Does Academic Lineage Generate Excess Returns? Evidence from Deep-Tech Venture Capital

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Abstract

Investors in deep-tech startups often cannot evaluate the technology, so they rely on the founders' academic lineage: the university, the lab and the advisors behind a doctorate. This paper asks whether academic lineage generates excess returns, that is, whether it predicts a startup's success beyond the price investors pay for it. Lineage carries two kinds of information. Salient prestige, such as an elite university or a famous advisor, is visible at a glance. Lineage capital, the founding experience, networks and alumni record of a founder's lab, must be reconstructed from dissertations, co-authorships and company records. The sample is built from academic lineages rather than firms: starting from every doctoral advisor active from 1997 to 2015 in the physical sciences and engineering at eleven U.S. universities of four types, dissertation records, lab alumni pages and the Academic Family Tree trace their doctoral students and postdocs, and those trainees' own trainees, wherever they went, and these descendants are matched to the founders of U.S. venture-backed startups in photonics, quantum technologies, semiconductors, advanced materials and energy founded from 2000 to 2022. Three tests follow: whether lineage predicts late-stage financing and profitable exits; whether investors pay for it through higher valuations, larger rounds and stronger lead investors; and whether, conditional on the price paid, it still predicts milestones and, where valuations allow, risk-adjusted returns. No residual effect means lineage is priced, a positive effect means it is underpriced, and a negative effect means investors overpay. Following evidence that investors neglect ties that are not salient, we predict that salient prestige is priced and lineage capital is not. Case evidence from seven Harvard and MIT lineages motivates the design. This paper reports a pre-registered research design and pilot feasibility results; it does not yet report confirmatory estimates.

Keywords: venture capital; deep tech; academic entrepreneurship; founder human capital; limited attention; academic lineage. JEL codes: G14, G24, L26, O32.

1. Introduction

In deep-tech venture capital, the information that matters most is the hardest to read. A photonic processor, a neutral-atom quantum computer or a new battery chemistry can take a decade and hundreds of millions of dollars to prove, and the partners who price early rounds can rarely judge the physics themselves. Venture capitalists say the founding team matters more than any other factor in their decisions (Gompers et al. 2020). In a science-based startup, the most legible feature of the team is its academic lineage: where the founders earned their doctorates, and with whom.

Whether academic lineage generates excess returns is an open question with direct financial stakes. If the market prices lineage correctly, founders from famous labs raise at higher valuations and their investors earn ordinary returns. If the market underprices it, investors who track lineages earn excess returns. If it overprices it, investors pay for names. Finance has asked the same question of public

markets, where mutual fund managers earn up to 7.8 percent a year more on firms whose board members share their educational networks (Cohen et al. 2008), and investors are slow to react to economic links between firms that are not salient (Cohen and Frazzini 2008). For scientific ties in private markets, the closest evidence comes from biotechnology initial public offerings, where firms affiliated with a Nobel laureate raised more in one IPO window but not in a later one (Higgins et al. 2011).

This paper separates two kinds of information in a founder's academic lineage. **Salient prestige** is what a pitch deck shows at a glance: an elite university, a famous advisor, a prize. **Lineage capital** is what the lab passes on to its members but no single credential reveals: an advisor who has founded companies, a record of alumni firms, second-generation founders, and co-founders and investors shared across the lineage. Limited-attention theories predict that investors price what is salient and neglect what must be assembled from dissertations, co-authorships and lab histories. If so, lineage capital generates excess returns and salient prestige does not. That prediction is testable, and either answer matters to investors.

Case evidence motivates the distinction. In the lineage of Harvard physicist Mikhail Lukin, the three most heavily financed firms were founded not by Lukin but by his trainees and their students. Suno, Lightmatter and Oratomic were each valued at $4.5 billion or more by 2026, while Lukin's own QuEra Computing had raised $277 million. In the lineage of Harvard applied physicist Federico Capasso, two firms share one founding structure a generation apart. Capasso co-founded Metalenz with his doctoral student Rob Devlin, who runs it; its metasurface optics were in more than 140 million devices by mid-2025, yet its last round, in 2022, valued it at $130 million. His former postdoc Marko Lončar co-founded the photonics firm HyperLight with his own trainees, one of whom runs it, and its 2026 round valued it at $867 million. Fifteen of the 40 doctoral graduates Lončar's lab lists for 2012 to 2026 work at startups. Such cases are chosen for visibility and cannot establish rates. They do suggest that much of the capital a lineage attracts may go to descendants whose prestige is less salient than the root's.

The design starts from lineages rather than firms. The roots are every doctoral advisor active from 1997 to 2015 in the physical sciences and engineering at eleven U.S. universities chosen from four types, from elite private universities to universities with one strong program but lower overall standing. Dissertation records, lab alumni pages and the Academic Family Tree trace each root's doctoral students and postdocs and their trainees, wherever they later worked, and these descendants are matched to the founders of U.S. venture-backed startups founded from 2000 to 2022 in photonics, quantum technologies, semiconductors, advanced materials and energy. Following lineages across universities finds founders whose lineage is strong but whose own credentials are not prominent, the comparison the pricing test needs. A second stage adds life-science startups and founders without a doctorate. Each advisor and lineage is coded for salient and latent attributes, measured before the startup's first priced round. Three tests follow: whether lineage predicts performance, whether investors pay for it at entry, and whether it generates excess returns, meaning milestones and, where valuations allow, risk-adjusted returns beyond what the price paid implies. Returns are estimated with corrections for the selective observation of valuations (Cochrane 2005, Korteweg and Sorensen 2010).

The excess-returns test does not require lineage to be randomly assigned. Like a test of an asset-pricing anomaly, it asks whether information available at the time of a round predicts outcomes beyond the price paid. The main threats are therefore measurement threats, namely selective disclosure of valuations, contract terms that inflate reported valuations (Gornall and Strebulaev 2020) and backfilled database coverage, and the design addresses each directly. The question of where any edge comes from

is causal, and the design treats it separately, comparing founders trained before and after their advisor's first founding and firms founded with and without the advisor.

The paper makes three contributions. For the finance of venture capital, it offers a direct test of whether the founder signal investors use most in deep tech generates excess returns, and of which parts of it are already priced. For research on academic entrepreneurship, it moves the question from whether scientists found firms to what science-based firms are worth, complementing evidence that advisors pass on commercial orientation (Azoulay et al. 2017) and that advisor entrepreneurship shifts students' academic careers (Roche 2023). Finally, it builds a lineage-linked map of deep-tech founders, to be released with the paper, that investors, universities and policymakers can use.

2. Related Literature

Founders and venture capital decisions. Whether investors should back the founder or the business is an old question in venture finance. Following firms from business plan to public company, Kaplan et al. (2009) find that business lines stay stable while management turns over, which suggests that the business matters more than the founding team. Investors nonetheless weigh the team heavily (Gompers et al. 2020), and in a field experiment early-stage investors respond to information about the team more than to traction or lead investors (Bernstein et al. 2017). Founders with prior founding experience raise at higher valuations (Hsu 2007), entrepreneurs accept lower valuations from high-reputation venture capitalists (Hsu 2004), and successful serial entrepreneurs are more likely to succeed again (Gompers et al. 2010). This paper studies a founder attribute that matters most where the business is hardest to evaluate: scientific training, and the lineage it comes from.

Networks, school ties and limited attention. In public markets, educational ties carry information that prices do not fully reflect. Mutual fund managers earn higher returns on firms whose board members share their educational networks (Cohen et al. 2008), and returns are predictable from economic links that investors neglect (Cohen and Frazzini 2008). In venture capital, better-networked firms perform better (Hochberg et al. 2007), and biotechnology ventures endorsed by prominent alliance partners and investors go public faster and at higher valuations (Stuart et al. 1999). We bring the question of ties and attention to the scientific lineages around which deep-tech financing is organized, and distinguish ties investors can see at a glance from ties they would have to reconstruct.

Star scientists and academic entrepreneurship. The location of star scientists predicted where U.S. biotechnology firms were born (Zucker et al. 1998), and firms tied to them patent more (Zucker et al. 2002). Biotechnology firms affiliated with a Nobel laureate raised more at their IPO in one window but not in a later one, consistent with a signal that fades as other information arrives (Higgins et al. 2011). Scientists found firms when their colleagues do (Stuart and Ding 2006, Bercovitz and Feldman 2008); trainees adopt their advisors' patenting (Azoulay et al. 2017); and advisor entrepreneurship lowers students' publications and faculty placement (Roche 2023). Exposure to entrepreneurs and inventors shapes who becomes one (Nanda and Sørensen 2010, Bell et al. 2019), and entrepreneurial peers can reduce failed ventures more than successful ones (Lerner and Malmendier 2013). This literature measures founding and patenting rather than the value and pricing of the firms that result.

Deep tech and the measurement of venture returns. Capital-intensive, slow-maturing ventures fit the venture model poorly (Gaddy et al. 2017, Ewens et al. 2018, Lerner and Nanda 2020), which makes

founder signals especially important in these sectors. Returns on venture investments are observed only when a firm raises a new round or exits, and correcting for that selection changes estimated returns substantially (Cochrane 2005, Korteweg and Sorensen 2010). Reported post-money valuations also overstate fair value because preferred shares carry protective terms (Gornall and Strebulaev 2020). The returns test here uses these methods, so an excess return cannot be an artifact of which valuations are reported or how they are computed.

3. Concepts and Hypotheses

3.1 Salient prestige and lineage capital

A founder's academic lineage sends two kinds of information, which differ in how easily an investor can see them. Salient prestige is visible in a pitch deck or a biography: the doctoral institution, the advisor's name and honors, and how well known the advisor is. Lineage capital is what a lab passes on to its members through practice rather than credentials: the advisor's own experience of founding firms, the lab's record of alumni firms, the reach of founding into later generations, and the co-founders and investors that circulate within the lineage. Lineage capital is public in principle, since lab rosters, dissertations, co-authorships and company filings are open records, but assembling it takes work that few investors do. Table 1 lists the measures, each fixed as of the date of the startup's first priced round.

Table 1. Salient prestige and lineage capital measures

Measure	Type	Construction	Visible to an investor at the round
Elite doctoral program	Salient	Doctoral institution in the top ten of its field	In the founder's biography
Star advisor	Salient	Advisor is a National Academy member or in the top 1 percent of field citations	From the advisor's name and profile
Advisor visibility	Salient	Wikipedia page created before the round; news articles naming the advisor in the three years before the round	Directly
Entrepreneurial advisor	Lineage	Advisor founded a firm before the founder's degree	Requires matching advisor to company records
Lab founding record	Lineage	Firms founded by the advisor's earlier trainees before the round	Requires reconstructing the lab roster
Second generation	Lineage	Advisor trained in a lab whose root or members founded firms	Requires a two-generation genealogy
Lineage network	Lineage	Co-founders, early employees or investors shared with earlier firms of the lineage	Requires founder and investor records across

Measure	Type	Construction	Visible to an investor at the round
			firms

The two types can coincide, since a famous advisor may also have founded companies, so every test reports the salient measures alone, the lineage measures alone and both together, with their correlation. The distinction is empirical rather than definitional, and the classification of each measure is fixed in Table 1 before any outcome is observed.

Salience score. Salience is measured, not assumed. An advisor's salience score at the date of a round is the mean of four standardized indicators fixed in advance: membership of the National Academy of Sciences or Engineering, a major prize (Nobel, Wolf, MacArthur or Breakthrough), a Wikipedia page created before the round, and the count of news articles naming the advisor in the three years before the round. The score is the primary salient-prestige measure in every test; its four components are reported separately.

Firms with several doctoral founders. When a firm has more than one doctoral founder, each salience and lineage measure takes its maximum across them, so a firm counts as high-lineage if any doctoral founder is. Robustness checks use the measures of the founder who is chief executive or chief technology officer at the first priced round, and the mean across doctoral founders. The number of doctoral founders enters every specification as a control.

3.2 Hypotheses

H1 (Performance). Startups whose doctoral founders carry salient prestige or lineage capital reach a successful milestone more often and sooner. A milestone is a Series B or later round, an initial public offering, or an acquisition for more than the equity raised.

H2 (Pricing). At the first priced round, investors pay for salient prestige through higher pre-money valuations, larger rounds and more prominent lead investors, conditional on stage, sector, year and observable traction. Lineage capital is priced less, if at all.

H3 (Excess returns). Conditional on the price paid, salient prestige does not predict milestones or risk-adjusted round-to-round returns, whereas lineage capital predicts them positively: lineage capital generates excess returns and salient prestige does not. The question is whether lineage predicts outcomes beyond the price paid at entry, not whether it predicts success. The test is two-sided, and a negative coefficient on salient prestige would mean investors overpay for names.

H4 (Sources). If lineage capital reflects knowledge and norms passed on in training, its effect should be larger for founders trained while their advisor was founding a firm, should appear in firms founded without the advisor as well as with them, and should survive controls for the identity of the lead investor. If it reflects only access to the advisor's investors, it should be confined to firms that share them.

H3 is the paper's central hypothesis and the question in its title. Table 2 sets out how each pattern of results would read.

Table 2. Reading the pricing and returns tests together

Pattern	Pricing (H2)	Excess returns (H3)	Interpretation	Implication for investors
Efficient pricing	Positive	Zero	Investors pay for lineage and receive what they pay for	Lineage earns no excess return
Underpricing	Zero or small	Positive	Lineage predicts value beyond its price	Tilting toward the signal earns excess returns
Halo	Positive	Negative	Investors pay more for prestige than it returns	Discipline on price for well-known names
Salience split (predicted)	Positive for salient, small for lineage	Zero for salient, positive for lineage	Investors price what they see and miss what they must assemble	Edge lies in measuring lineages, not in famous names

4. Case Evidence from Seven Lineages

Seven hand-collected Harvard and MIT lineages are consistent with the distinction between salient prestige and lineage capital, but they were selected for commercial visibility and motivate rather than test the hypotheses. The roots are four physical scientists (Federico Capasso, Charles Lieber, Mikhail Lukin and Marin Soljačić) and three life scientists (Robert Langer, George Church and Feng Zhang). Sources are lab websites, curricula vitae, the Academic Family Tree (David and Hayden 2012), company websites, press releases, public filings and PitchBook records, collected between June and November 2026.

Table 3. Seven lineages: who founds, and who succeeds

Lineage root (institution)	Field	PI-founded firms	Alumni-founded firms	Successful firms, PI / alumni	Second-generation founding
Capasso (Harvard SEAS)	Photonics, metasurfaces	2	15	1 / 3	Yes
Lieber (Harvard Chemistry)	Nanoscience	2	25	1 / 10	Yes
Lukin (Harvard Physics)	Quantum science	3	8	1 / 6	Yes
Soljačić (MIT Physics)	Photonics, electromagnetics	3	0	2 / 0	Not documented
Langer (MIT Chemical	Drug delivery,	~40	~5	Not coded	Not

Lineage root (institution)	Field	PI-founded firms	Alumni-founded firms	Successful firms, PI / alumni	Second-generation founding
Engineering)	biomaterials				documented
Church (Harvard Medical School)	Genomics, synthetic biology	~50	10	Not coded / 9	Yes
Zhang (MIT and Broad Institute)	Genome editing	7	1	7 / 1	Not documented

Notes: Counts are lower bounds; "~" marks widely cited totals rather than individually documented firms. A firm is PI-founded if the root is a listed founder, and alumni-founded if a founder is the root's trainee or a trainee's trainee and the root is not a founder; advisory roles do not count (Ding and Choi 2011). A firm is successful if it raised a Series B or later round, went public or was acquired for more than the equity it raised. The Church row counts firms founded by Church's descendants, including Zhang and Zhang's trainees, so the Church and Zhang rows share firms. Online Appendix A lists every firm with its founders, advisor link, generation, tie strength, financing basis and sources. On training ties documented beyond co-authorship, the alumni counts are 8 for Capasso, 14 for Lieber, 8 for Lukin and 3 for Church.

Three patterns stand out. First, **value sits with descendants.** In the Lukin lineage, Suno (co-founded by doctoral alumnus Georg Kucsko) had raised $819 million by June 2026 at a $5.4 billion post-money valuation. Lightmatter (co-founded by two students of former postdoc Dirk Englund) had raised $821 million by December 2025, with a $4.5 billion valuation recorded in October 2024, and Oratomic (co-founded in 2025 by doctoral alumnus Dolev Bluvstein with former postdoc Manuel Endres) was valued at $5.4 billion in October 2026. Lukin's own QuEra Computing had raised $277 million. The Capasso lineage offers a closer comparison. Metalenz and HyperLight were each co-founded by a professor with his own trainees, and each is run by a trainee: Capasso's doctoral student Rob Devlin at Metalenz, and Lončar's former postdoc Mian Zhang at HyperLight. Metalenz has the lineage's largest product footprint, with metasurface optics in more than 140 million devices by mid-2025 through its license to STMicroelectronics, but its last priced round, in October 2022, valued it at $130 million post-money. HyperLight, one generation down, raised its Series C in June 2026 at $867 million post-money. The rounds are years apart, and HyperLight's wafer-scale production needs more capital than Metalenz's licensing model, so the pair shows where financing went rather than which firm is worth more.

Second, **in physical science, founding runs through the lineage rather than the root.** In three of the four physical-science lineages, alumni founded about 3 to 12 times as many firms as the root, and about 3 to 7 times on training ties documented beyond co-authorship; in all three life-science lineages the ratio is about 0.2 or lower. Third, **founding persists across generations.** Capasso's former postdoc Marko Lončar co-founded HyperLight with his own trainees, and 15 of the 40 doctoral graduates Lončar's lab lists for 2012 to 2026 work at startups. Doctoral students of Englund, himself a former Lukin postdoc, co-founded Lightmatter, and a doctoral student of Lieber alumnus Yi Cui co-founded Cuberg.

For investors, these patterns raise the paper's question. A screen built on famous names would have found the roots' own firms, such as QuEra or Metalenz; it would have been less likely to flag a second-

generation founder from Lončar's or Englund's lab. The cases cannot say whether such founders were underpriced, because they were chosen with hindsight and lack a comparison group. The population design in Sections 5 and 6 supplies both. Several of the firms cited here also fall outside the estimation sample, because they were founded after 2022 (Oratomic and Lightsynq) or work outside the six deep-tech sectors (Suno, WindBorne and Polygence), so they enter the case evidence only. The others meet the sample rules and, with Harvard and MIT among the anchors, enter the estimation sample; because their outcomes were known before registration, every test is also reported without the seven case lineages.

5. Data

5.1 Sample

The sample is built from academic lineages. Eleven universities of four types anchor it: elite private research universities (Harvard, MIT, Stanford and Caltech), elite public research universities (UC Berkeley and the University of Illinois at Urbana-Champaign), large public engineering universities (Georgia Tech, the University of Texas at Austin and Purdue), and universities with one nationally strong program but lower overall standing (the University of Arizona and the University of Central Florida, both strong in optics). Within each type, universities were chosen by doctoral output in the relevant fields and by whether their dissertation records can be read in bulk, before any lineage-linked outcome was examined; the sector-level pilot (Section 5.4) had already reported aggregate milestone rates by founders' university (see Disclosure). The roots are every faculty member who supervised a doctoral dissertation from 1997 to 2015 in physics and applied physics, chemistry, chemical engineering, electrical engineering, materials science, mechanical engineering, and aerospace and nuclear engineering at these universities, whether or not any trainee founded a firm. Generation 1 is each root's doctoral students and postdocs at the anchor university; generation 2 is the trainees of generation-1 members who became advisors, wherever they worked; generation 3 is defined the same way. Descendants are matched to the founders of U.S.-headquartered startups founded from 2000 to 2022 that raised at least one equity round from an institutional investor, drawn from PitchBook under an academic license. A startup is deep-tech if PitchBook industry codes or a keyword classification of business descriptions place it in one of six physical-science sectors: photonics and optics, quantum technologies, semiconductors and electronics, advanced materials and nanotechnology, energy generation and storage (including fusion), and sensing and instrumentation. Robotics and medical devices built on these technologies, such as surgical robots, enter only in a sensitivity analysis.

Following lineages across universities serves two purposes. It finds founders whose lineage capital is high but whose salient prestige is low, such as trainees of founding labs who became faculty at less prominent universities, and it allows comparisons within a tree through root fixed effects. The cost is that founders whose lineages begin outside the eleven universities enter only through descendants who trained or worked there. Trees overlap, so a founder linked to two roots is listed under both and counted once, under the nearer root. Matching does not rely on name search alone: each descendant is matched to founder records by name, doctoral institution and years, current and former founder roles are taken from company founder records rather than individuals' current titles, and matches below a preset similarity threshold are reviewed by hand. A second stage, reported separately, adds two benchmarks: startups in therapeutics, diagnostics and life-science tools, where the star-scientist

literature was built and where more information about quality is available, and deep-tech firms without a doctoral founder, which show whether lineage measures pick up anything beyond doctoral training. Commercial databases add firms retroactively once they succeed, so the primary sample keeps only firms whose first institutional round appears in an SEC Form D filing or in contemporaneous press within a year of the round; the full PitchBook sample is a robustness check.

5.2 Founders and advisors

Founders come from PitchBook company founder records, the related-persons section of Form D filings, principal investigators on SBIR and STTR awards, inventors on patents assigned to startups, and company websites. Doctoral institution, field and year come from biographies and dissertation records. Each doctoral founder is linked to an advisor in order of reliability: a dissertation record naming the advisor (ProQuest, MIT DSpace, Harvard DASH and other repositories); a lab alumni page or curriculum vitae; and, failing both, co-authorship in OpenAlex between the founder's pre-degree papers and a faculty member at the degree institution. Each link is coded by strength: A for an advisor of record in a dissertation repository, B for training documented in another source that names the relationship, and C for co-authorship alone. Dissertation committee membership, recorded at several of the eleven universities, is coded separately as a network tie rather than as training. Primary estimates use A and B links; adding C links is a robustness check. Founders whose advisors these sources miss are found by a second screen, which matches every OpenAlex co-author of a lineage's members against the related-persons section of Form D filings. In the seven case lineages this screen added nine firms that the manual search had missed, and the hand-verified case firms in Online Appendix A serve as the benchmark for measuring the recall of each screen. Postdoctoral advisors come from lab alumni pages, curricula vitae and the Academic Family Tree, coded B, and from OpenAlex co-authorship, coded C, where no document names the relationship. Before outcomes are merged, a hand-checked validation sample of 150 founders measures the accuracy of each link type and of the name match between PitchBook founders and dissertation authors, including common names, name changes and abbreviated middle names; matches below a preset similarity threshold are reviewed by hand.

Tests of the sources in November 2026 show what the links will cost. Seven of the eleven universities expose dissertation records through public interfaces with an advisor field: MIT (125 of 128 sampled doctoral records name an advisor), Stanford, Illinois, Georgia Tech, Texas (97 of 97 sampled), Purdue and Central Florida (100 of 100 sampled); Arizona records name an advisor mainly for recent dissertations. Georgia Tech, Illinois, Purdue and Texas also record committee members. Harvard, Caltech and Berkeley records, and descendants at every other university, come from ProQuest Dissertations and Theses, read in bulk through ProQuest TDM Studio: of 839,870 doctoral dissertations in the physical sciences and engineering, the advisor field is filled for 3 to 4 percent of those before 1985, 65 to 74 percent of those from 1990 to 2009, 81 percent from 2010 to 2014 and more than 90 percent from 2015, which is why roots are defined from 1997. The Academic Family Tree covers lineages unevenly: three of ten randomly drawn MIT roots are absent and four have only a few trainees recorded, so it supplies B-strength links only. Postdocs are the weakest link: in the alumni pages of three case labs, dissertation records and the Academic Family Tree had found 84 of 132 listed doctoral graduates but only 11 of 150 postdocs, so lab alumni pages and curricula vitae are the primary source for postdoctoral links. One such link joins two case lineages: Marko Lončar, whose lab co-founded HyperLight, was a

postdoc in Capasso's lab, so HyperLight sits in the second generation of the tree whose first generation includes Metalenz.

5.3 Prices, traction and outcomes

Prices and terms. For each priced round, the data record pre-money and post-money valuations, round size and type, the lead investor, the lead's exits in the preceding ten years and its network centrality (Hochberg et al. 2007), and whether the valuation was disclosed.

Traction visible at the round. Patents and applications, publications, federal SBIR and STTR awards (Howell 2017), founders' prior founding experience (Hsu 2007, Gompers et al. 2010), team size and firm age capture what investors could see besides lineage.

Outcomes. A milestone is a Series B or later round, an initial public offering or an acquisition for more than the equity raised; failure is a firm recorded as out of business. The round-to-round return is the change in log value between the post-money valuation of one round and the pre-money valuation of the next, annualized by the time between them. For exits with disclosed values, the exit return is the log ratio of exit value to the last post-money valuation. The distance between the founder's dissertation and the firm's technology is measured by text similarity between the dissertation abstract and the firm's patents and business description.

5.4 Pilot

The lineage firms already documented for the seven case lineages (Online Appendix A) serve as a seed for testing link rates and valuation disclosure. A pilot on one sector, photonics and optics, then sizes four quantities before the full build: the number of doctoral-founded firms, the share with a disclosed valuation at the first priced round, the share with two consecutive disclosed valuations, and the share of doctoral founders linked to an advisor. Section 7 states how these figures decide which tests are primary.

Pilot results (PitchBook screener, 5 November 2026). U.S.-headquartered firms founded from 2000 to 2022 with at least one seed or venture round number 133 under the keyword "photonics" and 1,751 across nine physical-science categories (photonics, optoelectronics, quantum computing, semiconductors, advanced materials, nanotechnology, energy storage, fusion and lidar). In the broad sample, 87 percent record at least one founder, 54 percent disclose a post-money valuation in at least one venture round, 35 percent have two consecutive disclosed valuations, and 38 percent reached a Series B or later round. In the photonics sample, 43 firms have a founder educated at one of eight leading physics and optics programs (MIT, Harvard, Stanford, Caltech, Berkeley, Rochester, Arizona and Central Florida). Of these, 65 percent disclose a valuation, against 50 percent of other firms with recorded founders, and 42 percent reached Series B or later, against 36 percent. The disclosure gap confirms that selective disclosure must be modeled (Section 6.2); the milestone gap is far from significant at this sample size and is reported only as a feasibility check. PitchBook records education but not degree level, so doctoral status and advisor links come from the sources in Section 5.2. Three feasibility tests followed on 5 November 2026. First, a random sample of 128 MIT doctoral graduates from eight departments (1997 to 2018) found an advisor of record for 125. Searching their names in PitchBook identified nine founders, three to five of them of U.S. physical-science startups; name search

both missed founders and matched namesakes, and current titles hide founders who have moved on, so the full build uses company founder records. At this rate, two universities would yield only 150 to 350 firms. Second, ten advisors were drawn at random from that sample as roots, and the two whose lineages are well recorded in the Academic Family Tree were traced and searched in PitchBook; because they were chosen for good records, they are not representative. One tree, with 53 recorded descendants, held five founders of six U.S. firms, all in generation 1. The other, with 73 descendants, held eight founders of seven U.S. firms: three in generation 1, four in generation 2 and one in generation 3, most of them trained or working at universities outside the elite tier. Third, the source tests reported in Section 5.2. On this evidence the frame was set to lineages rooted at ten universities before any lineage-linked outcome was examined, although the aggregate milestone rates by founders' university reported above were already known (see Disclosure). Two changes followed before any outcome in the estimation sample was examined. Harvard was added as an eleventh anchor, because the case evidence shows its physical-science lineages are among the most active in founding; every test is also reported without Harvard. The root window was extended from 2010 to 2015, because labs founded in the late 2000s, such as Lončar's, graduated their first doctoral students after 2010. The resulting frame holds 9,887 roots and, counting each name once and setting aside names shared by several dissertation authors, 80,735 first-generation, 78,255 second-generation and 46,434 third-generation descendants, of whom 7,792 are postdocs.

6. Empirical Strategy

Three outcomes are primary and fixed in advance: the milestone hazard for H1, the log pre-money valuation at the first priced round for H2, and the milestone hazard conditional on that valuation for H3. Round-to-round returns are a secondary H3 outcome whose status depends on the pilot (Section 7). Every specification is also estimated with root fixed effects, which compare founders within the same tree. Standard errors are clustered by root lineage, which nests advisors, with wild cluster bootstrap inference where clusters are few (Cameron et al. 2008), and the primary outcomes are adjusted jointly for multiple testing (Romano and Wolf 2005).

6.1 Performance (H1)

Firm-years are followed from the first priced round to the first milestone or the end of 2026. With S the salient-prestige measures, L the lineage-capital measures, X the traction measures visible at the round and μ sector-by-founding-cohort effects, the hazard is:

$$\Pr\left(M_{ft}=1 \mid M_{f,t-1}=0\right)=\lambda_t+S_f'\beta_S+L_f'\beta_L+X_f'\delta+\mu_{k(f),c(f)}+\varepsilon_{ft}$$

Here λt are duration effects, k is the sector and c the founding cohort. Cumulative milestone probabilities at five and ten years are reported for each lineage group.

6.2 Pricing (H2)

At the first priced round, the log pre-money valuation is regressed on the same measures, with sector-by-quarter and stage effects η:

$$\ln V_{f1}^{\text{pre}}=S_f'b_S+L_f'b_L+X_f'd+\eta_{k(f),q(f)}+\eta_{\text{stage}(f)}+u_f$$

Round size and the lead investor's prior exits are estimated the same way as alternative measures of what investors pay or offer. Valuations are disclosed for only part of the sample, so disclosure itself is modeled on the same variables; estimates are reweighted by the inverse probability of disclosure, and Lee (2009) bounds show how far selective disclosure could move them.

6.3 Excess returns (H3)

H3 asks whether lineage predicts outcomes beyond the price paid at entry. Its sharpest version compares founders in the same tree whose own doctoral universities differ in standing: their lineage capital is shared and their salient prestige is not. The primary H3 test adds the log post-money valuation of the first priced round and lead-investor fixed effects to the H1 hazard. If the coefficients on S and L fall to zero, investors priced the information; a positive residual coefficient means the signal predicts success beyond its price, and a negative one means investors overpaid. Because it needs only one valuation per firm, this test is feasible even where later valuations are missing. A valuation prices the size of success as well as its probability, so a residual milestone effect indicates mispricing only if lineage does not also lower the value of success; the return test, which captures both, checks this.

The secondary test uses round-to-round returns, $r = \ln V^{pre}(n+1) - \ln V^{post}(n)$, which are observed only when a firm raises a new round or exits at a disclosed value. A firm that fails is a total loss, and a firm that neither raises nor fails is censored. Following Korteweg and Sorensen (2010), the return equation is estimated jointly with a selection equation in which the chance of observing a valuation rises with the firm's value, and the difference in selection-corrected expected returns between lineage groups is the parameter of interest; Cochrane (2005) is a benchmark. A portfolio exercise translates the estimates into what a first-round investor tilting toward high-lineage or high-salience founders would have earned, in multiples of invested capital.

Excess returns are measured net of risk. In the Korteweg and Sorensen (2010) model, log returns load on the public-market return through a beta and carry an intercept, the alpha; the test compares alphas between lineage groups, so a higher raw return that only compensates for higher systematic risk does not count as an excess return. Betas are estimated separately by sector, because deep-tech sectors differ in their exposure to public markets.

6.4 Sources of any edge (H4)

Four splits trace where an effect comes from. First, among founders whose advisors ever founded a firm, those who earned their degree after the advisor's first founding are compared with those who earned it before, within advisor and conditional on degree year. Second, firms co-founded with the advisor are separated from independent firms, since only the latter show transmission rather than recruitment. Third, the effect is interacted with the distance between the dissertation and the firm's technology: transmitted technical knowledge should fade with distance, while transmitted norms and networks should not. Fourth, estimates with and without lead-investor fixed effects show whether lineage capital works through which investors a founder attracts, the matching channel emphasized by Sørensen (2007). A causal design for the first split, at the level of all students rather than founders, is set out in Online Appendix B.

6.5 Threats and responses

Table 4. Threats to the pricing and returns tests

Threat	Consequence	Response
Valuations disclosed selectively	Biased pricing and return estimates	Disclosure model, inverse-probability weights, Lee bounds; milestone tests need no later valuation
Preferred terms inflate post-money valuations	Prestigious-lineage firms with richer terms look more expensive	Controls for round size and known terms; adjustment following Gornall and Strebulaev (2020) where terms are observed
Database backfill	Successful lineage firms over-represented	Primary sample anchored on contemporaneous Form D filings or press
Look-ahead in measures	Lineage measured with information that arrived later	Every measure fixed at the round date, including Wikipedia page creation dates and alumni firms founded before the round
Sector hype cycles	Prestigious lineages concentrated in hot sectors and years	Sector-by-quarter effects; leave-one-sector-out estimates
Advisor-link errors	Attenuation and misclassification	Validation sample of 150 founders, including name-match errors; co-authorship-only links used only in robustness
Many outcomes and measures	False positives	Three primary outcomes fixed in advance; Romano–Wolf adjustment

7. Feasibility, Power and Falsification

Power. Table 5 shows minimum detectable effects at 80 percent power and a two-sided 5 percent level, for a design effect of 1.2 from clustering by advisor. The milestone row assumes a 30 percent baseline milestone rate; the valuation row assumes that half of first priced rounds disclose a valuation and that the residual standard deviation of log valuation is 1.0. Both assumptions are illustrative, and the pilot replaces them with measured values. The power limits are binding. The frame holds about 159,000 first- and second-generation descendants. At the founder rate in the MIT sample, 2 to 4 percent of doctoral graduates founding a U.S. physical-science startup, and allowing for lower rates outside the elite tier, descendants who work abroad and founders of several firms, it should yield on the order of 1,500 to 3,500 linked firms; the projection remains uncertain until descendants are matched to founder records. At 500 firms only a milestone gap of about 13 to 15 percentage points is detectable; at 1,000, about 9 to 10. This is why the milestone hazard conditional on the entry valuation, which needs one valuation per firm, is the primary H3 test, and why the second stage is planned from the outset.

Table 5. Minimum detectable effects by sample size

Linked doctoral-founded firms	Milestone gap, 25% high-lineage (pp)	Milestone gap, 40% high-lineage (pp)	Valuation premium, 25% high-lineage	Valuation premium, 40% high-lineage
250	20.5	18.1	88%	75%
500	14.5	12.8	57%	49%
1,000	10.3	9.1	37%	32%
2,000	7.3	6.4	25%	22%
4,000	5.1	4.5	17%	15%

Decision rule. Round-to-round returns become a co-primary H3 outcome only if at least 500 firms have two consecutive disclosed valuations; otherwise they are reported as secondary. If fewer than 1,000 doctoral-founded firms can be linked to an advisor, sectors are pooled and the H4 splits are reported as descriptive.

Tests that could falsify the interpretation.

1. *Salient prestige should be priced.* If the salience score and star advisors do not raise entry valuations, the measures miss what investors see, and the contrast between salient and latent signals is uninformative.
2. *Specialists should leave less on the table.* Under limited attention, residual lineage effects should be concentrated in rounds led by generalist investors and smaller in rounds led by deep-tech specialists, who can assemble lineage information at lower cost.
3. *Learning should erode any edge.* Signals matter less as other information about quality arrives (Higgins et al. 2011), so residual effects should be larger in young sectors such as quantum technologies than in mature ones such as semiconductors, should shrink over time within a sector, and, in the second stage, should be smaller in therapeutics.
4. *Information that came later cannot have been priced.* Lineage events that occur after a round, such as an advisor's later founding, should not predict that round's valuation. If they do, lineage measures also proxy for lab quality that investors observe directly, and H3 is read accordingly.
5. *Doctoral training alone should not explain the result.* Lineage effects are estimated among doctoral founders only, so they cannot reflect a general return to the doctorate; the second-stage non-doctoral benchmark measures that return separately, in the same sectors and years.

8. Implications

For investors. If salient prestige is priced and lineage capital is not, excess returns in deep tech come from measuring lineages rather than from backing famous names. The information exists before a company does: lab rosters, dissertations, co-authorships and earlier firms are public records, and a lineage map identifies which trainees of which labs are likely to found and succeed. If instead prestige carries a halo, the implication is price discipline on well-known names. Either way, the tests say which part of the founder signal investors should pay for.

For founders. A pricing premium for salient prestige, if found, is a cost borne by founders who lack it. Second-generation founders and trainees of less famous but entrepreneurial labs would then have evidence that their lineage predicts success, and grounds to negotiate on it.

For universities and policy. Labs whose members found companies generate value that accrues years later and often outside the root field, and campus metrics that count only faculty founding miss it. Early-stage grant programs raise later venture financing (Howell 2017); targeting them at early-career scientists from founding lineages could amplify that effect where private investors underprice those lineages. Regional strategies for tech clusters (Kerr and Robert-Nicoud 2020) can use lineage maps to see where founding capacity is concentrated.

9. Limitations and Conclusion

Five limitations bound the design. First, the sample contains only venture-backed firms, so the pricing and returns tests describe the opportunity set investors actually face, not all science-based firms. Second, valuations are disclosed selectively and overstate fair value; the design models disclosure and leans on milestone outcomes that need no later valuation, but return estimates remain noisier than in public markets. Third, lineages are rooted at eleven universities, so founders whose lineages begin elsewhere enter only through descendants who trained or worked at those universities; advisor fields are sparse in dissertation records before the late 1990s, so third-generation founders are reported descriptively, and postdoctoral links, which come mainly from lab pages, remain incomplete for labs without public alumni lists, which attenuates lineage effects. Fourth, the performance test (H1) shows prediction, not causation; only the exposure comparison in H4 and the companion design in Online Appendix B speak to whether lineages transmit capability. Fifth, the period includes unusual swings in deep-tech financing, and results for 2000 to 2022 may not carry over to later cycles.

Deep-tech investors rely on academic lineage because they must. This paper asks whether that reliance generates excess returns, or whether the market already charges for it. Separating what investors can see at a glance from what a lineage passes on to its members turns a question about founders into a question about prices. The answer tells investors which part of the founder signal is worth paying for, tells founders from less famous labs whether their lineage is undervalued, and tells universities where the value of their labs' founding actually lands.

Disclosure

Analysis plan. The hypotheses, sample, primary outcomes, measures and decision rules in Sections 3, 5, 6 and 7 were registered at OSF Registries on 7 November 2026 (Secondary Data Preregistration; https://doi.org/10.17605/OSF.IO/9NGXK) before outcome data were merged into the lineage-linked estimation sample, and all primary estimates will be reported regardless of sign. One step preceded the registration on the same day and is not described in it: descendants were matched by name to executives in SEC Form D filings and to principal investigators of SBIR and STTR awards, and two random samples of 150 matches each were checked by hand to measure identity accuracy. Name alone identified the same person in about 7 percent of matches, weighted across name-frequency strata; matches with a second identifier (the company among the person's OpenAlex affiliations or authorships, an STTR partner that is the person's doctoral university, or a rare name appearing in both sources)

identified the same person in 64 of 75 checked cases, 2 were different people and 9 could not be resolved. No financing, valuation or outcome variable was consulted in these checks.

Outcomes seen before registration. Two sets of outcome information were seen before registration. First, the sector-level pilot (Section 5.4, PitchBook screener, 5 November 2026) reported aggregate Series B rates by founders' university before the university frame was fixed; these counts were not linked to lineages, are excluded from the confirmatory analysis and are reported only as feasibility evidence. Because the pilot's photonics sample overlaps the estimation frame, every primary test is also reported excluding the firms in that sample; this robustness check was added after registration. Second, outcomes of the seven case lineages were known; every test is also reported without them.

Data. PitchBook data are used under an academic license; firm-level identifiers and valuations are not redistributed. The lineage map released with the paper contains public information only: advisor links, firm names, founding years and milestone indicators.

Conflicts of interest. The author declares no competing interests.

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Online Appendices

Online Appendix A: Lineage firms in the seven case lineages. Every firm in Table 3 with its founders, degree stage, advisor link, generation, tie strength, role, financing basis, success coding and sources, with the search protocol that added or excluded firms (Online Appendix A). Financing figures for Suno, Lightmatter and QuEra are from PitchBook, accessed 1 November 2026; Oratomic's are from press reports of October 2026. Metalenz and HyperLight financing and valuation figures are from PitchBook, accessed 5 November 2026, and Metalenz's shipment figure is from ID Tech Wire (July 2025).

Online Appendix B: Student-level exposure design. The causal test of transmission behind H4, run on all doctoral students rather than on founders. It compares students already enrolled when their advisor first founded a company with earlier students of the same advisor and with contemporaneous students of advisors who had not yet founded, using staggered-adoption and stacked estimators, sensitivity bounds and placebo dates (companion manuscript).

Online Appendix A: Firm-Level Sources for Table 3

Abbie R. Lee, Eigen Flow Research · Nov 1, 2026; revised Nov 6, 2026

This appendix lists, firm by firm, what stands behind each count in Table 3. As of 3 November 2026, 68 of the 73 individually counted firm entries are confirmed or partly confirmed, 1 still rests only on the June 2026 lineage dossiers, and 4 are recommended for exclusion: three because the sources opened show no tie to the lineage root, and Quantum-Si because its Capasso-linked scientist was an early employee rather than a founder. Each alumni entry also carries a tie-strength code, so every count can be restated on documented training ties alone.

Definitions

- **Generation.** 0 = the root PI founded or co-founded the firm. 1 = founded by a trainee of the root: a doctoral student, a postdoc or a research staff member supervised in the root's group. The rule is the same for every root; it is what places Capasso's Bell Labs staff in generation 1. 2 = founded by a trainee of a generation-1 scientist. A firm tied to two roots is listed under each (Lightsynq; the seven firms shared by the Zhang and Church rows), so lineage rows are not additive.
- **Tie strength.** A = advisor of record in a dissertation repository (DASH, DSpace, ProQuest). B = training documented in another source that names the relationship (lab alumni page, curriculum vitae, institutional biography, LinkedIn). C = co-authorship or shared affiliation only, with no supervision named. U = tie asserted only in the June 2026 dossiers. For generation-2 firms the code is the weaker of the two links. The code appears in brackets in the Gen. column; strict counts use A and B only.
- **Founded with a trainee.** A firm a scientist co-founded with his or her own trainee, flagged because the trainee often leads it: Metalenz (Capasso with Devlin), Lightelligence and Lux Labs (Soljačić with Yichen Shen), Sherlock (Zhang with his student Abudayyeh) and CavilinQ (Lukin with former postdoc Bernien, tie per dossier), and one generation down, HyperLight (Lončar with Mian Zhang and Cheng Wang) and Axoft (Jia Liu with Le Floch). The flag does not change the generation code. It lets the paper's comparison of firms founded with and without the advisor (H4) be run on the case firms, and it makes Metalenz and HyperLight a matched pair one generation apart.
- **Table 3 column.** PI-founded firms are generation 0. Alumni-founded firms are generations 1 and 2 without the root among the founders.
- **Check.** *Confirmed*: a source opened states both the founder role and the lineage tie. *Partly confirmed*: a source states one of the two. *Not yet verified*: taken from the dossiers and not yet checked. *Tie not found*: the founder role is confirmed, but no source opened shows the tie, so the firm is left out of the recount.
- **Sources.** S-numbers point to the Sources list. DASH = the advisor field of Harvard dissertation records, queried on 1 November 2026; DSpace = the same field in MIT DSpace thesis records. PB = PitchBook founder, round and exit records checked on 1 and 3 November 2026; licensed, so cited but not reproduced. LI = LinkedIn profile viewed on 3 November 2026; login required, so cited but not reproduced.

- **Financing / status** is coarse and descriptive. Outcomes Y1 (successful founding) and Y3 (venture-backed founding) will be coded from financing records, not from this column.
- **Success.** A firm is successful if it raised a Series B or later round, went public or was acquired for more than the equity it raised. This is the firm-level counterpart of outcome Y1 in the paper. Acquisitions at undisclosed prices are coded as not yet successful; the strict recount below also reports them coded as successful.

Recount against Table 3

The recount keeps the physical-science pattern of Table 3: in the Capasso, Lieber and Lukin lineages, alumni found more firms than the PI even on confirmed entries alone. Two Capasso firms and Soljačić's single alumni firm lack a documented tie, and a third Capasso firm, Quantum-Si, is excluded because its lineage scientist was not a founder. Lab alumni pages read on 6 November 2026 (S63 to S66) were checked against PitchBook the same day. They add one firm not counted in Table 3: Modern Electron (later Modern Hydrogen; Bellevue and Woodinville, WA; founded 2015), co-founded by Lieber alumnus Max Mankin (tie B, lab page) with Tony Pan, which raised $128.2 million, reached a Series B2 round at a $180.8 million post-money valuation in March 2023 and ceased operations in July 2026 (PB). It meets the success definition through its Series B round and also shows that a milestone does not guarantee survival. The Lieber alumni count is therefore a lower bound by one. Three other executives named on the pages lead firms outside the sample: NEEM Scientific and OmniZare have no PitchBook record of institutional financing, and IRSweep, co-founded by Capasso research fellow Markus Geiser, is Swiss. Capasso's page also lists Ali Kabiri as a Quantum-Si co-founder; company and press sources name Jonathan Rothberg as founder and the sources opened for this appendix show Kabiri as an early employee, so the exclusion stands.

Lineage	Table 3 PI / alumni	Alumni confirmed	Alumni partly confirmed	Alumni not yet verified	Excluded (tie or founder role not found)	Alumni-to-PI ratio, confirmed + partly	Ratio if all unverified hold
Capasso	2 / 15	8	7	0	3	7.5	7.5
Lieber	2 / 25	12	13	0	0	12.5	12.5
Lukin	3 / 8	7	1	0	0	2.7	2.7
Soljačić	3 / 0	0	0	0	1	0	0
Zhang	7 / 1	1	0	0	0	0.14	0.14
Church (alumni column only)	~50 / 10	9	1	0	0	—	—

Strict recount. The next table restates the alumni counts by tie strength.

Lineage	PI firms	Alumni, tie A or B	Alumni, tie C	Alumni, tie U	Alumni-to-PI ratio, A or B only	Successful alumni, A or B only	Successful alumni, all ties, with undisclosed-price exits
Capasso	2	8	6	1	4.0	3	4
Lieber	2	14	9	2	7.0	4	11
Lukin	3	8	0	0	2.7	6	6
Soljačić	3	0	0	0	0	0	0
Zhang	7	1	0	0	0.14	1	1
Church (alumni column only)	~50	3	7	0	—	2	9

On training ties documented beyond co-authorship, alumni still found more firms than the PI in the Capasso, Lieber and Lukin lineages, with ratios of 4.0, 7.0 and 2.7, so the physical-science pattern does not rest on co-authorship ties. The Church row is different. Its seven Zhang-line firms rest on a C tie, because Zhang's 2009–10 Junior Fellowship was an independent position and no source opened names Church as his supervisor; on A and B ties the Church alumni column holds three firms, two of them successful. Coding the two undisclosed-price acquisitions (IRsweep and Cuberg) as successful raises the count of successful alumni firms from 3 to 4 for Capasso and from 10 to 11 for Lieber.

PI-firm checks: Capasso 2 of 2 confirmed, Lieber 1 of 2, Lukin 3 of 3, Soljačić 3 of 3, Zhang 7 of 7. Church's alumni column holds the seven Zhang-line firms other than Editas (Beam, Arbor, Sherlock, Pairwise, Aera, Moonwalk and Tome) plus three firms founded by his former postdocs: Octant Bio, Boundless Bio and Shape Therapeutics.

Search protocol

Firms entered the table in four passes, each dated. First, lab websites, curricula vitae, the Academic Family Tree, faculty pages, company websites, press releases and public filings were searched for each root and its documented trainees between June and November 2026. Second, on 1 November 2026, every OpenAlex co-author of the Capasso and Lieber roots and of the 17 first-generation alumni of those lineages who supervise students was matched against the related-persons section of SEC Form D filings (S56, S57). This screen added Validere and NanoMosaic to the Capasso row and IsoPlexis, Singleron Biotechnologies, AtlasXomics, Kula Bio, Biko Biolabs, Feon Energy and HighT-Tech to the Lieber row; because Form D covers only U.S. offerings, firms financed abroad were checked separately. Third, Marko Lončar's lab alumni page added Lumina and Lightsynq to the Capasso row; Lightsynq co-founder Bart Machielse was co-advised by Lukin and Lončar, so the firm also appears in the Lukin row. Fourth, PitchBook founder records checked on 1 November 2026 confirmed founder roles at Suno, QuEra,

Lightmatter, Lightsynq and Moonwalk Biosciences, and PitchBook and LinkedIn checks on 3 November 2026 added Peak Power Optics and CellsBin to the Capasso row and removed Quantum-Si, whose Capasso-linked scientist was an early employee rather than a founder. MIRO Analytical and SkyCool Systems (Capasso) and Aliro Quantum (Soljačić) are excluded because no source documents a tie between their founders and the root. The Church and Zhang rows of Table 3 share seven firms: Beam, Arbor, Sherlock, Pairwise, Aera, Moonwalk and Tome. Success was coded from PitchBook round and exit records checked on 3 November 2026, and, for four firms first coded from press reports, from PitchBook profiles opened on 5 November 2026.

Success coding

Every firm counted in Table 3 except the Langer and Church PI firms is coded against the success definition from PitchBook round and exit records, checked on 3 November 2026. PitchBook's daily limit of 50 profiles was reached on 3 November before Moonwalk, Tome, Octant and WindBorne were opened, so those four were first coded from press reports of their Series B rounds (S31, S59 to S61). Their PitchBook profiles, opened on 5 November 2026, confirm all four codes. Rounds that PitchBook labels only as later-stage VC, without a series letter, are coded as not yet successful (Optics11, LifeLabs Design), as are acquisitions at undisclosed prices (IRsweep, Cuberg), following outcome Y1. The definition records reaching a milestone, not survival: four firms that met it later closed (Alphabet Energy, Modern Hydrogen, Natron Energy and Tome Biosciences). Firm-level codes are in the success_status column of the CSV version of this appendix.

Lineage	Firms coded	Successful, PI / alumni	Successful firms	Acquired at undisclosed price	Not yet successful	Not found or restricted
Capasso	17	1 / 3	Metalenz; HyperLight, Validere, Lightsynq	IRsweep	11	Rhizome Works
Lieber	27	1 / 10	Nanosys; Alphabet Energy, Amprius, EnerVenue, Crossbar, MemryX, Modern Hydrogen, Nantero, Natron Energy, IsoPlexis, Singleron	Cuberg	13	Vista Therapeutics, AIScientists
Lukin	11	1 / 6	QuEra; Suno, Lightsynq, DUST Identity,	—	3	Quantum Network Technologie

Lineage	Firms coded	Successful, PI / alumni	Successful firms	Acquired at undisclosed price	Not yet successful	Not found or restricted
			Lightmatter, Oratomic, WindBorne			s
Soljačić	3	2 / 0	WiTricity, Lightelligence	—	1	—
Zhang	8	7 / 1	Editas, Arbor, Pairwise, Sherlock, Beam, Aera, Moonwalk; Tome	—	0	—
Church (descendant firms)	10	— / 9	Beam, Arbor, Pairwise, Sherlock, Aera, Moonwalk, Tome, Octant, Boundless Bio	—	1	—
Langer	—	Not coded	Section A.6 lists examples only	—	—	—

Lightsynq appears in both the Capasso and Lukin rows, and Beam, Arbor, Pairwise, Sherlock, Aera, Moonwalk and Tome in both the Zhang and Church rows. The lineages were chosen for visibility, so these shares describe the motivating cases, not population rates.

A.1 Capasso (Harvard SEAS; Bell Labs before 2003)

Both PI firms and eight alumni firms are confirmed. MIRO Analytical and SkyCool Systems should leave the count and are now excluded from Table 3. The co-author and Form D screen added Validere and NanoMosaic, both founded by students of Marko Lončar, so the alumni count stayed at 12; Lončar's lab alumni page then added Lumina and Lightsynq, raising it to 14. LinkedIn and PitchBook checks on 3 November 2026 added Peak Power Optics and CellsBin and removed Quantum-Si, because Ali Kabiri, the Capasso-linked scientist the dossier named, was an early employee rather than a founder; the count is now 15. The same checks confirmed the founder roles of Mariano Troccoli, Alan She and Balthasar Mueller and Wei Ting Chen's role as CTO; their ties to Capasso rest on many joint papers rather than a named supervisor, so they are coded C.

Metalenz and HyperLight. The two firms share a founding structure one generation apart. Metalenz was co-founded by Capasso with his doctoral student Rob Devlin, who runs it as CEO; HyperLight was co-founded by Capasso's former postdoc Lončar with his own postdoc Mian Zhang, who runs it as CEO, and his doctoral student Cheng Wang. In each, a professor founded with his trainees and a trainee leads.

Under the coding rules Metalenz is PI-founded in the Capasso row and HyperLight is alumni-founded, because Lončar rather than Capasso is the founder; from Lončar's own position, HyperLight is his PI firm in the same sense that Metalenz is Capasso's. Metalenz is the lineage's clearest commercial success in product terms: its optics, made under an exclusive license by STMicroelectronics, had shipped in more than 140 million units by July 2025 (S62). Its last priced round, a $30 million Series B in October 2022, valued it at $130 million post-money, and PitchBook records no round since; it has raised $47 million in total (PB, checked 5 November 2026). HyperLight's $80 million Series C in June 2026 valued it at $867 million post-money, with $135 million raised in total (PB, checked 5 November 2026; S46). The two rounds are 44 months apart and the firms differ in capital intensity, since HyperLight is scaling wafer production of thin-film lithium niobate while Metalenz licenses its designs to an existing fab, so the pair shows where financing and valuations went, not which firm is worth more. Both meet the success definition.

Firm (founded)	Founders and role	Tie to root	Gen. (tie)	Financing / status	Check	Sources
Metalenz (2016) · PI	Capasso, Rob Devlin (CEO), Bart Riley; co-founders	Capasso (root); Devlin PhD 2017 with Capasso. Public launch 2021.	0	VC-backed; $30M Series B (Oct 2022) at $130M post-money, no round since; $47M raised (PB); optics in over 140M units shipped via STMicroelectronics by Jul 2025 (S62)	Confirmed	S1; DASH; PB; S62
Pendar Technologies, via Eos Photonics (2010) · PI	Capasso, Mark Witinski, Christian Pfluegl, Laurent Diehl; co-founders of Eos	Capasso (root). Eos later merged into Pendar.	0	Grants and debt only (PB)	Confirmed	S2; PB
Alpes Lasers (1998)	Jérôme Faist, Antoine Muller, Matthias Beck; founders	Faist: postdoc, then member of technical staff, in Capasso's Bell Labs group from 1991	1 (B)	Controlled by Elbit Systems; no venture rounds	Confirmed	S3; S4; PB

Firm (founded)	Founders and role	Tie to root	Gen. (tie)	Financing / status	Check	Sources
				recorded (PB)		
IRsweep (2014)	Markus Mangold, Andreas Hugi, Markus Geiser; founders (PB)	ETH Zurich spin-off; link to Faist's group not stated in the sources opened	2 (U)	Acquired by Sensirion (2021), price undisclosed; $0.1M raised (PB)	Partly confirmed	S5; PB
HyperLight (2018)	Mian Zhang (CEO), Cheng Wang, Christian Reimer, Kevin Luke and Marko Lončar; co-founders (PB)	Lončar was Capasso's postdoc, 2003–2006; Zhang and Reimer were Lončar postdocs and Wang a Lončar PhD	1–2 (B)	VC-backed; $80M Series C (Jun 2026) at $867M post-money, $135M raised (PB)	Confirmed	S6; S7; S46; S58; PB
Optics11 (2011)	Hans Brouwer and Davide Iannuzzi; co-founders (PB)	Iannuzzi: postdoc at Bell Labs, then Harvard; 26 joint papers with Capasso, 2003–2005; supervisor not named	1 (C)	Unlabeled later-stage VC rounds and debt, $40M raised (PB)	Partly confirmed	S8; S9; S57; PB
Leadoptik (2020)	Reza Khorasaninejad (CEO) with Jiang You; co-founders (PB)	Former postdoctoral fellow in Capasso's lab	1 (B)	$4.6M Series A (2025), $11.5M raised (PB)	Confirmed	S1; PB
Evolution Photonics (2017)	Mariano Troccoli; founder and president (LI)	51 joint papers with Capasso, 2002–2018; profile lists Harvard SEAS (LI)	1 (C)	No financing recorded (PB)	Partly confirmed	LI; S57; PB
SNOChip (2022)	Wei Ting Chen; CTO since 2022 (LI, PB); co-	Harvard research associate in metasurfaces to	1 (C)	$1.05M seed (May	Partly confirmed	S12; LI; S57; PB

Firm (founded)	Founders and role	Tie to root	Gen. (tie)	Financing / status	Check	Sources
	founder role not stated	2020 (LI); 67 joint papers with Capasso		2026, PB)		
Dynacyte Bio (2021)	Alan She; founder (PB)	She: Harvard PhD 2018, Applied Physics (DASH); 17 joint papers with Capasso	1 (C)	Accelerator funding only (PB)	Partly confirmed	DASH; S57; PB
Rhizome Works (2018)	J. P. Balthasar Mueller; founder and principal, 2018–2024 (LI)	Harvard Applied Physics PhD, 2016 (LI); 17 joint papers with Capasso	1 (C)	Not in PitchBook	Partly confirmed	LI; S57
CellsBin (2022)	Ali Kabiri; co-founder and CEO (PB, LI)	Kabiri: Harvard SEAS postdoc in nanoplasmonics, 2011–2013 (LI); 4 joint papers with Capasso, 2012–2013	1 (C)	$7.3M Series A (Sep 2026, PB)	Partly confirmed	LI; S57; PB
MIRO Analytical (2018)	Morten Hundt, Oleg Aseev; founders	Empa spin-off; no Faist or Capasso link in the source opened	—	Private	Tie not found	S10
SkyCool Systems	Aaswath Raman; co-founder	Raman was a Stanford postdoc; no Capasso link in the source opened	—	VC-backed; private	Tie not found	S11
Quantum-Si (2013)	Ali Kabiri was an early scientist, 2013–2022, not a founder (LI); PitchBook names no Capasso-linked founder	Kabiri: Capasso postdoc (see CellsBin)	—	Public (NASDAQ: QSI)	Founder role not found	LI; PB
Validere	Ian Burgess	Burgess: Harvard	2 (B)	VC-backed;	Confirmed	S47; S48;

Firm (founded)	Founders and role	Tie to root	Gen. (tie)	Financing / status	Check	Sources
(2015)	(co-founder, President) with Nouman Ahmad	PhD 2012, advisor Marko Lončar; Lončar was Capasso's postdoc		$43M Series B (2022), $66M raised (PB)		DASH; S7; S58; PB
NanoMosaic (2018)	Qimin Quan (CSO) with John Boyce; co-founders (PB)	Quan: Lončar lab PhD 2012 (lab alumni page)	2 (B)	Series A and A1, $48M raised (PB)	Confirmed	S49; S58; PB
Lumina	Keith Powell; co-founder and CEO (LI, PB)	Powell: Lončar postdoc 2024–2026 (lab alumni page)	2 (B)	Seed round (Feb 2026); Sydney-registered (PB)	Confirmed	S58; LI; PB
Peak Power Optics (2018)	Haig Atikian; co-founder and chief scientist (LI, PB)	Atikian: Lončar lab PhD 2016, then postdoc to 2018 (lab alumni page; LI)	2 (B)	Accelerator funding only (PB)	Confirmed	S58; LI; PB
Lightsynq (2024), also in the Lukin row	Bart Machielse (CTO) with Mihir Bhaskar and David Levonian; co-founders	Machielse: Harvard PhD 2021, advisors Lukin and Lončar; listed as a Lončar lab alumnus	2 (B)	$18M Series A; acquired by IonQ for $306M (May 2025, PB)	Confirmed	DASH; S58; PB

Where Lončar's doctoral graduates went. His lab lists 40 PhD graduates for 2012 to 2026, with positions as last updated by the lab (S58). Startups take the largest share, and HyperLight alone employs five of them.

Destination	PhD graduates	Names
Startups and small firms	15	HyperLight (Warner, Xin, Cheng, Renaud, Holzgrafe); Nubis (Joe, Rimoli Assumpção); Lightsynq (Haas); Aliro (Chalupnik); Q-CTRL (Maity); Metalenz (Latawiec); Lazurite (Puma); Peak Power Optics (Atikian, co-founder); Validere (Burgess, president); NanoMosaic (Quan, CSO)
Large firms and finance	12	AWS (Ding; Machielse, who later co-founded Lightsynq), Google, Analog Devices, Illumina, DRS Daylight, Draper, Exponent, Sonos, Glassdoor,

Destination	PhD graduates	Names
		Physical Sciences Inc., Amber Group
Faculty	7	Peking, Virginia Tech (2), KAIST, CityU Hong Kong (Cheng Wang, HyperLight co-founder), UW–Madison, Michigan
Postdocs, research staff, government labs	6	NYU, Boston University, Caltech, Harvard SEAS, Fermilab, A*STAR

Five of the 40 co-founded firms (Burgess, Quan, Wang, Machielse and Atikian). Among postdocs, Mian Zhang (HyperLight) and Keith Powell (Lumina) are co-founders.

A.2 Lieber (Harvard Chemistry)

Nine firms founded by students of Lieber's alumni were missing: Cuberg, Natron Energy, Feon Energy and HighT-Tech in Yi Cui's line, and IsoPlexis, Singleron Biotechnologies, AtlasXomics, Kula Bio and Biko Biolabs in Peidong Yang's line. With them the alumni count rises from 16 to 25. All 25 alumni entries are confirmed (12) or partly confirmed (13). For InventWood and Solidec, PitchBook confirms the founder roles, but the training ties rest only on the dossiers, so their ties are coded U. AIScientists is partly confirmed because no source opened states Jia Liu's founder role. Nanosys is confirmed as a PI firm (co-founded by Larry Bock, Lieber and Paul Alivisatos); Vista Therapeutics is not yet sourced. One source says Peidong Yang was a founding advisory-board member of Nanosys, not a co-founder.

Firm (founded)	Founders and role	Tie to root	Gen. (tie)	Financing / status	Check	Sources
Nanosys (2001) · PI	Larry Bock, Charles Lieber, Paul Alivisatos; founders	Lieber (root). PitchBook lists only Larry Bock and Peidong Yang as founders	0	Acquired by Shoei Chemical (2023)	Confirmed	S32; S13
Vista Therapeutics (2007) · PI	Charles Lieber; co-founder (dossier)	Lieber (root)	0	Private	Not yet verified	DOS
Alphabet Energy	Peidong Yang with Matthew Scullin; co-founders	Yang: Harvard PhD 1997 with Lieber	1 (B)	VC-backed	Confirmed	S13
Nirmidas Biotech	Hongjie Dai; co-founder, scientific advisor	Dai: Harvard PhD 1994 with Lieber	1 (B)	Private	Confirmed	S14

Firm (founded)	Founders and role	Tie to root	Gen. (tie)	Financing / status	Check	Sources
Amprius (2008)	Yi Cui; founder	Cui: Lieber doctoral student	1 (B)	Public (NYSE: AMPX)	Confirmed	S15; S16
4C Air (2015)	Yi Cui; founder	As above	1 (B)	Private	Confirmed	S15; S16
EEnotech	Yi Cui; founder	As above. The dossier spelled it “EEnovate”.	1 (B)	Private	Confirmed	S16
LifeLabs Design	Yi Cui; founder	As above	1 (B)	Private	Confirmed	S16
EnerVenue (2020)	Yi Cui; founder	As above	1 (B)	VC-backed; private	Confirmed	S16
Crossbar (2010)	Wei Lu; co-founder	Lu: postdoc in Harvard Chemistry 2003–05 and Lieber co-author; supervisor not named	1 (C)	VC-backed; private	Partly confirmed	S17
MemryX (2019)	Wei Lu; co-founder, CTO	As above	1 (C)	VC-backed; private	Partly confirmed	S17
Modern Hydrogen	Max Mankin; co-founder, former CTO	Mankin: Harvard PhD 2015, Chemistry and Chemical Biology, advisor Lieber	1 (A)	VC-backed; private	Confirmed	S18; DASH
Axoft (2021)	Paul Le Floch (CEO), Jia Liu, Tianyang Ye; co-founders	Jia Liu: Harvard PhD 2014 with Lieber. Le Floch: PhD 2021, advisor Jia Liu.	1 (A)	VC-backed; private	Confirmed	S19; DASH
Nantero (2001)	Thomas Rueckes; co-founder (PB)	Co-authored the 2000 nanotube-memory paper with Lieber; training role not checked	1 (C)	Series F to H; acquired by SBM Investors (2021), price	Partly confirmed	S20; DOS

Firm (founded)	Founders and role	Tie to root	Gen. (tie)	Financing / status	Check	Sources
				undisclosed (PB)		
Elastro	Jia Liu; co-founder (paper disclosures, dossier)	Jia Liu: Harvard PhD 2014 with Lieber	1 (A)	Private, early stage	Confirmed	DASH; S56
AIScientists	Jia Liu; co-founder (paper disclosures, dossier)	As above	1 (A)	Private, early stage	Partly confirmed	DASH; S56
InventWood	Liangbing Hu with Josh Cable, Amy Gong and Alex Lau; founders (PB)	Hu: Yi Cui postdoc (dossier)	2 (U)	Series A and AA, $43M raised (PB)	Partly confirmed	DOS
Solidec (2023)	Haotian Wang (chief scientist) with Ryan DuChanois and Yang Xia; co-founders (PB)	Wang: Yi Cui doctoral student (dossier)	2 (U)	$2.1M seed (Apr 2026, PB)	Partly confirmed	DOS
Cuberg (2015)	Richard Wang; co-founder	Wang: Stanford PhD in materials science with Yi Cui	2 (B)	VC-backed; acquired by Northvolt (2021)	Confirmed	S40
Natron Energy (2012)	Colin Wessells; founder, while a Stanford PhD student	Stanford materials-science PhD; 27 joint papers with Yi Cui, 2008–2014; advisor not stated in sources opened	2 (C)	VC-backed, about $200M by Sep 2024; ceased operations Sep 2025	Partly confirmed	S41
HighT-Tech	Liangbing Hu; founder	Hu: Yi Cui postdoc (dossier); 41 joint papers with Cui, 2009–2014	2 (C)	Seed; private	Partly confirmed	S50; S56; S57

Firm (founded)	Founders and role	Tie to root	Gen. (tie)	Financing / status	Check	Sources
Feon Energy (2022)	Wenxiao Huang; co-founder, CEO	Stanford spin-out; 22 joint papers with Yi Cui, 2019–2026	2 (C)	VC-backed; $6.1M seed	Partly confirmed	S51; S57
Kula Bio (2018)	Kelsey Sakimoto, listed on Form D; founder role not stated in sources opened	Sakimoto: Berkeley PhD 2016 with Peidong Yang	2 (B)	VC-backed; $10M seed and $50M Series A	Partly confirmed	S52; S53; S56
Biko Biolabs	Kelsey Sakimoto; founder and director	Sakimoto: Berkeley PhD 2016 with Peidong Yang	2 (B)	Private	Confirmed	S52
IsoPlexis	Rong Fan; co-founder	Berkeley chemistry PhD 2006; 18 joint papers with Peidong Yang, 2002–2009; advisor not stated in sources opened	2 (C)	VC-backed (Form D filings)	Partly confirmed	S54; S56; S57
Singleron Biotechnologies	Rong Fan; co-founder	As above	2 (C)	Private	Partly confirmed	S54
AtlasXomics	Rong Fan; co-founder	As above	2 (C)	Private	Partly confirmed	S54

A.3 Lukin (Harvard Physics)

All eight alumni firms have a documented tie, and seven are fully confirmed; WindBorne Systems and Polygence were added from Lukin's own list of alumni. CavilinQ, co-founded in 2026 by Lukin with his former postdoc Hannes Bernien, adds a third PI firm. Oratomic, founded in 2025 by Lukin's PhD student Dolev Bluvstein with his former postdoc Manuel Endres, reached a $5.4 billion valuation in October 2026, seven months after its public launch. Two run through Dirk Englund, who was Lukin's postdoc; Lightmatter is generation 2 through Englund's students. DUST Identity counts through Englund alone, because co-founder Jonathan Hodges did his MIT PhD with David Cory (DSpace, 2007).

Firm (founded)	Founders and role	Tie to root	Gen. (tie)	Financing / status	Check	Sources
QuEra Computing (2018) · PI	Lukin, Vladan Vuletić, Markus Greiner, Dirk Englund, Nathan Gemelke, John Pena; founders	Lukin (root)	0	VC-backed; private	Confirmed	S21; PB
Quantum Diamond Technologies (2012) · PI	Ronald Walsworth with Lukin and others; co-founders	Lukin (root)	0	Private	Confirmed	S34
Suno (2022)	Georg Kucsko with Mikey Shulman, Martin Camacho, Keenan Freyberg; co-founders	Kucsko: Harvard PhD 2016, Physics, advisor Lukin	1 (A)	VC-backed; private	Confirmed	S22; DASH; PB
Lightsynq (2024)	Mihir Bhaskar (CEO), Bart Machielse (CTO), David Levonian; co-founders	All three: Harvard PhD 2021, Physics, advisor Lukin	1 (A)	VC-backed; acquired by IonQ (2025)	Confirmed	DASH; PB
DUST Identity (2018)	Ophir Gaathon (CEO), Jonathan Hodges, Dirk Englund; founders	Englund: postdoc in Lukin's group	1 (B)	VC-backed; private	Confirmed	S23; S24
Quantum Network Technologies	Brendan Shields (dossier); listed as an Englund spin-off	Shields: Harvard PhD 2014, advisor Lukin; Englund: Lukin postdoc	1 (A)	Private	Partly confirmed	S24; DASH
Lightmatter (2017)	Nicholas Harris (CEO), Darius Bunandar, Thomas Graham; founders	Harris (PhD 2017, advisor Englund) and Bunandar (PhD 2019, advisors Englund and Vuletić), per DSpace	2 (B)	VC-backed; private	Confirmed	S25; S24; PB
Oratomic	Dolev Bluvstein	Bluvstein:	1 (A)	VC-backed:	Confirmed	S35; S36;

Firm (founded)	Founders and role	Tie to root	Gen. (tie)	Financing / status	Check	Sources
(2025)	(CEO), Manuel Endres and others; co-founders	Harvard PhD 2025, Physics, advisor Lukin. Endres: listed among Lukin's former postdocs.		$300M Series A (Jul 2026); $475M Series B at $5.4B (Oct 2026)		S37; DASH
WindBorne Systems (2019)	Andrey Sushko; co-founder, CTO (team page, S38; PitchBook's founder list omits him)	Sushko: Harvard PhD 2022, advisor Lukin	1 (A)	VC-backed; $37M Series B (Aug 2026) at $250M post-money, $62M raised (S61; PB)	Confirmed	S38; DASH
Polygence	Janos Perczel; co-founder, CEO	Listed among Lukin's former PhD students (MIT PhD, theoretical quantum physics)	1 (B)	VC-backed; private	Confirmed	S39; S37
CavilinQ (2026 seed) · PI	Lukin and Hannes Bernien, scientific co-founders; Shankar Menon (CEO), Brandon Grinkemeyer (CTO)	Lukin (root); Bernien: former Lukin postdoc (dossier)	0	VC-backed; $8.8M seed (Apr 2026)	Confirmed	S55; S56

A.4 Soljačić (MIT Physics)

Lightelligence is confirmed as a PI firm; it went public in Hong Kong in April 2026 (PB, checked 5 November 2026). The one alumni firm, Aliro Quantum, has a confirmed founder but no documented tie to Soljačić, so the alumni count falls from 1 to 0 until one is found. Lightmatter is not counted here: its founders trained with Englund, not Soljačić.

Firm (founded)	Founders and role	Tie to root	Gen. (tie)	Financing / status	Check	Sources
WiTricity (2007) · PI	Marin Soljačić; founder	Soljačić (root)	0	VC-backed; private	Confirmed	S33
Lightelligence (2017) · PI	Yichen Shen with Marin Soljačić, Huaiyu Meng, Spencer Powers; founders	Soljačić (root); Shen: MIT PhD 2016, advisor Soljačić (DSpace)	0	Public (Hong Kong IPO, Apr 2026; PB)	Confirmed	S26
Lux Labs · PI	Soljačić with John Joannopoulos, Yichen Shen and Spencer Powers; co-founders (PB)	Soljačić (root)	0	$1.5M seed (2017); closed 2024 (PB)	Confirmed	PB
Aliro Quantum (2019)	Prineha Narang; founder, CTO	Technology from Narang's Harvard lab; postdoc link to Soljačić not found	?	VC-backed; private	Tie not found	S27

A.5 Zhang (MIT and Broad Institute) and the firms shared with Church

All seven Zhang PI firms are confirmed. Church's alumni column holds the same seven Zhang-line firms except Editas, plus Tome; Zhang links to Church as a Harvard Junior Fellow (2009–10), and Church is listed among his academic advisors (S28). A Junior Fellowship is an independent position and no source opened names Church as Zhang's supervisor, so the Zhang–Church tie is coded C and the strict recount leaves these seven firms out of the Church row. Editas is a PI firm in both rows.

Firm (founded)	Founders and role	Tie to root	Gen. (tie) from Zhang / Church	Financing / status	Check	Sources
Editas Medicine (2013) · PI in both rows	Zhang, Jennifer Doudna and Harvard colleagues; co-founders (Church, Liu and Joung per dossier)	Both roots are co-founders	0 / 0	Public (NASDAQ: EDIT)	Confirmed	S28

Firm (founded)	Founders and role	Tie to root	Gen. (tie) from Zhang / Church	Financing / status	Check	Sources
Arbor Biotechnologies (2016) · PI	Zhang; co-founder	Zhang (root)	0 / 1 (C)	VC-backed; private	Confirmed	S28
Pairwise (2017) · PI	Tom Adams, Haven Baker; scientific founders Zhang, Liu, Joung	Zhang (root)	0 / 1 (C)	VC-backed; private	Confirmed	S29
Sherlock Biosciences (2018) · PI	Zhang; co-founder (James Collins, Omar Abudayyeh and Jonathan Gootenberg per dossier)	Zhang (root). The dossier gave 2019. PitchBook's founder list omits Zhang.	0 / 1 (C)	VC-backed; acquired by OraSure (2024)	Confirmed	S28
Beam Therapeutics (2018) · PI	Zhang with David Liu; co-founders (Joung per dossier)	Zhang (root). The dossier gave 2017.	0 / 1 (C)	Public (NASDAQ: BEAM)	Confirmed	S28
Aera Therapeutics (2023 launch) · PI	Zhang; co-founder	Zhang (root)	0 / 1 (C)	VC-backed; private	Confirmed	S28
Moonwalk Biosciences (2024 launch) · PI	Zhang with Alex Aravanis (CEO); co-founders	Zhang (root)	0 / 1 (C)	VC-backed; $70M Series B (Sep 2026) at $250M post-money, $127M raised (S59; PB)	Confirmed	S30; PB
Tome Biosciences (2023	Omar Abudayyeh, Jonathan Gootenberg; co-	Abudayyeh: MIT PhD 2018, advisor	1 (A) / 2 (C)	$213M raised; $117.5M	Confirmed	S31; S28; DASH

Firm (founded)	Founders and role	Tie to root	Gen. (tie) from Zhang / Church	Financing / status	Check	Sources
launch)	founders	Zhang (DSpace). Gootenberg's advisor of record (DASH, 2019) is Allon Klein.		Series B (Dec 2023) at $417.5M post-money (S31; PB); out of business Nov 2025 (PB)		
Octant Bio	Sri Kosuri with Ramsey Homsany; co-founders	Kosuri: postdoc in Church's lab, 2009–2011	— / 1 (B)	VC-backed, $116M raised; $80M Series B (Apr 2022) at $300M post-money (S60; PB)	Confirmed	S42; S43
Boundless Bio	Prashant Mali; scientific co-founder	Mali: postdoc in Church's lab, 2013–2014	— / 1 (B)	Public	Confirmed	S44; S45
Shape Therapeutics	Prashant Mali; co-founder (not yet confirmed in an opened source)	Mali: postdoc in Church's lab, 2013–2014	— / 1 (B)	VC-backed, $112M Series A (reported)	Partly confirmed	S45

A.6 Langer and Church: examples behind the "~" totals

Table 3 reports widely cited totals for these two roots, so this section lists only the firms the dossiers name. None is verified yet. The dossier's "~50" for Church also counts advisory roles, which would overstate a PI-founded count. Several Langer alumni firms may list Langer as a co-founder, which would move them to his PI column.

Firm	Root	Column claimed	Lineage founder (dossier)	Check
Moderna	Langer	PI	Langer, co-founder	Not yet verified

Firm	Root	Column claimed	Lineage founder (dossier)	Check
Alkermes, from Enzytech	Langer	PI	Langer, founder of Enzytech	Not yet verified
Seer	Langer	PI	Langer with Omid Farokhzad	Not yet verified
Momenta Pharmaceuticals	Langer	PI	Langer	Not yet verified
T2 Biosystems	Langer	PI	Langer	Not yet verified
Selecta Biosciences	Langer	PI	Langer	Not yet verified
Sigilon Therapeutics	Langer	PI	Langer with Daniel Anderson and Omid Veiseh	Not yet verified
Frequency Therapeutics	Langer	PI	Langer with Jeffrey Karp	Not yet verified
Kala Pharmaceuticals	Langer	PI	Langer	Not yet verified
Lyra Therapeutics	Langer	PI	Langer	Not yet verified
SQZ Biotechnologies	Langer	PI	Langer	Not yet verified
Living Proof	Langer	PI	Langer	Not yet verified
Microchips Biotech	Langer	PI	Langer	Not yet verified
BIND Therapeutics	Langer	PI	Langer with Omid Farokhzad	Not yet verified
Semprus BioSciences	Langer	PI	Langer	Not yet verified
Celero Systems	Langer	PI	Langer with Giovanni Traverso	Not yet verified
OMEAT	Langer	Alumni	Ali Khademhosseini, Langer postdoc	Not yet verified
Avenge Bio	Langer	Alumni	Omid Veiseh, Langer postdoc	Not yet verified
PrognomiQ	Langer	Alumni	Seer spin-out, Farokhzad line	Not yet verified
TARIS Biomedical	Langer	Alumni	Farokhzad line; Langer’s own role to check	Not yet verified
Tissium (Gecko Biomedical)	Langer	Alumni	Karp line; Langer’s own role to check	Not yet verified
eGenesis	Church	PI	Church, co-founder	Not yet verified
Dyno Therapeutics	Church	PI	Church with Eric Kelsic	Not yet verified
GRO Biosciences	Church	PI	Church with Dan Mandell	Not yet verified

Firm	Root	Column claimed	Lineage founder (dossier)	Check
Rejuvenate Bio	Church	PI	Church with Noah Davidsohn	Not yet verified
AbVitro	Church	PI	Church with Francois Vigneault	Not yet verified
Veritas Genetics	Church	PI	Church, co-founder	Not yet verified
Nebula Genomics	Church	PI	Church with Alex Ng	Not yet verified
Gen9	Church	PI	Church, founder	Not yet verified
Colossal Biosciences	Church	PI	Church with Ben Lamm	Not yet verified
Joule Unlimited	Church	PI	Church, founder	Not yet verified

Open items

- ☐ Capasso: find a source naming Capasso as supervisor for Troccoli, Wei Ting Chen, Alan She, Balthasar Mueller, Iannuzzi and Kabiri, whose ties now rest on joint papers; confirm IRsweep's origin in Faist's group and whether Chen is a co-founder of SNOChip.
- ☒ Capasso: Atikian co-founded Peak Power Optics (LinkedIn, PitchBook), and Lumina raised a seed round in February 2026 (PitchBook).
- ☐ Lieber: source Lieber's co-founder role at Vista Therapeutics and Jia Liu's at AIScientists (neither found in PitchBook); find sources for the training ties of Rueckes, Hu and Haotian Wang, whose founder roles PitchBook now confirms.
- ☐ Lukin: check whether the alumni Lukin lists at Chromatic, Fig Tech, Qunett, Data Plus Math, Sympany and a stealth startup founded them; confirm Shields's founder role at Quantum Network Technologies.
- ☐ Soljačić: find Narang's postdoc record or drop Aliro (alumni 1 → 0). Lux Labs is now confirmed in PitchBook.
- ☐ Church: confirm Prashant Mali's founder role at Shape Therapeutics; Lieber: confirm Yi Cui as Colin Wessells's advisor (Natron Energy).
- ☐ Langer and Church: classify each named firm from the labs' own company lists, separating co-founder from advisory roles.
- ☒ Lukin: Jonathan Hodges (DUST Identity) did his MIT PhD with David Cory (DSpace, 2007), so DUST counts only through Englund.
- ☐ Church: find a source documenting Zhang's work in Church's lab, which would raise the Zhang–Church tie from C to B and return seven firms to the strict Church count.
- ☐ Capasso and Lieber: upgrade the 18 C and U ties (7 Capasso, 11 Lieber) where a dissertation record or lab page names the supervisor.
- ☒ Metalenz: PitchBook, checked 5 November 2026, records no financing after the October 2022 Series B.

- ☐ All lineages: code the Langer and Church PI firms from PitchBook (Moonwalk, Tome, Octant and WindBorne were opened on 5 November 2026 and confirm their codes); the Quantum Network Technologies and Qunett profiles are restricted under the current subscription.

Sources

Pages opened on 1 November 2026.

- S1: Harvard Gazette, "Can tech developed at Harvard disrupt lens-making industry?" (Aug 2022)
- S2: Harvard OTD, "Commercializing innovation: Prof. Federico Capasso and Eos Photonics"
- S3: Wikipedia, "Alpes Lasers"
- S4: Wikipedia, "Jérôme Faist"
- S5: Wikipedia, "IRsweep"
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- S7: M. Lončar, curriculum vitae (Harvard SEAS)
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