

Prospectus Supplement No. 4
(To Prospectus dated September 10, 2025)

BridgeBio Oncology Therapeutics, Inc.
63,054,549 Shares of Common Stock by the Selling Securityholders

This prospectus supplement no. 4 (this “Prospectus Supplement”) amends and supplements the prospectus dated September 10, 2025 (as may be supplemented or amended from time to time, the “Prospectus”), which forms part of our Registration Statement on Form S-1 (Registration Statement No. 333-289940). This Prospectus Supplement is being filed to update and supplement the information included or incorporated by reference in the Prospectus with the information contained in the attached Current Report on Form 8-K, filed with the Securities and Exchange Commission (the “Securities and Exchange Commission”) on March 26, 2026 (the “Form 8-K”). Accordingly, we have attached the Form 8-K to this Prospectus Supplement.

This Prospectus Supplement updates and supplements the information in the Prospectus and is not complete without, and may not be delivered or utilized except in combination with, the Prospectus, including any amendments or supplements thereto. This Prospectus Supplement should be read in conjunction with the Prospectus, and if there is any inconsistency between the information in the Prospectus and this Prospectus Supplement, you should rely on this Prospectus Supplement.

Our common stock, par value \$0.0001 per share (“Common Stock”) is listed on Nasdaq Global Market (“Nasdaq”) under the symbol “BBOT”. On March 25, 2026, the closing price of our Common Stock as reported on Nasdaq was \$9.25 per share.

We are an “emerging growth company” as that term is defined under the federal securities laws and, as such, are subject to certain reduced public company reporting requirements.

Investing in our securities involves risks that are described in the “Risk Factors” section beginning on page 10 of the Prospectus.

Neither the SEC nor any state securities commission has approved or disapproved of the securities to be issued under this prospectus or determined if this prospectus is truthful or complete. Any representation to the contrary is a criminal offense.

The date of this Prospectus Supplement is March 26, 2026.

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

FORM 8-K

CURRENT REPORT
Pursuant to Section 13 or 15(d)
of the Securities Exchange Act of 1934

Date of Report (Date of earliest event reported): March 24, 2026

BridgeBio Oncology Therapeutics, Inc.

(Exact name of Registrant as Specified in Its Charter)

Delaware
(State or Other Jurisdiction
of Incorporation)

001-41955
(Commission
File Number)

39-3690783
(IRS Employer
Identification No.)

256 E. Grand Avenue, Suite 104
South San Francisco, CA 94080
(Address of principal executive offices, including zip code)

(650) 405-4770
(Telephone number, including area code, of agent for service)

(Former name or former address, if changed since last report.)

Check the appropriate box below if the Form 8-K filing is intended to simultaneously satisfy the filing obligation of the registrant under any of the following provisions:

- Written communications pursuant to Rule 425 under the Securities Act (17 CFR 230.425)
- Soliciting material pursuant to Rule 14a-12 under the Exchange Act (17 CFR 240.14a-12)
- Pre-commencement communications pursuant to Rule 14d-2(b) under the Exchange Act (17 CFR 240.14d-2(b))
- Pre-commencement communications pursuant to Rule 13e-4(c) under the Exchange Act (17 CFR 240.13e-4(c))

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

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Common Stock, par value \$0.0001 per share	BBOT	The Nasdaq Global Market

Indicate by check mark whether the registrant is an emerging growth company as defined in Rule 405 of the Securities Act of 1933 (§230.405 of this chapter) or Rule 12b-2 of the Securities Exchange Act of 1934 (§240.12b-2 of this chapter).

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.

Item 5.02 Departure of Director or Certain Officers; Election of Directors; Appointment of Certain Officers; Compensatory Arrangements of Certain Officers.

(d) Director Appointment

On March 24, 2026, the board of directors (the “Board”) of BridgeBio Oncology Therapeutics, Inc. (the “Company”) increased the size of the Board to nine (9) directors and, upon the recommendation from the Nominating and Corporate Governance Committee of the Board (the “NCG Committee”) appointed Peter Lebowitz, M.D., Ph.D. as a member of the Board, with immediate effect to fill the vacancy created by the increase in Board size. Dr. Lebowitz will serve as a Class I director with a term expiring at the Company’s 2026 annual meeting of stockholders and thereafter until his successor has been duly elected and qualified or until his earlier death, resignation or removal. Dr. Lebowitz was appointed to serve on the NCG Committee and on the Compensation Committee of the Board, effective as of the date of his appointment as a director. The Board has determined that Dr. Lebowitz is “independent” as contemplated by the Nasdaq Stock Market and other governing laws and applicable regulations.

There are no arrangements or understandings between Dr. Lebowitz and any other persons pursuant to which he was appointed as director. There are no transactions in which Dr. Lebowitz has an interest requiring disclosure under Item 404(a) of Regulation S-K of the Securities Act of 1933, as amended.

Dr. Lebowitz will receive compensation for his services as a non-employee director and for any committee service in accordance with the Company’s amended and restated non-employee director compensation policy, a copy of which was filed as Exhibit 10.25 to the Company’s Annual Report on Form 10-K for the fiscal year ended December 31, 2025 filed with the Securities and Exchange Commission (the “SEC”) on March 5, 2026, including the automatic grant of a one-time nonqualified stock option under the Company’s 2025 Stock Option and Incentive Plan to purchase 63,350 shares of the Company’s common stock, \$0.0001 par value per share at an exercise price per share equal to \$8.72 per share, the closing price on the Nasdaq Global Market on March 24, 2026, the effective date of his appointment to the Board.

In connection with his appointment, Mr. Lebowitz entered into the Company’s standard form of indemnification agreement, a copy of which was filed as Exhibit 10.26 to the Company’s Current Report on Form 8-K filed with the SEC on August 13, 2025. Pursuant to the terms of the indemnification agreement, the Company may be required, among other things, to indemnify Mr. Lebowitz for certain expenses (including attorneys’ fees), judgments, fines and settlement amounts actually and reasonably incurred by him in any action or proceeding arising out of his service as a member of the Board.

SIGNATURES

Pursuant to the requirements 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.

BRIDGEBIO ONCOLOGY THERAPEUTICS, INC.

Date: March 26, 2026

By: /s/ Eli Wallace

Name: Eli Wallace

Title: Chief Executive Officer