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From academic concept to commercial reality: How to accelerate translational drug discovery

Authors: Adam Stoten, Anne-Claire Kröger, Michael Draper, Friedrich Reinhard, Thomas Hanke

For further information:
Thomas Hanke
EVP Head of Academic Partnerships
Thomas.Hanke@evotec.com

Chapter 2: Source. Plan. Invest. Execute. Navigating the tough roadmap of pre-seed therapeutics investment

In the first Chapter of this series on best practices for accelerating the translation of academic drug discovery, we examined the associated challenges from the perspective of an academic researcher. We concluded that to lower the hurdles for academics, it is imperative to make all discussions a conversation at eye-level, to increase practical feasibility, to walk the talk of genuine collaboration and to improve on transparency and speed of implementation. We further described some of the solutions deployed both by Evotec's BRIDGEs and others in accomplishing these changes.

In this second Chapter we turn our attention to the viewpoints of the different commercial parties essential for advancing early-stage therapeutics originating from academia and to the particular challenges they face in funding the translation from basic research data towards robust preclinical proof of concept (PoC). The prize is – of course – significant and the promise of identifying a novel target and developing a first-in-class therapy is as relevant as ever to the sector's appetite for external innovation. But the risks are also manifest and so in this paper we dissect the various characteristics of different types of pre-seed investors and discuss solutions for unlocking the abundant potential of academic innovation.

What are the main barriers for investors?

A robust, i.e. pharma-compatible, PoC for a new therapeutic is a critical foundational step in developing new medicines. However, while the demand for novel targets and thus access to academic innovation remains high for pharma, biotech and life sciences venture capital investors (collectively 'investors'),

there are numerous barriers that can make investing in academic projects at this early stage a difficult proposition.

Finding the needle in a haystack – sourcing new projects from academia

A significant practical challenge for any investor is simply to find the right projects. There exist numerous market intelligence databases with comprehensive information on commercial (i.e. late preclinical or clinical) pipelines across the globe, but – to the best of our scrutiny which includes numerous 'on-the-job' feasibility studies – there is no corresponding repository of information that meaningfully covers academic projects.

Two key value propositions that investors seek in academic projects are (i) novelty and (ii) differentiation from competition, both of which together can create the prospect of a future product superior to standard-of-care. Such projects are typically not yet listed in patent databases or on a Technology Transfer Office (TTO) website. True novelty precludes publication of relevant data in peer-reviewed journals which could enable competition. Hence, early-stage investors are seeking access to 'hidden gems', i.e. unpublished and proprietary data indicative of future therapeutic efficacy and safety. And once such potential projects are identified, their scientific assessment requires a discussion with and expert review by a person trusted by the academic group(s).

Large pharma companies and some of the larger venture capital firms have relatively small expert teams responsible for scouting new academic opportunities. Due to their limited bandwidth, they often focus on top-tier universities with the greatest density of high-quality research such as in Boston in the US or the Golden Triangle in the UK. Few have developed truly effective models for sourcing new therapeutic concepts from the broader academic milieu, and many struggle to identify the 'right' projects from academics due to a lack of access to the relevant (unpublished) information, inability to establish trust and/or a common understanding on what ingredients a promising project needs to possess.

Aligning experimental de-risking with investor expectations

As detailed in Chapter 1, academics often aim to advance translational projects using public funding before seeking commercial partnerships. Where an academic institution has been able to secure funding for PoC studies, there is a risk that, in the absence of commercial input from the outset, the chosen work packages may not align with the requirements of investors.

Some examples of where a pre-PoC translational project from academia may be viewed by investors as sub-optimal for further commercial development include

- Insufficient target validation (absence of human *in vitro* data, human genetic correlation etc)
- Safety concerns associated with off-tissue target distribution
- Low quality and/or diversity of chemical libraries used for initial screening
- Questionable relevance of assays employed for Hit identification
- Lack of assays or data to assess biophysical target engagement
- Lack of orthogonal assays to aid hit-to-lead (H2L) and lead optimization (LO) activities
- Lack of structure-activity relationship (SAR) for small molecules
- Lack of 'developability' of a compound or compound series due to structural/safety limitations

Based on the Evotec team's experience, the result can be disappointment when the academic researcher or the university's TTO considers a project to be more mature than a potential partner's assessment. For example, a project considered by an academic institution to be at LO stage, if not aligned with commercial LO criteria, may require additional validating assays to be performed or re-screening against a superior compound library. Even if the commercial partner is prepared to enter negotiations regarding a licence or new company formation in the absence of further work, the perceived 'value' may be much lower than assumed by the academic institution (see below).

The question around reproducibility of academic research

Multiple publications describe the challenges experienced in replicating academic results in commercial laboratories. Success rates of 25% and 11%, respectively, were initially cited by Bayer and Amgen, although the papers did not cite in detail which experiments the pharma companies failed to reproduce (Begley & Ellis, 2012; Prinz et al., 2011). More recent attempts such as the Reproducibility Project: Cancer Biology (RPCB) have attempted to examine the issue more comprehensively and transparently, but still found material challenges in robust replication (Curran, 2018; Macleod & the University of Edinburgh Research Strategy Group, 2022; Mullard, 2022; Errington, Denis, al., 2021; Errington, Mathur, et al., 2021).

Various explanations are postulated, including insufficient description of materials and methods, inadequate experimental conduct, poor experimental design, selective

reporting, and lack of statistical power (Begley, 2012; Errington et al., 2021). The constant pressure on academics to 'publish or perish' may also be a factor (Ghasemi et al., 2022). All point to the need to establish reproducibility as quickly as possible in the commercial environment that will ultimately support the development towards clinical candidates, and in which publication is not the greatest motivating factor.

What types of investors are active in supporting pre-seed projects?

Venture Capital Funds are the 'classical' solution

'Classical' VC funds are commonly thought of as the primary source of early-stage investment for life science innovations (Karpa & Griginovic, 2020). However, investing significant funds at the pre-PoC stage can represent a structural challenge for VCs, as most biotech VC funds are ten-year limited partner structures (Lerner & Nanda, 2020). This means investments are made in the first five years, with a further five-year period (plus sometimes an additional two years) to achieve the exits needed to generate financial returns (The British Private Equity & Venture Capital Association (BVCA), 2022). This structure derives from the fact that the average time to exit from biotech company creation is more than five years and can exceed ten years (Brown & Elmhirst, 2021). Furthermore, if the exit is an IPO (initial public offering), an investor may be subject to additional three to six month lock-in periods which further extend the time until they can sell shares and thus receive a return on their investment.

Notwithstanding some recent, but short-lived, trends, the majority of IPO exits are for companies with later, clinical stage assets (Huayamares et al., 2022). The same is true for companies exiting via acquisition by a third party; typically a large biotech or pharma company. Given that it usually takes more than seven years to go from initial hit identification to phase IIb clinical proof of concept, this defines how long an investor must usually wait for an exit. For a VC to invest at a pre-seed stage – i.e. earlier than initial preclinical PoC – it may need to be comfortable with a longer timeframe than the usual "5+5(+2)" structure or rely on other risk-mitigating measures. It can also be difficult under the terms of a VC's Limited Partner Agreement for them to invest in any other form than for equity in a company – meaning that material pre-incorporation funding is not always possible.

To overcome this limitation, some 'classical' VCs have embarked on introducing an 'accessory', earlier-stage/pre-seed compatible funding vehicle (e.g. Biovelocita from Sofinnova, n.d.; Pre-Amp from Amplitude, 2023; BGV with Forbion, 2006 and Exceed from Epidarex, 2019) or academia-centric startup studios (e.g. Autobahn-Labs, 2020; Argobio, 2021; Home Biosciences, 2020 and Cumulus Oncology, 2017). While a clear verdict on commercial efficiency remains to be determined, we view these approaches as promising tools to structurally address key pre-seed needs.

Pharma companies and associated Corporate Venture Capital as an alternative source

The structural limitations of VCs do not tend to apply to pharma companies. However, while recent data indicate that such companies have steadily increased the number of early-stage in-licensing deals, candidates with clinical PoC are often more attractive due to the lower development risk profile (J.P. Morgan & DealForma, 2022; Banks, 2021).

Many pharma partnerships with academia focus on sponsored research collaborations, and in some cases on pre-competitive consortia models such as the Structural Genomics Consortium (SGC, 2006), the Sanger Centre's Open Targets initiative (Open Targets, 2014), or early seed funding awards such as the Sanofi iAwards (Sanofi iAwards, n.d.) which provide a stepping stone to further investment). These are often built around specific researcher networks and usually aim to enable increased familiarity with an area of interesting science and mechanistic or clinical insights in a 'pre-competitive' (better: 'non-exclusive') setting rather than generating a pipeline of new drug candidates.

For better-validated therapeutic in-licensing or acquisition opportunities, big pharma typically looks to VC-backed biotechs formed to progress university-derived therapeutic assets and/or platforms towards clinical PoC. This means that pharma companies rely on VCs to fund and develop such companies and may act as both potential partner/acquirer of VC-backed biotechs and as a limited partner in such funds (Melchner von Dydiowa et al., 2021).

Over the last decades, many pharma companies have started their own "corporate venture arms", acting as VCs in their own right, and usually in the form of an evergreen structure. While important sources of capital for early-stage life science companies, these pharma VC arms do not typically invest pre-seed, nor do they usually lead investments. They may also prefer to keep shareholdings in arising companies below 20% to avoid the complication of financially consolidating such investment should it not be successful.

So while pharma companies continue to innovate and experiment to bridge the pre-preclinical PoC funding and knowledge gap, they remain heavily reliant on partners to identify and create a pipeline of robust opportunities.

Patient capital funds as a viable alternative?

The limitations of classic VC funds have led to the creation of alternative fund structures designed to be better suited to long term investments in early stage, university-derived projects; so-called 'patient capital' or "evergreen" funds. Such funds are often (but not always) created as companies limited by shares which invest from the funds held on their balance sheet.

Examples of patient capital investors include university-linked funds such Oxford Science Enterprises (OSE, 2015) and Northern Gritstone (Northern Gritstone, 2020), independent life science funds such as Syncona Ltd (Syncona, 2012), charities such as LifeArc (LifeArc, n.d.) and government venture funds such as CDP Venture Capital (CDP Venture Capital, n.d.) and bpiFrance (bpifrance, 2013).

Such funds can conceivably support earlier stage projects which take longer to mature to the point of exit, as they do not have the same hard deadline for returning cash to their investors. However, their bar for investment remains high in terms of the robustness and investment-readiness of a given therapeutic opportunity, and funding basic research or early translational activities in most cases remains out of scope. In addition, patient capital investors often look to more traditional VCs or corporate venture arms for follow-on investment and additional scientific expertise, and this can lead to a divergence of exit expectations in the long run.

The virtues and limitations of brick-and-mortar biotech incubators

Yet another approach to provide pre-seed investment is that of the biotech incubator, where translational projects receive financial support and are able to access on-site lab services and infrastructure. Examples such as FutuRx in Israel (FutuRx, 2014) and the BioInnovation Institute in Denmark (BioInnovation Institute, 2020) operate a model whereby therapeutics projects derived from academic labs are progressed in their facilities initially with prescribed grant, loan or pre-seed funding. If promising results are generated, they can receive additional seed investment to establish an incorporated company. FutuRx has served as a prototype mechanism to give several big pharma partners and investors, including Takeda, Johnson & Johnson and Bayer, an early insight into potentially attractive partnering or acquisition targets (FuruRx, 2014). Other incubators such as Start Codon in the UK (Start Codon, 2020) and international networks such as Biolabs (Biolabs, n.d.) and Mission BioCapital (Mission Biocapital, n.d.) cater to very early start-ups rather than pre-incorporation projects, and with varying degrees of direct access to capital.

While the incubator model has certainly gained traction over the last decade there remains a fundamental challenge in terms of capital efficiency. An incubator must bear the costs associated with maintaining a building and associated laboratory infrastructure, which can consume a large proportion of the incubator's available capital. This in turn reduces the capital available to spend on actual scientific projects. In addition, the laboratory facilities offered by such incubators are typically restricted to standard *in vitro* biology and some core equipment; rarely do they support chemistry labs, house more specialised high throughput screening platforms or provide bespoke preclinical *in vivo* models to satisfy very specific needs which differ from startup to startup.

In conclusion, a handful pre-seed investment categories are available to support pre-PoC projects maturing into 'investable' data points. A non-exhaustive overview is provided in Table 1.

	VC	VC arm of Pharma	Pharma	Patient capital	Incubators/ accelerators
Desired project outcome	Acquisition, IPO	Acquisition, IPO, Scientific know-how	Licensing, Scientific know-how	Acquisition, IPO, socio-economic impact	Follow on investment by other entity
Investment timelines	10+2 years	No restriction	No restriction	No restriction	2-3 years until PoC
Fixed (overhead) costs	Low	Low	High	Low	High
University engagement model	Direct arm's length	Direct arm's length	Indirect*	Direct, sometimes embedded	Direct arm's length
Risk appetite	High	Medium	Low	High	Medium

** Via VC or other investor*

Table 1: Comparison of different entities providing investment for early-stage academia derived pharma projects.

Contractual challenges between investors and universities
A long-lamented challenge to accelerating academic translation is the difficult nature of negotiating licensing and investment agreements between investors and universities.

As public institutions, a university needs to include various restrictions and obligations into legal agreements which are not typically encountered in business-to-business transactions. For example, they frequently include retained rights for the university to continue to use the licensed IP for non-commercial research, the right for university academics to publish on licensed IP, longer termination notice periods and limitations on representations, warranties and other liabilities to avoid potential conflicts with the tax and/or charitable status of universities (Dorzodoff & Fairbairn, 2015). Investors (or lawyers) unused to such requirements may struggle to adapt from normal business-to-business contractual terms.

However, acceptable compromise positions for most of the key contractual components are exemplified e.g. in the recent University Spinout Investment Terms (USIT) Guide published by TenU and co-created by a group of UK universities, venture capital investors and law firms (Haines et al., 2023) as well as the comprehensive University Startup Basic Outlicensing Template (US-BOLT, *Types of technology transfer agreements & policies*).

Beyond the legal terms, negotiation of financial terms can be delayed by differing views on the value created by the academic institution (licensor) at the point of license grant, versus the risk and investment required thereafter and shouldered by the licensee. This applies particularly where a new company is to be formed, as not only do the financial terms of a licence need to be agreed, but also company-specific terms such as pre-money valuation of any investment and the proportion of founding equity each partner will hold.

Together, agreeing on legal and commercial terms can -in extreme cases- take up to two years of negotiation, representing lost ground in the scientific race for translational leadership on a particularly interesting therapeutic target and for the creation of a defensible IP-position.

Innovative solutions to catalyse pre-seed investments

With the above-mentioned challenges being recognized by many commercial parties, a growing spectrum of new approaches, tools and models are enabling capital to be deployed expediently at pre-seed stages. We next look at some of the most important enabling factors.

Exploring the value-add of an embedded 'Expert-in-Residence' (EIR)
It is impossible to fully understand the breadth, depth and diversity of even one academic institution's research environment from afar. As introduced in Chapter 1, an embedded presence that facilitates daily interaction and dialogue with academic researchers is by far the best way get to know the innovations emerging from a given institution.

This approach is proximity-enabled and resource-intensive, and therefore works most effectively within one or a

small cohort of academic institutions. In the case of Evotec BRIDGEs, the EIR model enables our investment partners to outsource not only the sourcing of projects, but also the integration from project idea to an industry-validated drug discovery experimental work-plan, an effort too frequently under-valued by investors focussed on more advanced-stage assets.

Defining industry quality experimental plans together

Academic medical research is constantly elucidating new targets for therapeutic intervention, and whereas a couple of decades ago this was limited to small molecules, the modern researcher needs access to a full range of therapeutic modalities, from gene therapies to monoclonal antibodies to antisense oligonucleotides. The creation of industry-standard project plans to achieve robust preclinical PoC is therefore even more challenging for the many academics without specific knowledge of this downstream process. Early access to the right expertise is thus critical to ensure that the format and choice of PoC experiments align with what an investor will expect to see.

The Evotec EIR model, where a seasoned drug discovery expert is embedded among the university community, provides a seamless interface with the wider community of Evotec platform and disease experts, ensuring that the right expertise is applied early on to diligence project ideas and to help academics develop project proposals. Other commercial investors such as Curie.Bio and Orange Grove Bio have similarly recognised the value this approach brings and employ teams of subject-matter experts to make sure that their pre-seed bets are at least placed on the right race.

Using validated industry platforms to yield robust, reproducible data

Integrating an industry partner able to provide access to high-quality platforms at the earliest stages of an academic drug discovery programme is advantageous – if not indispensable – in developing a package of data and IP that is trusted by an investor as robust and reproducible. Such early access enables a programme to optimally leverage the resources and capabilities of both academia and industry.

Very few pre-seed translational mechanisms build in such a partner with broad disease expertise and multi-modality capability. Curie.Bio reportedly works with an established panel of 100+ contract research organisations (CROs) [Curie.Bio, n.d.]. In this respect, the value-proposition as a one-stop-shop for project sourcing, experimental replication, forward-looking workplan-building and execution as well as in-kind and as capital deployment by Evotec for our BRIDGE investment partners is unique, since the embedded EIR, our technical experts, industry platforms - and indeed downstream NewCo investment resources - come together in a seamless package.

Pre-defining framework agreements to accelerate negotiations

The use of pre-defined framework agreements can ensure that follow-on investments into pre-seed projects proceed swiftly and that development time of novel candidate therapeutics is not lost on lengthy negotiations. Such frameworks can be time-consuming to set up, as often they must work across multiple academic institutions and for a variety of projects spanning different therapeutic areas and modalities. However, once agreed, the time saving is significant. A further advantage is that even before a funding application is submitted, both academic applicant and investor know exactly what success looks like for them with respect to downstream financial terms, especially regarding founding equity distribution.

Evotec has negotiated such agreements for the majority of its BRIDGE partnerships and we have seen first-hand the value of transparency in co-creating novel companies from the individual BRIDGEs. Underpinning the value of pre-agreed terms, others also adopt this approach, e.g. Deerfield (Deerfield, 1994), Apollo Therapeutics (Apollo Therapeutics, 2016) and Northpond Labs (Northpond Labs, n.d.) in their partnerships with the Wyss Institute, the Broad Institute and Stanford Medicine.

Engaging different types of investors through structures that recognise and address their needs

Earlier in this Chapter we discussed some of the structural challenges for investors wanting to support early translational projects. But how can partnership structures provide solutions that address these challenges and enable greater – and smarter – deployment of capital into pre-seed drug discovery?

Across the current portfolio of BRIDGEs, Evotec has worked with 18 different investors, from big pharma to VC to patient capital investors. Finding structures that work for these very different organisations – and for our academic partners – has required us to flex the BRIDGE model on a case-by-case basis in order to leverage our deep expertise, reduce partner fixed costs and enable investors to share risk and expense, all while remaining true to BRIDGE core principles.

For pharma partners, we have developed BRIDGEs that provide a seat at the table for project selection and validation and which enable them to leverage Evotec's capabilities and expertise without adding to their fixed costs. Examples include beLAB2122 and beLAB1407 (with Bristol Myers Squibb), LAB150 (with Amgen) and LAB eN² (with Novo Nordisk).

For classical VCs, we have deployed multiple solutions. Firstly, we have co-created start-up studios as separate legal entities focused on accelerating academic concepts into product candidates either as a pre-seed project or as a bespoke daughter company. Examples include Autobahn-Labs in the US with Samsara Biocapital and KCK as investors (Autobahn-Labs, 2020), Argobio Studio in France with Kurma Partners and bpiFRANCE (Argobio, 2021) and Extend in Italy with CDP Ventures and Angelini Ventures (Extend, 2022). These entities both share risk and enable VC's to invest for equity into a company structure that then supports pre-seed, pre-incorporation projects. These funding vehicles may be fully functioning companies or merely conduits for investment.

A further model for enabling VC investment at pre-seed stage is our BRIDGE with Amplitude Ventures in Canada; and specifically with their Pre-Amp company creation studio vehicle, where Evotec's expertise and platforms are used to de-risk new venture hypotheses identified by Amplitude (Pre-Amp, 2023).

Evotec's latest BRIDGE – 65LAB – in Singapore is a further example of multiple investors working together to share risk and financial commitment at the pre-seed stage. 65LAB combines Evotec's delivery capabilities with dedicated financial support from the local investor and ecosystem builder ClavystBio, the classic VCs Lightstone Ventures and Polaris Partners, as well as the pharma corporate venture arm Leaps by Bayer (65LAB, 2023).

'Good science requires deep capital, guidance from experienced drug developers and time to mature. While the typical VC fund structure doesn't foster a strong appetite for pre-seed innovations that have yet to demonstrate proof-of-concept, venture creation vehicles like 65LAB are pioneering a new approach through partnership. 65LAB brings together established life science specialist funds ClavystBio, Lightstone Ventures, Leaps by Bayer and Polaris Partners, with Evotec as the experienced development partner to tap into the wealth of innovation from leading Singapore academic institutions. This melting pot provides an optimal mix of patient capital and experience around the table to harness the most innovative ideas into commercially attractive companies.'

Ho Wen Qi, Therapeutics Lead, ClavystBio

BRIDGEs aim to also progress potential company creation projects to a stage at which they can attract a higher quality management team compared to a project spun out prematurely from a university. A first example is the Oxford University spin-out company Dark Blue Therapeutics which was founded in 2020 based on LAB282-originated project IP and which has now matured into a bona fide biotech company (Dark Blue Therapeutics, 2020).

In summary, our BRIDGEs aim to provide an operationally feasible business framework to address most of the key conceptual challenges of pre-seed investments. A distillery of BRIDGE value-propositions is shown in Table 2.

Challenges		BRIDGE Solutions
Sourcing of promising new projects in academia		Embedded EIR (expert in residence) presence in partner institutions
Reproducibility of academic research		Work packages undertaken by Evotec to industry standards
Expertise for experimental de-risking project planning		Joint project planning leverages Evotec's wide scientific expertise
Project maturity level & related risk		Project portfolio sufficiently scaled to overcome attrition
Investment timelines of traditional funders		Deployment of non traditional fund structures
Protracted negotiations between investors & academic institutions		Pre-negotiated framework agreements covering licensing and new company creation

Table 2: How the BRIDGEs model is designed to overcome the major challenges of early stage academic translation in drug discovery

Conclusions and Outlook

Here, we have summarized how novel partnership structures and operating models – illustrated by reference to our various BRIDGEs – are needed to overcome key hurdles for the VC community and pharma companies in accessing and de-risking pre-seed/pre-PoC translational projects from academia.

At the heart of pre-seed success is the development of highly embedded collaborative models, which fuse commercial capabilities and expertise with academic innovation in a manner that enables the establishment and maintenance of deep and trusted relationships. Only through such relationships can investors be confident of unearthing the "hidden gems". An expectation that truly novel projects will be routinely discovered through an annual 'show and tell' session with a TTO is destined for disappointment.

Similarly, finding novel approaches to sharing risk between multiple investors in such models unlocks the ability of VCs and pharma to invest, especially if the result is a portfolio of better validated investment opportunities. Such investments can become even more attractive in capital-efficient models that avoid significant overhead costs.

While the above "success factors" may be increasingly well-understood by both Evotec and others, the practical implementation is often where such things live or die. Hence, in Chapter 3 we will focus on how to overcome day-to-day operational challenges and provide examples for practicable solutions to topics important for academic researchers, for TTOs, for VC investors and for potential pharma licensees. You will experience how 'a day in the life of an Evotec EIR' is a constant exposure to a broad range of very different scientific, commercial, legal and relationship issues which all need to be addressed for successful advancement of translational ideas to investable data sets.

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