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University – Industry collaborations: models, drivers and cultures

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Summary

The way academic institutions and pharmaceutical companies have been approaching collaborations has changed significantly in recent years. A multitude of interaction models were tested and critical factors that drive successful collaborations have been proposed. Based on this experience the current consensus in the pharmaceutical industry is to pursue one of two strategies: an open innovation approach to source discoveries wherever they occur, or investing selectively into scientific partnerships that churn out inventions that can be translated from bench to bedside internally.

While these strategies may be intuitive, to form and build sustainable relationships between academia and large multinational healthcare enterprises is proving challenging. In this article we explore some of the more testing aspects of these collaborations, approaches that various industrial players have taken and provide our own views on the matter.

We found that understanding and respecting each other's organisational culture and combining the intellectual and technological assets to answer big scientific questions accelerates and improves the quality of every collaboration. Upon discussing the prevailing cooperation models in the university – industry domain, we assert that science-driven collaborations where risks and rewards are shared equally without a commercial agenda in mind are the most impactful.

Key words: *academia; university; industry; collaboration; alliance; organisational culture; biomedical; pharmaceutical; innovation; model*

Why do universities and pharma companies collaborate?

The healthcare sector is undergoing environmental changes at an unprecedented pace that has led to an increase in pressure on pharmaceutical companies, which are challenged by rising complexity of the research and development (R&D) process, soaring costs [1, 2] and extending drug development times. Furthermore, the number of new molecular entities entering the market, an indicator for innovative capability, seems to have plateaued in recent years [3].

Hence, to gain competitive advantage pharma's R&D departments around the globe are reconsidering their business model and approach to collaborations with academia in order to continue to source disruptive ideas, concepts, technologies and scientific talent [4]. In addition, pharma companies are engaging with academia to access specific knowledge on pathways and pathophysiologies to better understand disease mechanisms, at times to free up financial resources and in other cases because the scope of the scientific question at hand is too large to be addressed by the company alone.

At the same time university faculties are trying to further their research by forming relationships with industrial partners to access materials, equipment and to test the applicability of their ideas [5]. Contact with industry is also being sought for tapping additional funding streams through contract research, consulting activities, and joint grant applications. Reputation gain through co-publications in high impact journals can be an additional incentive.

Some of the mentioned stimuli, however, are not unique to either industry or academia. Some pharmaceutical companies' research departments have hired academic leaders into their management, striving to build scientific meritocracies with career tracks that resemble academic ones, while some universities have become increasingly active in creating intellectual property rights for subsequent exploitation by commercially driven faculty members [6]. In this context many universities incentivise their staff to work closely with their technology transfer office and pursue appropriation through patenting, licensing or spinning off new ventures [7, 8].

What are the prerequisites for a successful collaboration?

To paraphrase Tolstoy: successful collaborations are all alike; every failed collaboration is unsuccessful in its own way. All productive collaborations have some basic features in common, regardless of the setting. Such relationships are based on mutual trust, have a shared mission and the risks taken are accredited appropriately.

Impeding factors are, however, abundant and the successful launch of mutually beneficial relationships between academia and industry mandate a number of pre-requisites. While these aspects are not *sine qua non* conditions individually, the combination of several factors can determine the fate of newly formed interactions.

When entering collaborations both sides need to be clear in which areas they are ready to collaborate, in which they remain competitive, and what they can bring to the table. A clear understanding on common but also diverging interests is the most truthful and realistic negotiation basis. Moreover, signaling one's skills and aspirations to the collaboration partner helps guide a decision on whether and where to invest resources. The equivalent in game theory would be to determine which contributions would create an equilibrium of pay-offs for a cooperative strategy. Reality shows that this factor alone does not guarantee success, there being many other behavioural factors that equally determine the fate of an alliance.

Even if we assume that contributions from the partners are complimentary, the expectations on what represents a positive outcome are often asymmetric. The pharmaceutical company's decision making is guided by risk, time and cost factors and every project in the company faces fierce internal competition to make it into the pipeline. Only if the collaboration can expand the access to previously unknown targets or molecules or answer a key scientific question on the suitability of a molecule or target for clinical development and as such enable decision making on the progression of an existing programme in the pipeline, it will be deemed a success. On the other hand, academia depends on the ability to build knowledge, publish discoveries, increase reputation or get support for research grant applications. Whatever the pay-offs may be, the perceived value of the newly formed interaction should guide each side's negotiation, rather than pure financial metrics.

Practice shows that initial propositions can at times fail to provide a clear strategy to create true win-win situations, e.g., pharma is being asked to further develop an invention of which academia retains full rights if a proof of concept is achieved, leading to a relationship where financial risk and invested time is not shared equally. On the other hand, the academic partner's publication submission can get delayed due to the subject falling under a collaboration agreement and therefore requiring a sometimes lengthy internal review. This can diminish the competitiveness of academic output, particularly in research areas that are en vogue where getting "scooped" presents a viable threat.

It has been shown that the ease with which these hurdles can be overcome is primarily determined by the level of inter-organisational trust [9]. Once pre-requisites are met alliances can be highly efficient research engines and enable tackling of bigger research questions than the individual party would have dared to pursue. For partnerships to realise their maximum potential, universities and companies have attempted to find suitable collaboration models.

Comparing different collaboration models

Historically, the collaborative pursuit of scientific projects at the academia-industry interface received a big boost in the 1980s, through policy changes such as the Bayh-Dole Act in the United States and governmental programmes elsewhere that allowed universities to make profit from federally funded inventions. The legislative alterations resulted in a surge of universities setting up offices for technology licensing that promoted the creation of intellectual property for commercial purposes.

Likewise the pharmaceutical companies started to embark on in-licensing inventions made by state-funded universities. In fact the predominant innovation sourcing model at the time was to form large multi-year framework agreements with the aim to tap discoveries of entire research institutions. The large sums involved in these models were not only pushing the envelope of ethical boundaries, but the long investment times incentivised academic investigators to pursue their own agenda over collaborative objectives. The funds were used as a welcome support by academia and gave rise to great science at times, but often the outcomes were neither commercially meaningful nor helpful to the industry.

Such framework prevailed through the 1990s, only to be discarded when new business models brought a paradigm shift, exemplified by the open innovation approach that emerged a decade ago [10]. While the idea was not conceptually novel, its large scale application in pharma came only after the method has been proven successful in other industries. This made many pharma companies rethink their methods of sourcing innovations and adopt new strategies accordingly. Many have embraced the opportunity to innovate collaboratively and several partnership models have emerged.

At GSK, for example, the model for discovering and translating innovations has evolved over the years from a monolithic R&D structure with centralised management to a federated model consisting of autonomous Drug Performance Units (DPUs) [11]. Each unit is thereby competing internally for funding and can decide on the ratio of sourcing innovations from internal or external parties. Specific academic DPUs are set up for bringing in projects up to lead optimisation and are supported through a virtual platform with a group of internal experts that can provide access to know-how and technology. If deliverables and targets are not met, the funding can be cut and units closed. Through this tactical approach, the entire organisation mirrors a covenant of individually accountable subunits with a highly entrepreneurial culture where relations to the academic research labs are being built if there is a clear rationale of how the DPU can use the external inventions to achieve its goals [12].

The transition into the DPU structure was initially catalysed through a programme with about 20 scientists that dedicated their efforts exclusively to working with external collaborators and their projects. Between 2005 and 2012 the programme had brought 16 new alliances that had built the trust into external partnerships. Later external alliances were increasingly generated by scientists across the entire

organisation and the programme was no longer the driver by external early stage projects [13].

Other companies equally acknowledge that it is critical to bring scientists from both sides together to work jointly in a co-located manner on drug discovery projects. Pfizer's Centers for Therapeutic Innovation (CTI) are based in the global biotech hubs where they work with pre-selected partners to share bench-and-clinic time. The agreement involves shared decision making and a financial reward for the academic side if the project proceeds. In case the project is not picked up the intellectual property generated will go back to the academic institutions so they could pursue the project with a different partner [14]. The CTI initiative was put in place to tackle research questions that address the gap in translational medicine, where early discovery concepts need assessing in order to test them in humans. This structure provides an environment in which chemists, biologists and protein engineers from the university come together with the pharmacokinetics and pharmacodynamics specialists to evaluate and formulate regulatory and clinical development avenues to the market, where the unique expertise of both partners can be brought together to accelerate finding and validating new medicines. The CTI network of 23 academic medical centers has to date produced 25 large molecule programmes with the first compound expected to reach the clinical stages in 2014. More importantly the co-location approach has established critical links to thought leaders in the biotech hubs of Boston, New York, San Diego and San Francisco [15].

Novartis' approach in the pre-competitive area follows an academic institute model where an entire research institute in bricks and mortar is established to form a bridge between the participating institutions. These research centres are placed strategically at the innovation hotspots of La Jolla, Basel, Singapore and Siena where the staff participates in both academic curricula and pharmaceutical R&D activities on a daily basis.

For instance, the Friedrich Miescher Institute for Biomedical Research (FMI), originally founded by Ciba and J.R. Geigy in 1970 and later inherited by Novartis, was created to form a bridge between the company, the University of Basel and other local research institutions and hospitals. Today the Institute has established itself not only as an intermediary between industry and academia, but has also gained international recognition as a centre of biomedical excellence producing results in basic research as well as contributing to commercial successes such as Gleevec® and Afinitor® [16, 17]. The Institute is currently home to more than 300 scientists, working in 23 research groups, of which 12 group leaders regularly teach as adjunct professors at the university. Judging by the citation rate per article calculated over a ten year period, the FMI easily bears comparison with the larger Swiss universities and the Swiss Federal Institutes of Technology. The exceptional research environment and the ability to translate research ideas into biomedical applications for the benefit of patients is one of the most critical factors enabling the Institute to attract young research group leaders from internationally renowned centres such as Harvard, Yale, Columbia and the Max Planck Institute. The bulk of FMI's funding is provided by the Novartis Research Foundation, and in addition it is supplemented by prestigious research grants from public agencies, e.g., European Research Council accounting for about a quarter of their budget [18].

Another example in this category is the Research Institute of Molecular Pathology in Vienna, a basic biomedical research centre founded in 1985 and sponsored by Boehringer Ingelheim since 1993. Additional resources are contributed by research grants from national and international funding agencies. Over the years, the Institute has rapidly established an excellent international reputation and is today one of the European "hot spots" for research in the area of molecular biology. Following on this success, in 2009 Boehringer decided to replicate the model in Mainz, Germany where an Institute for Molecular Biology has been founded with an € 100 million investment over 10 years, in a collaboration with the Johannes Gutenberg University and the state of Rheinland-Pfalz, who provided a new building for this purpose [19].

Both cases demonstrate that the model of an institute operating at the interface between basic research and applied pharmaceutical R&D, which is sometimes viewed as obsolete, can continue to be a successful framework for exchanging high-quality biomedical research.

Contrasting different organisational cultures

Apart from choosing a suitable collaboration model, we found it equally important how the relationship is being handled. As such the interactive behaviour between institutions is largely guided by their organisational principles. In a classic view academia and industry are portrayed as functioning within distinct organisational cultures that differ considerably in their underlying values, beliefs and processes.

In the case of universities this comprises the pursuit of basic, curiosity-driven research that aims at the creation of knowledge in order to educate the workforce of the future. Investigators in professional bureaucracies such as universities are focusing on their own needs as long as their interests can be aligned with those of the organisation [20]. In this context the strategic direction is only orientated on

Figure 1

Comparison of the organisational cultures in universities and in the pharmaceutical industry. The traditional view on the collective processes and values that make up culture are indicated in the left and the right panels. Successful collaborations defy the polarised view, have a shared purpose and follow a paradigm based on common beliefs and assumptions (middle panel).

a public mission that provides researchers with academic freedom in their choice to pursue scientific initiatives. Success and efficient work in such an environment is therefore measured by a prolific authorship in high impact journals and acclaim by peers in the field.

In contrast, the pharmaceutical industry can be perceived to be positioned at the other end of the scale where knowledge is utilised primarily to develop drugs from research applications according to market needs. In this commercial setting the intellectual property that leads to an innovation is protected to preserve exclusivity in the market to gain revenues that can offset the high development costs and create shareholder value.

While this polarised view may have been true in the past, collaborations that have shown to be productive and sustainable long-term have done so by banking on the common denominators of the partners' organisational cultures (fig. 1). In principle, both parties are trying to advance biomedical research in order to create societal value by finding cures for patients in need. The key to success however is to be able to translate discoveries that were made at the bench into the clinic, and use the experiences gained there to provide feedback to the lab to inform earlier investigations.

As with any knowledge-based field of work, both universities and the pharmaceutical industry depend on their reputation to attract scientific talents globally and to find collaborators with whom to exchange know-how in order to tackle health care challenges innovatively. The role of proximity of the partners should not be underestimated, as it allows frequent interactions that help develop trust faster and maintain a maximum degree of flexibility to arrange ad-hoc meetings. If difficulties appear, whether operational or on the communications level, joint and timely problem solving helps to further strengthen the relationship.

In addition, depending on the nature of the project it may be amenable to share research scientists under dual mentorship from both parties, a method that allows efficient know-how exchange and aims to train future leading scientists. A successful example here are industrial postdoctoral fellowship programmes [21] where researchers pursue projects that are of personal interest to the academic side and allow mutually challenging scientific questions to be tackled. To prevent conflicts of interest or obligation, project and publication goals are clearly defined at the onset of a project.

Conclusion – ingredients for mutual success

As with any human endeavour, interpersonal communication and relationships are critical in determining the success of a university – industry cooperation. We conclude here that irrespective of the type of alliance model one is pursuing, it is the science driven partnerships without a pre-conceived commercial agenda that deliver the most sustainable output. In cases where money comes onto the table early on, the incentives are skewed and the science is pushed into the background.

Varying philosophies and cultures of the collaborating parties provide an additional source of creativity that lives off the dissimilarities of each party's perspectives and expertise. In fact, disruptive innovations often occur at the trajectory of interfacing scientific disciplines; an area of opportunity for game changing discoveries, which may be overlooked if a general consensus is reached prematurely. However, pursuing an inclusive approach demands high levels of trust and open communication. Strategic alliances are relationships that need to be nurtured carefully and may reach a desired stability only over a period of time.

Like in academia, industry includes innovative researchers with a passion for science, who are equally driven by curiosity to find the next breakthrough discovery, that publish and are on the lookout for true scientific partners both internally and externally. Many productive scientific cooperations are actually driven by existing strong relationships of principal investigators. Such interactions are built on mutual respect, over time, and are fostered through a common language. Management enforced top-down match making that ignores this personal aspect leaves oneself open to failure at a very basic level.

Reviewing the different approaches chosen by the pharmaceutical players, the preferred model is to promote and support direct scientist-to-scientist interactions where researchers can debate their ideas and concepts. Understanding each other's needs and the focus on common interests while respecting and exploiting the differences also, increase mutual trust. In addition, the exchange of scientific know-how based on in-kind contributions from each party allows sharing risks appropriately and unites scientists behind the primary objective of the research question at hand. Once the scientific rationale has been established the resources that enable the project can be determined, but the reverse approach rarely leads to effective outcomes.

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Figures (large format)

Figure 1

Comparison of the organisational cultures in universities and in the pharmaceutical industry. The traditional view on the collective processes and values that make up culture are indicated in the left and the right panels. Successful collaborations defy the polarised view, have a shared purpose and follow a paradigm based on common beliefs and assumptions (middle panel).