempt to sell the shares as agent, but may position and resell a portion of the block as principal to facilitate the transaction;
- purchases by a broker-dealer as principal and resale by the broker-dealer for its account;
- an exchange distribution in accordance with the rules of the applicable exchange;
- privately negotiated transactions;
- short sales effected after the date the registration statement of which this prospectus is a part is declared effective by the SEC;
- through the writing or settlement of options or other hedging transactions, whether through an options exchange or otherwise;
- broker-dealers may agree with the selling stockholders to sell a specified number of such shares at a stipulated price per share;
- a combination of any such methods of sale; and
- any other method permitted by applicable law.

The selling stockholders may, from time to time, pledge or grant a security interest in some or all of the shares of common stock owned by them and, if they default in the performance of their secured obligations, the pledgees or secured parties may offer and sell the shares of common stock, from time to time, under this prospectus, or under an amendment to this prospectus under Rule 424(b)(3) or other applicable provision of the Securities Act, amending the list of selling stockholders to include the pledgee, transferee or other successors in interest as selling stockholders under this prospectus. The selling stockholders also may transfer the shares of common stock in other circumstances, in which case the transferees, pledgees or other successors in interest will be the selling stockholders for purposes of this prospectus.

In connection with the sale of our common stock or interests therein, the selling stockholders may enter into hedging transactions with broker-dealers or other financial institutions, which may in turn engage in short sales of the common stock in the course of hedging the positions they assume. The selling stockholders may also sell

shares of our common stock short and deliver these securities to close out their short positions, or loan or pledge the common stock to broker-dealers that in turn may sell these securities. The selling stockholders may also enter into option or other transactions with broker-dealers or other financial institutions or the creation of one or more derivative securities which require the delivery to such broker-dealer or other financial institution of shares offered by this prospectus, which shares such broker-dealer or other financial institution may resell pursuant to this prospectus (as supplemented or amended to reflect such transaction).

The aggregate proceeds to the selling stockholders from the sale of the common stock offered by them will be the purchase price of the common stock less discounts or commissions, if any. Each of the selling stockholders reserves the right to accept and, together with their agents from time to time, to reject, in whole or in part, any proposed purchase of common stock to be made directly or through agents. We will not receive any of the proceeds from this offering. Upon any exercise of the pre-funded warrants by payment of cash, however, we will receive the exercise price of such pre-funded warrants.

The selling stockholders also may resell all or a portion of the shares in open market transactions in reliance upon Rule 144 under the Securities Act, provided that they meet the criteria and conform to the requirements of that rule, or another available exemption from the registration requirements of the Securities Act.

The selling stockholders and any underwriters, broker-dealers or agents that participate in the sale of the common stock or interests therein may be "underwriters" within the meaning of Section 2(a)(11) of the Securities Act. Any discounts, commissions, concessions or profit they earn on any resale of the shares may be underwriting discounts and commissions under the Securities Act. Selling stockholders who are "underwriters" within the meaning of Section 2(a)(11) of the Securities Act will be subject to the prospectus delivery requirements of the Securities Act.

To the extent required, the shares of our common stock to be sold, the names of the selling stockholders, the respective purchase prices and public offering prices, the names of any agents, dealer or underwriter, and any applicable commissions or discounts with respect to a particular offer will be set forth in an accompanying prospectus supplement or, if appropriate, a post-effective amendment to the registration statement that includes this prospectus.

In order to comply with the securities laws of some states, if applicable, the common stock may be sold in these jurisdictions only through registered or licensed brokers or dealers. In addition, in some states the common stock may not be sold unless it has been registered or qualified for sale or an exemption from registration or qualification requirements is available and is complied with.

We have advised the selling stockholders that the anti-manipulation rules of Regulation M under the Exchange Act may apply to sales of shares in the market and to the activities of the selling stockholders and their affiliates. In addition, to the extent applicable, we will make copies of this prospectus (as it may be supplemented or amended from time to time) available to the selling stockholders for the purpose of satisfying the prospectus delivery requirements of the Securities Act. The selling stockholders may indemnify any broker-dealer that participates in transactions involving the sale of the shares against certain liabilities, including liabilities arising under the Securities Act.

We have agreed to indemnify the selling stockholders against liabilities, including liabilities under the Securities Act and state securities laws, relating to the registration of the shares offered by this prospectus.

We have agreed with the selling stockholders to use commercially reasonable efforts to cause this registration statement to be effective and to remain continuously effective until the earliest of (i) the third anniversary of the effective date of this registration statement, (ii) such time as all of the Shares purchased by the selling stockholders pursuant to the terms of the Purchase Agreement have been sold pursuant to this registration statement, or (iii) such time as the Shares become eligible for resale by non-affiliates without any volume limitations or other restrictions pursuant to Rule 144(b)(1)(i) under the Securities Act.

LEGAL MATTERS

The validity of the securities offered hereby will be passed upon for us by Wilson Sonsini Goodrich & Rosati, Professional Corporation, Boulder, CO. Additional legal matters may be passed on for us, or any underwriters, dealers or agents, by counsel that we will name in the applicable prospectus supplement.

EXPERTS

The financial statements of Enliven Therapeutics, Inc. incorporated by reference in this Prospectus have been audited by Deloitte & Touche LLP, an independent registered public accounting firm, as stated in their report. Such financial statements are incorporated by reference in reliance upon the report of such firm, given their authority as experts in accounting and auditing.

WHERE YOU CAN FIND MORE INFORMATION

We file annual, quarterly and current reports, proxy statements and other information with the SEC. Our SEC filings are available to the public over the Internet at the SEC's website at *www.sec.gov*. Copies of certain information filed by us with the SEC are also available on our website at *www.enliventherapeutics.com*. Information accessible on or through our website is not a part of this prospectus.

This prospectus and any prospectus supplement is part of a registration statement that we filed with the SEC and do not contain all of the information in the registration statement. You should review the information and exhibits in the registration statement for further information on us and our consolidated subsidiaries and the securities that we are offering. Forms of any documents establishing the terms of the offered securities are filed as exhibits to the registration statement of which this prospectus forms a part or under cover of a Current Report on Form 8-K and incorporated in this prospectus by reference. Statements in this prospectus or any prospectus supplement about these documents are summaries and each statement is qualified in all respects by reference to the document to which it refers. You should read the actual documents for a more complete description of the relevant matters.

INCORPORATION BY REFERENCE

The SEC allows us to incorporate by reference much of the information that we file with the SEC, which means that we can disclose important information to you by referring you to those publicly available documents. The information that we incorporate by reference in this prospectus is considered to be part of this prospectus. Because we are incorporating by reference future filings with the SEC, this prospectus is continually updated and those future filings may modify or supersede some of the information included or incorporated by reference in this prospectus. This means that you must look at all of the SEC filings that we incorporate by reference to determine if any of the statements in this prospectus or in any document previously incorporated by reference have been modified or superseded. This prospectus incorporates by reference the documents listed below and any future filings we make with the SEC under Sections 13(a), 13(c), 14 or 15(d) of the Exchange Act (in each case, other than those documents or the portions of those documents furnished pursuant to Items 2.02 or 7.01 of any Current Report on Form 8-K and, except as may be noted in any such Form 8-K, exhibits filed on such form that are related to such information), until the offering of the securities under the registration statement of which this prospectus forms a part is terminated or completed:

- our Annual Report on Form 10-K for the year ended December 31, 2023, filed with the SEC on March 14, 2024;
- our Current Reports on Form 8-K filed with the SEC on March 19, 2024, April 9, 2024 and April 11, 2024; and
- the description of our common stock contained in the Registration Statement on Form 8-A relating thereto, filed with the SEC on March 9, 2020, including any amendment or report filed for the purpose of updating such description.

You may request a copy of these filings, at no cost, by making a written or oral request at the following address and telephone number:

Enliven Therapeutics, Inc.
6200 Lookout Road
Boulder, Colorado 80301
Attn: Investor Relations
(720) 647-8519

6,428,649 Shares of Common Stock

Offered by the Selling Stockholders

PROSPECTUS

April 30, 2024