



## POSITION PAPER

# It pays to promote joint PhD programmes between academia and the private sector

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**Abstract:** The prosperity of a country is closely related to its level of education to fuel research and innovation. Doctoral graduates have attained the highest education level and should be the key players in research and innovation. The number of doctoral graduates is increasing rapidly in most/many countries, but is less well correlated to changes in prosperity of a country.

The innovative medicines initiative (IMI) was established to help Europe strengthen its position in biomedical research and development. During its planning stage IMI observed large gaps in the scientific interaction between academia and industry in Europe, and that undergraduate students were not realizing the career opportunities within biomedical R&D. A major objective for the education and training section of IMI, the European Medicines Research Training Network (EMTRAIN, <http://www.emtrain.eu>), has therefore been to work out a framework for public private partnership PhD (PPP-PhD) and to create a cohort of networking, industry-aware scientists.

**Keywords:** public-private partnership, PhD, industry-awareness, competency profiles, IMI, EMTRAIN

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## 1. Introduction

The prosperity of a country is closely related to its level of education to fuel research and innovation<sup>[1–3]</sup>. Doctoral graduates have attained the highest education level and should be the key players in research and innovation. In most European universities, the number of doctoral graduates by far exceeds the number of tenured academic positions. The situation in the USA is similar and has led to the

suggestion of the need to “rethink some fundamental features of the US biomedical research ecosystem<sup>[4]</sup>”. The European Science Foundation (ESF) is running a pilot study to provide up-to-date information about career tracking of doctorate holders in Europe to aid policy makers<sup>[5]</sup>. There has been an increasing realization that the education of a PhD student should also include career coaching that extends beyond the traditional academic community and training in transferable skills. In recent years, a number of programs have

been developed to support career transitions for PhDs. In addition to these formal programs, there are numerous online services, books and articles that focus exclusively on the non-academic path<sup>[6]</sup>. In December 2014, a joint statement on doctoral training<sup>[7]</sup> included, “Doctoral candidates should be offered the opportunity to acquire additional methodological competences as well as transversal, soft and generic skills helpful for careers in science, the wider science-based job market and in the job market outside of science. Doctoral candidates select such offers on their own choice.” These modifications to the PhD education have been important steps forward to improve the interaction between academia and society. Still, much remains to be done before society can fully take advantage of the resources used for the highest level of education.

The field of drug discovery and development is an excellent example of an area that can gain tremendously from a close interaction between academia and industry in the training of PhD students. The pharmaceutical industry is dependent on substantial investments in research and development. The Innovative Medicines Initiative (IMI)<sup>[8]</sup> was established to help Europe strengthen its position in biomedical research and development. During its planning stage, IMI observed large gaps in the scientific interaction between academia and industry in Europe, and that undergraduate students were not realizing the career opportunities within biomedical R&D. This was partly due to the lack of understanding about how the industry worked, career options and collaborations, and intellectual property and publication strategies, which had been exacerbated by the previous, outdated “fee for service” model for industry-academia partnerships. A major objective for the education and training section of IMI, the European Medicines Research Training Network (EMTRAIN), has therefore been assigned to work out a framework for public private partnership PhD (PPP-PhD) and to create a cohort of networking, industry-aware scientists.

To obtain a well-substantiated basis for a more formalized PPP-PhD programme in medicines, we have interviewed eight large European-based biopharmaceutical companies. All companies unanimously declared that the major driving force to operate PPP-PhD programmes would be to build scientific relations to academic research centres of excellence. Other important factors were recruitment of outstanding students, possibility to arrange PhD opportunities for employees and generation of co-authored publications

in top-ranked scientific journals. All companies emphasized the importance of presenting the student with pre-competitive projects. The number of ongoing PPP-PhD programmes was relatively limited, but the over-all impression was that they are an asset and a potential investment for the company. The industries with the most extensive PPP-PhD programme are located in the UK and in Denmark. Both countries have well developed routines for national support to PPP-PhD programme. The pharmaceutical companies Novo Nordisk and Lundbeck have been extensively involved in the Danish Industrial PhD programme<sup>[9]</sup> which has now been running for more than 30 years and resulted in higher number of patent applications and increased gross profit for the participating companies. The PPP-PhD graduates spend 50% of the PhD time in the company and earn about 10% more than conventional PhD students. Very few experience long-term unemployment and they are three times more likely to hold leadership or senior scientist positions in the company than conventional PhDs. The universities have welcomed this supply of highly qualified and motivated students and the programme has increased the national competitiveness for both industry and academia<sup>[10]</sup>.

The concept of PPP-PhD programmes is not new, but a combination of increased industry awareness, involvement of new academic and industry partners and student networking would represent a considerable advantage. A larger scale implementation of PPP-PhD programmes in the field of medicine will however require changes in attitude from both academia and industry. The academic society may worry about the prospect to have to perform more applied and less basic science, and the industrial body may feel that academia is still pursuing the ivory tower philosophy to be disconnected from the practical concerns of everyday life. Mutual understanding and interaction are keys to success. Since changes of attitude are best implemented via the young generation, we have invited students from existing PPP-PhD programmes to participate in a series of workshops hosted by the industry and organized in collaboration with representatives from academia. We now have experience from 4 workshops, hosted by AstraZeneca in 2012, GlaxoSmithKline in 2013, UCB in 2014 and Janssen in 2015. The 2016 workshop will be hosted by Bayer.

The attendance has been limited to approximately 26 students to promote interaction and networking. The vast majority of the students are enrolled in ex-

isting PPP-PhD programs, but only a few students from universities that do not have existing PPP-PhD programmes are invited and selected on a competitive basis. A faculty consisting of staff members from biopharmaceutical companies and universities attended the entire meeting. The topics are selected to boost the interaction between academia and industry, promote networking and provide future perspectives on drug discovery. Examples of themes are: future directions in the field of drug discovery, importance of multidisciplinary research, interaction with academia, entrepreneurship in action, activities in emerging countries and role of in-house discoveries. All students are asked to give a short oral presentation of their research project. These presentations have provided an impressive exposé of what can be accomplished when the collaboration between industry and academia is enhanced by the joint responsibility of a talented young PhD student. So far a total of 107 students have participated, representing 22 countries, 56 universities and 17 companies. The student feedback has been excellent: 98% gave the workshop a good or very good overall opinion; more than 95% stated that their awareness of drug industry had increased and 100% said

that they would recommend the workshop to others. An important spin-off effect has been that the student participants have continued to stay in contact and now forming a network of future industry-aware scientists.

## 2. PPP-PhD Framework

Based on the information from the interviews with the industrial partners and the workshops, we have set up a proposal for a PPP-PhD framework, where the workshops, with their proven capacity to promote networking, are a cornerstone (Figure 1).

Based on the workshop experience, and in consultation with academic and industry supervisors as well as PhD students, a competency profile for industry-aware PhDs is being developed. The high-level topic list is shown in Figure 2. The profile will provide guidance for PhD students to facilitate working in both the academic and the industry setting.

In order to help students identify suitable PhD training posts, the on-course® database<sup>[11]</sup> includes a section on such opportunities, and on courses (university or private providers) that might help them acquire the appropriate knowledge to support their training.

1. The PhD programme will roughly follow the Bologna process. National considerations have to be taken into account.
  2. The PhD programme will usually include 3.5–4 years of training. The PhD thesis should correspond to 3–4 years of research written up as a single monograph or as published papers in accordance with university guidelines. Publication of papers in peer-reviewed journals is encouraged\*. Details on the format of publications should be covered by the PhD contract.
  3. The EMTRAIN PhD student will have two supervisors; the main supervisor will be active in academia and the co-supervisor in industry.
  4. The EMTRAIN PhD student will spend a minimum of 3 months in industry and remaining time working on a research project in an academic environment. This will promote mobility between industry and academia.
  5. The EMTRAIN PhD student is recommended to attend courses, visit other laboratories and attend international meetings and workshops in accordance with the university requirements. One such event could be the annual EMTRAIN PhD Workshop. This will promote mobility across countries. EMTRAIN supports the use of the Bologna process for PhD training where courses or other learning activities corresponding to 30 ECTS credit points is recommended.
  6. The EMTRAIN PhD student should take a minimum of three EMTRAIN recommended core courses. One course should be on Drug Development. The remaining courses should be selected from a list of topics recommended by EMTRAIN. It is suggested that at least one course is taken abroad.
- \*in some universities this is mandatory

**Figure 1.** The EMTRAIN joint (Public Private Partnership) PhD framework.

1. Knowledge and understanding
2. Personal proficiency and aptitude
3. Research management and organisation
4. Communication, engagement and team work

**Figure 2.** Competency profile – high-level topics.

Once they have received their PhD degree, they can maintain their professional development by further knowledge acquisition (via on-course®) and by transforming the learning into practical applications via further competence development<sup>[12]</sup>.

### 3. Conclusion

The process of implementation of a PPP-PhD framework, to be incorporated as a branch of the university's PhD training programme, has now been initiated. All universities that have had students participating in the workshop have been contacted. So far the proposal has been met with a very positive attitude. A key question is: who will be financially responsible for the PPP-PhD programme in drug development? We propose that economic responsibility should be shared between industry, university and national or EU funds, because it will serve the purpose to strengthen the sense of common responsibility and it will be a highly rewarding long-term investment for all partners. Furthermore, we would like to encourage each company to set up a PhD students' coordination office in order to help strengthen the links with academic partners and to facilitate the integration of students within the company, and make them feel that they belong to a "dynamic and agile science PPP sharing community".

### Conflict of Interest and Funding

No conflict of interest was reported by the authors.

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