

**A Triple Helix Model for the Development of the Life Sciences / Biotechnology Industry: An Analysis using Patents Data**

**Primary Sub-theme:** Indicators/Measurement of Triple Helix Linkages and Dynamics

**Secondary Sub-theme:** University Technology Commercialization & Spin-offs

**Research Topic**

There is by now a vast literature on the genesis and growth of biotechnology clusters in the world (see e.g. Cooke 2003, 2004). Notwithstanding some regional variations, the general consensus appears to be the critical new knowledge generation role of universities and public research institutes in the emergence and sustained growth of every major biotechnology cluster in the world (Feldman & Francis, 2003; Casper, 2003).

As argued by Etzkowitz et. al. (2000), universities around the world increasingly operate within a Triple-Helix nexus involving interaction with government institutions and private industries. As argued by Cooke (2003), the science-driven nature of the biomedical industry suggests a higher degree of governmental role in the Triple-Helix nexus compared to other industries. In the context of life science, the nexus is characterized by a number of special characteristics. Notwithstanding some regional variations (Cooke 2003, 2004), literature on the emergence and growth of leading life science industrial clusters in advanced countries suggest that they all share the core elements: in the private sector, there is the presence of large pharmaceuticals MNCs, specialised biotechnology firms and VC firms; in the government sector, public research institutes, public hospitals and regulatory authorities are important players; in the universities, the nexus is characterised by research labs and the emerging importance of university technology commercialisation arms.

This paper uses patents data to examine strategies to develop of several locations as regional centres for commercialization of life sciences and the changing role of universities in this process. The key biotechnology hubs of interest are those in San Diego and Boston's Route 128 in the USA, Cambridge in the UK, Hyderabad in India, South Korea and Singapore.

**Methods / Data**

The paper examines life-sciences-related patents granted by the US Patents and Trademark Office (USPTO) and the European Patents Office (EPO). A database of life-sciences patents invented in the six hubs is constructed, with detailed inventor and assignee information and citations links.

*This sample abstract is an example. The methods and results mentioned do not represent any actual research.*

It is postulated that universities would have a disproportionately important role, especially in the traditional centres in the USA and UK, while in the emerging Asian centres, the role of public sector research is expected to dominate. By analysing the assignee information of life sciences patents, as well as assignee information coded in the backward and forward citations linkages, the paper attempts to understand the interaction between universities, government RIs and private industry in the development of the life sciences centres.

Forward bibliographic as well as forward patent citation linkages also reveal the dependence of commercialised life sciences on basic research originating from universities. The development paths are expected to differ substantially between the different centres.

We devote a section of the paper to examining the special case of university-invented patents in order to understand how university biotechnology is commercialised. By further categorising assignees according to their status as university-linked companies and spin-offs, we are able to determine the degree of technology diffusion through spin-off activities by analysing citations linkages.

## **Results**

Preliminary results reveal that universities and public research institutes played major roles in the early development of life sciences in the major hubs in the USA and UK. In Asia, similar trends are emerging but several notable regional distinctions are highlighted.

Our findings also point towards increasing specialisation of the life sciences hubs, particularly in terms of the commercialised applications emerging from private industry.

Additionally, the evidence points towards the special role of universities in shaping the path of life sciences development in the selected centres. Even while the Asian hubs have a greater reliance on government research, the universities appear to dictate the life-sciences research agenda in terms of basic research and basic science forming the basis of technological development.

The full paper will include more detailed analysis of the government – private sector citation linkages, which will further inform our understanding of this segment of the Triple Helix nexus in the context of life sciences.

We believe that this paper will represent a step forward in the use of patents data to examine intra-industry relationships between universities, government and private industry.