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An Alternative to the University Spin-out: CC Bio as a Case Study of a New Biotech Creation Model

David B. Corcoran^{1*}, Matthew J. Cummings^{1*}

* Corresponding authors: david@ccbio.co.uk, matthew@ccbio.co.uk

¹ CC Biotech Ltd, C/O The Cambridge Partnership Limited The Dorothy Hodgkin Building, Babraham Research Campus, Babraham, Cambridge, United Kingdom, CB22 3AT

Abstract: CC Biotech Ltd are an early-stage synthetic biology start-up, based between Cambridge and London. CC Bio's core mission is to develop biological tools and therapeutics which augment the human microbiome with surgical precision. Through targeted interventions, the company may cure and prevent microbiome disease whilst preserving the commensal microbiome which is so pivotal to our general health and immunity. CC Bio represent the vanguard of a new approach to company creation in the biotechnology space. Where academic institutes once represented the sole source of innovation in the field, companies such as CC Bio have been created and fostered by the investment community itself, and the wider entrepreneurial ecosphere. This article documents the advantages and disadvantages of this new approach, using CC Bio as a case study. As of late 2020, CC Bio are securing financial support which will fund the next stage of their preclinical development programme (specifically focused upon the modulation of the vaginal microbiome).

Keywords: CC Bio, spin-out, biotechnology, accelerator, Matthew Cummings, David Corcoran, Cambridge, Babraham Research Campus, Accelerate@Babraham

David B. Corcoran CC Biotech Ltd, C/O The Cambridge Partnership Limited The Dorothy Hodgkin Building, Babraham Research Campus, Babraham, Cambridge, United Kingdom, CB22 3AT,

Email: david@ccbio.co.uk

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1. The success story

CC Bio was formed by two post-doctoral researchers (Dr Matthew Cummings and Dr David Corcoran) in mid-2018. Unlike most fledgling biotechnology companies, CC Bio did not capitalise and build upon prior university funded background technology or IP. In fact, upon receiving the first tranche of investment the technologies underpinning CC Bio were simply ideas in the minds of their creators.

Despite its atypical creation, CC Bio has quickly established itself as one of the most promising synthetic biology focused start-ups in the British biotech cluster. Over this short period, the company have raised £130k in private funding and complemented this capital by securing highly competitive Innovate UK Smart grants worth £280k^{1a, 1b}. The founders have used this modest capital to take the first steps in validating their exciting vision of specific and preventative human microbiome modification. The innovative nature of the CC Bio approach has been validated by the wider biotech community: the company were chosen by AstraZeneca as winners of the AstraZeneca StartUP 2019 competition for most promising new start-up, receiving a year's worth of invaluable membership from the AstraZeneca executives². Additional recognition came from LifeArc, who pinpointed CC Bio as the most exciting company to emerge from the prestigious Accelerate@Babraham programme in 2020 (this award was shared with Reflection Therapeutics)³. The continued momentum of the company has attracted the attention of the investor community, with CC Bio set to close a seed round of c. £1M in late 2020, despite the challenges posed by the ongoing Coronavirus pandemic. This round will fund the exciting scientific programme of the company, facilitating its further growth and expansion.

It is important to emphasise that the success of CC Bio to date does not solely lie with the efforts of the founding team, and that the contribution of a number of others must be recognised and is described in further detail in this case study. Key members of this group include the initial investors, Deep Science Ventures, who allowed an idea and entrepreneurial ambitions to become a livelihood for the founders. As the company grew, the support of the wider ecosystem was especially important for the first-time founders of CC Bio, who lacked the track record, network, and experience of more seasoned bioentrepreneurs. The support of all of those involved in the Accelerate@Babraham programme and the P4 precision medicine programme have helped fill this gap. Both accelerators have contributed immensely to the success enjoyed by the company to date.

2. How did we start

The formation and scientific focus of CC Bio is linked to the prior experiences (and on occasion, frustrations) of its two founders, who both wished to create a biotech start-up. Matthew Cummings completed a BBSRC funded DTP PhD programme in Chemistry at the University of Manchester which focused on the genetic engineering of bacteria using synthetic biology tools to produce complex high value small molecules. He had begun post-doctoral studies in a school with a strong focus on conducting translational drug discovery and was afforded multiple opportunities to grow and hone entrepreneurial skills during his studentship, including completion of the SynbiCITE 4day more business acumen programme focused on

building a synthetic biology-rich biotechnology company from scratch and the BioCity BioSparks Business Accelerator Programme Boot Camp, Alderley Park BioHub. Such experiences crafted ambition, provided a flavour of the biotech Start-up space, and established a valuable network of young entrepreneurial minds in biotech. Throughout his studies, it was clear to Matthew that the transition of academic synthetic biology research from large institutions into the private sector was often frustrated by cumbersome administrative, organisational and hierarchical hurdles: a situation which is echoed across many universities. With a thirst to establish his own biotech start-up, Matthew began to search for alternative, more expedient and less encumbered ways to build venture backable biotechnology companies.

While Matthew searched for more exposure to commercial biotech during his studies, David Corcoran was immersed in the sector throughout his early career, qualifying as a Pharmacist and briefly working in large-scale Pharmaceutical manufacture (Servier). This exposure continued during his PhD studies at KCL, as David developed commercially valuable anticancer agents under the tutelage of Prof. David Thurston, a pioneering figure in the discovery of DNA binding agents known as pyrrolobenzodiazepines. Prof. Thurston founded a spin-out company, Spirogen (sold to AstraZeneca in 2013 for \$440M), and throughout his PhD, David was exposed to the principles of research commercialisation. After his PhD, David joined Femtogenix, another KCL-Thurston spin-out, as a scientist in 2017. This experience taught David the fundamentals of early-stage biotech growth and development. However, as a non-executive member of the team, David lacked strategic control over the company's commercial and scientific programmes. Like Matthew, he searched for routes to start his own biotech company. At this point in mid-2018, the two co-founders' paths crossed. CC Biotech, a case study for an alternative company creation model, would emerge.

3. Our technology

The story of CC Biotech's development differs starkly from many traditional biotech companies, who have been forged from University research. In many respects, CC Biotech's development acts as a case study for a new approach, which eschews the traditional, University-based model. Before describing the journey of the company through this alternative method of biotech development, it is important to understand this standard model, and why an alternate model evolved.

There are many advantages to the traditional approach of developing commercial biotech companies from promising academic research. Known as the University "spin-out" approach, this model allows the opportunity to de-risk technology through academic grants and often secures outstanding facilities and specialised founders for the company. This approach has proven dividends for the industry itself and the broader economy, with approximately 1,950 scientific "spin-out" companies formed from academia in the United Kingdom between 2011 and 2018, and £8.86B raised in investment⁴. However, there are downsides to this model, especially from the perspective of a potential founder.

1) The opportunity to form "spin-out" companies is biased towards larger, well-established Universities, with most companies based in the "golden-triangle" of London and the South-

East, (with Edinburgh and Manchester noted exceptions⁴). This concentration of commercialisation in Universities such as Cambridge, Oxford, UCL, KCL and Imperial has led to inequality of opportunity for budding academic entrepreneurs based upon geography. It also limits spin-out opportunities to highly specialised, research focused academics who secure positions at prestigious institutions. These figures may not be best placed to grow and manage a commercial enterprise.

2) Incubation of commercial entities within academic institutions often comes with significant sacrifice of equity and IP to the University *via* the technology transfer process. While technology transfer remains an important part of the monetisation of public/charitable research funding, for many innovators, the increasing bureaucracy associated with untangling research from the academic laboratory represents a significant barrier to company creation. Beyond this, a tendency for overvaluation of nascent IP and technology by the university technology transfer offices, and the reliance of company-owned foreground IP on university owned IP, can hamper significant investment from commercial partners and reduce company valuation at an early stage.

It is in this light that a growing industry has emerged to facilitate an alternative approach to biotech/healthcare company development which co-exists in parallel with the university/institutional model. This new paradigm provided the basis for the development of CC Biotech, which is described below.

4. The journey so far: CC Bio as a Case Study of the Alternate Venture Creation Model

Venture Creation Houses: The first Step of the Alternative Approach

The first sector of this alternative approach involves focused creation of biotech companies. Several venture creation houses have emerged who aim to decouple the biotech creation process from the auspices of a university. These organisations include Entrepreneur First, Y Combinator, IndieBio, Antler, StartCodon (Cambridge-based) and Deep Science Ventures, the programme from which CC Bio emerged. While the finer details of each venture creation house differ by area of focus/candidate selection process, their model is often similar. Typically, this involves an initial recruitment of talented early-career academics/post-graduates to found ventures in commercially viable spaces, and education of these founders in the basics of early-stage company management prior to company formation. Often a limited stipend is provided to the recruits at this stage to facilitate the development of their commercial concepts. Once a viable and stress-tested business plan is developed, the venture creation houses typically invest pre-seed capital into the fledgeling ventures, facilitating the generation of critical early data packages. Each venture house has a different investment model, however many leverage existing tax incentives designed to support early-stage R&D research heavy companies. While searching for methods to establish a biotech company, David and Matthew were recruited to Deep Science Ventures⁵, where they quickly began to work effectively together. They collectively began to research commercial opportunities around the microbiome/antimicrobial field, ultimately settling on the development of novel technologies

for the treatment of bacterial vaginosis. After building a commercially viable business plan, and recruiting scientific advisors of sufficient expertise, CC Bio (rather originally named from the surnames of the two founders!) was incorporated. After providing the founders with basic education in concepts such as organisational structuring, IP management and investment strategy, Deep Science Ventures invested £70,000 in the company as an SEIS investment in November 2018. Through a combination of LP-mediated SEIS funding and support from larger organisations such as CRUK, Deep Science Ventures has repeated this process extensively, founding 27 companies over the past three years. Several of these companies have raised significant grant and seed investment funding in the intervening period.

Venture creation houses overcome several issues associated with the university model: they can rapidly and nimbly form companies to tackle emerging areas of value in the industry through effective recruitment of specialised, committed young founders. This recruitment may not be geographically or organisationally limited, as in the case of a university. Additionally, the companies formed from these venture houses are free from the equity (bar a small venture creation house stake) and IP ownership handicap often associated with university spin-out companies.

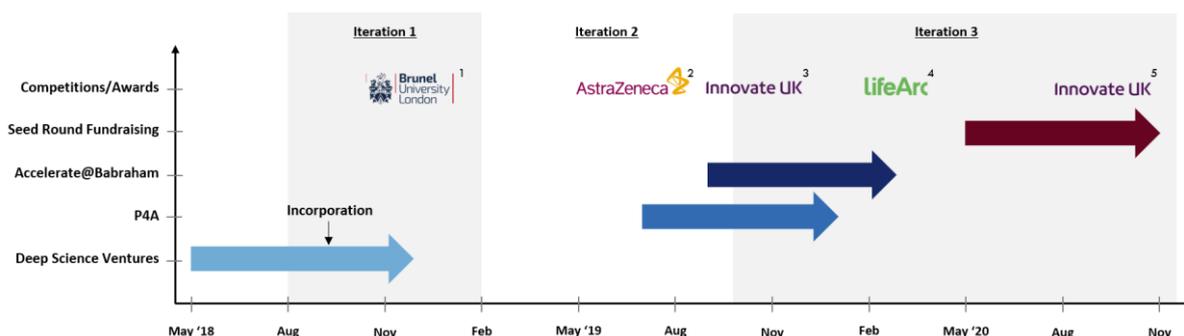


Figure 1 Timeline schematic plotting accelerator attendance, the growth of the CC Bio narrative in iterations and competition/grant success. Iterations are defined as a significant shift in the CC Bio value proposition. 1: Brunel Innovate Voucher grant award for development of anti-*Gardnerella vaginalis* technologies. 2: Grand final winners of the AstraZeneca Start-Up Exchange competition. 3: InnovateUK SMART grant award supporting development of novel therapeutics for the treatment of bacterial vaginosis. 4: Winners of the LifeArc most progressed venture from the Accelerate@Babraham programme 2019-2020: this award was shared with another promising start-up, Reflection Therapeutics. 5: Award of an InnovateUK Covid-19 Continuity Funding.

CC Bio’s First Steps: From Creation to Acceleration

While the company initially benefitted from the advantages of the venture creation model, CC Bio faced other significant challenges when compared to an early university spin-out. As an idea-stage enterprise, the company’s vision and technology was underdeveloped when

compared to the technological development/de-risking of a standard university spin-out. Further compounding this issue was a lack of resources. While the pre-seed funding from Deep Science Ventures enabled company formation and basic scientific studies, it was extremely challenging to secure sufficient data and IP required for follow-on investment. CC Biotech did not experience this challenge in isolation: this difference in technology readiness from traditional spin-outs is experienced by many companies emerging from the venture creation house model and is a significant disadvantage of the model. To address this challenge, CC Bio engaged with the second critical support sector of the alternate investment model: accelerators and early-stage academic/commercial innovation schemes.

Brunel University Partnership

Although founded without a tangible university connection, CC Bio developed one through availing of an “innovation voucher” style programme (promoted by Brunel University, London) in late 2018/early 2019. This type of programme provides a small amount of university funding to commercial partners, often coupled with access to university facilities, with a view to fostering relationships with university academics for future funding applications. Critically, the university typically will not claim IP during this early collaborative work. For CC Biotech, this interaction allowed the generation of critical data during its early stages at an affordable cost. For the university, the initial cost of the voucher (£5k) was vindicated as the collaboration subsequently won a shared Innovate UK grant award with a value of £280 K. CC Bio’s interaction with Brunel represents a case study of how the alternate venture creation model may still include university facilities, in a fashion which benefits all parties involved.

Accelerators

Some challenges faced by a non-university spin-out biotech such as CC Bio are shared with their peers of more traditional origin. Although the early collaboration with Brunel University had helped develop data which supported the company’s vision (culminating in a key Innovate UK grant award), the founders had immature networks and lacked facilities so critical to securing the longer-term security of the company. In 2019, the company participated in two accelerator programmes which aimed to enhance the company’s prospects in both of these areas.

The P4 precision medicine accelerator programme⁶ was particularly focused upon enhancing the data-driven element of CC Bio’s technologies. While housed at the technology hub of IDEA London as part of the programme in early-mid 2019, the founders built their network in the space through the assistance of programme leaders Dr Phil Beale (Congenica/UCL) and John Spindler. Critically, the programme signposted the founders towards industry-specific funding such as the CAP-AI scheme, which allowed the company to employ a talented data scientist. This greatly assisted with the development of the company’s candidate discovery programme, Zeus. Zeus has greatly enhanced the indications/markets addressable by the CC Bio’s technological approach, and the P4 programme enabled its development.

After the conclusion of the P4 programme in mid-2019, it became clear to the founders of the company that their network of commercial advisors and investors was not adequately developed, hampering their prospects of securing longer-term investment. In this context, the acceptance of CC Biotech to the prestigious Accelerate@Babraham programme⁷ in late 2019 was pivotal to the company's recent progression and development. Based at the Babraham Research Campus in Cambridge, the company was embedded in a dynamic and collaborative biotech community for six months. The accelerator programme, coordinated by Dr Karolina Zapadka, consisted of regular workshops/seminars led by some of the foremost biotech leaders in the country. These interactions with otherwise unavailable figures dramatically improved the founders' network, facilitating their network of key commercial advisors, and helped craft important commercial aspects of the CC Bio narrative. The accelerator programme was especially important in forming foundational relationships with corporate Pharma figures, including those at AstraZeneca (further burnished through formal mentoring), Roche Genentech, Johnson & Johnson, Merck MSD and Shionogi. In the longer term, these organisations could become valuable collaborative partners with CC Bio, pushing the company's technologies to market. Additionally, the £10,000 funding and 6 months' free lab space offered by the Accelerate@Babraham programme allowed the company to attain pivotal data which further developed their therapeutic concept.

Critically, the increased profile gained from acceptance into the programme also facilitated several interactions with highly specialised investor partners. By the end of the programme in February 2020, the company was ready to engage with these investors as part of a seed round to secure the medium-term growth and development of the company. The Covid-19 crisis presented challenges and delays to the entire industry, and CC Bio was no exception. However, this seed round is now expected to be successfully completed by the end of 2020.

5. Looking to the future

CC Biotech's vision for the future has matured over the two years of the company's existence. From initial origins as a narrow therapeutics company for bacterial vaginosis, the influence and exposure to talented advisors at Deep Science Ventures, P4 and Accelerate@Babraham has facilitated the maturation of this vision. With this impending seed round, Matthew and David intend to develop highly potent, specific and preventative therapies to modulate the human microbiome. In the immediate future, this vision will focus primarily on vaginal and lung health. Over the next 18 months, the company will complete animal studies for a lead therapeutic candidate, providing the platform for a significant series A round to further their clinical programme. Ultimately, Matthew and David hope to foster CC Bio as a pivotal player in the emerging microbiome therapeutic market.

The founders' unique experiences in a venture creation pathway divorced from the University has shaped how they will realise this vision. While unencumbered IP assets/clean cap tables will undoubtedly prove advantageous in the longer term, David and Matthew's recent experiences with subcontractor organisations as replacements for academic partners have

been mixed. Accordingly, the company will seek to develop longer-term partnerships with university academics, while preserving the background company IP generated to date. The resources provided by the impending investment will also allow the establishment of an in-house facility. The company's founders are excited to end their nomadic experience and establish a home of scientific excellence! Whilst the journey thus far has been difficult, it has been immensely enjoyable, mainly as a result of the fantastic minds and personalities that the founders have had the privilege to work with.

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The company would like to thank the figures who have facilitated this unorthodox journey to date, often for little personal gain. Key figures include but are not limited to: Mark Hammond and Dominic Falcão (Deep Science Ventures), Prof. Ronan McCarthy (Brunel University), John Spindler, Dr Philip Beales and Nathan McNally (P4 Precision Medicine Accelerator), Dr Karolina Zapadka, Derek Jones and Dr Andy Richards CBE (Accelerate@Babraham) and Dr Abel Ureta-Vidal.

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The company



C/O The Cambridge Partnership Limited
The Dorothy Hodgkin Building
Babraham Research Campus
Babraham, Cambridge
United Kingdom, CB22 3AT
www.ccbio.co.uk

Dr David Corcoran is a Pharmacist and recent PhD graduate in Medicinal Chemistry from King's College London, where he specialised in the development of new DNA binders for the treatment of cancer, publishing in the area and authoring a patent. He became an early employee of an KCL spin-out company, Femtogenix, which emanated from his research group under Prof David Thurston. After joining Deep Science Ventures, a London based accelerator for science entrepreneurs, David co-founded CC Bio, where he acts as COO.



Dr Matthew Cummings completed his PhD in synthetic biology at the University of Manchester, where his research focused on design, development, and implementation of automated systems for the discovery of new. Outputs of this work were high impact publications, patents, and design of a new standard for the reporting of genetic information. After completing his PhD, Matthew joined Deep Science Ventures as an entrepreneur-in-residence tasked with scoping plausible venture opportunities in the antimicrobial resistance space. This role led to the formation of two new enterprises, CC Biotech Ltd. and Ancillia Inc., both of which take unconventional approaches to tackle difficult biological problems. Matthew is CEO of CC Bio.

