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The International Mobility of the Highly Skilled:
A Case Study of the Biotechnology Sector in Vancouver, B.C.

Kathrine Richardson (University of British Columbia)

Working Paper 2006 D-15

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Abstract

The study examines the migratory nature of professionals in the B.C. biotechnology sector. With in-depth interviews of the human resource managers of firms and some chief scientists and executives, the findings reveal that foreign workers constitute a significant part of executives and professionals in the biotechnology sector in the Vancouver area. The study also examines factors that influence the movement of these highly skilled professionals and executives, and provides a better understanding of the role of networks and strategic alliances among these scientific professionals and executives.

Résumé

L'étude porte sur la nature migratoire des professionnels du secteur de la biotechnologie de la Colombie-Britannique. Des entrevues approfondies avec des gestionnaires de ressources humaines d'entreprises et certains dirigeants et scientifiques en chef ont révélé que les travailleurs étrangers forment une part importante des cadres et des professionnels du secteur de la biotechnologie de la région de Vancouver. L'étude traite aussi des facteurs qui influent sur le mouvement de ces cadres et professionnels hautement qualifiés et permet de mieux comprendre le rôle des réseaux et des alliances stratégiques chez les cadres et les professionnels scientifiques.

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2. Introduction and Literature Review

This research project, "International Mobility of the Highly Skilled: A Case Study of the Biotechnology Sector in Vancouver, B.C.," included an examination of the international mobility of the highly skilled within the biotechnology sector, or industrial cluster, of the greater Vancouver area, British Columbia**.**

2.1 General Background on the Internationally Highly Skilled

One key feature to creating and maintaining an innovative country is access to the highly skilled,[1] both foreign and domestic.[2] This need, coupled with an increasingly global economy, has given rise to many different types of industries depending on the professional abilities, cultural fluidity, and internationally mobility of the highly skilled. Lopes (2004) emphasized that business, especially big business, is increasingly competing for highly skilled labour in a global market. Thus, the highly skilled must be willing to be internationally mobile in order to make full use of their professional talents. This phenomenon has been elegantly demonstrated by Beaverstock and Smith (1996) in their study of the transnational investment banking community in the City of London; Beaverstock's separate work on the international migration of skilled labour in the global accountancy industry (1996); and Findlay et al. (1996) study regarding the complex relationships of the internationally mobile and the organization of the transnational corporation in the global city of Hong Kong. All of these studies focused primarily on the relationship of the large multinational corporation (MNC) and the internationally highly skilled. However, there is a growing shift in the needs for smaller, non MNC firms to have a global reach up firm inception. For example, Saxenian (2000) demonstrated that Chinese and India engineers started 29 percent of Silicon Valley's technology companies between the years of 1995-98.[3] Saxenian expanded on this idea two years later in a study conducted for the Brookings Institution in 2002 by stating the following,

> "As recently as the 1970s, only giant corporations had the resources and capabilities to grow internationally, and they did so primarily by establishing marketing offices or manufacturing plants overseas. Today, new transportation and communications

[1] As defined by Gera, Laryea, and Songsakul (2004).
[2] This study will focus primarily on the internationally high skilled.
[3] In supra note 1.

> technologies allow even the smallest firms to build partnerships with foreign producers to tap overseas expertise, cost-savings, and markets. Start-ups in Silicon Valley are often global actors from the day they begin operations."[4]

The above findings help to confirm Canada's experience regarding its emerging information and technology sector. For example, a recent study conducted by Industry Canada in 2002 through early 2003 found that a number of Canadian Information and Technology (IT) firms continued to hire highly qualified international professionals over high quality Canadian university graduates. The preference towards the internationally high skilled remained in effect even though there was a sudden abundance of domestic IT professionals due to a downturn in the IT industry.[5] The study emphasized that various positions within the firms surveyed required very unique skill sets, which could not be found in the local market.[6] It should be noted that a majority of the firms included in the study were considered small sized firms, usually consisting of a couple hundred employees or less.[7] The OECD[8] (2002) also helped to confirm the importance of mobility of the highly skilled originating from not only developing countries, but also other developed countries, and may be lured to another OECD country where environments for excellence in scientific research and innovation exist. Additionally, the OECD (2000) stressed that start-up firms play an important role in the innovation process since they were a crucial source of new ideas and innovations.[9] Using an industry example, the study cited that fact that access and availability to high risk financing such as venture capital in addition to the fact that 25 percent of all founders of biotechnology firms in the U.S. are foreign born[10] and were seen as key contributors to building a solid foundation for such a strong but relatively new industry.

2.2 Clusters and Skilled Labour

The literature in the above paragraph helps to draw attention to the nascent North American biotechnology industry, which is highly dependent on its ability to operate as a cluster within the

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[4] Saxenian, AnnaLee, "Brain Circulation: How High-Skilled Immigration Makes Everyone Better Off," *The Brookings Review*. Winter 2002. Vol. 20 No. 1, pp. 28-31.
[5] Berezovsky, Felix, and Keuylian, Ohannes. *Survey of ICT Companies-Hiring Practices of Foreign HQP*. Industry Canada. Ottawa, Ontario. April 2003.
[6] In Lopes 2004.
[7] Personal phone conversation with Felix Berezovsky (study author), Industry Canada. November 23, 2005.
[8] Oganization for Economic Cooperation and Development (OECD)
[9] This is especially true regarding the relationship between biotechnology firms and large pharmaceutical firms. For an in-depth discuss regarding this relationship see Angel 2004.
[10] Stephan and Levin (1999) cited in supra note 1.

local environment, but also develop and maintain crucial alliances and networks regionally and globally. Key ingredients that are needed to operate a cluster, in general, included entrepreneurship, linkages to a major and growing market, and the availability of skilled labour (Bresnahan, et. al. 2002).[11] Biotechnology firms must also nurture and grow strategic alliances regarding financing, Research and Development (R&D), and science in general, if the firm stands a strong chance of success.[12] The reason for these vast and complicated networks is that the global biotechnology industry is an inherently risky and complicated one with many processes and potential pitfalls. Thus, it requires extensive finances and seasoned experience, which is sometimes beyond the realm of the immediate firm. In addition to these needs, a biotechnology cluster specifically needs close physical proximity to key research centers that attract star scientists (Darby and Zucker, 1996), and a subsequent entourage of leading international researchers and graduate students with (or developing) highly sophisticated skills. Wolfe and Gertler (2003), midway through their extensive study of various types of industrial clusters throughout Canada, added to this milieu of critical factors, stressing that the centrality of skilled labour was seen as the single most important local asset to a cluster (p. 54). They elaborated on this phenomenon,

> "The local endowment of 'talent' in the labour force is emerging as a crucial determinant of regional-industrial success. This endowment is created and maintained by the retention and attraction of highly-educated, potentially mobile workers who are drawn to thick, deep, opportunity-rich local labour markets. The emergence of a strong, concentrated talent pool in local and regional economies also serves as a key factor in launching individual clusters along the path to sustained growth and development. Critical mass appears to be important here: Until this is achieved, local employers will fight a losing battle in attempting to retain or attract the skilled talent they need. Once it is achieved, this set in motion a positive self-reinforcing circle through which regions with a critical mass of highly skilled workers in a particular sector are able to attract still more workers of this kind. The initial source of the local talent pool can be highly varied, with both government laboratories and local anchor firms playing a key role in developing the initial talent base. Post-secondary educational institutions also play a central role in many of the health-based biotech clusters, but seem to be less critical for the initial launch of many of the other clusters."

[11] In OECD, 2002 as cited in supra note 1.
[12] See Darby et. al. 1999 as cited in supra note 1.

2.3 Traditional and Innovative Factors that Draw the Internationally Highly Skilled

The above quote provides a closing point for some of the key attributes found within biotechnology clusters. The topic of discussion now turns to some of the more traditional factors that are deemed as crucial in encouraging the highly skilled to move from one country another.[13] The more traditional factors include better employment opportunities, more stable political environments and social conditions, and tertiary graduate education for the highly skilled (Boyle et. al. 1998). Additionally, The MORI survey for PricewaterhouseCoopers[14] (2002) found that "pay" (rank #1) and "improve living standards" (rank #2) were the two most important motivators for mobility. Followed by "experience of life abroad" (rank #3) and "developing skills" (rank #4). Surprisingly, "new employment opportunities" (rank #5) and "enhancing career opportunities" (rank #6) were seen as a lower motivating factor towards moving abroad. Perhaps this is due to a shifting of the "type" of the internationally highly skilled, which was once dominated in many respects by the mid career MNC executive track professionals who saw an overseas assignment as an almost guaranteed entrance into the executive levels of a firm. However, due to cost cutting measures, many large corporations are scaling back on these types of overseas assignments for their executive ranks, and incorporating shorter-term assignments with the expectation of performance (Lopes, 2004). Thus, these types of assignments are no longer seen as a "perk" or a "fast tracking" mechanism to the executive level as they once were (Li, 2005). Perhaps a growing type of the internationally highly skilled is something that Boyle and Motherwell (2004) found in their policy study, which examined how to lure highly skilled Scots away from the vibrant city of Dublin, Ireland back to Scotland. Through a series of 10 focus groups conducted in Ireland with newly located highly skilled Scots (usually since 1998), they noted one of the following themes,

> "A definitive feature of the Scottish expatriate community in Dublin is the foot-looseness of migrants. Throughout the Focus Groups, there was a constant trivialization of the decision to migrate. This casualisation of what still is an international relocation decision after all, was most manifest when participants talked about the almost accidental and happenstance circumstances that surrounded their decision to migrate, and when they

[13] The four general types of the internationally highly skilled as defined by Gera, Laryea, and Songsakul (2004) are, 1) The 'traditional permanent migrant-skilled individuals move on a permanent basis from one country to another; 2) Temporary skilled migration; 3) Intra-company transferee generally associated with MNEs; and 4) Temporary visiting foreign scholars and researchers.

[14] Hereafter PWC.

> proffered the belief that it would not be a problem to reverse the decision were they to feel unhappy in Dublin. Clearly the relative youth and lack of ties of the Focus Groups cohort allied to the close proximity of Dublin to Scotland (repeatedly mentioned in relation to the growth of low cost airlines), goes some way to explaining this liberated attitude to displacement."

The study also worked to move beyond the traditional motivators of the highly skilled being economic, career enhancement, and quality of life factors by examining something called "cultural cosmopolitanism," based on the use of key cultural indices (the Bohemian Index, the Gay Index, and the Multicultural Index) developed by Richard Florida in his 2002 book, *The Rise of the Creative Class*. According to Florida, members of the creative class are essential to the success, dynamism, and ability to innovate for regional economies. The creative classes represent a wide range of people with vastly different talents. Florida (2002) described these people as a fast growing, highly paid and highly educated segment of the workforce. They work in industries ranging from technology to entertainment, journalism, finance, high-end manufacturing, and technologies to arts. Within this group there is a "super core" group made up of university lecturers, writers, actors, entertainers, researchers, analysts and opinion formers. This super core group also includes people working within marketing, business, and health care. Although these people do not see themselves as a group, they share a common ethos that values creativity individuality, difference, and merit.

The core of Florida's analysis focused on the idea that the members of the creative class can propel or lessen the robustness of a regional economy by their decision to locate, or not locate, to that region. Based on the creative class's core ethos of creativity, openness, difference, tolerance, diversity, and festivity, the ability of a work-place, city, or region to recreate itself under these parameters is key towards its future success. Florida (2002) expands on these ideas by developing indices such as the "High Tech Index," the "Innovation Index", the "Fitness Index", the "Gay Index", the "Bohemian Index", and the "Melting Pot Index," to actually rank American cities' ability to attract members of the creative class. Based on these indices, cities like Seattle, San Diego, Boston, and San Francisco would rank rather high, whereas cities like New Orleans, Memphis, Buffalo, and Okalahoma City would rank comparatively lower. Knowing these new attributes, Boyle and Motherwell (2004) stress that the major policy prescription is then to transform seemingly conservative, bureaucratic and stifling work places to

liberal, bohemian, multicultural and cosmopolitan places. Thus, for their research, Boyle and Motherwell (2004) took Florida's Gay, Bohemian, and Melting Pot[15] Indices and called the combined factors "cultural cosmopolitanism." As stated earlier, the ideas are relatively nascent, but the concept of "cultural cosmopolitanism", Florida (2002) and Boyle and Motherwell (2004), adds a new perspective to the more traditional factors that draw the internationally highly skilled to some places but not others.

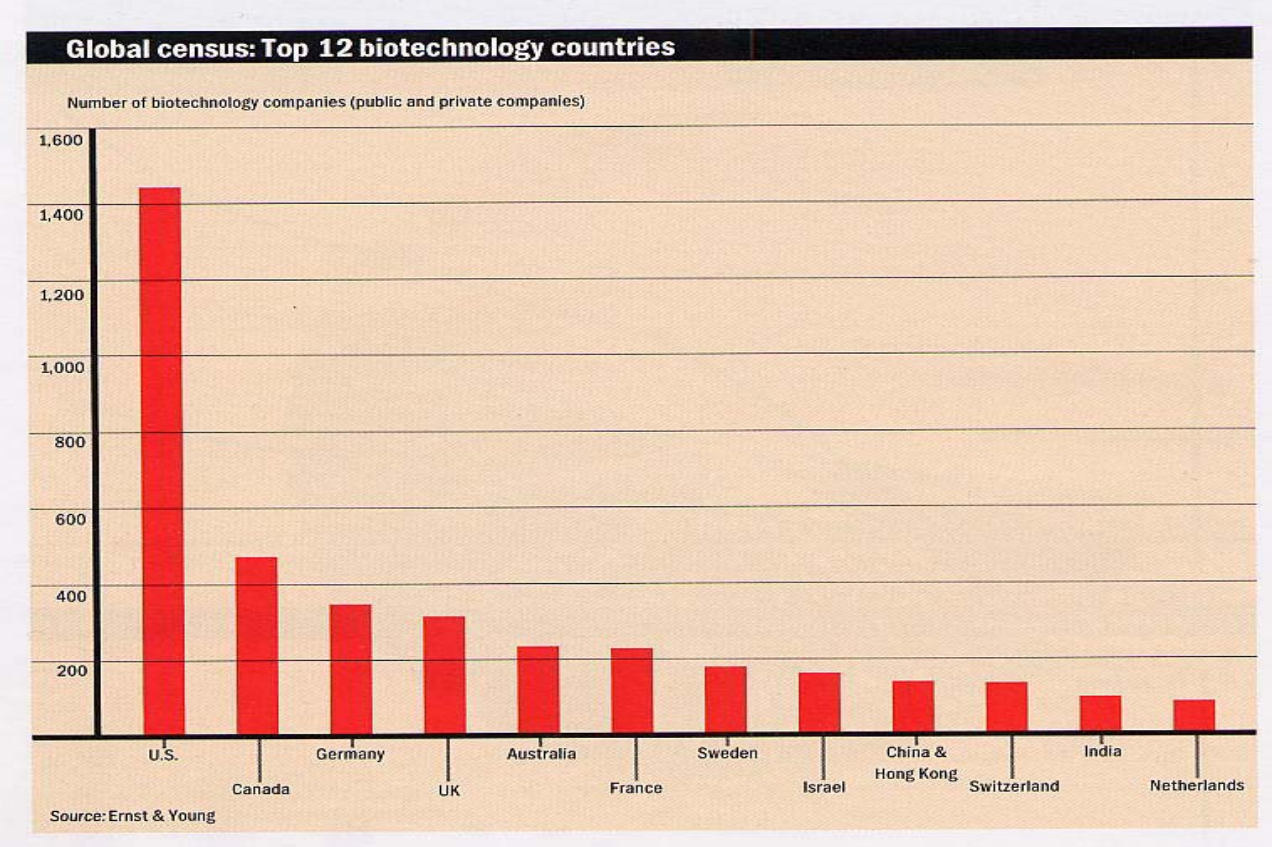
Based on this literature review regarding the many facets of the internationally highly skilled, this research study shall attempt to uncover findings for the following topic areas regarding the internationally highly skilled in B.C. Biotechnology sector: 1) What evidence exists for overseas highly skilled labour in the Vancouver based biotechnology sector?; 2) Why does the biotechnology sector tends to hire a certain number of professional employees who are international in origin rather than from regional or national labour markets?; 3) What are the types of incentives that encourage the highly skilled to be internationally mobile?; and 4) To what extent do executives and professionals in the Vancouver biotechnology sector develop and maintain professional networks?

The paper now turns to a brief introduction of the North American biotechnology industry and follows with a more detailed analysis of the B.C. biotechnology cluster.

2.4 The North American Biotechnology Industry

The North American biotechnology industry may be considered a leader in the global sector with the U.S. comprising over 1,400 public and private firms with a market capitalization of $330.3 billion U.S., and employing 187,500 people, as of 2004 (Ernst and Young, 2005: 18). The Canadian biotechnology industry has enjoyed incredible success during the 1990s, by growing tenfold to 375 firms, which included 77 public companies with a market capitalization of $17.5 billion, and employing roughly 7,370 people (Ernst and Young, 2005: 38). Canada's success and rapid grow in the past decade has allowed it to rank second in the world, only behind the U.S., as to numbers of biotechnology firms. (Please see Graph 1).

[15] Boyle and Motherwell (2004) used the term "multicultural" for their research.



Source: Ernst and Young, 2005 Graph 1

The growing success in North American biotechnology has warranted various studies, which attempt to distill what makes these regional clusters so successful. For example, Cortwright and Mayer (2002) conducted a study sponsored by the Brookings Institute, which examined the location and intensity of key biotechnology clusters throughout the U.S. They found that three relatively new biotechnology centers (Seattle, San Diego, and Raleigh-Durham) leveraged their success through well-funded medical research establishments in addition to a more general established research based and strong and consistent access to private sector investments and partnerships. These findings were similar to the Vancouver region in some respects, as demonstrated by a follow-up study specifically focused on Vancouver - although the local region accomplished "more with less" (Vancouver Economic Development Commission et. al. and Sui, 2002).

In fact, regarding skill levels, a recent study that examined the role of foreign worker scientists in the U.S. biotechnology industry found that between 6 percent to 10 percent of all professionals working in the U.S. biotechnology industry held H-1B visas[16] (Sevier and Dahms, 2002). Part of the paper argued that the U.S. Congress should continue to raise the limit on H-1B visas beyond the 195,000 mark (as of 2003), stressing that "there is not enough specialized domestic talent to meet the needs of the surging high-technology or biotechnology industries," in the U.S. Additionally, a study conducted by the Government of Canada's Sector Council Program in 2004, which examined the state of Canada's biotechnology human resources, recognized that the internationally high skilled were needed at many levels within the industry. Thus, one of the Canadian government's challenges was how to create a competitive package for these foreigners and their families that went beyond salary.[17] Part of these internationally highly skilled needs may be attributed to the demand for general human capital not available in a region. However as mentioned in the introduction, a new area of immigration research goes beyond the idea of drivers such as foreign human capital needs (and subsequent pay) and quality of life issues. It examines the idea of "cultural cosmopolitanism," (Florida, 2002) (Boyle and Motherwell, 2004), within a region, which is seen as key lure to attracting the internationally highly skilled. Florida expanded on these ideas in 2004 in an article in the *Washington Monthly* entitled "Creativity Class Wars."[18] He subsequently expanded on many of the ideas from this article in his most recent book published in early 2005, *The Flight of the Creative Class: The New Global Competition for Talent*. He quotes,

> "Though the data are not as perfect at the metropolitan level, other cities are also beating us for fresh new talent, diversity, and brainpower. Vancouver and Toronto are set to take off: Both city-regions have a higher concentration of immigrants than New York, Miami, or Los Angeles. So too are Sydney and Melbourne. As creative centers, they would rank alongside Washington, D.C. and New York City. Many of these places also offer such further inducements as spectacular waterfronts, beautiful countryside, and great outdoor life. They're safe. They're rarely at war. These cities are becoming the global equivalents

[16] A U.S. H-1B visa is issued to foreign professionals falling under a wide range of professions and job types. The foreign professional is allowed to work in a professional capacity temporarily in the U.S. for a certain employer up to three years with the opportunity to renew the visa for three more years.

[17] Government of Canada's Sector Council Program. *Converging Science and Leadership, The Key to the Future: 2004 Canadian Biotechnology Human Resources Study*.

[18] Florida discussed the U.S. economy and it ability to attract key foreign talent in a post 9/11 environment. He stresses that the Bush presidency has influenced much of the current climate of anti-elitism in the U.S., which is also impacting the U.S.'s ability to attract key foreign talent.

> of Boston or San Francisco, transforming themselves from small, obscure places to creative hotbeds that draw talent from all over--including your city and mine."

Based on the above, Vancouver may be considered on the brink of a metamorphous from being a seemingly "small obscure place" to some, which served as an outpost to a staples economy (Innis, 1999; Hutton: 1997; Barnes, 1996) and a gateway to the Asia Pacific for over one hundred years (Edgington and Goldberg, 1992; Hutton, 1998) to becoming a creative hotbed of global talent and being seen as a leader in new ideas that propels the global biotechnology industry forward. In fact, the most recent Pew Global Attitude Survey (June 2005) found that Australia, Canada, Great Britain and Germany ranked before the U.S. in regards to being seen as countries that offers opportunities to new comers. Thus, one purpose of this research project is to provide initial data as to whether or not the Vancouver area truly is attracting the internationally highly skilled who may have the opportunity to locate elsewhere, but chose Vancouver based on its apparent reputation as being "cultural cosmopolitanism," as well as other factors. The paper now turns to the actual B.C. biotechnology sector and some of its current key attributes.

2.5 The B.C. Biotechnology Sector

The biotechnology sector in Vancouver can be considered a world leader in the industry with over 60 companies being created between 1991-2001, placing it third in North America with only San Francisco (71) and Boston (65) having founded more companies during this time period. Specifically, 354 biotechnology patents have been issued for discoveries within the Vancouver area from 1990-1999, most originating out of the University of British Columbia (UBC) research laboratories (Vancouver Economic Development Commission et. al. and Sui, 2002). In fact, since the inception of UBC's University-Industry Liaison office in 1984, UBC has spun off 91 companies, raised more than $1.3 billion dollars from private investors, and generated more than 2,100 jobs within the local biotechnology cluster (UBC UILO). UBC's renowned research within its Faculty of Medicine and related scientific disciplines have made a solid contribution towards the foundation of the industry with over 60 percent of B.C. biotechnology companies developing biopharmaceutical and biomedical applications.[19] The breadth of these firms' products range from new classes of antibodies to AIDS/HIV and cancer

[19] See Rees 2004.

therapies, drug delivery systems and the treatment of inflammatory diseases such as asthma and arthritis (BC Biotech, 2004: 56).

As of 2004, the B.C. biotechnology industry went through a transition from being primarily dominated by earlier stage development companies to having a number of companies at different stages of maturation. While the larger and later stage firms are becoming more and more successful at securing rounds of financing, earlier stage companies continue to struggle with attracting investment and human capital (BC Biotech, 2004: 6). Even though there are signs of a growing schism between these successful and struggling firms, the B.C. biotechnology sector is still perceived as a marvel, overall, in its ability to become so successful in such a short time frame of approximately twelve years. Although there are many factors that have contributed to the B.C. biotechnology industry's success as a whole, such as close ties between the university and local commercial activities[20], world class medical research, and ease and availability of venture capital for later stage firms, there still remains the question of the need and the contribution of international human capital towards this industry, especially for firms at critical yet vulnerable stages of development.

3. The Exploration of the Role of the Internationally Highly Skilled in the Vancouver Biotechnology Sector

Based on the above, the first objective of this research study included gaining a wider understanding of what evidence exists for international highly skilled labour in the Vancouver based biotechnology sector. Based on preliminary research with one of the leading biotechnology firms in the greater Vancouver area, all executive personnel, key managers, and leading researchers for this firm originate from the U.S. in addition to other foreign countries such as Britain. (It should be stressed that this firm's leading scientific researchers are primarily from the San Francisco Bay area.)[21] This initial evidence begs the question as to what is the foreign/domestic composition of executive and professional personnel for other Vancouver based

[20] See Holbrook et. al. 2003 .

[21] This is based on evidence from an interview with a leading Vancouver based biotechnology firm for my existing Ph.D. research. This research examines the mobility of North American professionals under NAFTA who work for high technology/biotechnology firms located in Vancouver and Seattle.

biotechnology firms since leading biotechnology regions such as the state of California estimates that approximately 10 percent of all professionals working in its biotechnology sector are foreigners?[22] Additionally, the San Diego biotechnology cluster, estimates that as of late 2005, anywhere from 15 percent to 23 percent of the cluster's professional workforce is foreign.[23] Thus, a reasonable argument may be made that there is possibly a significant number of foreign highly skilled working within Vancouver's biotechnology sector, and warrants further exploration. Based on this statement, a second objective included examining what are the hiring strategies used by firms to attract the internationally highly skilled. A related third objective explores the fundamental key drivers or influencing factors propelling the international mobility of these highly skilled professionals. For example, to what extent have incentives, such as pay structures, unique career opportunities/advancement, lifestyles, cultural cosmopolitanism, and/or permissive professional immigration policies, encouraged greater international mobility of highly skilled professionals? Additionally, how have regional trade agreements such as NAFTA encouraged the mobility of the North American highly skilled along with greater integration of services and foreign direct investment, for example? A fourth objective was to learn more about the types of networks and strategic alliances that these scientific professionals use. This includes understanding the depth of professional connections with other biotechnology and pharmaceutical firms, associations, and universities. Additionally, social connections with colleagues, alumni, friends, and family members who have similar professional backgrounds will also be explored.

So, in summary the study shall seek to explore the four topic areas:

1. How do the internationally highly skilled contribute to the success of the BC biotechnology industry?
2. Why are the internationally highly skilled drawn to B.C.'s biotechnology cluster in general?
3. How have firms at different stages of development been able to draw and retain these internationally highly skilled?

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[22] California State University Program for Education and Research in Biotechnology, *The Current and Future Workforce Needs of California's Biotechnology Industry: A Study and Summary of Public Hearings*, 2001.
[23] Personal interview with Communications professional, Biocom, San Diego, California. Information based on various recent studies regarding hiring practices within the local cluster, as well as regionally and nationally. November 19, 2005.

4. To what extent do executive and professional networks exists for the Vancouver based biotechnology firms?

5. Methodology

The research project was executed in a research program, which included interviewing key personnel (vice presidents, chief scientific officers, lead scientists, and human resource managers) of 12 biotechnology firms within the Vancouver area at various stages of firm development and an executive officer for one of the key regional biotechnology industrial associations. Specifically, three "mature" firms were interviewed that have over 100 employees; five "mid size" firms were interviewed that had between 40-100 employees; and four "small" firms were interviewed that had between 1-39 employees.[24] Questions asked to subjects fell under one of the four topic areas identified in the preceding section (Section 3) of the paper, and will be explored in more detail in the Research Findings portion of the paper. Not all interviewee subjects were asked the same questions since they were interviewed depending on their area of expertise and unique experiences. Thus, the sample subjects may be considered an expert panel, and the sampling methodology is one based on quasi-structured interview questions. Each interviewee was asked between 10-15 questions. At least one professional was interviewed for each firm included in the study, and it was usually the human resource manager of the firm. Two chief scientific officers and a vice president and operations executive also participated in the study. Additionally, the executive assistant for one human resource manager participated in the study on behalf of her supervisor. Thus, a total of 16 interviews were conducted for this study. The data set includes BC Biotech and Business in Vancouver's 2003, 2004, and 2005's listing of the 18 largest biotechnology companies in British Columbia in addition to The University of British Columbia's University Industry Liaison Office's listing of all fledging UBC companies which have filed patents with this UBC office, and are most likely still located on the UBC campus.

The next section, Research Findings, shall explore the preliminary results from these 16 interviews conducted in the summer of 2005.

[24] The original proposal sought to interview firms at the "fledging phase" of research, which usually includes a small-incorporated team of university researchers working on a newly patented idea and were most likely still within the university laboratory. However, the project was only able to secure interviews with one firm of this sort and it has jumped from 4 to over 20 employees in the past two years within its university lab.

5. Research Findings

The research findings for this project include the introduction of the results from 16 interviews with 12 biotechnology firms and one industrial association located in Vancouver, B.C. Four main themes were explored in the interviews:

- Evidence of the International mobility of the Highly Skilled
- Firm Hiring Strategies in relation to the Internationally Highly Skilled
- Drivers and Related Economic Factors relating the Internationally Highly Skilled
- The Professional and Social Networks of the Highly Skilled

Anywhere from four to nine main questions per theme were presented to the interviewee in hope of drawing out information and insights relating to the topic area. All interviewees answered all questions presented to them usually in one hour. It should be stressed that there were some areas that did not apply to the firm being interviewed, so these areas were not elaborated upon within the interview.

Of the 12 firms interviewed, 10 were included in the top 17 largest biotechnology firms in British Columbia (BC Biotech, 2005). Only two firms were held privately. All others were public. Additionally, only one firm was considered a subsidiary of an American firm based in the San Francisco area. All others considered themselves "based", if not "headquartered", in Vancouver, British Columbia. The following is a composite of the answers given or the main theme that emerged from the questions proposed.

5.1 Recent Evidence Of The International Mobility Of Highly Skilled Workers

This research theme attempts to uncover whether or not the biotechnology sector did, in fact, hire the internationally highly skilled, and over what type of duration (e.g. long term, short term) and under what conditions (permanent or temporary). A complementary component to this area was to seek evidence regarding the hiring of Canadians who have spent time working in a professional capacity abroad. The section begins with a summary of the key issues and analysis stemming from this theme, followed by the actual findings to the specific questions asked.

5.2.1 Key Issues and Analysis

There was strong evidence that the Vancouver based biotechnology sector depends on the hiring of the internationally highly skilled. In fact, the largest firm within the cluster, with over 300 employees at its Vancouver based headquarters, considered over 90 percent of its executive and professional staff to be international.[25] However, a more common percentage for six other firms, which ranged in size from 30 to 90 employees at their Vancouver operations, considered 20 percent to 35 percent of their professional and executive staff to be international. All firms noted that the trend in hiring international professionals and executives would continue as the firm advanced through the stages of drug development and clinical trials. The reason for the hiring of international executives and other professionals was that these people had considerable more experience in taking similar types of drugs candidates through the various stages of drug development and clinical trials in the United States as well as Europe, which had larger markets as well as seemingly more complicated processes than Canada. Thus, these people had more experience and could guide the firm through this long and somewhat challenging process of drug approvals. This topic area will be explored in more detail in section 5.3.1.

All firms hired international executives and professionals with the intention of retaining them permanently. However, the biotech industry may be considered somewhat volatile when it comes to sustaining employment levels from one year to the next, and frequently must layoff significant numbers of personnel if funding partnerships were not successful for a certain period of time. A partial explanation for these dramatic swings in employment levels is that a majority of the firms do not have any source of income yet and are highly dependent on rounds of funding from investors, pharmaceutical companies, or underwriters which usually last from one to three years. Additional rounds of funding (and investment in general) are frequently tied to the continued performance of the company and include achieving various agreed upon goals and successfully passing certain milestones. These obligations are particularly stressful for the adolescent firms, especially the ones approaching phases 1-4 of clinical studies. Thus, the firms tended to want to hire executives and professionals who have been through the process a few time in order to avoid not being successful, and these types of executives and professionals are usually found within certain biotechnology clusters in the United States and Europe.

[25] This particular firm announced in December 2005 that it would begin to lay-off approximately 100 worldwide employees. This downsizing was done in an effort to refocus and reposition the company in light of increasing product competition.

Unfortunately, despite firms' best efforts to attain goals and milestones, sometimes a firm's particular drug candidate was not successful with achieving financing or regulatory approval. The firm must then cut back staff in order to save costs, but continue to operate. When this happens, it is usually difficult on both the employer and the employee. From the employer's perspective, the firm went through considerable efforts to hire (especially if the employee was international) and train the professional specifically for the firm's unique area of research. Thus, the firm is loosing considerable human capital. From the employee's perspective, it is always difficult to lose a job, especially if he or she has a family to support or is somewhat "embedded" in Vancouver with children in school or if the other spouse has a good job in the area. These circumstances coupled with the fact that the nascent B.C. biotechnology industry cannot afford to loose any of its human capital that it has attracted, or grown over the past fifteen years, has encouraged the human resource managers for the 12 leading biotechnology firms to create their own collaborative group. One of the purposes of this group is to let other human resource managers know if a firm will be laying-off employees and to share resumes and related information of those affected prior to the actual layoff. All human resource managers noted that the system they devised was incredibly effective in finding new jobs for displaced employees, and, in fact, the group was almost always capable of finding a comparable job for the person somewhere within the lower mainland of British Columbia. One human resource specialist summed it up well by exclaiming that the biotechnology cluster and it human resource group was "sustainable by necessity."

B.C. biotechnology firms were always pleased to find a Canadian who had gain invaluable experience working abroad, and who was willing to return to Canada. Five firms were able to hire anywhere between one to five scientific professionals who had worked in the U.S. for a few years, which usually indicated that they were familiar with various types of research and clinical studies that were hard to experience quickly in Canada. Canadian professionals working in the business side of biotechnology were found to also return to Canada, and they brought with them an understanding of international patenting and funding processes, especially within the United States. They usually returned to Canada in order to raise a family or be close to their existing family, and ranged between 35-45 years of age.

Finally, firms did not have written policies regarding the hiring of domestic versus international employees, although they stressed that they preferred to hire a local person over someone from out of the area, if the qualifications were the same. It was considerably less expensive, and the cultural transition, even for Canadians coming from Eastern Canada, was always difficult for anyone not from the west coast of North America.

5.3.1 What percentage of your professional/executive staff may be considered international?

Nine firms interviewed had a significant numbers of international executives and professionals. In fact, the percentages of international executives and professionals ranged from15 percent to 90 percent, with an average of about 25 percent of executive and professional personnel being international.

Elaborating on the above, seven of the firms' chief executive officers were from the United States. Four firms noted that they had other executives originating from the United States, and two firms noted that all of their executive staff were from the U.S. and were considered an "executive team." Besides the United States, there was also a strong British influence within the sector. In fact, one firm stressed that over 20 percent of the firm's executives and professionals originated from Great Britain. Regarding professionals, the United States and Europe were areas that provided "seasoned" scientists and business professionals who had work experience that these Vancouver based firms would need as they continued with the stages of their drug development. Finally, there was also a "heavy Asian" component for one firm with over 30 percent of the firm's professionals originating from either China or Hong Kong.

Overall, though, the firms hired professionals from almost all over the globe[26] based on the firm intricate and highly sophisticated research needs. The remaining questions and answers within this section shall continue to explore and uncover why Vancouver's biotechnology sector tends to hire the internationally highly skilled.

[26] Latin America was the only continental area not mentioned as a source of highly skilled professionals for this study.

5.3.2 Have you always had these levels of international staff? If "yes", why? If "no", why has it increased/decreased? Do you see these levels continuing to increase/decrease in the future?

Of the nine firms that relied on international hires, all saw their foreign hiring patterns increasing as the respective firm advanced with drug development, or reaching a plateau if the firm was already at Phases 2 or 3 with clinical studies, or, in fact, gone to market with firm products. For example, the human resource manager for one large firm noted that the firm was originally all local executives and researchers, but as the firm grew and advanced through various research stages and clinical trials, it began to need a more sophisticated group of people, which could was hard to find locally or even nationally.

The two firms that tended not to hire international highly skilled professionals did so for different reasons. (It should be stressed that both these firms did have at least one American executive in Vancouver.) One firm just went through a round of lay-offs earlier in the year, and at the time of interview in July of 2005, the "bulk of employees were Canadian". The human resource manager also noted that the firm was at the point of pre-clinical studies, and they were able to find local talent at this stage of development. One firm, as mentioned earlier, was a subsidiary of a firm based in San Francisco, California, and conducted more routine laboratory functions in addition to operating a pilot manufacturing plant rather than on-site drug development. Thus, the firm hired many more research associates[27] and animal technicians[28], which could be found within the local region.

5.3.3 Regarding your international staff, are they here permanently or temporarily, or both? If they are here permanently, why is this so? If they are here temporarily, approximately how long do they stay with your firm, and where will they return to after they are finished with their work assignment?

All firms that hired international executives and professionals did so on a permanent basis. From an employer's perspective, a majority of firms noted that the firm does not want to make an

[27] Usually requires only a bachelor degree
[28] Usually does not require a bachelor degree, only certification

investment in moving a person, if it was only temporary. One firm spoke to the employee's perspective, stating that they as a firm cannot attract high quality people to a position if the job is temporary. One firm did hire some post docs through a National Science and Engineering Research Council (NSERC) program, which only lasted a year. However, the human resource manager noted that the firm tends to hire these post docs into more permanent positions within the firm once the initial NSERC program was over.

One firm noted that their international executives and professionals are here permanently, but many want to return to the United States due to a Canadian tax policy, which affects the foreign assets of foreigners who remain in Canada for over five years. The human resource manager stated that the firm is just beginning to deal with this issue, and is in somewhat of a quandary as to how to handle it. She noted that her firm is at a critical point in the drug development process and cannot loose these key international people. However, the firm was a medium size firm and did not have a vast array of professionals and firm finances that could be dedicated to this issue, which was more frequently the case for larger firms and multinational corporations.[29]

Two human resource managers had also worked within the high tech industry and noted that biotech is different than high tech in the sense that biotech projects last much longer, usually nine to thirteen years, as compared to high tech where a project usually lasts anywhere from six months to three years. So, the hiring mindset between biotechnology and high technology is different.

Although there was not a government mandate in place regarding a process that firms must adhere to before they displaced a large number of employees, as was frequently the case for European countries, it should be emphasized that the human resource managers for all of the larger B.C. firms have formed their own regional outplacement group. Among other things, this group has taken up the effort of direct firm-to-firm communications when a particular firm may be doing lay-offs due to not being successful in a round of funding or not achieving certain clinical studies outcomes. This system was incredibly effective in keeping highly qualified

[29]Li (2005) has done extensive work comparing the U.S. and Canadian tax policies as to how they may affect the mobility of the internationally highly skilled, both coming into and leaving Canada.

professionals, whether foreign or domestic, within the local biotech community. For example, one firm has just experience a second round of lay-offs in late June 2005 due to the unfortunate circumstances regarding one of their primary drug candidates. This drug candidate was not accepted for accelerated approval within a critical foreign government's drug approval process in December of 2004. The firm responded to this situation by scaling back firm employment from approximately 170 people in 2003 to 22 in June of 2005. The firm's human resource manager set up a very thorough outreach process for all affected employees, and noted that this regional human resource network was critical in placing a vast majority of displaced employees within the Vancouver area. In fact, the farthest away a person had to relocate was Seattle.

5.3.4 Do you have Canadians in your firm who have worked abroad, and have now returned to Canada? If "yes", where did they return from? How long were they there? Why did they return to Canada?

Although the B.C. biotechnology cluster did not like to loose any of their international employees once they have acquired them, they were always pleased when they did find a Canadian who has worked abroad and was willing to return to Canada for work. Five firms benefited from this situation. Each of these firms had at least one employee who had originally been working in the eastern parts of the U.S. or California, and sometimes London, England for a few years and wanted to return to Canada for a range of reasons. Personal reasons included being closer to existing family or wanting to start a family. Political reasons included the growing divide between Republicans and Democrats in the United States, and social reasons included Canada being more openly accepting of gays and lesbians as compared to the United States. When responding to the question, one human resource manager noted that Europeans who had originally taken jobs in the U.S. often looked to Canadian urban centres as possible places of continued employment in North America since Canadian cities have more of a "Europeanness" as compared to American cities.

If a Canadian scientist did seek professional work in the U.S. for a few years, the person usually acquired various skills and professional experiences that are not as easy to attain in Canada. Thus, the Canadian scientist was then seen as a "boon" to potential Canadian biotechnology employers. A lead scientist for one of the smaller firms noted that there was a preference for

hiring Canadians that had acquired skills in the U.S. and then wanted to return to Canada. She added that her firm had recently hired a Canadian Ph.D. who worked for a biotechnology firm based in California for two years before returning to Canada. Another chief scientific officer stressed that his firm did not have to "sell Canada" to a Canadian biotechnology professional working in the U.S. Hence, from a process of recruitment, a Canadian firm is already one step ahead when an expatriate Canadian is interested in a job at a Canadian firm. However, one human resource manager for one of the larger firms was a bit more cautious about the availability of expatriate Canadians returning to Canada for work. In his professional experience, he noted that Canadians who have actually acquired permanent residency status (a "green card") in the U.S. actually have less than a 10 percent chance of returning to Canada. So, he added that it is usually those Canadians that do not secure permanent residency in the U.S. who are most willing to return to Canada.

5.3.5 Can you provide me with socio-economic profiles (e.g. skills, education, occupation, marital status, age, wage ranges) of these returning Canadians?

Almost all of the returning Canadians had at least a master degree and usually a Ph.D. if they were in the sciences. Their skills included experience with advanced research and clinical and regulatory issues, which were much easier to experience in the U.S. at a greater intensity in a shorter amount of time, as compared to Canadian employment. The other returning Canadians included professionals in sales and marketing. These Canadians tended to have undergraduate degrees in commerce or professional degrees such as a Master in Business Administration (M.B.A.). A majority of the returning Canadians were between the ages of 35-45 and married. Most wanted to returning to Canada to start a family or be closer to family. It was noted that many of these returning Canadians did not want to raise their children in the U.S. Salaries ranged from $50,000 to $230,000 CN.

5.3.6 Do you have firm policies regarding the hiring of domestic versus international professionals? If "yes", what do these policies cover? May I have a copy of these policies?

All firms interviewed did not have firm policies regarding the hiring of domestic versus international professionals. However, three of the larger and more advanced firms expressed the

fact that they have guidelines that they followed. One human resource manager did an excellent job at summing up the typical approach that firms used when searching for professional and or executive staff. She used a concentric circle policy by looking first within the local and regional areas, and then moving to the rest of Canada, and then international. All human resource managers noted that it was incredibly expensive to hire someone from out of the area, and relocation packages range from anywhere from $25,000 for research associates to over $100,000 for executives. Thus, just from a financial perspective, firms would prefer to hire locally if they could find that person locally.

5.4 Hiring Strategies Related To The International Mobility Of Skilled Workers

This particular theme examines some of the key hiring strategies that the firms used when recruiting the internationally skilled to the Vancouver biotechnology cluster. The section begins with a summary of the key issues and analysis stemming from this theme, followed by the actual findings to the specific questions asked.

5.4.1 Key Issues and Analysis

The greatest factor that influenced firms' tendency to hire the internationally highly skilled is an urgent need for executives and scientists who have extensive experience in leading other successful biotechnology firms as well as being able to navigate the four phases of clinical studies and key foreign governments' regulatory approval processes. These firms also had a high demand for astute business professionals who can raise vast amounts of financing, as well as securing licensing and patenting rights for the firm. Finally, there was always a great need for scientists with highly specialized skills. These are all very elite and highly sought after types of expertise, which every biotechnology cluster around the globe is trying to attract or retain. Thus, Vancouver's nascent biotechnology cluster must turn to regions and areas that have a relative abundance of these types of people until the Vancouver area is capable of developing its own critical mass of expertise. Regions seen as having a critical mass of these experts include San Francisco, San Diego, Philadelphia, Boston, New York City, and London, England. Until this

regional critical mass is realized, local firms and their human resource managers will continue to draw from other biotechnology clusters located around the world for key expertise and talent.

The greatest obstacles for these firms when it came to attracting the internationally highly skilled to Vancouver included the relatively small size of the cluster (approximately 2,500 people). However, the cluster was growing, and would most likely reach a critical mass of approximately 5,000 people within the next ten years. Although the Provincial Nominee Program (PNP) was seen as excellent for all firms that used it, any type of immigration or foreign work status application that fell outside of the PNP's scope was usually fraught with confusion and difficulties for both the firm and the governmental department involved. Specifically, the firms found it challenging to get the Human Resources and Skills Development Canada (HRSDC) to understand and support the global hiring needs of the biotechnology industry. Additionally, the general slowness and seemingly unresponsiveness of Citizenship and Immigration Canada towards the firm's foreign hires' and their families' applications were also perceived as a big deterrent to luring foreign executives and professionals to the Vancouver area.

5.4.1 What types of professionals/executives do you need to hire in order for your firm to be successful?

All firms but one mentioned that they needed people with experience in pharmacology, which included latter stage drug development and successfully moving a particular development through a series of clinical studies and foreign regulatory bodies, namely the Food and Drug Administration in the United States and the newly formed European Union's drug and health regulatory system. They also needed professionals who had the business acumen and ability to garner substantial financing for the next round of research in addition to being able to license and patent the firm's developments. As well, there was always a continued need to find very specialized scientists who could contribute to the actual advancement of research within the firm. For example, two medium sized firms talked about the fact that they had a difficult time finding chemists, and one of these firms actually need something called a "medicinal chemist." One human manager stressed that these groups are hard to find even at an international level, and his firm was in serious competition with other firms throughout North America when it came to attracting these highly sought after individuals to his firm and the Vancouver area. One

executive expanded on this concept by stating that the search for foreign professionals and executives was not a Canadian problem, every biotechnology firm around the world wanted to hire that person. He explained,

> *"We do not have the experience in the [local] industry right now to hire locally for key positions…..In fact, we are very young as an industry with about 2,500 people working within the cluster. We need about 5,000 people working in the local cluster in order to reach a critical mass. Having to hire internationally [for key professionals and executives] is not a Canadian problem. We are all fighting for that same person. We are a global industry, and so we need to hire globally."*

The executive bolstered his comments by expressing the fact that several local firms had conducted successful acquisitions of other biotechnology firms located in Europe and the United States within the past two years. Thus, the B.C. regional cluster was continuing to prove its leadership abilities within the global biotechnology industry.

5.4.2 Can you find these types of people within the local/regional labour market? If "yes", at what levels of professional employment? If "no", why is this the case?

Two firms noted that they have been very successful and content with hiring needed personnel from the region. However, the nine other firms needed executives and professionals from outside of the greater Vancouver area when it came to the scientist and executive level. Firms noted that they had no problem finding research associates, which usually required a bachelor or master degree in the sciences from within the local area. However, as has been discussed in question 5.4.1 above, as the level of job sophistication rose, it was harder and harder to find this type of person within a local or regional human resource pool.

One human resource manager emphasized that all human resource professionals within the British Columbia biotechnology cluster have an unspoken agreement to not headhunt or "poach" each other employees. She noted that she had work in the high tech sector before moving to biotechnology, and this ruthless practice was damaging for not only the firms but

also the high tech industry as a whole.[30] Additionally, this collaborative spirit helped to establish the human resource managers' own system of immediate outplacement assistance for any firm forced to conduct layoffs, as explain initially in the preceding theme. This system was being used at the time of the interviews in the summer of 2005. In fact, four human resource managers stressed that there was a temporary abundance of highly qualified professionals and executives in the Vancouver area at the time of this study, since one firm had just completed a round of layoffs in late June 2005, and it was the firm's second in a six-month period. As has been discussed in the answers to question 5.3.3, the other human resource managers noted that when something like this happens, the other local firms reviewed the resumes of all displaced employees and usually hire a few scientists or business professionals, if their firm was in any sort of financial position to do so. Three firms stressed that this system has been helpful to the other firms both from a perspective of general recruitment and eliminating major relocation costs since it allows the other firms to "pick up" highly qualified people "along the way" from the local labour market that would otherwise not be within the Vancouver/Victoria areas.

It should also be acknowledged that two chief scientific officers emphasized that the Vancouver area will not always have to draw senior "highly skilled" people from outside of the area. A chief scientific officer discussed the idea that although these people are hard to find in Vancouver, a seasoned professional can teach scientific skills to others that have not actually been through the process. Thus, direct and deliberate mentoring can help to create a highly qualified talent pool, locally.[31] Another chief scientific officer bolstered this idea by

[30] It should be stressed that that this network of human resource professionals worked in the spirit of maintaining the vitality of the nascent cluster, which included encouraging scientists to remain with their projects (and respective firms) until milestones were reached. Additionally, biotechnology companies, as a whole, do not usually generate profits. The culture found within these biotechnology firms places greater emphasis on the advancement of a technology or product so that it may eventually become profitable, which ,usually, then leads to a partnership with a larger pharmaceutical or biotechnology firm. In fact, there are only about 20 biotechnology companies in the world that are profitable, and three of these firms are located in British Columbia (BC Biotech, 2005).

[31] A study conducted by Vitesse Re-Skilling Canada in March 2005 regarding a skills needs analysis in the B.C. biotechnology sector found that over 50 percent of 39 firms interviewed conducted training in-house and on-the-job, spending less than $1,000 per employee annually on training. The Government of Canada Sector Council study found that training was not used as frequently in biotechnology as other sectors. However, firms did stress that they conducted some forms of mentoring and on-the-job training. However, it should be noted that within this same study, it was mentioned that QLT, Vancouver's largest biotechnology firm, has partnered with Simon Fraser University to support their Management of Technology MBA program. In fact, QLT ensured that the program did well initially by "enrolling a number of its managers in the program" (p. 79).

exclaiming that the local Vancouver biotechnology cluster is beginning to produce its own group of highly qualified scientists, who are then sought after internationally. He explained that Vancouver does put out good scientists, locally. He continued by stressing that even when a new scientist gathers over three years experience at a local firm, he/she can then go and work at another local firm and use his locally acquired skills as part of his/her portfolio of advanced professional abilities. He concluded by stating that in order for this mentoring process to reach a critical mass at the local biotechnology cluster level, it is very important that each firm ensures that senior people are making sure that junior people are learning these advanced skills and knowledge.

Although young local scientists may be taught hard-to-find techniques from highly regarding international senior scientists through on-the job training, one executive noted that it is hard to "teach" or "train" the regulatory process of drug approval to young local professionals. He stated,

> *"All though there is a role for training in the local biotechnology cluster, this is not really a training issue. Success in these areas [regulatory approval] is based on experience. You cannot "train" someone to work with the [U.S.] F.D.A……getting regulatory approval is key to a drug [and its company] succeeding. Therefore, you need to have in place experienced people who can develop and execute a successful regulatory strategy."*

5.4.3 If you do hire people from outside of the local/regional labour market, what regions/countries do you usually draw from? Why is this so?

Seven of the firms noted that they drew frequently from the U.S. when it came to hiring outside of the local labour markets. The biotechnology clusters in San Francisco and San Diego/Los Angeles were cited most frequently as having the greatest availability of scientists and executives who might want to relocate to Vancouver. One human resource manager noted that it was hard to draw people from the east coast of Canada and the U.S. to Vancouver, and so when the firm did look beyond Vancouver, they sought people who had a "westcoastness" to them. Another interviewee noted that this idea really only applied to California, since in his experience he had a difficult time getting professionals situated in Seattle and Portland, Oregon to relocate to Vancouver. These three northeast Pacific coast cities were perceived as being too similar.

Philadelphia, Pennsylvania provided the chief executive officer for one medium sized firm and an entire executive team for another larger firm. The Philadelphia area not only has a strong and mature biotechnology cluster but also a robust cluster of mature pharmaceutical firms.

Beyond the biotechnology clusters found in California and Philadelphia, Boston, New York, and London, England were also frequently cited as reliable sources that could provide excellent scientists and business people with considerable experience. After exhausting these more familiar areas, human resource managers then stressed that they then begin to search all over the world for the person that they are looking for. Countries included France, Poland, South Africa, China, Hong Kong, Iraq, Iran, Italy, and Australia. One human resource executive summed it up well with noting that he has spoken with potential hires in France, South Africa and the United States within the last few months. One lead scientist stressed that her firm sought anyone from around the world who can "speak the language of science well." Another human resource manager stated that he would do whatever it takes to bring a person with the experience that his firm needed to Vancouver. He stated,

> *"After searching locally and nationally with no results, I will reach out to anyone, anywhere in the world, who has the skills set that we are looking for."*

5.4.4 How does your firm advertise and attract international professional/executive job applicants?

The internationally highly skilled can be challenging, time consuming, and expensive to attract. As stated in the answers to question 5.3.6, all human resource managers always started out locally when looking for a new professional or executive. The most common method of advertisement for five firms was the B.C. Biotech website as well as word of mouth between the different human resource managers. For the research associate level, firms usually went directly to the local universities (i.e. The University of British Columbia, The University of Victoria, and Simon Fraser University). When this did not provide adequate results, the human resource

managers for three firms went to national professional associations with their employment needs. One human resource manager expanded on this concept by explaining that he usually sent a direct email to every member of a Canadian professional association in hopes of attracting a Canadian national. When this strategy failed to yield results, he them had to advertise more broadly in scientific journals and business magazines such as *Forbes* which tended to have an international readership. This advertising strategy was very expensive, running anywhere from $2,500 - $3,000 for a two-inch one-week ad in a well know magazine such as *Forbes* or *Science*, or a national newspaper such as the *Globe and Mail*. He also stressed that he spent considerable time at biotechnology conferences scouting for talent, as well as gaining exposure for his firm.

Five firms stressed that they did rely on search firms, or headhunters, but usually less than 10 percent of the time. Two firms noted that they used a headhunter for jobs over $100,000. Two other firms were more specific about the actual requirements of the headhunter that they hired. For example, one of these firms noted that they hired a *local* headhunter when the firm's efforts failed to provide a good pool of candidates. The other firm stressed that they only hired a headhunter or search firm that had considerable experience with placing people in Canada.

Three firms noted that the personal network of each firm's chief executive officer helped to draw a team of executives to the Vancouver area. However, from a broader management perspective, the cluster as a whole had a challenging time attracting an array of experienced people to the firms' boards. This influenced recruiting practices in the sense that each board member brought his/her "rolodex" of contacts to the firm that he/she helped to govern.

5.4.5 What types of executive/professional immigration statuses (e.g. temporary or permanent) do you use when you hire international personnel? Do you use the Provincial Nominee Program at all? If "yes", how helpful has it been in serving the needs of your firm? Has NAFTA helped to facilitate the movement of North American professionals within your firm?

The Provincial Nominee Program - All firms, as previously noted, hired international personnel permanently. Six firms used the Provincial Nominee Program (PNP) and had nothing but praise for the system. They did note that as of May 2005, it now costs $500 to process the application, but it cut the wait time for permanent residency from two years to anywhere from five to nine

months. Additionally, professions listed under the PNP program were not subject to Human Resource and Skills Development Canada (HRSDC) review, which made the system rather stress free.

Human Resources and Skills Development Canada - However, three of the four largest biotechnology firms expressed frustration and confusion with the HRSDC when it came to international professional hires not included within the PNP. For example, two managers noted that the HRSDC had an entirely different mindset compared to the biotechnology firms and potential employees when it came to advertising within Canada. As discussed in the answer to question 5.4.4 above, one manager noted that he sent a direct email to every member of Canadian national professional associations who may be eligible for the firm's advertised position. When this strategy did not provide adequate results, the firm was then force to hire more broadly, which included North America and beyond. If the firm actually found a particular international candidate, the HRSDC would sometimes reject the firm's application to hire the foreigner, stating that the firm did not advertise in newspapers such as *The Vancouver Sun* or *The Globe and Mail*. He was confused by this response since he found that he went through considerable efforts to conduct a more sophisticated, direct, and personal domestic job search than what *The Vancouver Sun* or *The Globe and Mail* were capable of accomplishing.

North American Free Trade Agreement Trade Agreement (NAFTA) – NAFTA's trade NAFTA or "TN" status, which applies to 65 professions, has been a great help to Vancouver's biotechnology sector. Six firms used the TN status to move Americans to their Vancouver based operations. Four firms noted that is was fast, easy, and inexpensive if the firm needed to get an American here quickly. All that was required for the Canadian officials at ports of entry was a letter from the company with the specific details and dates of employment. However, the human resource manager for one firm noted that they had just acquired a U.S. subsidiary, and she found herself frequent using NAFTA TNs to move key Canadian employees across the border into the U.S., which was a very different, and seemingly less favorable, experience.[32]

[32] The author's current Ph.D. dissertation research spends considerable time examining the experience of nine Vancouver based firms' employees when crossing the Canada-U.S. border for purposes of work under NAFTA.

Additionally, one manager noted that the Canadian immigration system was not that facilitative for Canadians returning to Canada with foreign spouses. She noted that it took about 18 months, on average, for a foreign spouse to receive work authorization in Canada, which was far too long. She stressed that these Citizenship and Immigration Canada application backlogs at the Vegreville, Alberta processing center and the Canadian Consulate in Buffalo, New York were causing a direct negative impact on her ability to recruit expatriate Canadians back to Canada if they had foreign spouses. She elaborated,

> *"Regarding immigration statuses, the CIC must provide a process that is fair and cautious, but it also must be timely. We are competing globally for these people, and we must be able to offer them [and their families], a competitive package, which includes a prompt and reliable experience with [Canadian] immigration."*

Two medium sized firms noted that they did hire the internationally highly skilled, but they considered themselves "second receivers." What this meant was that another local firm goes through all of the paperwork and recruitment processes requirements that actually bring the foreigner to Vancouver. Then for various reasons, such as firm layoffs, the international hire might finds him/herself on the job market again. It is at this point that these two firms take advantage of the situation and acquire foreign professionals without having to endure the complicated process of governmental paperwork and costly legal fees usually associated with recruiting a foreigner.

5.4.6 Do you hire international graduate students studying at Canadian universities as part of your professional staff? If "yes", approximately what percentage of your international staff is made up of former international Canadian graduate students? What is your experience during the transition from being an international graduate student to working professional? Is it a smooth one, both in terms of immigration visas and the socio cultural transition, to the Canadian work environment?

Four firms did not directly hire recent graduate students as part of their professional staff. Three firms noted that many recent Ph.D.s had a difficult time going from academe to the environment of a "for profit" firm. They mentioned that Vancouver based firms liked to see that they had work experience elsewhere or had done a post doc in another firm before these firms hired the

graduate on a full time basis. Even though the firms did not have a strong preference towards hiring new graduate students, whether international or domestic in origins, four firms stressed that they had undergraduate coop students working within the firm. Two firms had very sophisticated processes developed for these coop students, and one relied considerably on undergraduate coop students as part of routine firm operations.

5.5.1 Key Drivers And Other Factors Relating To The International Mobility Of The Highly Skilled

This section shall explore some of the key drivers and other economic factors that drew the internationally high skilled to the Vancouver area's biotechnology cluster. The section begins with a summary of the key issues and analysis stemming from this theme, followed by the actual findings to the specific questions asked.

5.5.2 Issues and Analysis

Key drivers or other factors that drew the internationally highly skilled to Vancouver included world class scientific research and an opportunity to be an executive or scientific leader within a nascent biotechnology cluster that is nowhere near its full potential and has much promise and opportunity. Vancouver as a region was also a big draw for people. Despite the high cost of living, it was still seen as less expensive than other biotechnology clusters in the United States and London, England. Additionally, the public schools were seen as very good, and there was an urban vibrancy and refinement to Vancouver that American cities seemed to lack. It should be mentioned that Vancouver's excellent tertiary educational system was also big draw for graduate students from around the world. Although this paper has not explored this concept in detail, there is anecdotal evidence that these world-class graduate students make a direct contribution to the University of British Columbia's science and medical faculties, which ranks among the best in the world for its discoveries and patents.[33] Despite the fact that Canadian personal taxes were

[33] It should be stressed that initial results from this research study has revealed that there is somewhat of a "gap" between the university laboratory and the local biotechnology firms. Emphasis was placed on hiring coop students, which are usually undergraduates, or highly skilled international executives and professionals. However, there was very little mentioned regarding the intense mentoring needed for highly trained, but inexperienced, local graduate students, some being international in origins.

seen as somewhat of a drawback for executives and scientists coming from the U.S., the B.C. provincial government has recently cut corporate tax rates for the biotechnology industry by 25 percent. Thus, there was clear evidence that the provincial government was committed to growing and supporting the biotechnology industry.

5.4.7 What are the primary factors that draw international professionals to Vancouver? What are the primary factors that deter international professionals from locating in Vancouver? How does this compare to the attributes of biotech clusters in the U.S.?

The Pursuit of Excellent Science in a New Cluster- Two chief scientific officers stressed that the Vancouver area has "very good science", and any true scientist from around the world is always lured to a region that pursues good science. Embellishing on this concept, one CSO stressed that the Vancouver based biotechnology cluster is working on many new and fresh developments. Thus, these scientists and executives in Vancouver have a chance to work on projects from beginning to end, and this would seldom be the case if they were working in a larger biotechnology firm or pharmaceutical company in a more mature biotechnology cluster, such as San Francisco or Boston.

Lifestyle and Family Issues - All human resource specialists explained that everyone who moves here greatly enjoyed the Vancouver lifestyle. This included first-rate urban amenities such as world-class cultural events, excellent restaurants, strong multiculturalism, and a multitude of outdoor sporting activities, all with a small town feel. The Canadian primary and secondary public schools were seen as excellent, and tertiary education in Canada was considerably less expensive than the United States. However, one firm noted that one of their new American professionals was concerned that his children were not getting enough U.S. history in their education in Canada. Additionally, another firm were concerned that one of their scientist's children were teased about being American while attending primary school in a suburb of Vancouver.

Livability and Employment Resiliency Issues - Although the Vancouver area lifestyle was hard to match, every human resource manager stressed that housing prices in the Vancouver area were a

strong deterrent when it came to persuading people to locate to the region. However, one human resource manager mentioned that housing prices in Vancouver are less than San Francisco and San Diego, and both of these cities support key biotechnology clusters. Additionally, she noted that it is very hard for the second spouse to find *any* professional job in Vancouver, if the couple does decide to relocate. There is also a dearth of comparable jobs if a biotechnology professional does want to change biotech firms within the Vancouver area after a few years work at his/her original Vancouver firm.

Regulatory Issues - From a regulatory perspective, it was seen as being much easier to attain work status and permanent residency in Canada than the United States. However, Canadian taxes were perceived as a "big deterrent," and made luring executives to the region rather difficult.[34] Also, one human resource manager noted that Canadian executives are paid about the same as American executives, but in Canadian dollars. So, there is some frustration for these executives, initially. Human resource managers noted that after awhile this resentment wore off, and the executive (and his/her spouse) realized that they live in a very nice area, and can see their tax dollars at work in the form of outstanding public schools, parks, festivities, public safety, and an overall "urban refinement," which was seen as harder and harder to find in American cities and suburbs. However, the three-month delay toward offering access to B.C.'s medical system to all foreigners residing in B.C. was seen as a regional deterrent for firms when it came to recruiting foreign executives/professionals and their families, who may have preexisting medical conditions and required seamless medical care.

5.4.8 Can domestic policy changes occur to increase the numbers of available domestic professional personnel that your firm may need to hire in the future? If "yes", what would these policy changes include? If "no", why is this the case?

A majority of firms noted that continuing to enhance the existing local university system in addition to getting primary and secondary students excited about careers in biotechnology would help to increase the supply of domestically available biotechnology professionals ten to fifteen years from now. However, the majority of firms could not wait for the local cluster to "grow"

[34] However, a recent study conducted by PricewaterCooper (2005) in (Li, 2005) found that the top combined federal and provincial income tax rates in Canada were comparable to the U.S.

these people, and thus, had to resort to bringing people in from the United States and elsewhere at this time. In order to begin to solve this problem, one human resource manager for a larger firm proposed a very clever idea to create an NSERC program dedicated to clinical development and regulatory affairs (both domestic and international) for graduate students or recent professional hires. Ideally, the program would last anywhere from one to two years, and help the firm defray costs by sponsoring the training sessions and helping to pay part of the grant recipient's salary.

Although personal taxes were seen a strong deterrent for many American executives and professionals considering relocating to the B.C. biotechnology sector, as discussed previously, an executive for one firm stressed that the B.C. Liberal government have put in a 25 percent corporate tax cut since coming into office a few years ago. He explained that this tax cut has made a serious contribution to the growing B.C. biotechnology cluster. He also stressed that the B.C. biotechnology sector has grown from zero to employing over 2,000 people locally as well as becoming a four to five billion dollar industry all within the past ten years. So, despite all of its drawbacks, the B.C. biotechnology cluster was quite remarkable.

5.6 Professional and Social Networks

This theme shall explore the social and professional networks that the firms and its professionals use in order to continue to propel each particular firm and its activities to the next level. The section begins with a summary of the key issues and analysis stemming from this theme, followed by the actual findings to the specific questions asked.

5.6.1 Issues and Analysis

There were many different types of professional and social networks that these biotechnology firms were a part of. These networks ranged from the acquisitions of other firms in foreign

countries, financial partnerships, consultants hired to move the firm's products through clinical trails and U.S. F.D.A. approvals, to more personal contacts with other executives, scientists, and universities located throughout the world. All of these networks had some sort of international or continental (U.S.) connection.

Internal referrals were relied upon frequently for most of the firms. Many firms found that there was a higher likelihood of a person fitting into the firm if someone already within the firm could validate the potential hire's professional expertise and character. Headhunters and search firms were only used when a very senior professional or executive with a unique skill set was needed for the firm. The local universities were seen as graduating very good young professionals, especially U.B.C. However, many of the medium and smaller sized firms did not have the time nor the funding needed to properly train these new graduates. The firms did need the local universities to graduate more chemists.

5.6.2 What sort of activities does your firm engage in that require cross border (international) flows (e.g. investment, ideas, services, research people)?

Five of the firms had recently acquired other biotechnology firms, which were usually located in the United States, Europe, or Asia as part of the firm's growth strategy. Human resource managers stressed that when this happens there is increased traffic between Vancouver and the subsidiary. There was also a considerable amount of cross border activities between Vancouver and the U.S. when it came to the clinical trial stages of drug development. This included work with consultants and contract labs. Additionally, distribution and sales offices for the firms were found throughout the U.S. and Europe (primarily France). For example, the human resource manager for one large firm stressed that they have a key distribution center just outside of Seattle, Washington just in case the Canada-U.S. border is shut down, similar to the events following September 11, 2001.

5.6.3 Does your firm partner with other firms, institutions, and/or research teams in the development of your products? If "yes", where might these partners be located? At what stages in the development of your products do you partner with these other entities?

All firms noted that they needed financial partnerships all along the way with product development. They noted that financial partners come in at various stages of drug development, and they exit when certain milestones are reached. Two firms stressed that they are always looking for financial partners. Two chief scientific officers discussed that they had an extensive network of research partnerships, which lasted over decades. For example, some of the origins of one firm began with partners at Princeton University in the early 1990s.

5.6.4 If you do have partnerships, how long have you know the people involved with the other entity? Where did you meet these people (e.g. university, professional conferences, mutual colleagues, friends, family, etc.)? Do you consider these lasting relationships?

The financial partnerships could be considered somewhat ephemeral, but the academic and research partnerships seemed to stand the test of time. One chief scientific officer noted that he is still in contact with people that he worked with from the 1970s. Additionally, all firm executives' networks and contacts were seen as key and a vast source of social and potential human capital for the firm in general. Additionally, academic and industry conferences were also seen as essential when it came to expanding the firm's network and meeting new people in the industry.

5.6.5 What about the hiring of professionals within your firm, do you rely on the connections of other professionals already working within your firm for referrals? What percentage of your professional staff was hired through internal referrals? When do you use the services of headhunters?

For nine of the firms, anywhere from 15 percent to more than 50 percent of a firm's professional and executive hires were done by referrals. Two firms noted that they did not do internal referrals. However, the human resource manager for one of these two firms thought that this was a good idea though, and they would start doing this in the future. As noted earlier, headhunters and search firms were seldom used, usually less that 10 percent of the time. Although they were useful when a firm needed a senior level person with a very particular type of expertise.

5.6.6 How effective have the University of British Columbia and Simon Fraser University been in providing local highly skilled new professionals, whether originating internationally or nationally? Do you have other universities that you draw professionals from? What about the Canadian Research Chairs, has this national program, designed to attract star researchers to Canadian universities, contributed towards the success of your firm?

It was stressed that The University of British Columbia and Simon Fraser University put out good students. However, these new graduates had very little work experience. The majority of the firms were at such a critical stage of development, that they did not have the time, or the availability of extra funding to train these new graduates. However, firms did stress that they needed the local universities to graduate more chemists. A majority of the human resource managers did not know what the Canadian Research Chairs (CRC) program was about. However, two chief scientific officers and one lead scientist stressed that over time, these CRC positions would help to continue to generate excellent research at U.B.C. and keep drawing a first rate pool of international graduate students to the Vancouver area.

6. Conclusion

This study has sought to provide an analysis of the existence and role of the internationally highly skilled in B.C. biotechnology sector. Through in-depth quasi-structured interviews with 16 human resource managers, chief scientific offices and executives, of 12 firms and one industrial association, the findings revealed that foreign professionals and executives constituted a significant portion of employment within the Vancouver area biotechnology sector for a variety of reasons. The study also examined the many factors that influence the movement of these highly skilled professionals, and provided a better understanding of the role of networks and strategic alliances among the scientific professionals.

Specifically, there was strong evidence that the Vancouver based biotechnology sector depending on the hiring of the internationally highly skilled, and was similar to Saxenian's findings for small start-up high technology firms in Silicon Valley (2002). In fact, one of the largest firms within the cluster stressed that 90 percent of their executive and professional staff were international. Many of the other firms interviewed considered anywhere from 20 percent to 35 percent of their executive and professional staff to be foreign. Reasons for the hiring of the

internationally highly skilled over local or domestic candidates included the fact that many of these foreigners had skill sets that were impossible to find within the local cluster at this time. These skills sets included the ability to lead other successful biotechnology firms in an executive and scientific capacity through key foreign governments' approval processes a number of times; the ability to raise substantial amounts of capital and license and patent firm discoveries, usually within the United States; and unique and highly specified scientific knowledge. The cluster would most likely continue to hire these types of international executives and professionals into the future since many firms were at critical stages of drug development and clinical trials, and needed the very best people in the world to guide the firm through these crucial milestones. If the firm erred during these stages, the firm stood a strong likelihood of closure or a serious scaling back on operations, which included substantial layoffs of firm employees, both domestic and foreign.

The need for the internationally highly skilled was not just a challenge for Vancouver. The biotechnology industry was a global one, and all local biotechnology clusters must "draw from" and "compete for" a global pool of talent as discussed by Richard Florida (2005 and 2004). The most common biotechnology clusters that the Vancouver area drew from were San Diego, San Francisco, Philadelphia, Boston, New York City, and London, England. However, as the Vancouver cluster grows and reaches a critical mass of approximately 5,000 people, there is a stronger likelihood of being able to hire key talent locally, but these people will have considerable experience elsewhere, usually in the United States. Despite the acknowledged reality that firms must search globally, all firms stressed that they started out locally and regionally when searching for any potential hire. Additionally, the cluster's human resource professionals had formed their own group and system of communication regarding firms that may be laying-off employees. This system was very effective in keeping both international and domestic professionals within the regional cluster. The system also allowed smaller firms to hire highly skilled international professionals and executives, who would normally be prohibitively expensive for a smaller firm to hire and relocate to the area. Currently, the greatest obstacles for these firms when it came to attracting the internationally highly skilled to Vancouver included 1) the relatively small size of the cluster (approximately 2,500 people); 2) the lack of understanding that the Human Resources and Skills Development Canada (HRSDC) exhibited towards these

firms when they needed to hire globally; 3) the general slowness and seemingly unresponsiveness of Citizenship and Immigration Canada (CIC) towards the firm's foreign hires' and their families' applications; and 4) the lag time of three months with the B.C. provincial medical services plan for foreigners just enrolling in the plan.

Despite the above impediments, the internationally highly skilled were still drawn to Vancouver for a number of reasons. These draws included world class scientific research and an opportunity to be an executive or scientific leader within a nascent biotechnology cluster that is nowhere near its full potential and has much promise and opportunity. Thus, general career opportunity as discussed by PWC (2002) was a draw to the region for executives. As well, the opportunity to be pioneers in a new region, having the freedom to experiment and grow institutions and organizational forms without the confines or perhaps the traditions of more mature regions[35] were indicated as additional factors for the local biotech cluster. Vancouver as a region was also a big draw for people. It was seen as a world-class city, but with a small town feel. Despite the high cost of living, it was still perceived as less expensive than other biotechnology clusters such as San Diego in the United States and London, England. There were other key factors such as the more traditional livability factors, as well as the idea of "cultural cosmopolitanism" that drew the internationally highly skilled to Vancouver, as well as luring expatriate Canadians back to Canada from the United States. For example, the public schools were very good, and there was an urban vibrancy and refinement to Vancouver that American cities seemed to lack. Regarding regulatory issues, despite some of the frustration with the HRSDC and the general slowness of Citizenship and Immigration Canada, all firms were very happy with the Provincial Nominee Program, which fast-tracked permanent residency status for various biotechnology and business professions. Additionally, firms frequently used the NAFTA TN status when they wanted to move Americans to Vancouver quickly. However, Canadian personal taxes were seen as somewhat of a drawback for executives and scientists coming from the U.S., initially.

[35] These enticements were similar to the high tech pioneers who helped to establish Silicon Valley from the mid 20th century onward (Saxenian, 1994).

Regarding networks, there were many different types of professional and social networks that these biotechnology firms were a part of. They ranged from being vastly international to the personal connections of firm employees. For example, several firms within the past few years have expanded their operations to include the acquisitions of other firms in the U.S. and Europe, which seems to be a growing trend for the B.C. biotechnology cluster. These networks also included financial partnerships, consultants hired to move the firm's products through clinical trails and U.S. F.D.A. approvals[36], to more personal contacts with other executives, scientists, and universities located throughout the world.

At the more local scale, internal referrals for employment were relied upon frequently for most of the firms. Headhunters and search firms were seldom used, and only when a very senior professional or executive was needed. The local universities were seen as graduating very good young professionals, especially U.B.C. However, many of the medium and small sized firms did not have the time nor the funding needed to properly train these new graduates, but many of the firms did need the local universities to graduate more chemists.

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[36] See Rees 2004.

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