Career feature

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Mind the gap: closing the growing chasm between academia and industry

Academia and the pharmaceutical industry must unite to offer more comprehensive opportunities for those wanting to stay in research in the field of drug development.

Within the field of drug development, a continued chasm between academia and industry is being exposed. Previous analysis has shown that of the 252 new drugs approved between 1998 and 2007 by the US Food and Drug Administration, a growing majority has been produced by biotechnology companies. Most of these drugs were acquired from university projects; in turn, there is an ever-shrinking number of large pharmaceutical companies developing innovative medicine themselves[1].

In the United States, a significant amount of public investment funded the development of many drug candidates submitted for approval during the 2010s. Notably, this amount grew substantially from that of previous decades[2]. Among the candidates were blockbuster drugs such as remdesivir from Gilead Sciences, venetoclax from AbbVie and atezolizumab from Roche's Genentech subsidiary[3].

Despite the demonstrated success of publicly funded research, spinouts from universities and reliance of big pharma pipelines, research positions at universities are becoming ever harder to fill as the attractiveness of postdoctoral positions wanes[4]. Much of this can be attributed to the lack of career progression[5] and the extremely low pay available for positions at the qualification level[6].

Developing talent and having access to new drug developers is clearly vital for the success of the field. However, as a result of the previously stated issues and the fact that industrial postdoctoral positions are rare[7], it is hard to see how industry will fill the void via new postdocs. Moreover, both industry researcher and academic postdoc positions rarely encourage blue-sky thinking and curiosity, with the accompanying prestige in grants, publications and conference appearances. Industry research drives value to its own portfolio and aims solely to return investment to shareholders[7]. As such, it is often considered a failure for a postdoc to move into the area, and academics are hesitating to go[8].

As a result, there seems to be two sides of a wall that rely on one another, yet seldom share their unique abilities to conquer the others' shortcomings. If both sides were to come together and amalgamate specialist research, the mentorship and support of talent, and their drug development skills into the next generation of biotech entrepreneurs, it could allow for a new wave of expertise and help reach the goal of creating more drugs that bring about great patient benefits.

Drug developers

Drug developers are often unconventional people, eager to venture into new areas and test their boundaries. Therefore, they can feel out of place within academia[9]. Unfortunately, during their educational journeys from undergraduate to postdoc, they are seldom prepared to take a leap from academia into industry and drug development[10]. Multiple subjects are never taught, including the nuances of topics such as commercial, economic, regulatory, law and intellectual property (IP) skills, as well as knowledge of basic project management. In addition to these hard skills, they also lack training in the vital soft skills such as networking. With such a substantial gap in the education of a new startup generation, it is no wonder that fewer biotech workers are succeeding[10].

A difference in culture in education and funding

Unsurprisingly, some of the best schools for an education in drug development are located in the European Union (EU), United Kingdom and United States[11], with curricula ranging from early stage discovery to the regulatory approval process. European academic entities and large pharma companies have had many successful collaborations — one notable example being the collaboration between the University of Oxford and AstraZeneca, which led the development of a COVID-19 vaccine[12]. However, US-based companies and their respective academic groups have formed strong alliances; thus, most drugs that end up reaching the market come from US-based institutions and their subsequently formed biotechs — a trend consistently seen within drug development[1].

The difference in the financing ecosystem between Europe and the United States can also potentially explain why fundamental education in drug development may be superior in Europe, while the United States does better in translating and commercializing discoveries. European biotech has remained reliant on US funding throughout each biotech's life cycle. While trends have changed in recent years with later-stage funding limited within the established EU vehicles (as opposed to early stage funding 10 years ago), many EU-based biotechs are turning to US venture capital and public markets such as NASDAQ to access the necessary capital[13]. With a less-risk-averse set of investors in the United States and more of them active in the sector, more inventions can be funded[13]. Nevertheless, if it were possible to generate more aligned science between academia and industry, as well as management teams who are experienced to navigate the intricate maze, it may be possible to also benefit investors as well.

Building relationships with early stage venture capitalists, such as Arch Venture Partners, Flagship Pioneering, Third Rock and now Deerfield Management, as well as RA Capital in the United States and Sofinnova Partners in Europe[13], and having their involvement in shaping young drug developers careers from an early stage is another aspect to creating a more productive sector.

Within the academic setting

Academia often misses the entire purpose of drug development — understanding how to

take a scientific idea, translating it to the clinic and then bringing it to the market in the most timely and cost-effective manner. It cannot be achieved by small-scale projects with minimal funding from one lab in a university setting, but through cooperative work between academia and industry.

Students and early career professionals without any exposure to the industry may not understand the major differences between programs and how they are rooted in different disciplines, and therefore end up on a course that does not align with their career goals. This extends to educators who have not built a program that benefits an early career professional's overall goal, and it often leads to a financial penalty for those who complete the course[14].

Despite some differences in programs and modules, they typically contain a research-based project that simulates the real-life expectations of a drug development process. Although the projects will provide some insight, they are often too limited in scope to provide exposure to a comprehensive drug development program. This gives a false impression of industry to students, which further harms their integration from academia to industry[8]. This false sense is further instilled by the fact that these projects are highly unlikely to progress out of the educational environment to become a viable commercial project. Although basic science should be and is necessary to bring about scientific revolutions, focusing drug development projects on discovery and preclinical science generally does not match the industry's needs.

The overarching theme is that people achieve their degrees within academia and are taught pure science rather than tackling the practical side of the field. This brings us back to the fact that there is a lack of drug developers bringing their knowhow back to students, which further perpetuates the divide. Although professionals not returning to academia is not unique to the pharma and biotech industries, there is a limited number of academics who are well versed in the nuances of day-to-day drug development. In addition, few professional drug developers have the ambition to finalize their careers in the field of education. This leads to educational experiences being heavily entrenched in scientific rhetoric, lacking the translational element to real-life applicability.

The expertise and experience of educators is paramount to the student experience. Moreover, having instructors with real experience would enable them to offer advice on the many career options available in such a broad industry. We have seen educators leave academia and do well in industry, such as David Altshuler (chief scientific officer and executive vice president of global research at Vertex Pharmaceuticals), Sandra Horning (former chief medical officer at Roche and Genentech) and Jay Bradner (former president of Novartis Institutes for BioMedical Research). However, few return to lead a curriculum. This is critical to change because it is important that seasoned drug developers share the lessons that they have learned, as well as their ability to understand and navigate critical decisions in their personal and professional lives.

If professionals are unwilling to return to academia, it would be wise for students to gain hands-on experience via industrial internships in the early stages of the educational process and to open collaborations later in their careers. One notable example is Northeastern University in Boston, where the new Roux Institute integrates research, venture and entrepreneurship. The program has undergraduate programs that span five years instead of four, with students spending six months as interns within the industry. Another example of this integration is the Health Acceleration Challenge and Health Lab Accelerator, which are shared between Harvard schools. However, these are two isolated examples that leave many students without these skills.

Currently, our system does not provide the proper support for students throughout all stages of their academic life. For the drug development field to thrive, it is vital that students are given access to mentors. Fundamental changes are needed to bring together the unique expertise of educational institutes and the knowledge of the private sector to better train the next generation of drug developers, form the next wave of companies and advance the field. However, there seems to be limited cooperation and, even more concerning, limited desire between the two sides to combine their efforts. They understand each other's survival is dependent on the success of their relationship, but neither seems ready to make the first move to make it better.

Industry flaws

Despite the vital nature of early exposure to industry to develop both necessary practical and technical skills, there are limited opportunities for students to interact with industry professionals[15]. One such example is Immunocore, which recently announced it had taken on 16 students during their undergraduate degrees. This represents around 5% of Immunocore's total employees, which is a major investment. However, overall, there remains a limited number of positions available in the industry for undergraduate, graduate and master's degree students. This perpetuates the cycle of these students needing to continue their academic careers in a doctoral program; approximately three-quarters of students who complete their master's degrees continue to a doctoral program[16]. Notably, a PhD is almost ubiquitously required by any company to progress in the pharma industry. This career path will deepen a person's scientific understanding, but it is possible that it makes an individual even more distant from roles and duties needed in emerging life science enterprises.

The pharma industry likes to continuously remind the public that it is innovative and forward-thinking. While true — as witnessed through the advent of cell and gene therapies, personalized and digital medicines, and the lightning speed in which the COVID-19 vaccines were developed — despite the ever-expanding need for multiple disciplines to work alongside one another cooperatively, many roles in biotech and in pharma companies require a PhD. Although the industry has never liaised with that person or that PhD program, we nevertheless perpetuate the need for a specific archetype of person to join the field even though it may not answer our problems. As such, both the employee and employer end up facing a financial penalty; the employee's wage stagnates, and the employer does not receive the desired work potential[8].

Scientific knowledge is fundamental, but more than that is needed to create the right professional, and for that person to integrate well into a company. This is especially true considering that being able to decide quickly requires an entirely different skill set, and this is necessary should a person choose to start their own biotech. Knowhow and intuition can only be acquired through practice[17]. Educational credentials such as the sought-after MD, PhD, MPH and MBA (or even Juris Doctorate) are a valuable baseline. However, simply acquiring these credentials often overlooks an elementary point: will you be able to work with this person to bring this idea to fruition as effectively as possible? Simon Sinek, an inspirational speaker, points out that trust is a better team selection criterion than performance. Sinek echoes Antoine Papiernik's point about companies backing the same inventors multiple times. Although weighted metrics toward performance are systemic in all businesses, a middle performer who is also a trusted person brings more to a team

than a high performer who has developed low trust. However, these middle performers will likely be skipped in the recruitment for biotech companies due to their lack of apparent qualifications.

The crux of the matter

The culmination of this is that educational establishments and the industry are meant to act in a mutualistic symbiotic relationship, similar to clownfish and sponges, instead of adversarial rivals that cannot admit they need one another. We currently have a system where the R&D comes from the university; however, there is not enough opportunity or progression along this career path. Subsequently, as these people came through a system that never was supported by industry, they move to attain further education, such as working toward a MSc, MPH or a PhD. To ease the current pressures on the job market on both sides, a solution must be found to support early stage career professionals and provide them with a real option to move into industry, while also giving them an understanding of what it takes to develop drugs.

A proposal for change

To bring about real change, all members of the drug development sector — governmental bodies as well as public and private entities — must unite to support the next generation. They need to open a dialog to create multiple opportunities for young drug-developing professionals who can gain expertise from seasoned professionals and apply this knowledge. Here, we suggest programs that could drive such changes and explain how these could benefit the collective.

Develop a curriculum that suits the needs of the students. We need to develop a comprehensive program for all students and postgraduates that is not only pure science but also considers the major skill sets that a drug developer needs, with input directly from the industry. As discussed above, it has been suggested that commercial, law and IP, finance, manufacturing, regulatory, project management and other skills are all necessary for drug developers.

This curriculum can only be created with input from the entire ecosystem. This may mean that courses are taught with modules from different faculties and that basic introduction courses must be developed. Facilities are already available within many establishments; thus, this is a logistical issue rather than a resource one, lowering the bar for change.

Finally, these curricula should be taught by both academics and industry experts, as this will allow for the benefits of both sides to be taught together. These curricula should evolve to align with the changing industry, such as when new technologies and regulations enter the frame. As such, curricula boards must have a changing board of advisors made up of academics and drug development professionals but must include governmental as well as private funds to achieve economic goals such as job opportunities for students and early career professionals, while also providing companies with a return for their enduring efforts in these collaborations.

Establish centers of excellence to serve innovation and education. Pharma companies have become heavily dependent on acquiring or licensing third-party biotech products instead of funding large internal R&D departments. However, there is currently little partnering with academia to fund academic research or to educate future drug developers. We argue that pharma should align with academic institutions to create centers of excellence through long-term research collaborations that allow students to participate in the full drug development process from discovery to preclinical and clinical research. Such collaborations have already seen success.

The high level of rivalry between large pharma companies makes it likely that individual companies would align independently with their chosen institutions to focus on a particular disease state, therapeutic area or even therapy area. In turn, these institutions would become recognized experts in particular fields. The sponsoring company could have an option to acquire the resulting research. As part of the program, they could provide internships for students to work on downstream aspects of the drug development process such as clinical testing, market research, target validation or regulatory strategy.

This would continue to bring new first-in-class assets into the pipeline, create potential future niche pharma players and move drug development away from 'me too' development and the dominance of a handful of companies[18]. This could also allow for new drugs to be developed in much-needed areas, such as neglected tropical diseases and other infectious diseases. In this way, it would propel a new wave of pipeline drugs, biotech and entrepreneurs. This benefits research by developing new drugs while also bringing about a more investable group of first-time entrepreneurs that could align with seasoned professional mentors who could pair off into companies. In this system, the innovations, entrepreneurs and startups would have been served by their respective universities, rather than the other way around, which is the case at present[19].

The curriculum would set out to provide students with the ability to network and to understand the development process. Thus, they would have worked alongside a larger company on their R&D strategy; in turn, this means that venture capitalists would have a lower risk as they would be investing in validated and trusted teams. Finally, this takes a major gripe away from young academics who are under intense pressure to publish and obtain research grants. This vicious cycle ensues where the pressure becomes insurmountable. Instead, the young academics can focus on what academic science is about, disseminating findings via publications and conferences. The new monetary benefit from forging relationships between younger academics and companies will mean that research of greater commercial interest will be conducted. In turn, this will mean that young researchers' careers will not always be at risk[20].

Internship and mentorship programs. Currently, students are required to seek internships and mentors, which can be difficult. Often, both parties — industry and student — are willing but they do not know how to reach each other. Efforts have been made in this area, but with some more successful than others. One notable example is VC University, a joint initiative from the University of California–Berkley School of Law, the National Venture Capital Association and Venture Forward, in which students who are typically not represented in venture capital can enter the program to gain valuable connections and experience. The program even includes a specific life science track to hone industry-specific skills. However, initiatives such as this are few and far between, and many students are left behind. More platforms that work in this way would be beneficial as different sectors in pharma often require distinct skill sets. Therefore, teaching students to understand how the sectors work would be an excellent way to support their career development. Furthermore, these programs act as professional leverage for individuals to excel in their careers. Every drug developer remembers when they were at their starting point, and they remember the influential person that supported their career.

Collaborative working groups. With the lingering COVID-19 pandemic and resulting Zoom fatigue, in-person events are back and more popular than ever. These events are necessary for like-minded individuals to come together and discuss everything from life to their ongoing work efforts. It is important to set up collaborative groups whereby scientists of similar disciplines can connect outside of conferences and openly discuss what they are up to, share tips and tricks and work collaboratively. This would also allow new drug developers to take in different perspectives of what it takes to bring ideas from the bench out into the world.

As examples, Deerfield Management and Alexandria Venture Investments are both aiming to bring biotech campuses to New York City. Similarly, the French government has supported a public biocluster for oncology in Paris, with support from Sanofi, Gustave Roussy, Inserm, Institut Polytechnique de Paris and the University of Paris-Saclay. Whether publicly or privately funded, these clusters bring about opportunities for chance interactions, whether sharing ideas or the opportunity to network with people outside of their immediate organization.

Bringing students into the field. Beyond the widening of the curriculum background, it would be valuable for both biotech and pharma companies and academic institutions to propose and implement codirected educational positions, taking place ideally in the labs of both organizations and managed by directors from academia and industry. This has already been successfully implemented in France under the CIFRE status (Industrial Agreements of Training through Research), immersing students who have completed their master's degree into the realities of R&D in industries within a funded PhD position.

Such a system is a triple-win solution. First, the student gets firsthand details and experience on how pure science translates into development and how patients and end-users benefit. They are exposed to the expertise needed to be a well-rounded drug developer with skills such as non-clinical and chemistry, manufacturing and controls (CMC) development, regulatory and clinical affairs, finance, business development and IP. Second, the academic partner's relationship with industry is strengthened, which can lead to further long-term collaboration and funding. No matter what the student elects as career choice, building strong relationships with alumni in both academia or industry is valuable. The industrial partners will also usually pay for the PhD position, which provides the academic lab with funding for one more fulltime employees and alleviates worries of funding in smaller groups. Third, the industrial partner sees a wider and more diversified pool of talents nurtured by the research excellence of academia who possess the applicable knowhow to translate science to the patient's bedside.

Conclusions

Many steps must be taken to facilitate the emergence of new therapeutic alternatives and their translation into lifesaving drugs. Among these, improving the relationship between those in the biopharma industries and academic institutions while also removing some cultural differences would benefit all parties involved. Students would receive knowledge that aligns with current knowhow and that will be necessary for their success; in turn, this would increase job prospects. Universities would have a curriculum that would lead to better business relationships and a more significant revenue stream. In addition, industry could have a pool of new technology to bring into their organizations, as well as a qualified workforce.

We hope that the stakeholders reflect on these ideas and acknowledge that we cannot continue with this divide. Shaping the next generation's future through academic–industry collaboration is important to continue to propel our industry to new and greater heights. Bringing together mentors, a proper curriculum and initial funding from seasoned partners could give rise to a more successful startup ecosystem, which will finally be properly supported from the first day of education. It would also bring Europe out of its credit risk to venture capitalists and lead to more venture creation, as we see in the United States.

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