Open Innovation in the Inhalation Field: Academia and Industry as Partners

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Summary

Is open innovation possible between academia and industry? how?

The relationship between academia and industry has steadily evolved from one where academia was a land of dreams and industry of applications, to one where ideas and tools cross boundaries in both directions. The relationship is now a fruitful partenariat. Some examples of this interplay are shown in the field of inhalation.

It is no longer the case that academia solves the problems of industry, or creates ideas that industry is eager to exploit. The current way is based on an “open innovation” partnership. Academia and industry benefit from each other’s insights and discoveries.

This however does require a change of expectations and ways of workings, and may require academia and industry to reconsider their roles and expectations.

Introduction

In the 1950s the world of academia was a lofty ethereal microcosm that looked upon industry as an unfortunate evil that would exploit their knowledge with un-avowable intents. Later on in the 1980s, academia was looking at industry as a possible source of funding and inspiration. In the mean time industry went from considering academia as a faraway land of hopeless dreamers, to a space where talent could be nurtured and harvested.

These diminutive perspectives on the relationship between academia and industry have now been replaced by a fruitful partnership, at least in the inhalation science. A series of examples are used to illustrate this collaboration, and how ideas from both sides lead to discovery, and strengthened understanding.

It is difficult in science to innovate and further ideas and theories in isolation. Open innovation is no new concept for scientists. However, in an increasingly commercially aware environment, concerned with generating revenue, new rules for open innovation have to be defined. A new understanding of the role and place of academia and its goals must be furthered. This must be accompanied by a re-assessment of how industry wishes to interact with academia.

Open innovation in Inhalation research

Over the years a number of research programs and ideas have flourished, which are the results of a close collaboration between academia and industry. These can be grouped under three headings: tools, knowledge and inventions, covering all aspects of inhalation science: from formulation, particle processing to testing. Some examples of idea exchange are listed in table 1.

One such area of close collaboration has been the development of the AFM as a standard tool to study interactions within inhalation products. The idea was first borrowed from colloid chemistry, where colloidal probe AFM had long been a standard technique to measure interactions. The earliest use of the AFM in the inhalation field seemed to have been led by Ashayer et al.[1] (Imperial college, London) at the request of Astra. Rapidly afterwards, work was started with Price et al.[2] (Bath University), who introduced the possibility of surface scanning. The original collaboration between AstraZeneca and Bath University looked at interactions within pMDIs[3], while other projects between Bath and Vectura were concerned with DPIs formulations[4]. Out of this work came the now famous CAB (cohesive-adhesive balance) model, now widely used in industry. The idea exchange went further with attempts to develop a pressurised AFM cell at the behest of AstraZeneca.

The study of the behaviour of excipients in HFAs is an other example of cross fertilization across industry and academia. Physical chemists have tended to concentrate their research efforts on aqueous systems. At the request of AstraZeneca their interest shifted to non-aqueous systems[5], in an attempt to understand the phase behaviour of PEG and PVP in HFA 227 and 134a. This work was carried out at the University of Cardiff. The data generated at Cardiff over the years has helped to shed lights on the unique properties of the HFAs, and draw parallel with other non-aqueous systems such as $C0_2$. A conference on the theme of non-aqueous colloidal systems was organised with the help of AstraZeneca as a consequence of that work[6]. The new insights into these systems led to the development of a better understanding of the solubilisation mechanisms in HFAs, and eventually on the proposal of a possible interaction mechanism, called Halogen bond. From an industrial interest, academia was given the opportunity to study an unchartered field of physical chemistry, and from this data industry was able to build up new predictive tools.

The study and formulation of pMDIs follows a similar path. First industry had developed tools to handle and prepare pMDIs samples, these tools were transferred to academia. In term, the academic partners studied some fundamental properties of pMDI formulations, namely solubility. This information was then used to develop and refine new formulations. These were characterised in the light of the newly generated information (suspension stability), information that could in turn be used to support the development of stability models, and better products.

To this list could also be added powder processing collaborations, such as the ones between Astra and Bradford University, that led to the industrialisation of the SEDS process, or Bath University and Prosonix for the SAXS process.

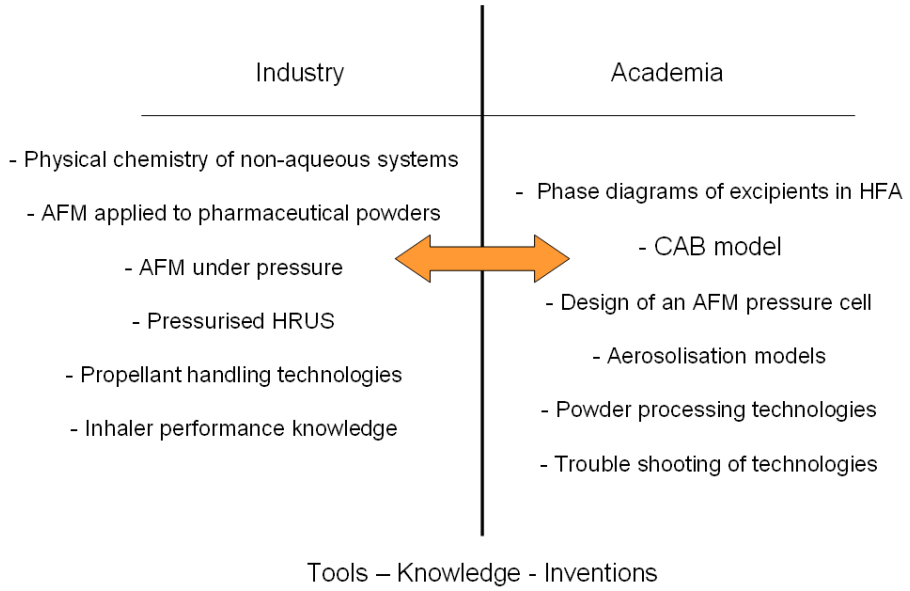

Table 1: some examples of collaborative work between academia and industry in the field on inhalation science.

The 3 examples mentioned above illustrate how open innovation can work.

The questions on what open innovation means, can one plan for it? and strengthen it? remain to be answered.

Can open innovation work?

What is open innovation?

"Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. [This paradigm] assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology"[7].

Open innovation has been the buzz word in science and technology research for a few years. It is best explained in opposition to closed innovation as set off in Table 2. Its premise is a mindset change, one where risking exchanging information leads to competitive advantage. Open innovation can only succeed if the different players are willing to divulge some of their information, and accept to recognise their needs for external input. A typical open innovation champion is Google. An example of a closed innovation company would be IBM in the 80's.

Closed innovation Principles	Open innovation Principles
The smart people in our field work for us.	Not all the smart people work for us. We need to work with smart people inside and outside our company.
To profit from research and development (R&D), we must discover it, develop it and ship it ourselves	External R&D can create significant value; internal R&D is needed to claim some portion of that value.
If we discover it ourselves, we will get it to market first.	We don't have to originate the research to profit from it.
The company that gets an innovation to market first will win.	Building a better business model is better than getting to market first.
If we create the most and the best ideas in the industry, we will win.	If we make the best use of internal and external ideas, we will win.
We should control our innovation process, so that our competitors don't profit from our ideas.	We should profit from others' use of our innovation process, and we should buy others' intellectual property (IP) whenever it advances our own business model.

Table 2: some guiding principles for open innovation contrasted to closed innovation principles.

Is academia ready for open innovation?

Universities have had a relative success in developing technologies. This is very country dependent, but the U.K. and the U.S.A. have contributed a great deal of novel technologies: formulations, devices and analytical methods. Yet, in many cases these developments, and the generation of I.P. seems haphazard, and unfocussed. It is also difficult for an external partner to understand in which direction the University wishes to go, and what are its expectations. Sponsoring PhDs, Post Docs, or commissioning measurements all suffer from a clear understanding of the business model of academia. Why do universities wish to generated I.P.?, solely as a source of revenue? Is academia wishing to service industry? Generate its own line of products? Why is Academia interested in routine measurements? Revenue? Knowledge? How would that sit with confidentiality requirements? The I.P. expectations of Universities is also often unrealistic: do all PhDs generate I.P.? Academics have the privilege of sitting on the fence between being independent external experts and direct industrial competitors. This can make collaborations difficult and possibly fraught in the long term.

To be fully in tune with open innovation, Universities would need to clarify their business model, improve the quality of their delivery, be customer focussed, accountable on their delivery, and realistic about I.P. exploitation.

Is the inhalation industry ready for open innovation?

Like academia, industry is no stranger to open innovation. It has backed successfully a number of technologies. However, industry could do better. The current model is that industry goes to academia to purchase ideas. There is a wealth of knowledge, technologies and ideas that are sitting in companies, that should be sold or lent to academia for further development. Industry must be

prepared to sell some of its I.P. to academia. A novel ideas trading model should be created. Industry should be prepared to cede some of its knowledge for its own benefit: to give information, and not simply money, in exchange for access to knowledge and idea, and profit from others' use of its innovation process. Academia must be prepared to receive that help and value it.

Conclusions

It is no longer the case that academia solves the problems of industry, or creates ideas that industry is eager to exploit. The current way, which is a challenge due to I.P. tangles, is based on an “open innovation” partnership. Academia and industry benefit from each other insights and discoveries, and use it to continually improve their own.

The case for open innovation is not a done-deal, and the definition proposed by Chesborough needs to be adapted and revised to accommodate the needs and requirements of industry and academia. There needs to be clarity on expectations and the limits of the open innovation model.

Will open innovation between academia and industry soon run into trouble?

Open innovation could run into some difficulties in the light of a recent article in the Wall Street Journal questioning the independence of Universities sponsored by the pharmaceutical industry:

“Some major universities are reviewing the way they handle funding from drug companies in the wake of criticism from Sen. Chuck Grassley, who is pressing the federal agency that controls government health-research money to get tougher on universities that don't disclose ties to the industry”[8].

References

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