

**A West Coast North American Comparative Study Of:
Venture Capitalists' Perception Risks
When Selecting Life Science Investment Opportunities**

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ABSTRACT

Life science technologies are some of the most comprehensive and difficult to evaluate as investment opportunities. If Venture Capitalists can only invest in a specific number of portfolio investments, it is crucial that the investment opportunities chosen are those that are also the most likely to succeed. Investor perception risks due to lack of qualification, technology comprehension, information asymmetry or overconfidence, are factors that may limit Venture Capitalists from choosing investments that create wealth.

To date, little research has been dedicated into the understanding of risk perception and technology comprehension among Venture Capitalists who specialize in life science investment opportunities. This study included a literature review as well as nineteen (19) semi-formal interviews with Venture Capitalists located on the West Coast of Canada and United States. Results show that interviewed Venture Capitalists are, overall, qualified in making life science investment decisions. However, results also showed that there are trends towards Venture Capital adverse selection and overconfidence during investment selection, particularly with respect to personal performance. Results further showed that adverse selection may occur simply as a way of reducing risk, particularly information asymmetry risk. In these instances it appears that opportunity selection is geared towards selection of known and trusted management rather than actual investment opportunity. Differences between West Coast Canadian and United States Venture Capitalists were also found. These differences specifically included the degree to which selection risks are taken, where interviewed Canadian Venture Capitalists appeared to be more ethical and cautious investors, and interviewed United States Venture Capitalists were concerned with creating wealth out of innovative technologies in a wide variety of geographical locations.

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GLOSSARY

ABBREVIATION/TERM	DEFINITION - Based on definitions from: http://www.oxfordreference.com/pub/views/home.html
Adequate Methodology	Sufficient and suitable method to achieve the intended purpose
Adverse Selection:	Is a type of poor or “bad” selection that occurs due to information asymmetries between buyers and sellers; such as between investors and entrepreneurs.
Biopharmaceutical:	Biopharmaceuticals are medical drugs produced by biotechnology. The first such substance approved for therapeutic use was recombinant insulin in 1982.
Biotechnology:	Biotechnology is technology based on biology mechanisms. It can be used in agriculture, energy production, food science, environmental purposes and medicine. Biotechnology uses the structure and function of biological systems and is often used to improve or assist cellular processes such as energy metabolism, gene transfer between unrelated species, or the engineering and development of synthesis of medical technology, drugs and therapies.
Biotechnology Company:	A corporation or venture that is engaged in the research, development, production and provision of biotechnology for the purpose of developing or providing products or processes for specific commercial or public purposes, including, but not limited to, medical, pharmaceutical, nutritional, and other health-related purposes, agricultural purposes, and environmental purposes.
Biologics:	These are viruses, serums, toxins, and similar products of natural or synthetic origin and include antitoxins, vaccines, live micro organisms, killed micro organisms, as well as components of micro organisms. Products are intended for use in the diagnosis, treatment, or prevention of diseases of humans and animals.
Clinical Trials:	These are systematic studies in human patients that endeavour to determine the safety and efficacy of new or unproven medical therapies. There are three phases of systematic clinical testing in the United States and Canada. Phase I trials determine the criteria for safety parameters of the therapy. These trials usually involve small numbers of patients and test the therapy in a range of doses to find the safest and most optimal dose. Phase II trials establish whether the therapy, at safe and optimal doses, works

ABBREVIATION/TERM	DEFINITION - Based on definitions from: http://www.oxfordreference.com/pub/views/home.html
	for the disease. Otherwise known as efficacy of the therapy. These trials should also help define factors such as which patients might benefit from the therapy. Finally, Phase III trials compare the new therapies to other therapies and/or to placebo. These trials are usually very large and they involve enough patients to reasonably show the drug's benefits and potential adverse reactions. A company must obtain phase III data before applying for FDA approval of a new drug.
Cold Calling Technique:	A technique via telephone, in person or by e-mail used to make contact with unknown person or organization for the purpose of setting up an interview, relaying information or gaining information. A basic introduction is given by the caller, explaining what the call is about in the hope that the information sought after is given.
Disease Disposition:	A position whereby a person has a particular risk of having or contriving a particular disorder or pathology that affects health.
Disease Indication:	A symptom or condition that indicates that a particular disorder or pathology is present of which requires a specific medical treatment or procedure; for example in cancer there are indications of breast, prostate, pancreatic, lung etc.
Efficacy:	The desired and measured ability of a drug/therapy to control or cure a disorder or pathology.
Evaluate:	To examine both the strengths and advantages, as well as the weaknesses and limitations of a question or project and then try to reach a judgment.
Exploratory Research:	A method used by a researcher when little information is known about the area to be researched and when research questions are unclear. It is a method that is not used to test specific research hypotheses.
Gene therapy:	The insertion of genes into a person's cells and/or tissues to treat a disease or a hereditary disease disposition. Gene therapy comprises of the replacement of a defective gene with a functional one. Gene therapy is a biotechnology that is still in early stages of development.
High Risk Investment	Occurs when there is an increased or extreme chance of failure of the investment involved.

ABBREVIATION/TERM	DEFINITION - Based on definitions from: http://www.oxfordreference.com/pub/views/home.html
Human Capital:	Human assets consisting of items such as experienced and skilled workers and management.
Information Asymmetry:	Occurs when one party to a transaction has more and/or improved information about a project than the other party. Typically it is the seller that knows more about the product than the buyer. The buyer may be impeded by lack of information due to education, comprehension or hidden information.
Innovative:	Being able to create a new idea, method, product, process or device.
Innovation:	The act of creating a new idea, method, product, process or device. Innovation includes both the invention as well as the work required to bring an idea to its final form.
Intellectual Property:	Intellectual property are ideas, inventions, literary and artistic works, symbols, names, images, processes, methods and designs used in business and all of which have commercial value. Intellectual property is usually protected from being used by others in the format of patents, trademarks and copyrights.
Investment Capital:	Money that is spent / allocated towards a project for the purpose of making a project successful in generating more money in the future.
Investment Opportunity:	Is a technology or idea that requires investment capital for further development.
Key Opinion Leader:	Within life science technologies, in particular those technologies that involve drug development and medical devices, Key Opinion Leaders are physicians and to some extent scientists, who influence their peers' medical practices, including but not limited to medical and prescribing behaviour.
Life Science Sector:	This is a business sector that is defined by the National Venture Capital Association of United States and includes both the biotechnology and medical device industries combined.
Likert Scale:	Is a response scale often used in questionnaires, and is the most widely used scale in survey research. The questions are set such that the respondents specify their level of agreement to a statement ranging from strongly agree to strongly disagree. The scale is named after Rensis Likert, 1932.

ABBREVIATION/TERM	DEFINITION - Based on definitions from: http://www.oxfordreference.com/pub/views/home.html
Medical Devices:	Instruments, apparatuses, diagnostics, machines, implants, or other similar or related article including a component part, or accessories which are intended for use in the diagnosis, prevention, and treatment of disease, disorders and pathologies.
Monitor:	To conduct continual examination activities such as checking, supervising, and screening of project progress or a situation.
Overconfidence:	Is defined as the state when people are or become more confident in their behaviour and attitudes than the situation warrants. It is also a state that is linked with excessive risk taking.
Perception Risk:	Is a type of cognitive risk that is linked with people's subjective judgement with respect to what is considered risky. It was recognized and discussed by Chauncey Starr in 1969.
Qualitative Research:	This refers to research where only characteristics of something are described, rather than exact numerical measurement.
Quantitative Research:	This refers to research comprised of observations that involve measurements and numbers.
Risk:	Risk is the potential harm that may arise from some present process or from some future event. It can be measured in terms of probability of harmful consequences, or expected losses.
Valuable Biopharmaceutical Project:	Are defined as projects that proceed and pass successfully into the market place after development has been completed.
Venture Capital:	Is the capital committed to an unproven venture. The initial, start-up money is referred to as "seed money" and entails the greatest risk.
Venture Capitalist (VC):	A Venture Capitalist is someone who invests venture capital raised from investors into promising but yet unproven business ventures. Typically, Venture Capitalists search for a higher rate of return than might be given by more traditional investments. VCs have three main roles 1) Raising capital from investors; 2) Selecting projects and 3) Assisting the management team of a project to manage selected projects. VCs also demand very high rates of return on investment – typically 35-40%.

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DEDICATION

This report is dedicated to my husband, Kevin, and my two children, Erik and Leah, whose ongoing support, love and encouragement has made this possible.

Marianne Schovsbo
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CHAPTER ONE – Introduction and Statement of Problem

1.1 Background

The development of life science technologies, particularly biotechnology and medical devices, are probably some of the most intricate, lengthy and complex processes that present themselves today within our global economies and financial systems (Baeyens *et al.*, 2006; Baum and Silverman 2004; DiMasi *et al.*, 2003; Fetterhoff and Voelkel, 2006; Shepard *et al.*, 2003). Biotechnology is technology based on biological systems. Defined by the United Nations Convention on Biological Diversity, an international treaty that was adopted at the Earth Summit in Rio de Janeiro, 1992:

"Biotechnology means any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use" (Earth Summit)

Medical devices are also becoming extremely complex as they move from a general medical instrument focus into actual becoming part of human drug delivery systems. The United States' Food and Drug Administration (FDA), the main regulatory body in North America for both biotechnologies and medical devices, define a medical device as:

"An instrument, apparatus, implement, machine, contrivance, implant, in vitro reagent or other similar or related article, including a component part, or accessory which is intended for use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of disease, in man or other animals, or intended to affect the structure or any function of the body of man or other animals, and which does not achieve any of its primary intended purposes through chemical action within or on the body of man

or other animals and which is not dependent upon being metabolized for the achievement of any of its primary intended purposes.” (FDA).

Biotechnology and medical devices reach into a large and diverse marketplace touching all fields of human knowledge, including pharmaceuticals, food, fuel, as well as our waste product processes; in a sense encompassing some of the most pioneering and valuable creations that people have had the courage to invent (DiMasi *et al.*, 2003; Rousu *et al.*, 2004). Within the life sciences realm of pharmaceutical, medicine and disease, however, it can assuredly be stated that biotechnology and medical devices have played some of their most important roles. Over the past two decades, biotechnology and medical devices have contributed enormously to our understanding of the molecular dimensions of pathology making huge contributions towards conquering human disease (Amir-Aslani and Negassi 2006; Bains 2004; Edwards *et al.*, 2003) In fact, thirty-five percent (35%), or 95 out of 256, of all new therapeutic products that have been approved in the past ten years have come directly from the life science field (Edwards, *et al.*, 2003). Presently thirty percent (30%) of all current clinical trials are biotechnology and medical device product based (Edwards, *et al.*, 2003). This is an amazing feat for a life science industry, especially biotechnology, that did not truly exist before its conception in the late 1970's (Amir-Aslani and Negassi 2006; Bains 2004; Edwards *et al.*, 2003).

It is therefore not surprising that within the life science sector industry, Venture Capitalists are courted and enamoured by biotechnology and medical device inventors with prospects of not only being part of “sexy” and innovative technology development for the greater benefit to society, but also by the possible wealth generated by potentially sky-scraping returns on

investment as these innovations are developed and enter the market place (Baeyens *et al.*, 2006; Baum and Silverman 2004; DiMasi *et al.*, 2003; Fetterhoff and Voelkel, 2006; Shepard *et al.*, 2003).

Venture Capital is capital, usually in the form of cash, used to invest an equity-based interest in a new or existing company, where a Venture Capitalist is a person who makes and decides on such investments. Investment return usually comes from preferred stock, a share of profits, royalties or capital appreciation of common stock. Most Venture Capitalists look for companies with high growth potential (Berlin, 1998; Dimov and Shepherd, 2004).

Traditionally, the Venture Capital Industry has been an important source of early stage investment capital to new life science ventures, enabling some of the most dynamic and exciting novel products to be developed in such unmet medical needs areas as cancer, diabetes, invasive surgery and infectious diseases including AIDS (Baeyens *et al.*, 2006; Baum and Silverman 2004; Champenois *et al.*, 2006; Coombs *et al.*, 2006). Whereas large public pharmaceutical corporations are mostly consumed with purchasing and bringing later stage biotechnology and devices into the market, Venture Capital has provided the seed funding for exceptional life science research to be developed (Angell, 2004). All in all, Venture Capital has been an important source of early stage investment capital, especially in the United States where approximately thirty-five percent (35%) of all Venture Capital investments, whether in life science, high tech, etc., are dispersed to seed and start up fledgling firms (Fried and Hisrich, 1994; Manigart *et al.*, 2000; National Venture Capital Association).

As selectors and investors of new ventures, Venture Capitalists are often portrayed, within the business world, as having superhuman characteristics for picking the right projects (Baeyens *et al.*, 2006; Baum and Silverman 2004; Bishop and Nixon, 2005). They are considered to be highly qualified selectors and investors of high risk projects, are described as reducers of information asymmetries, said to be “coaches” and “monitors” after investments have been made, and are depicted as having an instinctive capability to act within complex and uncertain environments (Amit *et al.*, 1998; Baeyens *et al.*, 2006; Baum and Silverman 2004; Bishop and Nixon, 2005; Shepard *et al.*, 2003; Shepard and Zacharakis, 2001).

Many life science investment opportunities that have been given large amounts of Venture Capital investment capital, however, fail, especially within the life science arena (Baeyens *et al.*, 2006; Baum and Silverman 2004; <http://www.biostrategy.gc.ca>). Venture Capital investment opportunities, generally, have a low success rate where only one in two hundred projects becoming highly profitable, with the majority of projects only just making a return on investment, and where approximately fifteen to twenty percent (15-20%) fail outright (Amit *et al.*, 1998; Berlin 1998; Sahlman, 1990; Zacharakis and Meyer, 2000). Life science technologies, however, especially technologies that specialize in the therapeutic drug development arena, are considered even higher venture risks (Baeyens *et al.*, 2006; Danzon *et al.*, 2005; DiMasi *et al.*, 2003). The initial failure rate during the discovery and developmental stages can be enormous, with postulations that only one in 10,000 new life science entities succeed to the market as new therapeutics (DiMasi *et al.*, 2003; Evans and Varaiya, 2003; Fetterhoff and Voelkel, 2006; Pharma Ventures 2005).

Regulatory and ethical uncertainty risks are some of the important reasons why this lack of success occurs. Regulatory boards of health, such as the FDA of the United States and the Therapeutics Products Directorate of Canada (TPD) are understandably mandated to protect the public from ineffective, unethical and unsafe life science technologies. But sometimes public opinion can also create an aura in which a project is perceived to be too unethical for its intended purposes such as in the case of stem cell research, nano-medical devices and genetically modified foods (DiMasi *et al.*, 2003; Rousu *et al.*, 2004).

Much life science technology has extremely long development timelines, especially within the biotechnology realm, where an average of ten to fifteen years of development before market sales, is not unusual (Baeyens *et al.*, 2006; Baum and Silverman 2004; DiMasi *et al.*, 2003; Fetterhoff and Voelkel, 2006). Long development timelines equates to long timelines before financial reward can be generated. Long timelines also present the risk of new life science ventures developing “better” technology and intellectual property before the initial technology investment can become financially productive (Baeyens *et al.*, 2006; Baum and Silverman 2004; DiMasi *et al.*, 2003; Fetterhoff and Voelkel, 2006). This poses both high risk as well as obstacles for life science investors, in particular Venture Capitalists, who want to see a return on their investments within an average of three to five years, depending on their fund portfolios (Berlin, 1998).

Life science projects have extreme appetites for investment capital (DiMasi *et al.*, 2003; Rawlins, 2005). Coombs *et al.* (2006) noted that the development of technology, and in particularly biotechnology

“...may be characterized as research engines fuelled with burning cash.”

It has been suggested that to bring a new innovative life science product forward from conception to market, particularly within the biotechnology arena, can be in excess of 800 million USD (DiMasi *et al.*, 2003). This is especially the case of biopharmaceutical ventures, which require human capital investments of highly trained personnel, including the Venture Capitalists themselves who assist with the operation of the ventures, specialized infrastructure and partnerships as well as large amounts of cash for the development of the technology.

1.2 Statement of Problem

With the amount capital needed along with the development risks involved it is perhaps somewhat surprising that these life science technologies get funding at all by Venture Capitalists. Because of the investment risks involved, it is also surprising that relatively little research has been dedicated into the understanding of risk perception and technology comprehension among Venture Capitalists who specialize in such high risk ventures (Coombs *et al.*, 2006; Franke *et al.*, 2006; Shepherd *et al.*, 2003). Whereas the area of risk perception, venture comprehension and risk aversion strategies have been greatly studied in entrepreneurial research (Baron, 2006; Dittrich, 2005; Forlani *et al.*, 2000; Gregoire *et al.*, 2006) it is only recently that research has been dedicated to the understanding of these risks within the Venture Capital industry (Franke *et al.*, 2006; Mullins and Forlani, 2005; Zacharakis and Shepherd, 2001). Risks associated with lack of life science comprehension and perception biases may be large contributors to whether a life science venture reaches a successful exit or even gets funded. Understanding the risk perceptions combined with the comprehension and aversion strategies used by Venture Capitalists that specialize in life science investments, is therefore important.

A large amount of life science technology is both scientifically novel as well as complex (Baeyens *et al.*, 2006; Baum and Silverman 2004; DiMasi *et al.*, 2003; Fetterhoff and Voelkel, 2006). Life science technologies, especially biopharmaceutical technologies, which cover complex biological systems and which may be presented with limited Proof of Principle data, are both difficult to understand and assess (Baeyens *et al.*, 2006; Evans and Nikhil, 2003; Lockett *et al.*, 2002). Experience level, venture comprehension along with adverse selection by Venture Capitalists, may be some of the most important factors involved with respect to why a life science investment is either made or denied as well as why some chosen investments fail. In addition, both venture comprehension and adverse selection may lead to higher technology development risks, longer timelines and higher requirements for capital, simply because poor initial decisions were made. It may also lead to increased risks from both the regulatory and ethical perspectives, because project comprehension may sponsor shortcuts that are poor choices. Subsequently, within the high risk environment of life science technology development, are Venture Capitalists, who specialize in investing in these technologies, aware of their own perception risks when they decide which investment opportunities will create value in the future, and which will not?

CHAPTER TWO – Scope and Study Objectives

2.1 Scope

The scope of this research will focus, logistically, on the West Coast of Canada and the United States and the life science Venture Capitalists that operate within this geographic area. On the West Coast of Canada and the United States, there are three cluster areas specializing in life science: Vancouver area, British Columbia; Seattle area, Washington State and California including San Francisco and San Diego (Global Direct Investment Solutions). Aside from being located on the West Coast of North America, these areas have traits in common: university core research centres, where innovative science and technology can be discovered; hospitals and other publicly/private funded research development centres; and importantly, a highly skilled labour pool where both scientific, technically and business trained people can be drawn from (Global Direct Investment Solutions). For logistic and project time constraint reasons, the research will focus on interviewing Venture Capitalists from the Vancouver area on the Canadian West Coast and the United States West Coast, focusing on Seattle but extending to California. A sample size of ten (10) from each of these two countries was endeavoured. It is important to note that some of the Vancouver Venture Capitalists operate all across Canada and the Seattle and California Venture Capitalists operate all across the United States.

The research will be centered on the perception risk, education and experience levels of, as well as selection strategies and evaluation processes used by Venture Capitalists who specialized in life science investments; the focal point being on new life science ventures and whether there are differences between the two main cluster regions chosen.

The research will further focus on Venture Capitalists who specialize in human pharmaceutical/medical life science opportunities only. The pharmaceutical/medical life science venture opportunity scope will include such technologies as drug molecules, biologics, medical devices and gene therapy, all of which will have the intent of having efficacy within the human internal systems to fight or correct disease dispositions.

2.2 Study Purpose and Objectives

The purpose of this study is to research, how Venture Capitalists evaluate and select life science investments for their fund portfolios and when doing so, whether Venture Capitalists are susceptible to potential perception risks. There are several primary objectives that are endeavoured to be investigated within this study:

- 1) To identify what the current and main investment strategies and criteria are of Venture Capitalists who invest in life sciences in Western North America.
- 2) To identify whether the current valuation methods/tools that Venture Capitalists use are functional in recognizing valuable life science investments.
- 3) To identify some of the Venture Capitalists perception risks when choosing potential life science investments including information asymmetries, overconfidence, as well as education and experience; and to see whether these risks differ between two life science cluster areas: West Coast Canada concentrating on Vancouver area and West Coast United States Concentrating on Seattle but extending down to California.
- 4) To identify, in lieu of possible perception risks, whether Venture Capitalists are qualified to decide on life science investment opportunities.

2.3 Research Questions

Four (4) main research questions have been identified, each testing whether there is a difference between the two identified areas of West Coast Canada: Vancouver area, and West Coast United States: Seattle area extending to the California.

1. Are there specific life science investment strategies and criteria that Venture Capitalists seek?
2. Do these Venture Capitalists use specific valuation methods to identify investment opportunities that they fund? If yes, what processes and methods do they use to select investment opportunities?
3. Are Venture Capitalists susceptible to perception risks such as information asymmetries when choosing life science investment opportunities?
4. Are Venture Capitalists qualified to make investment decisions on new life science investment opportunities?
 - 4.1. What are the educational and direct industry experience levels of Venture Capitalists?
 - 4.2. Does amount of education and/or experience have an effect on which life science investment opportunities are chosen?
 - 4.3. Does a life science investment choice influence future life science investment choice?

CHAPTER THREE - Study Design and Methodology

3.1 Overall Study Design

This study uses primary and secondary research data sources to gather the required information to respond to the research questions posed. The research design is comprised of two parts: 1) Secondary exploratory research is comprised of a literature review: formal peer reviewed journal articles and information gathered via internet resources; and 2) Primary descriptive and exploratory research via semi-structured interviews that were conducted using a pre-formed questionnaire.

3.1.1 Literature Review Method

The formal literature review provides a research foundation to this project and is comprised of expert and peer reviewed articles in the fields of business ventures, history and present day research on venture capital, venture capital models and international aspects, entrepreneurship, evaluation methods, business psychology, and life science. It also aspires to incorporate the important aspects of venture capital investment decision making and perception risk within the life science field both in Canada, United States and internationally.

3.1.2 Questionnaire Model and Semi-Structured Interview Method

The semi-structured interview technique was chosen because former literature has shown that Venture Capitalists are not likely to return mail questionnaires interviews before direct and personal contact have been made. (Baeyens *et al*, 2006). Face to face and telephone interviews have shown to be effective because they establish a relationship with the Venture Capitalists (Baeyens *et al*, 2006). Furthermore, in the semi-structured interview technique, the researcher is able to exercise his or her inventiveness with respect to following up a

respondent's answer to a question as well as the ability to clarify questions that the respondent may have understood (Hair *et al.*, 2003); yet the interview process is structured to ensure that cohesiveness and comparability can be made between respondents. This approach has been noted to give unexpected and insightful information that can enhance the findings of the research (Hair *et al.*, 2003).

The questionnaire was designed and structured in a three part sequence: 1) Opening questions asking specific background information with respect to the person being interviewed; 2) A middle section that directs questions specifically towards the research objectives, such as Venture Capital preferred investment criteria; and 3) A final section which asks general information questions such as "What are the preferred Venture Capital exit routes?", "What are the general costs of life science projects" and "Is there anything extra that you would like to add?" Please refer to **Appendix A** to view the established questionnaire, used with all interviews.

The questionnaire questions were a mix of Likert Scale and open ended opinion questions. Likert Scales, invented by Rensis Likert in 1932, are a type of response scale which is ideal for the use in gathering survey research information that can be pooled, compared and assessed statistically. Maurer and Pierce (1998) performed a comparative study of relevance with respect to the Likert type scales and traditional empirical measurement techniques. The authors found that Likert Scales were as efficacious, giving similar levels of reliability/error variance as well as levels of prediction and in some ways much more user friendly.

When responding to a Likert questionnaire item, individuals responding to the questionnaire, the respondents, specify their level of agreement to a statement ranging from strongly agree,

agree, neither agree nor disagree, disagree to strongly disagree. Likert Scales are a type of psychometric response scale, used in studies concerned with psychological measurements, knowledge, abilities and attitudes as well as personality traits.

The respondents were selected from publicly available Venture Capital listings, internet data bases and websites as well as from other life science contact resources (Bridgeway Career Development; Resources for Entrepreneurs; B.C. Science and Technology Resources). Initial contact with prospective respondents was made via e-mail notice of the study and/or cold calling telephoning technique. A focus was made to interview senior and middle Venture Capital managers, and these individuals were selected from internet sites etc., when and where possible. If an interest in the study was expressed and participation was consented to, a time was established to conduct the interview whether face to face or over the telephone. Interviews were set to be completed within a period of fifteen to twenty minutes. Confidentiality of all participants and respondents was and will be maintained at all times and there will be no identifiers in this report of who and how a person or company responded.

3.1.3 Internet Resources and Venture Capital Sites

In addition to the literature search and the semi-structured interviews, information and data were collected via internet resources and venture capital sites. Information such as general venture capital investment strategies, lists of venture capital companies located in specific areas on the West Coast of Canada and the United States, as well as specific information from participating venture capital companies, were collected (Bridgeway Career Development; Resources for Entrepreneurs; B.C Science and Technology Resources).

CHAPTER FOUR – Literature Review

4.1 Structure of Literature Review

Within the following literature review, I will firstly discuss the history of Venture Capital, the basic model that has been used within the United States for the past few decades, the roles that Venture Capitalists play with respect to their investments and in particular the main strategies and selection criteria that have been used, especially in regards to life science investment opportunities.

I will discuss and identify the current valuation methods/tools used for identifying valuable life science investments and assess as to whether they are functional as recognition methods/tools. I will also discuss some of the perception risks associated with Venture Capitalists that have been discussed in peer reviewed articles over the past decade, including information asymmetries and Venture Capitalist's overconfidence. Furthermore I will explore whether Venture Capitalists' risk perceptions and investment behaviours, experience and education levels differ between countries and why. To do this I will relate, as the Venture Capital model has been adopted and adapted by other countries, to how the Venture Capital model is changing and whether Canada is following the original United States Venture Capital model or whether it is beginning to draft a model of its own.

In all, this literature review will be related back to the life science industry, the life science investment opportunities where possible to discuss and highlight my research questions.

4.2 History of Venture Capital

The goal of the Venture Capital Industry has been one to encourage entrepreneurship, lessening the existing gaps between the established capital markets and the potential funding constraints experienced by new and innovative businesses (Berlin, 1998; Fried and Hisrich, 1994; Sahlman, 1990). Zacharakis and Meyer (2000) describe Venture Capitalists as:

“...organizations whose predominant mission is to finance the founding or early growth of new companies that do not yet have access to the public securities market or to institutional lenders”.

The Venture Capital Industry conception was originally devised in the United States by General Georges Doriot who is considered the industry's father (Campbell, 2003; Sahlman, 1990). In 1946, Doriot founded American Research and Development Corporation (AR&D) with the aim to invest in and encourage the development of new and innovative ideas into becoming successful new businesses (Campbell, 2003). With the passage of the Small Business Investment Act of 1958, the U.S. Small Business Administration (SBA) was given the ability to license private “Small Business Investment Companies (SBICs) which would provide financing and management assistance to small entrepreneurial businesses within the United States (Campbell, 2003). This matched the ideas and plans of Doriot, who in turn invested \$70, 000 USD in Digital Equipment Corporation in 1959 (Campbell 2003).

In 1968, when Digital Equipment went public, it provided AR&D with 101% annualized Return on Investment (ROI) and Digital Equipment was considered to have a market value of \$37 million USD.

Digital Equipment was a huge success story. It was an experience that helped to prove that the concept of Venture Capital not only could work but that it could also be extremely lucrative (Campbell 2003). Furthermore, this beginning established the notion of Venture Capital as being at the forefront of entrepreneurship, the funding vehicle of innovation.

4.2.1 Basic Venture Capital Model

Within the United States, the Venture Capitalist is typically a member of a small partnership network that employs six-to twelve individuals, managing assets averaging between \$50-100 million USD, that have in turn been raised from wealthy individuals, corporations, banking institutions, pension funds and government funds (Berlin 1998; Manigart, 2000). Many Venture Capital firms today are now managing assets in the hundreds of millions of dollars, with an overall United States Venture Capital investment into life sciences sector, of 4.8 billion USD, comprising only the first two quarters of 2007 (National Venture Capital Association).

Generally, Venture Capital firms plan to start at least one new investment fund every five (5) years with an expected fund lifespan of ten (10) years in total. Within each fund that a Venture Capitalist establishes, and depending on the original investors involved, a portfolio of firms is added, each firm receiving varying amounts of Venture Capital investment depending on development stage of the venture opportunity (National Venture Capital Association). A fund portfolio can hold many firms, usually five (5) to ten (10) (Fried and Hisrich, 1994), but in some cases, as noted by Berlin (1998), funds can hold as many as twenty-five (25) firms. The portfolio is usually diverse in terms of the type of firms that are invested in, but some funds are specialized, focusing on a specific industry area such as life

science, venture risk category or stage of venture funding required (Berlin 1998, Fried and Hisrich, 1994; Sahlman, 1990). Furthermore, because portfolio firms are added over time as new investment opportunities arise, the portfolio fund usually has a goal of having the optimal venture investments funded for only a period of two to three (2-3) years and no longer than five to seven (5 to 7) years (Berlin 1998, Fried and Hisrich, 1994; Sahlman, 1990).

After the first five (5) years of a fund portfolio's life, no new firms are generally added and instead, hopefully, the fund enters into a "reaping of reward" stage where initial hurdle rates of returns of up to 30-70% are hoped for. This occurs as the different investment opportunities are developed within the portfolio fund. At the end of the fund's lifespan of ten (10) years, all the firms within a Venture Capitalist's portfolio are exited via such methods as Initial Public Offerings (IPOs), Mergers and Acquisitions (M&As) and buy-backs by other firms (Amit *et al.*, 1998; Berlin, 1998; Fried and Hisrich, 1994). When the firms are exited and the funds are closed, the Venture Capital firm returns the exited funds, with a pre-established return on investment, to the original investors, or re-invests, if mandated to by the original investors, into new fund opportunities (Amit *et al.*, 1998; Berlin, 1998; Fried and Hisrich, 1994).

Initially when investing in an investment opportunity, Venture Capitalist firms will stipulate various developmental goals or milestones that the opportunity requires to reach within a specific timeline (Berlin 1998, Fried and Hisrich, 1994; Sahlman, 1990). Each major development goal or milestone is usually tied to a stage or "round" of financing that the Venture Capital firm sets at the beginning of the investment deal agreement allowing the

Venture Capital firm to deal out its capital in the most cautious way possible. Each round of financing will usually comprise of varying amounts of capital with varying timelines attached: from a few million USD in “seed stage” financing with a timeline of six (6) months to complete stage, to tens of millions USD required, on average, to complete later stages of development with varying timelines of one (1) to five (5) years long (Berlin 1998, Fried and Hisrich, 1994; Sahlman, 1990; National Venture Capital Association). Usually, with a promising life science investment opportunity, there is the initial seed stage financing and then three (3) subsequent financing rounds before a final exit from the investment is made (National Venture Capital Association, 2007). With each stage of financing, the Venture Capital firm is ensuring that it has as much control as possible in its investment capital, giving itself a “Go/No Go” option out of the investment with each financing round.

4.2.2 The Roles of Venture Capitalists: Fundraiser

Over the course of a Venture Capitalist’s fund’s history, the Venture Capitalist, by and large, performs three major professional roles: 1) fundraiser, 2) selector and investor of venture opportunities, and 3) as monitor of the ventures that have been invested in.

Logically, Venture Capitalists can only invest in firms and innovation if they themselves have funding capital from somewhere. Venture Capitalists receive much of their funding, approximately two thirds, from institutional investors such as pension funds, investment banking, government grants, and insurance companies (Berlin 1998; Elango *et al.*, 1995; Fried and Hisrich, 1994; Manigart *et al.*, 2002). All these institutional investors, in turn, expect reasonable returns from their investments over the portfolio fund’s lifespan (Berlin 1998; Elango *et al.*, 1995; Fried and Hisrich, 1994), and in a sense, Venture Capitalists are

the middlemen between the fund investors and the investment opportunities they invest within. After the firms of the portfolio fund are exited by the Venture Capitalist, funding is returned to these original investors, along with a return on investment averaging around 8% (Berlin 1998; Manigart *et al.*, 2002).

Another important source of investment funding to Venture Capital firms consists of wealthy families and groups of individuals who are known as “Angels” (Berlin 1998; Elango *et al.*, 1995; Fried and Hisrich, 1994; Sahlman 1990). By pooling the funds from these varying “Angel” sources, Venture Capitalists can invest large sums towards new and promising venture opportunities within their portfolios (Berlin 1998; Elango *et al.*, 1995; Fried and Hisrich, 1994; Sahlman 1990). “Angels” acting on their own may not be able to do this alone and the Venture Capitalist again becomes the middleman of investment and the Angel, the primary investor, expects reasonable returns over the portfolio fund’s lifespan (Berlin, 1998; Elango *et al.*, 1995; Manigart *et al.*, 2002).

4.2.3 The Roles of Venture Capitalists: Selectors and Investors

Venture Capitalists are best known as selectors and investors of business opportunities (Berlin 1998; Manigart *et al.*, 2002; Sahlman, 1990). In order for the Venture Capital firm to stay viable, it is vital for a Venture Capital firm to select venture opportunities that will return its investment profitably, and reject proposals that will not. From the point of view of a Venture Capital firm, the faster that proposal selection can be achieved and the less time and capital that is spent on the due diligence of an investment opportunity, the better. Therefore, the success of a Venture Capital firm is largely based on its ability to predict new portfolio

investment performance and the selection of investment opportunities that will give a good return on investment (Franke *et al.*, 2006; Zacharakis and Meyer, 2000).

When choosing ventures to invest in, Venture Capitalists use specific selection processes, and search for criteria that they wish to invest in (Berlin 1998; Elango *et al.*, 1995; Fried and Hisrich, 1994; Sahlman 1990). The rejection rate, of potential portfolio investment opportunities, is very high. Berlin (1998) states that for every 100 investment opportunities received by a Venture Capitalist, 90 are rejected immediately. Of the remaining ten (10) opportunities, only one to two (1-2) proposals are selected (Berlin 1998; Elango *et al.*, 1995; Fried and Hisrich, 1994; Sahlman 1990). It is these selection processes that are the key to which ventures are invested in and which are not.

4.2.4 The Roles of Venture Capitalists: Monitors

When investment into an opportunity is finally made, Venture Capitalists begin operating as monitors, spending as many as 100 hours per portfolio firm over a six month period (Baeyens *et al.*, 2006; Baum and Silverman 2004; Berlin 1998; Champenois *et al.*, 2006; Elango *et al.*, 1995; Fried and Hisrich, 1994; Sahlman 1990). Venture Capitalists' monitoring role is in part similar to that of a bank manager who monitors bank loans. But to the Venture Capitalist, the monitoring role is the most important role of all, especially with respect to Venture Capitalists who invest in early stage firms and who may have to deal with inexperienced entrepreneurs and management. The Venture Capitalist's monitoring role is one of trainer, guide, and linker, and relationship builder, providing advice, information and networks for getting in touch with key human capital. In all it is a role comprised of moving the investment opportunity forwards (Baum and Silverman, 2004). To perform this role, the

Venture Capitalist will sit on a portfolio firm's Board of Directors, guiding business strategy and policies to ensure, as much as possible, that the firm is successful (Baum and Silverman, 2004; Berlin 1998; Elango *et al.*, 1995; Fried and Hisrich, 1994; Sahlman 1990). In other words, Venture Capital monitoring periods are for nurturing the intangible assets that have been invested in.

4.3 Decision Making Process for Investment Selection

Much research has been performed in trying to discover what strategies Venture Capitalists use to choose investment opportunities, what evaluation methods are used and what characteristics/criteria are searched for (Baeyens *et al.*, 2005; Baum and Silverman, 2004; Fried and Hisrich, 1994; Le Bas and Picard, 2006; Manigart *et al.*, 2000; MacMillan *et al.*, 1985, 1987; Shepherd and Zacharakis, 2002; Zacharakis and Meyer, 2000).

Fried and Hisrich (1994) mention that:

"The decision to invest is a difficult one with serious adverse selection risk. Once an investment is made, the investment is illiquid, and its success is highly dependent on a small group of managers/entrepreneurs."

When assessing a new business investment opportunity, Venture Capitalists are left with a daunting task, especially with respect to assessing novel life science investment opportunities that have little to no baseline information available. Therefore it is not surprising that there has been so much discussion in the literature with respect to what decision making strategies are actually followed and used (Bishop and Nixon, 2006; Champenois *et al.*, 2006; Coombs *et al.*, 2006; Mullins and Forlani, 2005).

For the sake of this research project and report, I will use the Fried and Hisrich's (1994) model of Venture Capital investment decision making process as a basis. This model, whereas it is a perhaps a little elderly, was based specifically on interviewed Venture Capitalists who operated in the western parts of the United States and included life science within their portfolios. Elsewhere in the literature, there is little information as to which specific decision making strategies are used with respect to life science technological investments, with the exception of Baeyens *et al.*, (2005) and Baum and Silverman (2004). Baeyens *et al.*, (2005) followed a very similar strategic selection process with respect to the life science industry, validating to some extent the original Fried and Hisrich (1994) model and process. Baeyens *et al.*, (2005) further highlighted specific selection strategies including what life science technologies were targeted, preferred stages of development chosen, geographical location and minimum and maximum investment required to exit. With respect to Baum and Silverman (2004), a very similar model to Fried and Hisrich (1994) was again used to research whether Venture Capitalists selected investment opportunities in life science that incorporated management, intellectual property or both. In lieu of the similarities, the initial Fried and Hisrich (1994) investment selection model will be discussed and used for this project.

From their research, Fried and Hisrich (1994) established, a basic decision making process model that they felt captured the main criteria and strategies followed by Venture Capitalists in the United States when a new investment opportunity was assessed. This process included: Origination, the person who introduced the investment opportunity to the Venture Capitalists and who would be involved in the development of the opportunity; Venture Capital Firm specific screen, which included criteria such as investment size, location, stage

of finance; Generic Screen, which included a basic focus on the business plan and investment scrutiny; First Phase Evaluation, that determined the seriousness of interest in the investment opportunity and scrutiny of management and market comparisons; Second Phase Evaluation, that identified the obstacles that may be involved with the investment opportunity and its strategy; and Closing of Investment Deal, the incorporated the final decision on whether to invest in the business opportunity, the stages of financing required and the timeline attached to each of these financing rounds.

Revisiting the first research question:

- 1) *Are there specific life science investment strategies and criteria that Venture Capitalists seek?*

Fried and Hisrich (1994) discovered that of the general Venture Capital firm within the United States that they studied, there indeed has been a common selection criteria used to evaluate potential portfolio investment opportunities. They found that there were three (3) major subject areas that Venture Capitalists used in selection of portfolio firms to invest in: Business Concept, Return on Investment and Management Team. These strategies will be discussed further below.

4.3.1 Business Concept, Location and Intellectual Property

Within the Business Concept area, the important criteria sought after include the potential for earnings growth of the technology invested in, the location of the investment opportunity, and its intellectual property standing. The business idea must be able to prove that it works, can be completed to a certain level within two to three (2-3) years, and the concept must offer competitive advantages, in particular with respect to intellectual property (Fried and Hisrich,

1994). Immediately there is a discrepancy that can be identified with respect to successful life science investment opportunities that have a developmental life span, on average, of fifteen (15) years.

If Venture Capital firms are selecting investment opportunities that will not see a return on investment for fifteen years, yet their finance model is based on returns within two to three (2-3) years, there is divergence that needs to be dealt with. Venture Capital firms that invest in life science generally circumvent these challenges by focusing on rounds of financing and exit strategies for the life science at specific stages of the development process (Baeyens *et al.*, 2005; Baum and Silverman, 2004; Le Bas, 2006). As soon as the life science technology is developed to a certain phase and has born good results to that phase, strategies such as IPOs or M&As with other companies are used as an outlet to depart from the investment (Baeyens *et al.*, 2005; Baum and Silverman, 2004; Le Bas, 2006). These strategies will be further explored in the semi-structured interviews.

The location of the investment opportunity is an important focus of Venture Capital firms. As aforementioned, one of the roles of the Venture Capitalist is as monitor of the future investment. This requires that the Venture Capitalist firm has the logistical ability to monitor the investment opportunity. If there is a choice between two similar investment opportunities, it has been shown that the firm that is located within a reasonable distance to the Venture Capitalists head office will most probably be considered as the logistically feasible one to invest in, rather than the one which is located outside of the Venture Capitalists geographic area (Baeyens *et al.*, 2006; Baum and Silverman, 2004; Berlin 1998). Venture Capital monitoring has been discovered to be both important and crucial for success (Baum and

Silverman, 2004; Berlin 1998). This is particular the situation within the life science industry, where the development timelines and paths are intricate and where management requires to be fully aware of the pitfalls and hurdles that can occur (Amir-Aslani and Negassi, 2006; Baum and Silverman, 2004). Therefore the selection of investment opportunities that logistically favours monitoring, is not just a Venture Capitalist strong selection criterion, but it is also critical for when the Venture Capital firm begins working with the management team and monitoring of the portfolio firm's strategic goals.

Another Business Concept focus of Venture Capital firms, in particular for those who deal with life science investment opportunities, is the intellectual property involved (Baeyens *et al.*, 2006). Intellectual property rights are an important focus because to some extent these rights provide justification of the exclusivity of the technology involved. A typical piece of technology can be protected under patent for up to twenty (20) years (Canadian Intellectual Property Office; United States and Trade Office for Intellectual Property). The longer a technology is protected under patent, the more unique the technology is considered, the broader the concept platform is, and the more individuals interested in the intellectual property, then the more likely a Venture Capital firm will invest in the technology opportunity (Baeyens *et al.*, 2006; Baum and Silverman, 2004; DiMasi *et al.*, 2003). In essence, the intellectual property is what the Venture Capitalist is investing in and the more promising it is, the more likely the Venture Capitalist will see a return on investment (Baeyens *et al.*, 2006). It is the intangible asset that will be developed and later sold, if it succeeds. In circumstances where the investment opportunity's intellectual property cannot be protected or it is owned by several contesters at once, it has been shown that the Venture Capitalists interest readily decline and they will not usually invest (Baum and Silverman,

2004; DiMasi *et al.*, 2003; Evans and Varaiya, 2003; Fetterhoff and Voelkel, 2006; Pharma Ventures 2005). Baum and Silverman (2004) further found that Venture Capitalists are more likely to invest in venture opportunities that have more than one successful patent. The importance of intellectual property will be further explored in the semi-structured interviews and results of this study.

4.3.2 Return on Investment and Financial Valuation

The potential Return on Investment is important for the Venture Capitalist to stay viable and this leads to focus of the second research question:

2) Do Venture Capitalists use specific valuation methods to identify investment opportunities that they fund? If yes, what processes and methods do they use to select investment opportunities?

In order to survive as a Venture Capital firm, the investments that are made must make returns that allow for future capital to be raised and invested (Fried and Hisrich, 1994). Therefore a Venture Capital business opportunity must be able to provide an exit opportunity that offers a potential high rate of return ranging from 30-70%, before investment can be considered (Fried and Hisrich, 1994; Sahlman, 1990). However, for Venture Capitalists that specialize investing in innovative early stage firms, and especially in high risk industries such as the life sciences, it is not easy to ascertain what a reasonable rate of return on investment capitulates due to the lack of industry baselines on novel ventures (Baum and Silverman, 2004; DiMasi *et al.*, 2003; Evans and Varaiya, 2003; Fried and Hisrich, 1994; Sahlman 1990). Furthermore, it has been shown that many financial valuation techniques and models that could potentially be used when assessing return on investment, such as project

simulation models, Discount Cash Flow models, and enterprise valuation models, become unpredictable very quickly when used for novel early stage investment opportunities that have long timelines, unforeseen risks involved and no revenue stream flowing in for many years to come (Berlin 1998; Elango *et al.*, 1995; Fried and Hisrich, 1994; Sahlman 1990). Venture Capital firms, therefore, have been shown to demand extremely high rates of potential returns of 100-300% for these types of investments, setting strict guidelines in place, using experience, comparables, rules of thumb, and marketing assessments that gives them a sense of what similar investments are worth at a specific stage of development (Berlin 1998; Elango *et al.*, 1995; Fried and Hisrich, 1994; Patzelt *et al.*, 2006; Sahlman 1990).

This is why Business Concept and Return on Investment, go hand in hand, in particular with respect to life science opportunities. The Business Concept undertaken will need to be assessed comparably to understand whether it is a viable opportunity to invest in, what the market niche is, the intellectual property, what the competition is and whether investment into such a business/technology opportunity will give acceptable returns on investment from past experiences and examples (Baum and Silverman, 2004; DiMasi *et al.*, 2003; Evans and Varaiya, 2003; Fetterhoff and Voelkel, 2006; Patzelt *et al.*, 2006; Pharma Ventures 2005).

Business Concept and initial marketing assessments are therefore key determinants to understanding the return on investment of a life science investment opportunity and not so much the financial criteria and valuation techniques that are used with other types of investments such as computer software and hardware. This will be further explored in the semi-structured interview results and discussion of this study.

4.3.3 Management Team

The Management Team of an investment opportunity is probably the most important criterion that Venture Capitalists select for; especially in the United States (Baum and Silverman, 2004; Dimov and Shepherd, 2004; Franke *et al.*, 2006; Manigart *et al.*, 2002).

It is necessary for Venture Capitalists to be able to work with and trust the management team of their portfolio firms and to assure that relayed information during the development of the investment is correct (Dimov and Shepherd, 2004). Management criteria consequently include characteristics such as managers' personal integrity, good track records, realism, flexibility and the exhibition of good leadership (Fried and Hisrich, 1994). These criteria are highly subjective depending on how they are evaluated and they are difficult to assess, especially with regards to new entrepreneurial management that have no previous experience.

Further to their earlier work, Fried and Hisrich (1998) also discovered that the originator of an investment opportunity is the most important aspect of an investment opportunity due diligence. If an investment opportunity came from a trusted source, whether researcher or past manager, it was more likely to be considered as a possible investment. In addition, Fried and Hisrich (1998) found that none of the investment opportunities that had been assessed by the studied Venture Capital firms, originated from unknown sources, whether researcher or entrepreneurial manager. In addition, the authors discovered that investment opportunities that came from very trusted sources were generally scrutinized less and jumped several steps ahead of the decision making process model (Fried and Hisrich, 1994), before they received investment funding. In a sense the selection process was based in large part on who was who

and whether successful relationships with an investment opportunity's management had been established in the past.

Manigart *et al.* (2000) found a similar trend, when they studied United States Venture Capital firms that were part of a larger study that included Venture Capital firms from all over Europe. When Manigart *et al.* (2000) studied the selection criteria of Venture Capitalists in a number of countries, including the United States, France, Germany, Holland, Belgium and the United Kingdom, they discovered that, aside from Venture Capital firms' own due diligence processes, the number one criterion for investment opportunity selection in the United States was based on who the originator of the investment proposal was and the relationship the Venture Capital firm had with the potential entrepreneur.

This focus on management teams when assessing investment opportunities most likely stems from who the Venture Capital firm thinks it can trust. The more a Venture Capital firm trusts the origin of an investment opportunity, as well as the management that would be directing and developing the investment opportunity, the more likely it is that the information the Venture Capitalist has been given to assess the opportunity, is trustworthy. This will be further explored in the semi-structured interviews and discussion.

4.4 Risk, Perception Risk and Information Asymmetry

Risk is considered the degree of uncertainty associated with the outcome of a specific behavior (Forlani and Mullins, 2000). Within the field of research that hones in on the conceptual dimensions of risk, three main elements of risk have been discussed by Forlani and Mullins (2000). These three consist of 1) the recognition of potential losses associated

with the risk, 2) the significance of those losses and 3) the uncertainty of whether these losses will or will not occur.

Where risk can be constituted as a measurement, perception risk is a field of cognitive research that focuses on the subjective judgment that people make when deciding what constitutes high or low risk (Shoemaker, 1990). Generally, it is the study of how much risk people are willing to take (Forlani and Mullins, 2000). Perception risk theory has grown over the years beginning with its founder, Chauncey Starr (Starr, 1969) whose major finding was that people will accept risks 1000 greater if they are voluntary compared to when they are involuntary. Many cognitive theories have followed this first statement of perception risk where much of the majority of recent research has found that the spread between voluntary and involuntary risk taking, is not as great as first stated by Starr (Forlani and Mullins, 2000). Cognitive research has also found that risk behavior varies in degree among different groups of individuals (Baron, 2004; Baron, 2006). Not surprisingly, entrepreneurs and innovators have been found to be some of the individuals that have the highest degree of subjective judgment with respect to perception risk and their investment opportunity ideas (Baron, 2004; Baron, 2006).

3) Are Venture Capitalists susceptible to perception risks such as information asymmetries when choosing life science investment opportunities?

Generally, information asymmetry is a type of risk which occurs when one party in a business sale transaction or negotiation has more information than the other party (Zacharakis and Meyer, 2000). In the case of Venture Capitalists, perception risk lies particularly with how risky the information asymmetry is perceived when discussing an

investment opportunity with a new and unknown entrepreneur. Usually the party that is selling the opportunity or product knows more about the opportunity or product than the buyer or investor. The degree of information asymmetry associated with an investment opportunity is unknown to the investor and therefore the risk can be very high. With respect to investment opportunities of novel life science technologies, that have difficult to understand scientific theories underlying their concepts, the potential for inaccurate information to be “sold” to a Venture Capitalist can be perceived as even higher than normal (MacMillan *et al.*, 1987; Patzelt *et al.*, 2006; Shepherd and Zacharakis, 2002; Zacharakis and Meyer, 2000). Venture Capitalists, therefore, who invest in investment of these types, must, in a sense, have to have a high tolerance for risk. They must also perceive risk, with respect to information asymmetries, as one that can be overcome (Amit *et al.*, 1998; Baum and Silverman, 2004; Mullins and Forlani, 2005; Shepherd *et al.*, 2000).

Patzelt *et al.*, (2006) mention that:

“...VC [Venture Capital] portfolio ventures often operate in new industries such as the life sciences and employ new business models, where only scarce knowledge and experience is available to investors. Since many start-up managers tend to keep the use of their limited financial resources and operational problems secret, significant informational asymmetries arise between VC firms and their investees.”

From the viewpoint of the Venture Capitalists, information asymmetry risks must be lessened. Fried and Hisrich (1994) discuss the importance of lessening information risk through initial selection and investment decision making processes, especially with respect to management and technology due diligence. Much research has been conducted on the

abilities of Venture Capitalists in avoiding information asymmetry through due diligence efforts, but particularly through the relationship formations between entrepreneurs (Forlani and Mullin, 2000; Fried and Hisrich, 1994; Shepherd and Zacharakis, 2002). Forlani and Mullins (2000) as well as Busenitz *et al.*, (2004) suggest that risk can be lessened via the selection of the entrepreneur and management team, followed by the relationships that are then established after selection has been made. Forlani and Mullins (2000) found that entrepreneurs, from 540 firms, had tendencies for taking large degrees of risk, especially when new venture endeavours were concerned. Information asymmetry, with new entrepreneurs, was also found to be high. This was mainly due to the fact that the level of risk that new entrepreneurs were willing to take, were not necessarily known to the investors. The authors suggest that investors:

“...should consider the degree to which entrepreneurs in whom they choose to invest are well-matched to the investors’ own risk-taking propensities.” (Forlani and Mullins, 2000)

Other researchers have made similar statements and observations (Amit *et al.*, 1998; Manigart *et al.*, 2000; Manigart *et al.*, 2002). If the originator, entrepreneurial or management team is known and trusted, there is a feeling by the Venture Capitalists that the information asymmetry risk is lessened (Amit *et al.*, 1998; Manigart *et al.*, 2000; Manigart *et al.*, 2002). Rejecting proposals for the reason that the originator or entrepreneur is unknown is therefore also understandable, especially since the level of information asymmetry risk is both unknown and untried. With a new originator or entrepreneur, there may be a lack of faith with respect to whether the proposal’s information is frank and whether it can actually be achieved.

Information asymmetry needs to be recognized before it can be perceived as a risk. Manigart *et al.*, (2000) state that Venture Capitalists' expertise is established over time as they gain more experience. Manigart *et al.*, (2000) suggest that it would therefore not be surprising for Venture Capital firms that focus on early stage life science investments, also to have much experience with perception risk and the possibility of information asymmetries. Indeed, the authors found that United States Venture Capital firms, who have been on the venture stage for the longest period of time in the global capital markets, place huge emphasis on selection criteria that can lessen the potential of information asymmetries, in particular management teams and entrepreneurs. This is especially appreciated when considering that the overall United States Venture Capital Industry invests a large proportion of their investments (35%) in novel and innovative technologies (Manigart *et al.*, 2000).

Since Venture Capitalists spend much time evaluating investment proposals, they have also been credited with being information asymmetry reducers (Lockett *et al.*, 2002; Shepherd *et al.*, 2003; Baum and Silverman, 2004). Literature evidence, however, also shows that Venture Capitalists are "human" investors and that they have many demands with the respect to the availability of limited resources such as time, expert advisors and historical evaluation investment records (Bishop and Nixon, 2006; Shepherd and Zacharakis, 2002; Shepherd *et al.*, 2003). Baum and Silverman (2004) speak specifically to the strategies that Venture Capitalists pursue to overcome resource limitations, specifically the predisposition for the formation and nurture of investor- entrepreneur/management team relationships. It is through these relationships, from investment selection to post monitoring activities, that information asymmetry is diminished. It is therefore understandable that Venture Capitalists become very reliant on the relationships that they build over the course of their career,

knowing who to trust and who not to. New investment opportunities, therefore, that come from unknown sources, are therefore also understandably met with less enthusiasm than those that come from reliable resources. Unless the Venture Capitalist can invest the time and resources into the extra due diligence and relationship formation activities required, a new investment opportunity that comes from an unknown originator may, from the Venture Capitalist's risk perception point of view, be too risky to invest in.

To the Venture Capitalist, information asymmetries can therefore easily be avoided by choosing originators and management that are known to them. Originator and management are also criteria that can be quickly and easily selected for and this, in turn, also prevents large efforts in time and resources from being spent. Thus, from the literature reviewed, Venture Capitalists are affected by, if not susceptible to, perception risks with respect to information asymmetry. Interestingly, it also appears that Venture Capitalists have oriented their selection strategy to assist with risk avoidance.

4.5 Information Asymmetry Avoidance Leading to Adverse Selection

There are potential adverse selection issues, however, associated with the avoidance of information asymmetry via the usage of known and trusted management teams. Baum and Silverman, (2004) found that investment selection based on the entrepreneur and management team criteria has a high propensity for adverse selection that may actually increase selection risk; this is especially in the case of funding innovative and entrepreneurial technologies. The pool of firms and entrepreneurs that end up being funded by Venture Capital firms become limited to a select group of known individuals, an act which, in essence, defeats the entire concept of funding innovation and entrepreneurship. Furthermore,

Baum and Silverman (2004) state that because only a fraction of established Venture Capital portfolio funds succeed, in the first place, the management selection criteria used may actually exasperate the risk by limiting choice.

Since investment decisions appear to be based on management team trust, it is important to understand the concept of trust and how it is established. Trust in a particular management team is usually established via reputation and Ventura Capital firms' direct working experience and relations with individuals (Baum and Silverman, 2004; Forlani and Mullins, 2000). Of course, trust is a very qualitative type term, where the basis for trust can be very hard to define. Franke *et al*, (2006) studied twenty-six (26) Venture Capital firms located in Munich, Berlin and Vienna, and found some very interesting results. They discovered that there are large similarity profile biases between Venture Capital firms and the firms that they choose to invest in. When a Venture Capital firm is selecting portfolio start-up firms to invest in, particularly with respect to management, the closer the investment opportunity's management team profiles resembled that of the Venture Capital firms own management team profile, the higher the investment opportunity was rated with the increased likelihood of being funded.

Franke *et al*, (2006) state that they found Venture Capital investment selection based on originator and management troublesome. The emphasis, they state, is not on the actual investment opportunity, but on the aspects of the company structure and who will be managing the investment firm. In this type of scenario, it is implied that a specific management team can be successful, in running any investment opportunity to a certain stage, regardless of the opportunity's characteristics or concept. However, the project may be

compromised from the beginning, leading to a spectacular failure. This scenario is especially exasperated within the biopharmaceutical/life science industry that focuses on the development of medicinal therapeutics and where the development and associated timelines to bring a new product to a certain stage of development are both long and complex. In this type of environment, a Venture Capital backed firm that has been selected purely based on its management team, may have a management team that the Venture Capitalist can trust, but if the investment opportunity is a “dud” from the beginning, it may not be discovered for a long time. Before the “dud” discovery can be made, the Venture Capital firm may have invested over and over again in other similar opportunities that have been initiated or recommended by the same originator and management team, all of which may be questionable to begin with.

By and large, it has been shown from historical research on Venture Capital firms (Baum and Silverman, 2004; Franke *et al.*, 2006) that portfolio firms backed by Venture Capitalists have both higher and longer survival rates than non Venture Capital supported firms. This does not specify, however, whether the Venture backed portfolio firms are simply surviving because they are receiving funding from Venture Capital or whether these firms survive because their projects are successful. Franke *et al.*, (2006) as well as Baum and Silverman (2004) found that “similarity” biases between the Venture Capital firm and the management team of a selected portfolio firm affect the longevity of a portfolio firm, regardless of the potential return on investment in the investment proposal. Therefore, it may be that longevity of a Venture Capital backed firm is based not so much on the project itself, but the relationship between management, the monitoring of the Venture Capital firm and whether capital is invested or not. Again this is extremely problematic, especially with respect to life

science technologies and other such long term investment opportunities. If the focus is on the management of the project rather than the technology, the potential for a profitable return on investment could be tremendously skewed. Again, it also limits the choice of promising new technologies from being invested in.

The possibility of adverse selection resulting from information asymmetry avoidance is therefore one that needs to be considered when understanding Venture Capital selection and perception risk. It will be explored further in the semi-structured interviews, results and discussion.

4.6 Education & Experience Leading to Adverse Selection & Overconfidence

“Experience is not what happens to you. It is what you do with what happens to you.”

Aldous Huxley (1894-1963)

As Aldous Huxley intimates, our experiences are linked to our vision and what we will do in the future. But whether that experience will enable better future decisions is debateable.

This highlights the final posed research questions of this study:

4) Are Venture Capitalists qualified to make investment decisions on new life science investment opportunities?

4a) What are the educational and direct industry experience levels of Venture Capitalists?

4b) Does amount of education and/or experience have an effect on which life science investment opportunities are chosen?

4c) Does a life science investment choice influence future life science investment choice?

To begin with, Shepherd *et al.*, (2003) debate education and experience in their study on Venture Capitalists' experience level and whether more experience leads to reliable investment choices. The authors suggest that the more experience a Venture Capitalist has the more efficient that individual becomes in keying in on specific objectives. But the authors also state that with more experience there is also a tendency to become overconfident, performing short cuts to achieve the same objectives. This can be worrisome with respect to intricate assessments of investment opportunities that are all very different, potentially leading to decreased success rate in investment opportunity selection. That is exactly what Shepherd *et al.*, (2003) found. The authors found that Venture Capitalists with low experience levels face vast information burdens because they had less experience with decision processes and selection criteria. As experience grew, however, the Venture Capitalist was better able to streamline the information burden, relating it back to his/her successes with his/her mistakes. But the authors also found that at one point in the experience level, the actual experience curve would begin to decline in relation to success over time. In these situations, it appeared that overconfidence and heuristic opinions of the Venture Capitalist were leading the decision choices.

Shepherd *et al.*, (2003) state that Venture Capitalists, who they studied, with more than fourteen (14) years of experience were the most susceptible to the downward experience curve. The authors found this a concern with respect to investment opportunity selection, if older and more senior Venture Capitalists were also the ones that were involved with assessing new venture opportunities. The authors also mentioned that by the idiom "*you cannot teach an old dog new tricks*", many United States Venture Capital firms actually

place their senior experienced Venture Capitalists in managing roles, rather than in selection roles, thereby through promotion, inadvertently avoiding the problem.

Not only may too much experience be an important perception risk when making opportunity investment decisions, but too little experience may be as well. Franke *et al.*, (2006) found that adverse selection decisions are also aggravated in that most rejected investment opportunities are done early in the process by one person, usually the most junior and inexperienced Venture Capitalist within a Venture firm. Junior Venture Capitalists are generally those who are placed on early and first screenings of investment opportunities. Opportunities for this first screen are generally rejected on such criteria as investment size sought, location of proposal firm and stage of finance wanted; however, intellectual property and previous experience by the Venture Capital firm with the originator and management team of the proposal are also important selection criteria at this stage. Franke *et al.*, (2006) also found that the decision to reject was based in large part on whether the management team presenting the investment opportunity was similar in character to the inexperienced Venture Capitalist. They mention that not only is this perplexing from the point of view in selecting worthy investments, but the person who is evaluating investment opportunities may also have systematically different selection preferences from the Venture Capital firm that he/she was working for.

This leads back to the research question of whether Venture Capitalists are qualified when making investment decisions on new opportunities, especially life science investment opportunities. If they are relying on experiences from the past, especially in respect with management teams, to decrease investor risk and information asymmetries, are these valid

selector criteria? As well, if most of the investment opportunities are rejected early on in the selection process and these are rejected by an individual that may be inexperienced, are the investment opportunities that are selected the ones that will give the best return on investment?

Some recent research has been directed towards the understanding of whether Venture Capitalists are qualified when deciding on investment opportunities and whether the decision tools and processes that they use are effective (Baum and Silverman, 2004; Baron, 2004; Franke *et al.*, 2006 Shepherd *et al.*, 2000; Shepherd *et al.*, 2003; Zacharakis and Meyer, 2000). Where Franke *et al.*, (2006) and Baum and Silverman (2004) discuss how Venture Capitalists rely on past experiences to select projects, Zacharakis and Meyer (2000) discovered that Venture Capitalists rarely use any methods to recall and accurately assess how past selection processes and proposals fared. This is imperative because if Venture Capitalists are to educate themselves, especially in a particular industry that a Venture Capital firm wishes to invest in, a means of objective assessment is necessary. This is particularly important in the area of life science where the potential for information asymmetries are so large due to the complexity of the projects. Zacharakis and Meyer (2000) found that when Venture Capitalists do use decision tools, the risks and weight assigned to these analyses may be underweighted if the Venture Capitalist lacks expertise within a particular industry. Manigart *et al.*, (2000) established similarly that the decision tools and valuation methods that are used by Venture Capital firms vary extensively. Furthermore, some of the decision tools used, such as enterprise value methods from traditional companies to valuate innovative technology opportunities and the use of internal rates of return on long

term technology projects that would have many varying development cycles, were completely inappropriate in the assessment of long term technology proposals.

The focus of Venture Capitalists experience and decision criteria, in particular on management teams and entrepreneur characteristics, has also been emphasized in a study conducted by Bishop and Nixon (2006). The authors studied pre-nascent entrepreneurs (PNEs), defined as individuals that are engaged in the process of evaluating proposals before making development or investment choices. The authors related these PNEs to Venture Capitalists, focusing their research specifically on inexperienced PNEs and the types of decision criteria they use. They found that there were actually two main sets of criteria that PNEs and Venture Capitalists used: espoused criteria and actual criteria, where espoused criteria are defined as the perceived criteria that a person believes they use and the actual criteria that are used when evaluating a proposal opportunity. Bishop and Nixon (2006) discovered that inexperienced PNEs actually made their decision on whether to accept and invest in an opportunity before any formal evaluation had really started. Interestingly, the authors found that experienced PNEs and Venture Capitalists all used entrepreneur and management criteria to evaluate an investment opportunity, with much less emphasis on the actual opportunity's business concept and what it was trying to achieve. This was opposite to the criteria used by inexperienced PNEs, who they found focused surprisingly more intently on the probability of the investment's target market and market acceptance, in other words on which the "espoused" criteria were focused. Bishop and Nixon (2006) concluded that as more experience was attained with specific investment opportunities and entrepreneurs, confidence in decision choices increased with respect to certain scenarios, but information sought to select investments, decreased. In this case it appears that the more experience that

a Venture Capitalist has, the more reliant he/she is on past experiences, with, in particular regard to management and entrepreneurial characteristics. This supports the conclusions found by Franke *et al* (2006), Baum and Silverman (2004) and Shepherd *et al.*, (2003) discussed previously.

Bishop and Nixon's (2006) study corroborates the conclusions of Zacharakis and Shepherd (2001) in which they proposed that the implications of Venture Capitalist overconfidence may actually increase the behaviour of confidence in existing information that is easily attainable and thereby limit searches for additional information. The authors further discuss that this is mainly because of the natural inclination of people to remember past successes more clearly than failures. The authors conclude that this would result in the investment of opportunities that should perhaps not have been funded and rejecting others that should have been funded. This suggests that overconfidence by Venture Capitalists plays a major role in how investment selection is performed.

Another risk that links back to experience and overconfidence is information overload. During their research, Zacharakis and Shepherd (2001) found that 96% of the participating fifty-one (51) Venture Capitalists that they studied were overconfident in their ability to choose their investment opportunities. The authors found that this overconfidence was correlated back to the nature and amount of information that a Venture Capitalist had to assess. They state that the more information someone receives when making a decision choice, the more the information may contradicts itself. This in turn makes the choice more complex and confusing. Interestingly, they discovered that the more information a Venture Capitalist received during an investment assessment, and even when the complexity of the

decision to reject or accept an investment opportunity increased, the more confident the Venture Capitalist generally became in their decision choice. The authors also found that the more information that a Venture Capitalist had, the less accurate their decision choices became. Zacharakis and Shepherd (2001) thus concluded that overconfidence is negatively related to Venture Capitalists decision accuracy. Disconcertingly, the authors also found that the more unfamiliar an investment opportunity was, the more the Venture Capitalist would rely on contingent selection criteria, such as the management team. In a sense, the more familiar the Venture Capitalists was with the management team, the more overconfidence the Venture Capitalist displayed with respect to investment choice.

Zacharakis and Shepherd (2001) also discovered that Venture Capitalists were more overconfident in failure predictions than success predictions, but also that the more experience a Venture Capitalist had, the less overconfident he/she became in his/her predictions. This correlates back to Franke *et al.* (2006) who found that the least experienced Venture Capitalist within the firm usually handles the first rounds of proposal due diligence and evaluation. During this process most investment proposals are rejected. If these lesser experienced Venture Capitalists, as stated by Zacharakis and Shepherd (2001), also reject with high levels of overconfidence, the accuracy of the decision could be considered extremely low.

On another note, Venture Capitalists may have adverse selection techniques with respect to selecting life science investment opportunities simply by the fact that these opportunities are inherently difficult to understand in the first place. Discovery and design of new life science are some of the most intricate concepts to comprehend (Lockett *et al.*, 2002). They are novel

and sophisticated and a Venture Capitalist who does not have an educational or work experience background within the life science area may be at a disadvantage (Baeyens et al., 2006; Evans and Nikhil, 2003; Lockett *et al.*, 2002). Advances in the understanding of molecular interactions, nanotechnology and/or the human body systems, requires a selector who can at least comprehend, partially, which new mechanisms and biotechnologies have a chance of working. Amir-Aslani and Negassi (2006) discuss the necessity for and importance of life science venture investors to form investment partnerships with individuals and firms that have areas of expertise. The authors discuss the desperate need for novel drug discovery and how, in many instances the discoveries that are being made are not being funded because of associated complexity in understanding the new and forefront technology. Amir-Aslani and Negassi (2006) state:

“It is crucial to understand the nature of change in the industry [life science] and to exploit this knowledge by identifying areas where resources should be committed. This way the company can focus on product opportunities synergistic within its area of expertise and leverage its infrastructure.”

Shepherd *et al.*, (2002) found that there are links with the educational and industry experience that a Venture Capitalist has and those skills that are required to make investment decisions. If a Venture Capitalist does not have a scientific or industry background in the area of the particular life science opportunity being assessed, he/she may not be able to understand the importance of the underlying science involved, nor foresee the potential risks that such an investment opportunity may have. If there is a lack of opportunity comprehension, valuable life science opportunities are potentially at risk, from the start, of not being recognized for funding or at best be commenced with flawed development plans.

Investment into a novel life science project, with no baseline, that is both complex and difficult to understand, thus may be in large part doomed from the start.

Venture Capitalists are also hampered in their decision choices by lack of resources, methods and processes they use to assess intricate opportunities. This was discussed earlier as factors that affect information asymmetry risk. Zacharakis and Meyer (2000) discuss how Venture Capitalists can eliminate profitable investments from further consideration due to the adverse selection techniques that they use, such as known entrepreneur, or life science they are familiar with, simply because they need to keep the evaluation task manageable and on a specific time schedule.

Zacharakis and Meyer (2000) also found that certain types of models and processes help Venture Capitalists choose opportunities more accurately. They mention in particular actuarial decision aide, simulation and risk assessment models, where investment opportunity elements can be itemized into probability parts and reformed into a number or range of numbers. The authors found that these models assisted Venture Capitalists to cut down on a number of expensive resources, such as assessment time, and yet allow them to objectively screen and consider a proposal. The authors furthermore mention that objectivity would become more fully realized with such models, reducing adverse selection that can skew assessment, such as acquaintance with the entrepreneur and proposal originator. The implications of this study suggest that it may be possible to evaluate many complex investments in a consistent fashion as opposed to relying on human decision makers that may often be influenced by different espoused information that is available among different investment proposals. The authors also found that these specific model processes assisted the

Venture Capitalists to gauge past projects, enabling them to understand more fully why an investment had failed or why it had succeeded. Unfortunately, Zacharakis and Meyer (2000) found that very few of the Venture Capitalists that they studied used such methods, processes and tools choosing to rely on their intuitive strategies such as comparables, Rules of Thumb and management team selection.

Overall, from the literature assessed and with respect to the perception risks, whether due to education or experience at any level, adverse selection or overconfidence, it would appear that Venture Capitalists are indeed susceptible to these risks, during investment opportunity selection. Further investigation will be conducted via the semi-structured interviews to answer the research questions more fully posed in this report, especially with respect to whether amount of education and experience has an effect on investment choice and whether past investment choices influence future choices.

4.7 International Differences in Venture Capital & Opportunity Selection Criteria

As the Venture Capital Industry becomes increasingly more international with respect to funds that are raised and invested in, large differences within and across countries are also being noted with respect to valuation approaches of investment proposals, investment behaviours of Venture Capitalists, as well as the information used in the screening and selection processes (Bruton, 2003; Manigart *et al.*, 2000; Yoshikawa *et al.*, 2004). Manigart (2000) suggests that in large part this has to do with institutional, legal and cultural environments as well as the differences of governance structure and systems. In turn, these differences enhance the impacts that countries have on their entrepreneurial businesses, the investments that are made and the hurdle rates that the Venture Capitalists seek.

In Europe, for instance, where government funding to innovation plays a major role, Venture Capital investments are not generally allocated toward early stage firms and only an average of two to five percent (2-5%) of the Venture Capital investments are dedicated as seed or start-up capital (Lockett *et al.*, 2002; Manigart *et al.*, 2000, 2002). This is quite a small number compared to the United States where Venture Capitalists allocate approximately thirty-five percent (35%) of its investments into seed/early stage developments (Fried and Hisrich, 1994; Manigart *et al.*, 2000). Surprisingly, and most probably due to its government funding policies, France is the only country in Europe that comes close to this early stage investment strategy where Manigart *et al.* (2000) found that close to 20% of Venture Capital investing is directed to innovation and new start-up firms. Le Bas (2006) also found that this was the trend in France, where increasing investments toward innovation, especially within the high technology and life science industries, are being made.

The United Kingdom (UK) Venture Capital market is the next most experienced after the United States. Lockett *et al.*, (2002), however, found that despite increased industry experience, as well as improved due diligence techniques for assessing new technology investment proposals there exist large selection risks against early stage, innovation investment opportunities within the UK Venture Capital market. It appears that UK Venture Capitalists are “largely non-technology focused and are mainly governed by management buy-outs and other later-stage development activities” (Lockett *et al.*, 2002).

Where Canadian Venture Capital firms stand in terms of investment priorities and investment selection criteria, experience, and education levels, has not been greatly studied. Amit *et al.* (1998) found that when examining Venture Capital firms within Canada, they discovered that

Canadian Venture Capitalists were large investors of the technology industries, such as life science, but at later stages of development, rather than at the earlier entrepreneurial stages. The authors found that Canadian Venture Capitalists exited their portfolio firms through insider sales and management buy-outs rather than M&As and IPOs -- even during the period of the early 1990's where the markets were rather favourable to IPOs. From the findings that Amit *et al.*, (1998) made, it appears that the Canadian Venture market culture portrays Canada as one that mimics the UK Venture market rather than the United States. This behaviour is interesting when one considers the close proximity of Canada to the United States as well as the large financial trade that occurs between the two nations. But as Manigart *et al.* (2000) noted, government structures, as well as the institutional, legal and the culture environments of a nation, are much stronger forces in deciding how Venture Capital firms operate and invest. From that perspective, Canada is perhaps more strongly linked to the UK culture than the United States. This will be explored more fully through the semi-structured interviews and results, when comparing differences between the interviewed Canadian Venture Capitalists and the United States' Venture Capitalists.

4.8 Literature Review Summary

As a summary to the literature review the following major points were discussed in support of the main research questions of this project:

Based on the Fried and Hisrich (1994) model as well as other literature researchers, there indeed appears to be common selection criteria used to evaluate potential portfolio investment opportunities. There were three (3) major subject areas that Venture Capitalists used in selection of portfolio firms to invest in: Business Concept where potential earnings,

the business concept, location of investment and intellectual property value are assessed; Return on Investment, particularly as to which valuation techniques are used; and Management Team where management characteristics, experience and skills are evaluated.

Through the literature Venture Capital firms indeed use specific valuation methods to identify investment opportunities. Aside from demanding extremely high rates of returns (100-300%) for life science investments, Venture Capitalists rely on past experience, comparables, rules of thumb, and marketing assessments that gives them a sense of what similar investments are worth at a specific stage of development (Berlin 1998; Elango *et al.*, 1995; Fried and Hisrich, 1994; Patzelt *et al.*, 2006; Sahlman 1990).

With respect to investment opportunities of novel life science technologies, that have difficult to understand scientific theories underlying their concepts, the potential for inaccurate information to be “sold” to a Venture Capitalist can be perceived as a higher than normal. Venture Capitalists who operate within the life science are susceptible to information asymmetries, particularly if the entrepreneur or founder of the technology is unknown them (MacMillan *et al.*, 1987; Patzelt *et al.*, 2006; Shepherd and Zacharakis, 2002; Zacharakis and Meyer, 2000). It was found that Venture Capitalist use known and experienced management to partially avoid information asymmetries. It is presumed that by selecting for management, the Venture Capitalist is trading high unknown risk for a lower and known risk.

However, selecting management to avoid information asymmetry can lead to other unforeseen risks. A limited and stagnant pool of firms and entrepreneurs may develop, where little innovation actually develops. If Venture Capitalists generate wealth by supporting blockbuster innovation, supporting a select core group of individuals does not

necessarily assist with creating that wealth. Furthermore, monitoring of management by Venture Capitalists has shown to increase longevity of firms. In literature this has been associated with the relationships that are built between Venture Capitalists and management. But this has not been truly separated out to see if longevity and firm survival is simply related to the amount of capital that a Venture Capital firm invests in a firm/entrepreneur in the first place.

As to whether Venture Capitalists are qualified with respect to making investment decisions, there was, in the literature, both a debate on the education level as well as on the experience level, but particular focus was given to experience. It was found that the learning curve of Venture Capitalists is concave, where initially, as experience is gained, the slope of the experience curve is upward and to the right. As experience increases the curve begins to taper off, as is seen in normal experience curves, but then it seen to decrease downwards.

Literature links this downward slope with overconfidence. As overconfidence grows, so does inaccurate decision making. On the other hand, too little experience has also been shown to be an issue, especially since many investment opportunities are initially screened by junior Venture Capitalists.

Education, decision tools and past experience were explored to see how these were perceived to effect Venture Capital selection. It appears that Venture Capitalists rely heavily on direct experiences, linking these back to their day to day decision choices. The literature finds this a bit concerning, since there is a large body on research performed on the fact that people have a tendency of remembering successes, and underplaying failures. Decision tools to combat these types tendencies, such as re-evaluation synopsis to understand failures, are not being used widely by Venture Capitalists. It was also found that the more unfamiliar an

investment opportunity was, the more the Venture Capitalist would rely on contingent/actual criteria as opposed to espoused selection criteria, such as management team selection.

Labelling Venture Capitalists as overall highly successful decision makers probably is an inaccurate picture. All in all, Venture Capitalists' qualification most likely depends on the individual and that individual's track record within his or her career.

Within respect to international differences and since this project is a comparative study between West Coast Canada and United States, the literature suggests that there are differences with respect to how Venture Capitalists operate and invest. These differences are mostly said to be due to governmental and cultural differences between countries, differences that mandate how Venture Capitalist firms can and will operate. The literature suggests that Canada may operate more on the level of the UK, simply because the governmental system is more in line with the UK. However, the US is Canada's only neighbour and it may be that our characteristics with respect to gaining wealth are not that different.

This concludes the literature section of this report. The following sections will state the results of the semi-formal interviews, discuss the importance of these results with respect to the literature review, and then examine the implications of this study.

CHAPTER FIVE – Analyses and Results

5.1 Questionnaire Analyses

Using cold calling technique and e-mailing methods, as described in the methodology section, ten (10) Venture Capitalists on the West Coast of Canada from the Vancouver region; and nine (9) Venture Capitalists on the West Coast of United States, six (6) from the Seattle region and three (3) from California, were contacted and successfully interviewed. Of the ten (10) Canadian respondents, two (2) were from the same company and of the nine (9) United States respondents, two (2) were from the same company. The interviewing period expanded from the end of February, 2007 to mid July, 2007. Most of the Venture Capitalists interviewed were Senior Investors and Managers including Principals, Vice Presidents, and Partners, who had extremely busy schedules and therefore many time constraints. In order to successfully contact these Venture Capitalists, much diligence and patience was taken, with many phone calls and e-mails to schedule and re-schedule interviews that could be held to ensure the convenience of the Venture Capitalists time. Sometimes it took as long as two months to schedule one interview.

The interview was conducted either face to face or over the telephone with a brief introduction of the research that was to be conducted and why. It was aimed that the interview last between fifteen and twenty minutes but some of the interviews expanded a much longer time period, with the longest lasting almost two hours. Many of the Venture Capital respondents spent extra time discussing their positions and opinions. These comments and opinions will not undergo any statistical analyses but will be noted in comment tables or in the discussion section of this report, where appropriate.

Results for each question were collected in an Excel spreadsheet, breaking the responses into two groups: West Coast Canada: Vancouver Venture Capitalists and West Coast United States: Seattle and California Venture Capitalists. In each group, answers from the Likert Scale questions were separated into categories from strongly agree to strongly disagree and then summed. This is the normal practice for handling Likert Scale type data and Likert Scales are often referred to as summary scales (Maurier and Pierce, 1998). The data were considered as descriptive data because of small sample sizes.

Histograms were used to graph and show the differences between the two study groups. Where there were large differences between the two groups, Student T-test analyses, assuming unequal variances, were used to compare directly between the two groups, for one particular category. In some cases, categories of strongly agree and agree or strongly disagree and disagree were summed together and then compared between the two study groups. In such cases, the Likert Scale data were treated as ordinal data where one cannot assume that respondents could perceive the difference between similar adjacent answers. Analyses of Variance was used in such instances to first see if there were differences between the categories and then Student -T -test for two sample was used assuming unequal variances.

Chi-square analyses were also attempted, treating the data by placing them into categories of accept and reject for West Coast Canada and West Coast United States. Of these analyses, sample sizes were generally too small to give any meaningful answers.

Open ended questions, yes and no questions were summed where possible. If large differences were perceived between the two study groups, Student T-test assuming unequal

variances were used. General comments, where appropriate were collected in tables. There were also many other comments made generally during conversation with individual Venture Capitalists. These comments have been used, again where appropriate, in the discussion section of this report.

5.2 Questionnaire Results

To gather individual respondent background and demographic information, the first few questions of the semi-formal questionnaire were directed towards experience levels, job descriptions and geographical region of choice. Of the respondents from West Coast Canada, three (3) of the ten (10) Venture Capitalists interviewed were female and the rest were male. In the sample size from West Coast United States, all respondents were male.

When asked what the responsibilities of their positions were with respect to investment selection and evaluation, all respondents replied that they were involved at all levels of investment selection process within the firms. A typical answer was that he/she was involved in initial calls and opportunity searches, investment proposal reviews, evaluation, investment decisions/negotiations and board representation. All of the respondents spent time in active monitoring roles within their selected portfolio companies, either observing board practices, active on the board, networking, presenting achievements of their portfolios companies and in general, assisting portfolio companies in any manner that they could. One of the key interesting results from the study was that respondents from the United States (6/9) emphasized the importance of the technologies they invested in, especially with respect to the newness and the potential for gaining access to ways of meeting unmet medical needs. This was not reflected by the Canadian respondents who focused specifically on the roles that they performed. In later questions, two of the Canadian respondents did mention that bringing

forth technologies which had important medical needs were important to them, but it is interesting that the United States respondents mentioned that the technology was an integral part of their role as a Venture Capitalist. Table 1a) gives a summary of all comments with respect to the responsibilities of the interviewed Venture Capitalists. Table 1b) gives a summary of comments with respect to previous work experience within the Life Science sector.

When asked how long they had worked within the most recent Venture Capital employer, the West Coast Canadian respondents had a combined total of 60 years for all respondents with an average of 6 years and a median of 5.75 years per respondent with a range of 2-12 years (Figure 1). When asked how long in total they had worked as a Venture Capitalist, respondents from West Coast Canada had a total of 64 years combined, with an average of 6.4 years per respondent, a median of 6 years per respondent and a range was 3-12 years (Figure 1). The West Coast United States respondents, on the other hand, had a total of combined years of experience, with most recent Venture Capital employer, of 33.5 years, with an average of 3.72 years and a median of 2 years per respondent with a range of 1-10 years (Figure 2). When asked how long in total they had worked as a Venture Capitalist, West Coast United States, respondents had a combined total of 57 years of experience, an average of 6.3 years per respondent, a median of 5 years per respondent and a range of 3-15 years (Figure 2). Total years worked for most recent employer, for both Canadian and United States respondents, is given in Figure 3.

Table 1a. Comments by respondents on Venture Capital roles and responsibilities with respect to Investment Opportunity Evaluation.

West Coast Canada: Vancouver(n=10)	
1	All stages of investment: initial calls; proposal reviews; evaluation; investment decisions and Board representation.
2	Evaluate new investments; play active role in portfolio companies--monitoring the companies; some board participation; networking; assisting portfolio companies; presenting at conferences.
3	I am VP of investments. I seek, negotiate, evaluate and finalize investment deals with start-up companies. I oversee our investments in terms that I am either on the Board or an observer of the Board in each of the companies that have been invested in.
4	As CFO and Investment Manager I oversee investments, make recommendations and sit on the Board of Directors for XXX.
5	I am CEO; choose and assess new opportunities; sit on Board of Directors.
6	Typical role of a VC middle manager: sourcing proposals; evaluation of proposals; raising funds for proposals; representative on the Board of Directors of portfolio firms
7	Sourcing; evaluating; making investments; matrix organization and now managing XXX.
8	Started as a portfolio investor in ventures -- set up the life science portfolios, set up support staff; set up teams of assessment people; due diligence and Board attendance.
9	I am VP of investments in Vancouver. I seek, negotiate and finalize investment deals with start-up companies. I have to meet federal and provincial criteria fund criteria. I operate 5 different funds and oversee them in terms as that I am either on the Board or an observer of the Board in each of the companies that have been invested in.
10	From sourcing, evaluating to managing investments.
West Coast United States: Seattle and California (n=9)	
1	Manager. Selection of novel technologies for unmet medical needs; due diligence, Board presence
2	CEO and Investment Partner. Selection, due diligence and Board presence either directly or as an observer. Constantly searching for new ways of doing things better to find solutions to unmet medical needs.
3	Principal of XXX; everything; deal assessment and selection; setting teams up for new portfolio companies and monitoring current portfolio companies. This company is new on the coast and Board positions have not yet been established--looking for companies to invest in.
4	Partner. From evaluation all the way to sitting and board representation. Always looking for technologies that will bring newness to the field of life sciences.
5	Evaluate new businesses--due diligence; working with current portfolio companies as observer on Boards.
6	Member of a 4 person team. Diligence and research into investment opportunities; Less on Boards.
7	Partner-sourcing, due diligence, negotiations, Board representation; as well as assist other principles with due diligence. Finding ways of bringing forth incredible new technologies
8	Principal with the healthcare investment team searching for unmet medical needs. Investing partner, who searches, analyzes and invest in opportunities. Board representation.
9	General Partner: select, assess, invest and sit on Boards to drive. Always searching for the most provocative new technologies available.

Table 1b. Respondents previous work experience within the Life Science Sector. (N/A equates no previous experience in Life Science Sector).

West Coast Canada: Vancouver (n=10)	
1	N/A
2	Project Management and BD- 1 year
3	Research Lab Technician – 1 year
4	N/A
5	Founder and CEO - 10 years
6	Senior Scientist – 2 years
7	N/A
8	N/A
9	Lab technician, BD and Marketing – 5 years
10	Founder and CEO -5 years
West Coast United States: Seattle and California (n=9)	
1	Researcher – 5 years
2	N/A
3	Business Development -5 years
4	Entrepreneur and founder – 17 years
5	General management, sales and marketing – 5 years
6	N/A
7	Senior manager of BD - 3.5 years
8	Business Development - 8 years
9	Founder and CEO – 20 years

Figure 1. Total Years with Current Venture Capital Employer Compared to Total Years of Venture Capital Experience for West Coast Canadian (Vancouver) Venture Capitalists (n=10).

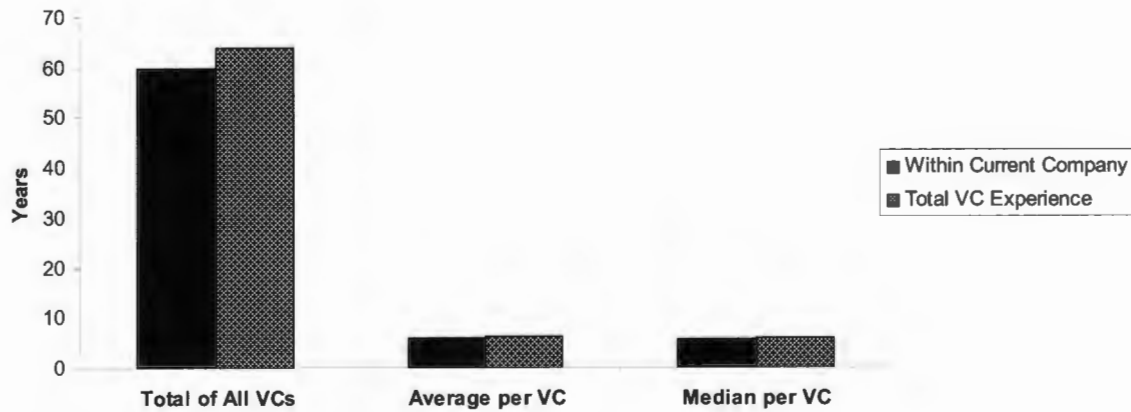


Figure 2. Total Years with Current Venture Capital Employer Compared to Total Years of Venture Capital Experience for West Coast United States (Seattle/California) Venture Capitalists (n=9).

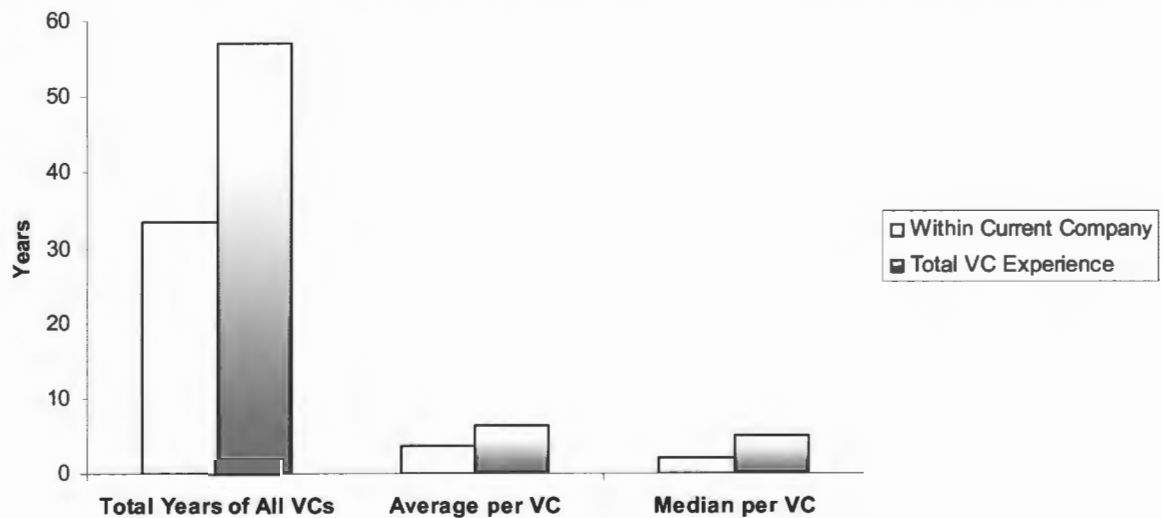
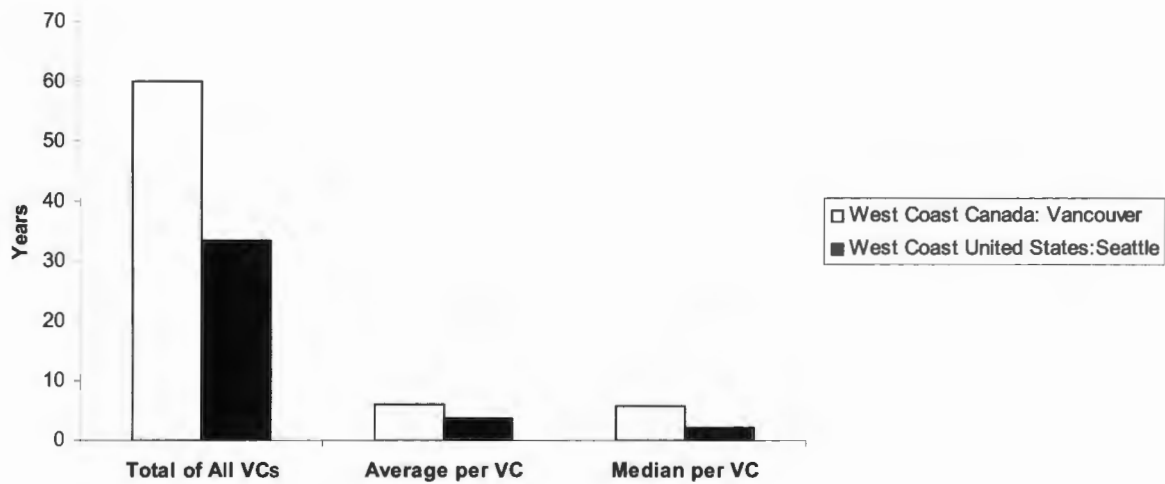


Figure 3. Total Years With Current Venture Capital Employer for West Coast Canadian (n=10) and West Coast United States (n= 9) Venture Capitalists.



When comparing total years of previous life science experience, Canadian Venture Capital respondents had a total of 24 years combined experience, an average of 2.4 years and a median of 1 year compared to United States respondents who had a total of 63.5 years combined experience, an average of 7 years and a median of 5 years (Figure 4).

When asked what their level of completed education was, 100% of respondents from both countries had completed High School and had a University undergrad degree. Aside from their Undergrad degrees, 20% of the Canadian Venture Capitalists had technical or professional degrees such as in engineering, law or medicine, 20% had Master degrees, 10% had PhDs and 70% had MBA degrees. With respect to the United States Venture Capitalists, 33% had technical or professional degrees, 22% had Master degrees, 44% had PhDs and 44% had MBA degrees (Figure 5). The major difference between the two countries was the PhD and MBA categories where there were more Venture Capitalists from the United States who had PhDs and more Venture Capitalists from Canada that had MBA degrees status. It is interesting to note that of all 19 respondents combined from both countries, 11 of the respondents had MBA degrees, that being 58% of the sample size.

Figure 4. Previous Experience in a Life Sciences Company for West Coast Canadian (n=10) and West Coast United States (n= 9) Venture Capitalists.

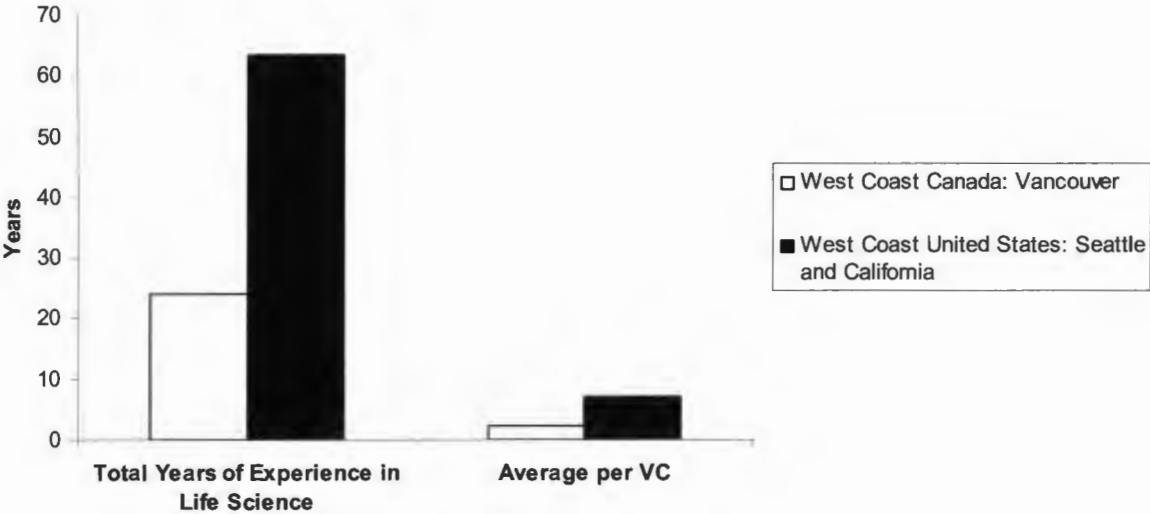
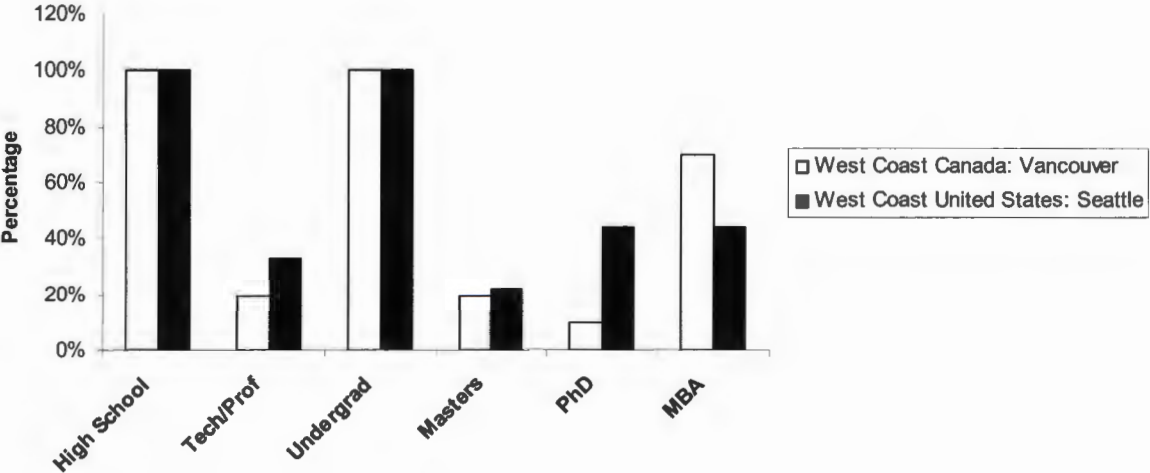


Figure 5. Level of Education Completed for West Coast Canadian (n=10) and West Coast United States (n= 9) Venture Capitalists.



The Venture Capital respondents were asked whether they or their companies invested outside of their geographic region, specifically outside of their province, state or country. The West Coast United States respondents were significantly more inclined to invest outside of their geographic region with a significance Student's T-test: two-tail $P(T \leq t)$ of 0.036 than the Canadian respondents (Figure 6) This was particularly the case with respect to European and Asian investment (Figure 7). 60% of the Canadian Venture Capitalists operated funds that mandated British Columbian investment within the life sciences. The Canadian respondents were more inclined to invest within Canada than within the United States and the United States respondents were more inclined to invest within the United States than the Canadian respondents.

Figure 6. Investment in Life Science Proposals Located Outside of Company's Geographic Region for West Coast Canadian (n=10) and West Coast United States (n= 9) Venture Capitalists.

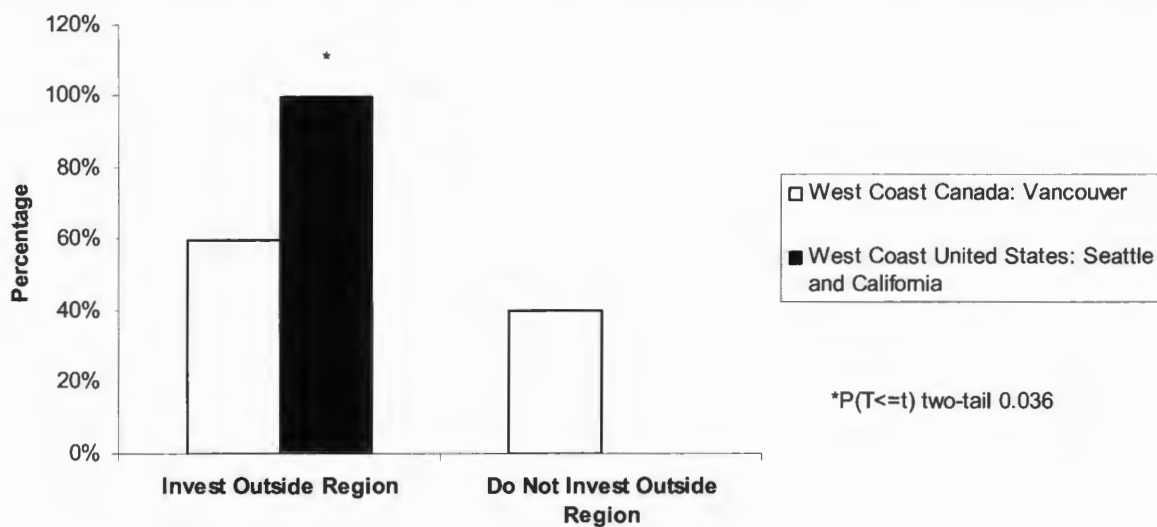
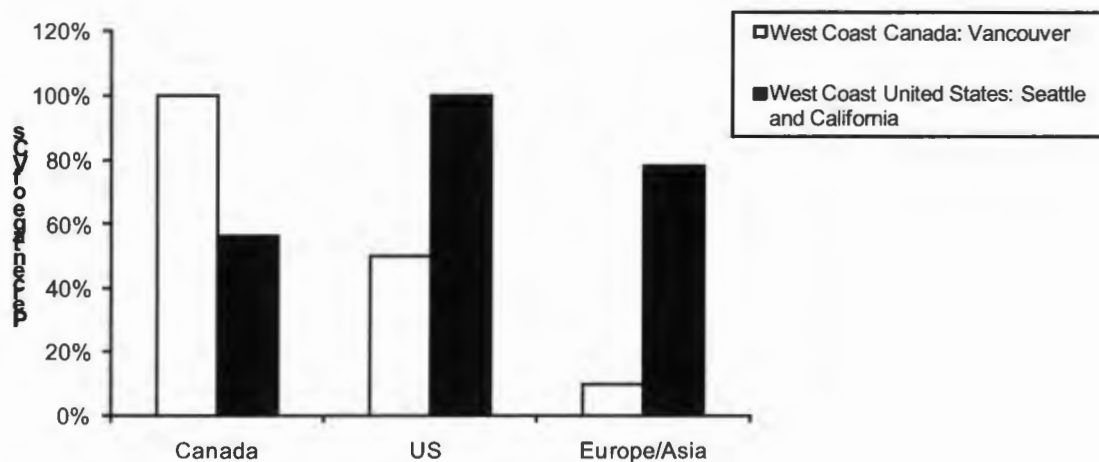


Figure 7. Global Regions for Life Science Investment by West Coast Canadian (n=10) and West Coast United States (n= 9) Venture Capitalists.



A series of six questions were asked with respect to screening life science investment opportunities and the respondent's strategy. The first question of this series asked whether there was a focus on specific life science industries, such as drug development versus device. The United States respondents (8/9) were more inclined to strongly agree and agree than the Canadian respondents (7/10), but there was no significance between the two groups. Combining the two study groups, there was a strong trend of agreement against disagreement with fifteen (15) of the respondents both strongly agreeing/agreeing and only four (4) of the Venture Capital respondents both disagreeing/strongly disagreeing (Figure 8).

The second question of the series asked whether there was a focus on specific life science technologies such as single agent small molecules, biologics, nanotechnology etc., when screening investment opportunities. It was found that 70% of the United States respondents agreed/strongly agreed compared to 20% of the Canadian respondents (Figure 9).

Figure 8. Percentage of Venture Capitalists who agreed that they focused on *Specific Life Science Industries* when Screening Investment Opportunities. West Coast Canada (n=10) and West Coast United States (n= 9)

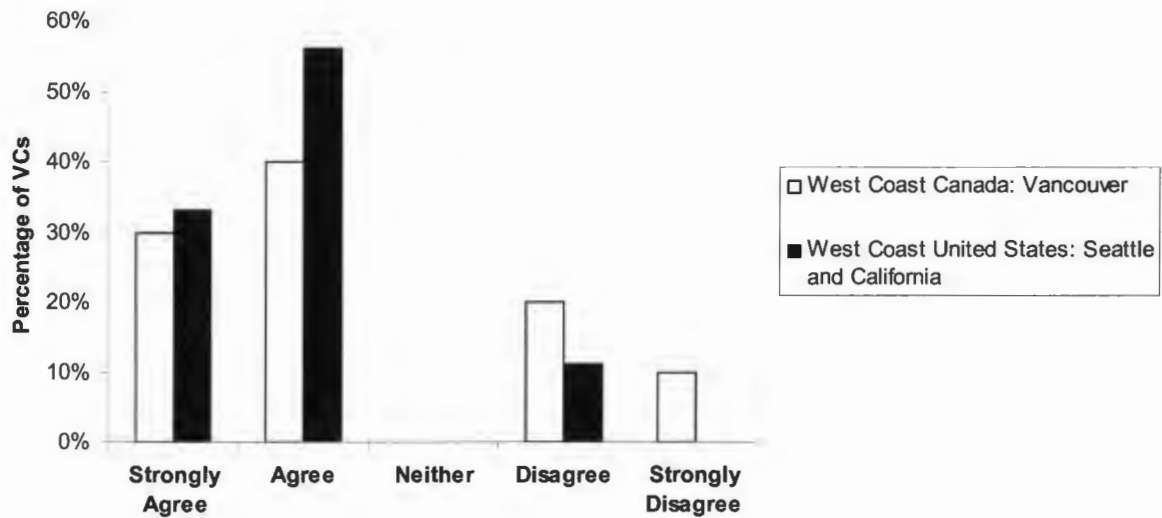
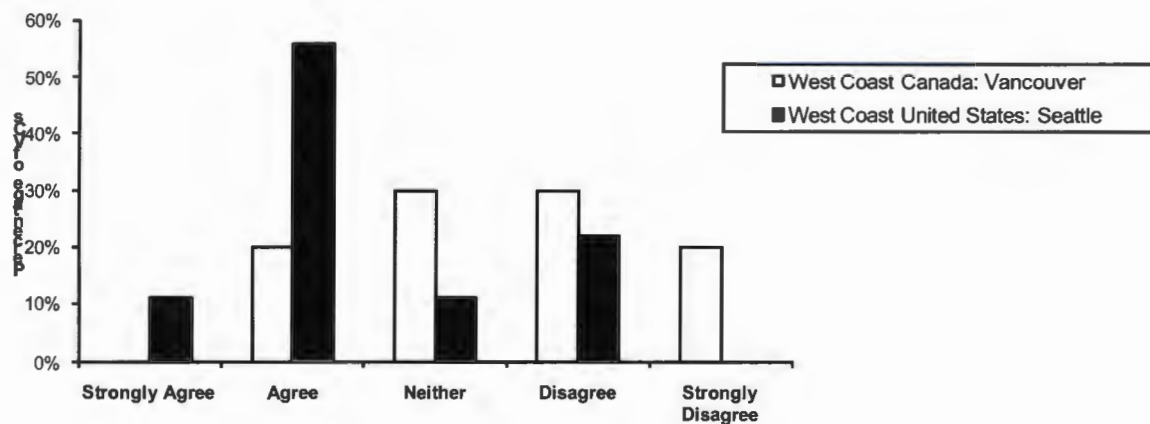


Figure 9. Percentage of Venture Capitalists who agreed that they focused on *Specific Life Science Technologies* when Screening Investment Opportunities. West Coast Canada (n=10) and West Coast United States (n= 9).



The third question of the series asked whether there was a focus on specific disease indications, such as diabetes, cancer, or heart disease, when screening investment opportunities (Figure 10). It was found that twelve (12) of all the respondents disagreed with this strategy. Three (3) of the ten (10) respondents from Canada, however, did agree that there was a specific disease indication focus when screening investment proposals.

The fourth question of the series asked whether there was a focus on preferred stage of technology development when screening investment opportunities (Figure 11). This question received a wide spread of responses with eleven (11) of the total nineteen (19) respondents either strongly agreeing or agreeing.

The fifth question of the series asked whether there was a focus on geographical location of the investment opportunity when screening investment opportunities (Figure 12). It was found that fourteen (14) out of all respondents either strongly agreed/ agreed that geographical location of the investment opportunity was a focus.

The sixth and final question of the series asked whether there was a focus on minimum or maximum investment required to exit when screening investment opportunities (Figure 13). It was found that 90% of United States respondents agreed or strongly agreed compared to 50% the Canadian respondents. Comments from five of the Canadian respondents addressed that minimum and maximum investment was not a focus because it depended on the fund rather than the technology being assessed.

Figure 10. Percentage of Venture Capitalists who agreed that they focused on *Specific Disease Indications* when screening Investment Opportunities. West Coast Canada (n=10) and West Coast United States (n= 9)

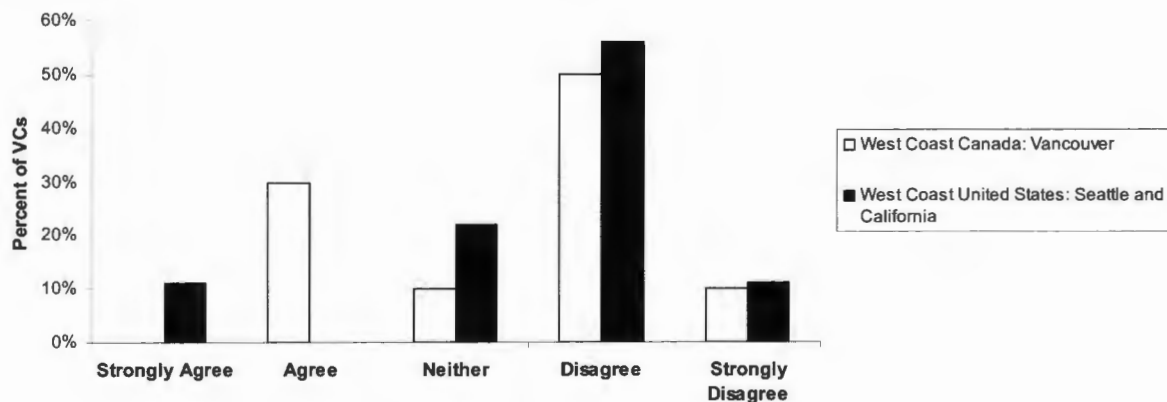


Figure 11. Percentage of Venture Capitalists who agreed that they focused on a *Preferred Stage of Technology* when Screening Investment Opportunities. West Coast Canada (n=10) and West Coast United States (n= 9)

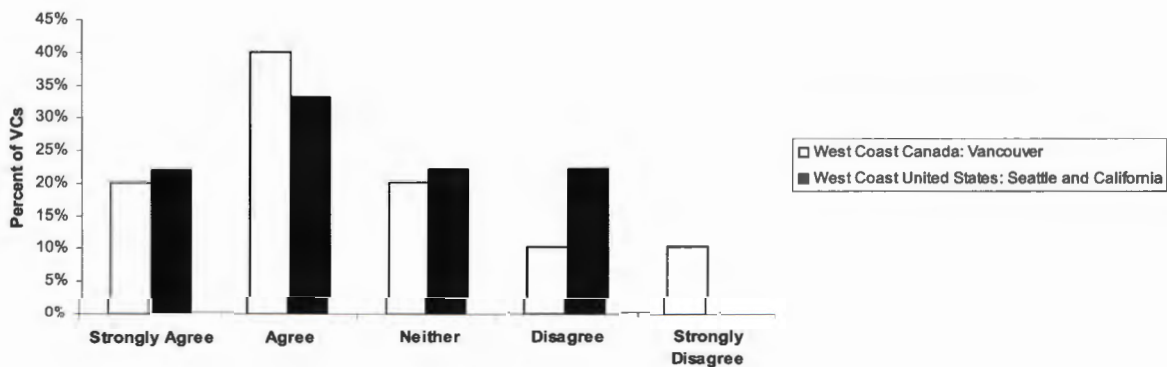


Figure 12. Percentage of Venture Capitalists who agreed that they focused on a *Preferred Geographic Location* when Screening Investment Opportunities. West Coast Canada (n=10) and West Coast United States (n= 9)

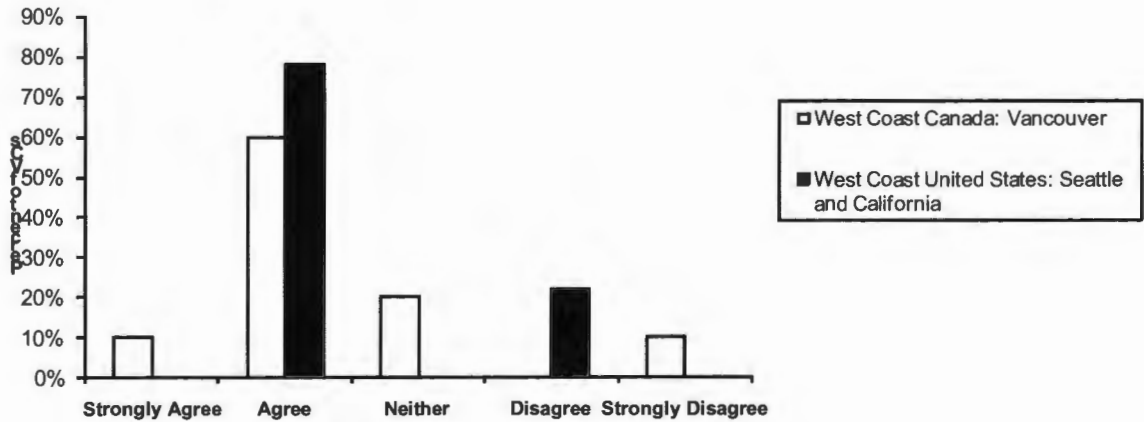
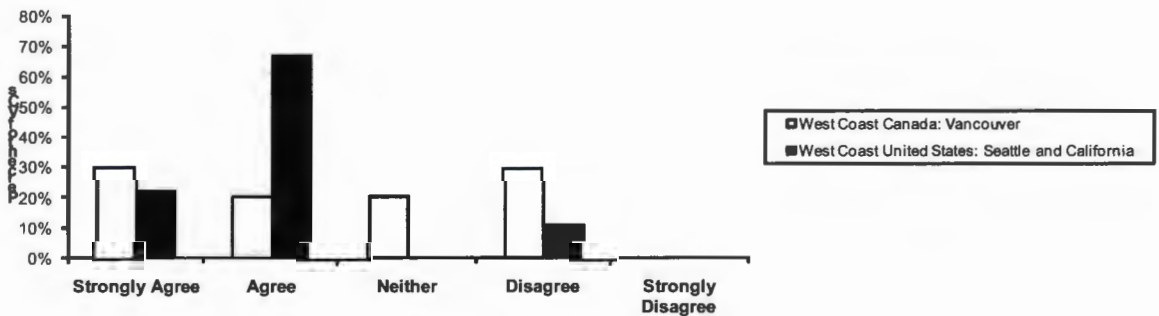
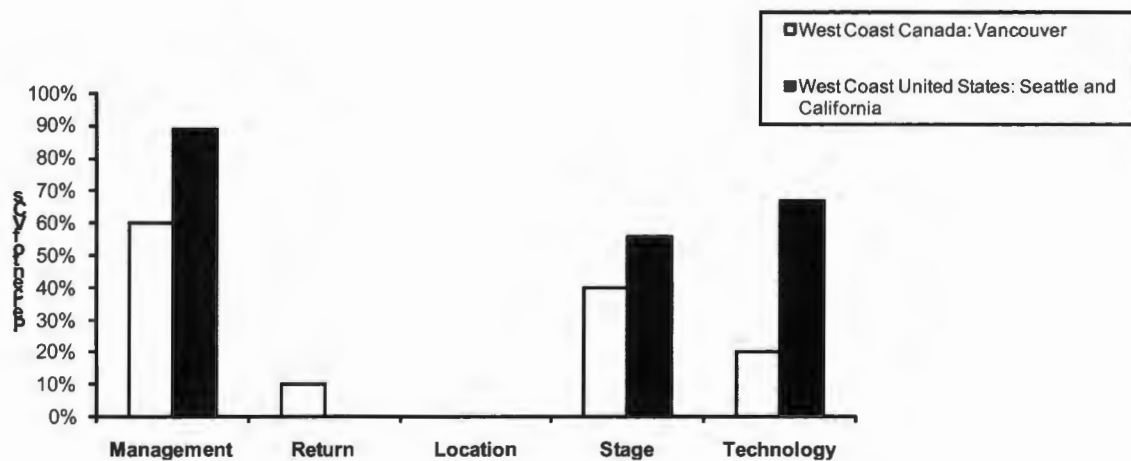


Figure 13. Percentage of Venture Capitalists who agreed that they focused on the *Minimum or Maximum Investment Required to Exit* when Screening Investment Opportunities. West Coast Canada (n=10) and West Coast United States (n= 9).



The respondents were asked what main investment strategies were used when screening life science opportunities (Figure 14). It is important to note that for this question, the respondents were able to identify more than one strategy. Of the five identified categories, management, return on investment, location, stage of development and the technology itself, three strategies, management, stage and technology, were mentioned by eighteen (18) of the nineteen (19) respondents, with only one respondent mentioning return and none of the respondents mentioning location. Of the three mentioned categories, the United States Venture Capitalists responded comparably stronger, with four (4) out of the nine (9) respondents giving more than one response, whereas the Canadian Venture Capitalists responded by mainly giving one strategy, with only one respondent giving more than one strategy. Of the three main strategies selected, management, stage and technology, the United States respondents used technology as a selection strategy much more than the Canadian respondents.

Figure 14. Main Factors Considered by Venture Capitalists when Screening Investment Opportunities. West Coast Canada (n=10) and West Coast United States (n= 9).



The respondents were next asked four questions with respect to criteria used when screening investment opportunities. These included financial, potential market size, intellectual property, and management team criteria. Firstly the respondents were asked whether financial criteria are important to estimate potential proposal worth, during initial screening of investment opportunities (Figure 15). Almost 100% of the respondents (18/19) replied that they either strongly agreed or agreed that the financial criteria were important. The respondents were then asked if potential market size criteria are important when screening investment opportunities (Figure 16). Here again 100% of the respondents (19/19) either strongly agreed or agreed. In this case and interestingly, the United States respondents were more likely to state that they strongly agreed and the Canadian respondents were more apt to state that they agreed rather than strongly agreed. The respondents were next asked whether intellectual property is important when screening investment opportunities (Figure 17). In this case fifteen (15) of the respondents strongly agreed, with three (3) respondents simply agreeing. One Venture Capitalist from the United States neither agreed nor disagreed. Respondents were finally asked whether management team and skill was important when screening investment opportunities (Figure 18). Here 100% of the United States respondents strongly agreed. Canadian respondents also strongly agreed, but two (2) of the respondents simply agreed.

The respondents were asked whether it is important to exclude investment opportunities that had unclear regulatory guidelines and risks. Interestingly 67% of the United States Venture Capital respondents either strongly agreed or agreed compared to 30% of the Canadian respondents and 40% of the Canadian correspondents disagreed (Figure 19).

Figure 15. Percentage of Venture Capitalists who agreed that Financial Criteria are important to estimate potential value of Investment Opportunity. West Coast Canada (n=10) and West Coast United States (n= 9)

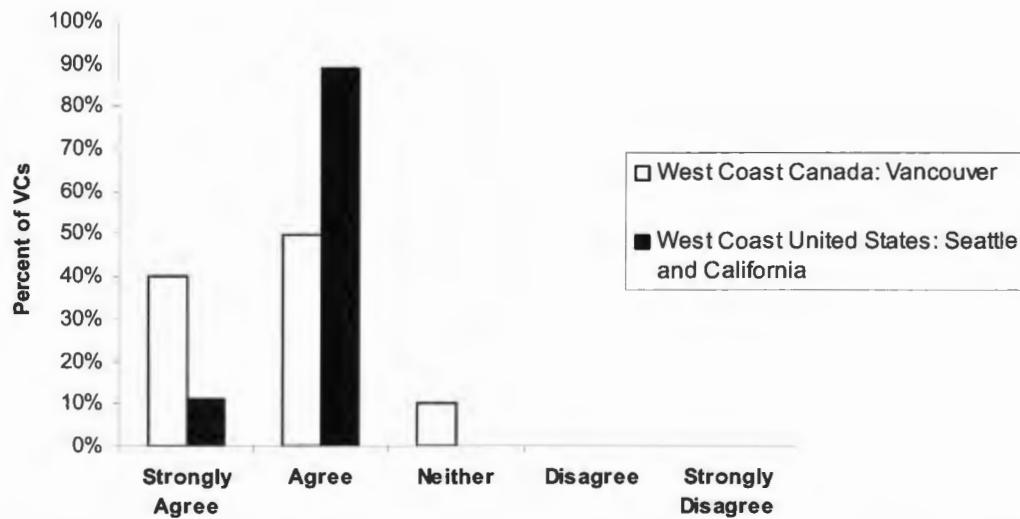


Figure 16. Percentage of Venture Capitalists who agreed that Potential Market Size is important when screening Investment Opportunities. West Coast Canada (n=10) and West Coast United States (n= 9)

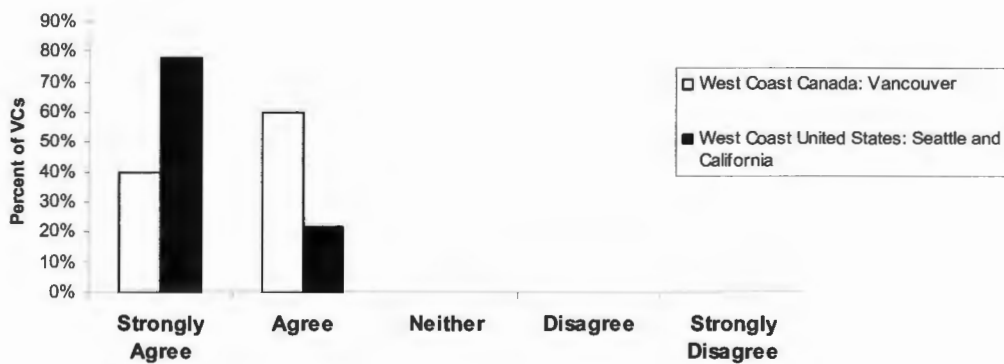


Figure 17. Percentage of Venture Capitalists who agreed that Intellectual Property Status is important when screening Investment Opportunity. West Coast Canada (n=10) and West Coast United States (n= 9)

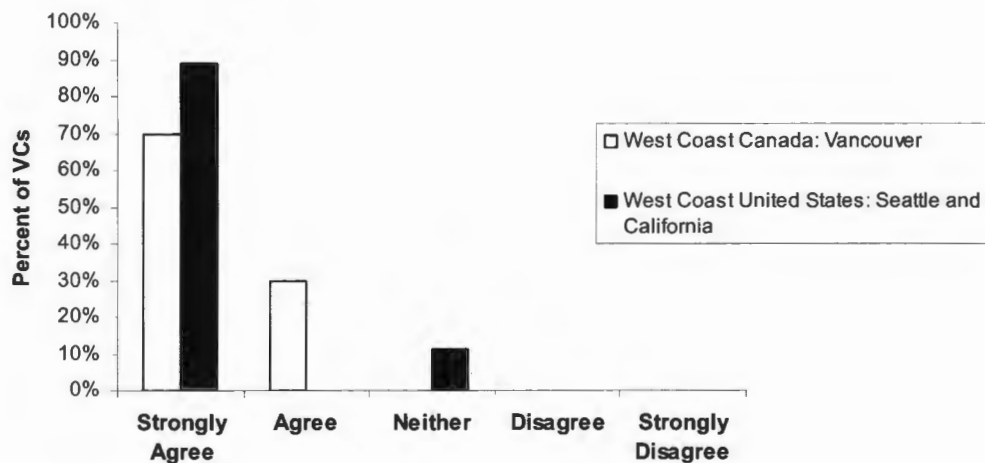


Figure 18. Percentage of Venture Capitalists who agreed that Management Team and Their Skills are Important when screening Investment Opportunities. West Coast Canada (n=10) and West Coast United States (n= 9)

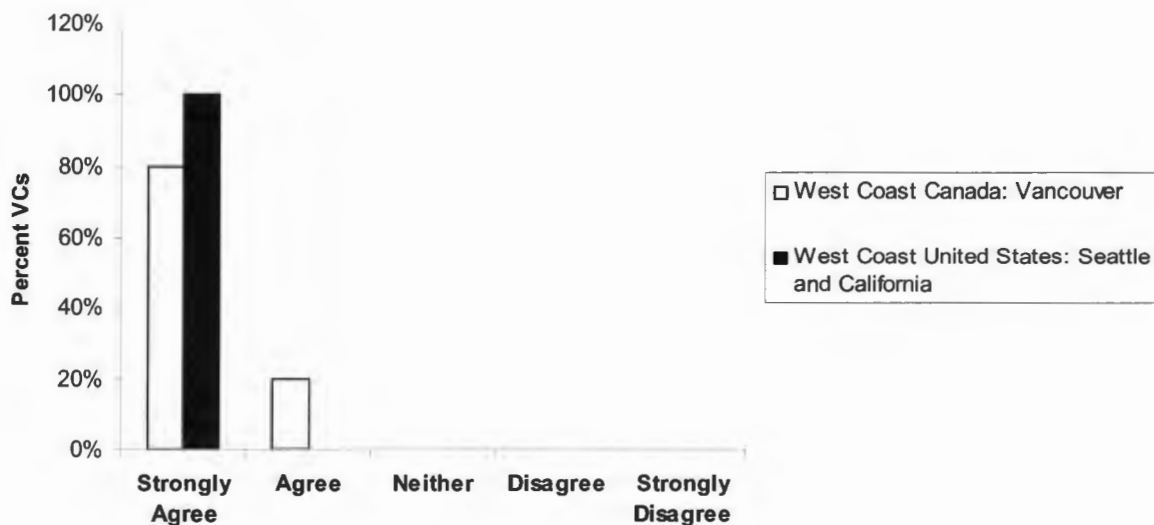
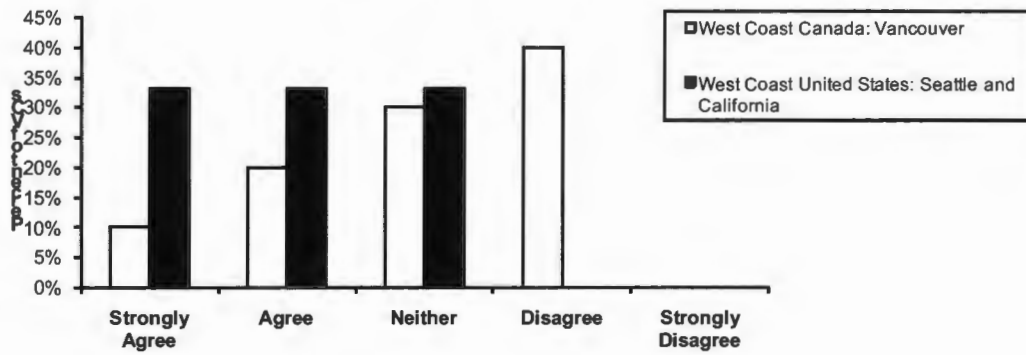


Figure 19. Percentage of Venture Capitalists who agreed that it is important to reject Investment Opportunities that have Unclear Regulatory Guidelines and Risks. West Coast Canada (n=10) and West Coast United States (n= 9).



The respondents were asked whether it is important to exclude investment opportunities that carry negative public opinion such as foetus stem cell research, genetically modified organisms etc (Figure 20). Captivatingly, the Canadian respondents (7/10) agreed that it was important to exclude these types of investment opportunities compared to the United States respondents (6/9). With respect to this question, the comments given by the respondents were quite different between the two countries, (Table 2) where three (3) of the Canadian respondents mentioned that Venture Capitalists were risk adverse, did not want to be tainted by bad news, or simply that because their funds were supported by the Canadian government, they had an ethical responsibility of not being involved with investment opportunities which were perceived as unethical by the public. Comments from two of the United States respondents reflected the emphasis on attempts to first overcome any public negativity and then deciding whether to move forwards, especially if the investment opportunity had good potential for great returns. One of the Canadian respondents concurred with this sentiment. However, one United States respondents also mentioned that even though, generally, he would not consider this an issue, if the investment opportunity was "*too hot to handle*" it may be difficult to exit such an opportunity.

Figure 20. Percentage of Venture Capitalists who agreed that it is important to exclude Investment Opportunities that carry Negative Public Opinion. West Coast Canada (n=10) and West Coast United States (n= 9).

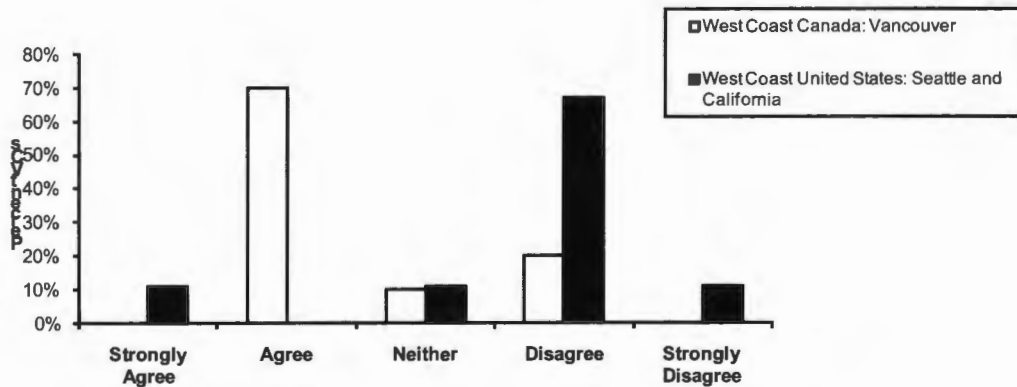


Table 2. Respondents' General Comments with Respect to the Importance of Excluding Investment Opportunities that Carry Negative Public Opinion. West Coast Canada (n=4) and West Coast United States (n= 2).

West Coast Canada: Vancouver	
Agree	Because fund is financed by the Canadian government, there is a burden of responsibility for ethical investment.
Disagree	Balance- what is the exit strategy- if the negative public opinion technology is still a good deal, then still invest.
Agree	VCs are somewhat risk adverse and don't want to be tainted by bad press
Agree	Government funded
West Coast United States: Seattle and California	
Disagree	Try to overcome any negativity and then decide whether to move forwards or not.
Disagree	Generally no, but could possibly impact the chance of successful exist -- too hot to handle – need to assess.

Respondents were asked whether it is important to exclude investment opportunities that are scientifically difficult to understand. Canadian respondents were split in opinion, with 50% agreeing and 50% neither agreeing nor disagreeing or simply disagreeing. United States respondents were also split on this question, but tended to strongly agree, 33%, rather than to simply agree (Figure 21). Respondents' comments can be viewed in Table 3.

A series of questions were asked with respect to life science investment opportunity valuation methods and whether methods were considered good, where "good" was defined as adequate or acceptable. The first question asked whether respondents considered Discounted Cash Flow methods, as good methods for assessing the value of life science proposals (Figure 22). Canadian respondents were more inclined to neither agree nor disagreed and United States respondents were more inclined to state that they either disagreed or strongly disagreed.

The next question asked whether simulation models, such as Monte Carlo, are good valuation methods for life science investment proposals (Figure 23). In this case there were mixed opinions from the Canadian respondents, but 8 out of the 9 respondents from United States either disagreed or strongly disagreed. The respondents were then asked whether multiples, such as Price Earning Multiples, were good valuation methods for life science investment proposals (Figure 24). More than 50% (11/19) of all respondents either disagreed or strongly disagreed that these multiples were useful. A number (4/9) of the United States respondents mentioned that they neither agreed nor disagreed. They mentioned that this method was particular good for later stage development, particularly in the case of medical device technologies.

Figure 21. Percentage of Venture Capitalists who agreed that it is important to exclude Investment Opportunities that are Scientifically Difficult to Understand. West Coast Canada (n=10) and West Coast United States (n= 9).

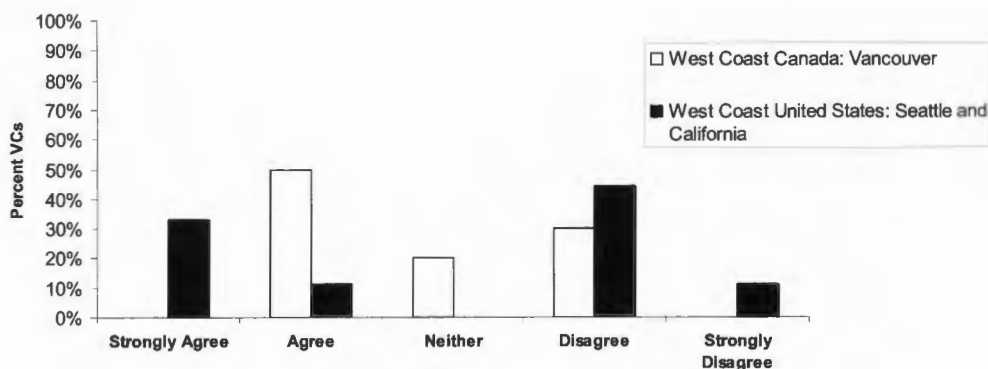


Table 3. Respondents Comments Regarding the Importance of Excluding Investment Proposals that are Scientifically Difficult to Understand. Comment was not required on this Likert Scale question.

West Coast Canada: Vancouver: 6 respondents' comments	
Agree	If business plan is poor; A person who wants a VC to invest can always simplify a difficult project - yes I would agree;
Agree	Yes, certain fields of medicine and life science do not have a clear scientific basis and should be excluded such as alternative medicines and herbal medicines.
Agree	Re-craft the idea and get the message across.
Agree	If a scientist can't explain, after several times, the story, then most likely won't invest
Neither Agree nor Disagree	Sitting down with the founding scientist is important, both to build a relationship, but also to get a handle on the technology. But it takes time to develop a trusting relationship and that is not always easy."
West Coast United States: Seattle and California: 2 respondents' comments	
Disagree	One can always get assistance from key opinion leaders and other scientists. Novel technologies are not always easy to understand.
Strongly Agree	Why invest in something that doesn't make sense.

Figure 22. Percentage of Venture Capitalists who agreed that Discounted Cash Flows are good valuation methods for assessing Life Science Investment Opportunities. West Coast Canada (n=10) and West Coast United States (n= 9).

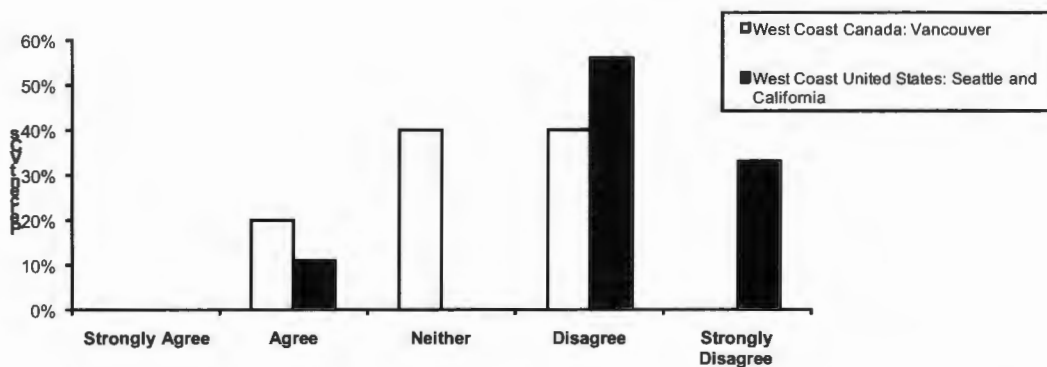


Figure 23. Percentage of Venture Capitalists who agreed that Simulation Models are good valuation methods for assessing Life Science Investment Opportunities. West Coast Canada (n=10) and West Coast United States (n= 9).

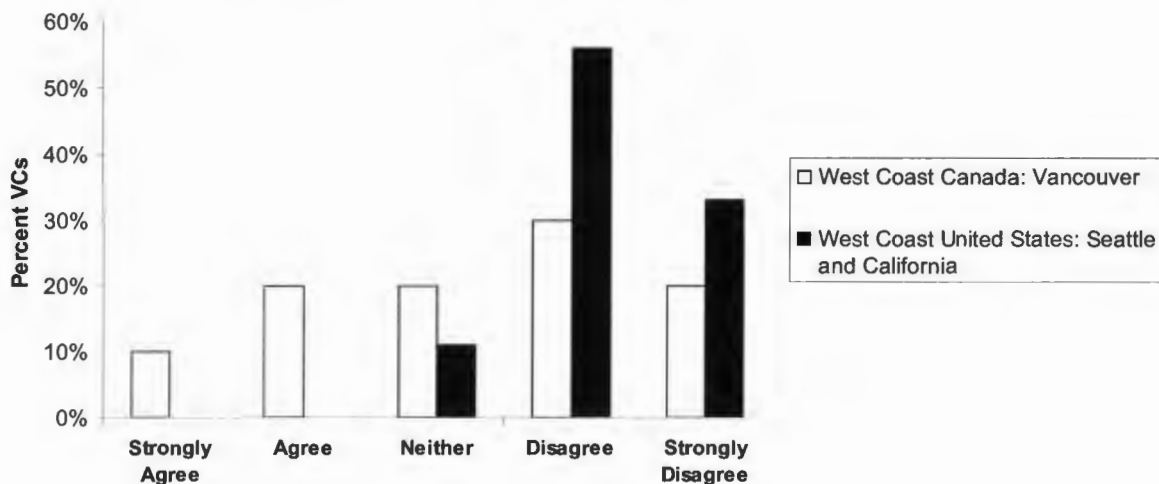
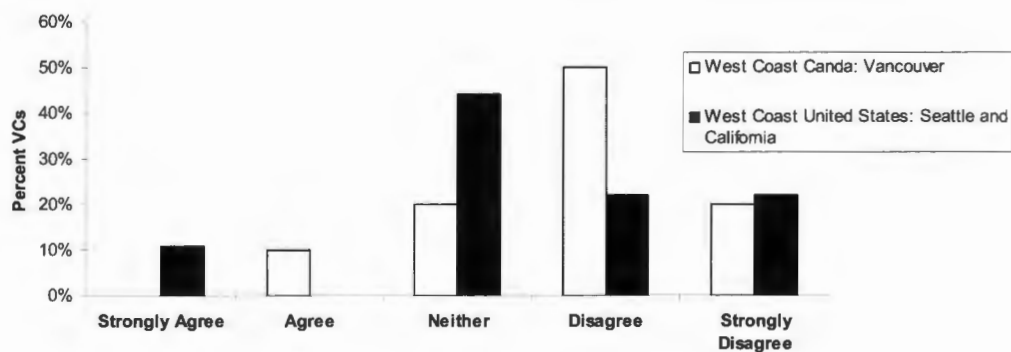


Figure 24. Percentage of Venture Capitalists who agreed that Multiples such as Price Earning Multiples are good valuation methods for Life Science Investment Opportunities. West Coast Canada (n=10) and West Coast United States (n= 9).



Finally respondents were asked whether technology market value assessments, such as for a particular disease indication, are good qualitative valuation methods for life science investment opportunities (Figure 25). All United States respondents strongly agreed or agreed that market assessments were good valuation methods, compared to Canadian respondents in the same categories, where only 60% of the Canadian respondents also agreed.

Respondents were then asked which other valuation techniques were used (Figure 26). Some of the respondents mentioned that Enterprise Value and Payback Period were used, but 100% of the respondents mentioned Comparables as the preferred method. Respondents were then asked which evaluation techniques they had found to be the most useful when evaluating life science investment opportunities (Figure 27). All respondents, 100%, found that Comparables were the most useful with 42% (8/19) of the respondents also mentioning Rules of Thumb. When respondents were asked whether they felt that current valuation methods are adequate at evaluating life science investment opportunities, 58% of the respondents agreed (Figure 28). Again, some of the respondents mentioned that when the current valuation methods were used, they provided a “*sanity check*” as to what an investment opportunity was worth. It was mentioned by one of the United States respondents that in essence these are the techniques that are available, but in reality an investment opportunity is worth only what people are willing to pay and what the market can bear. Comments can be viewed in Table 4.

Figure 25. Percentage of Venture Capitalists who agreed that Technology Market Assessments are good qualitative valuation methods for Life Science Investment Opportunities. West Coast Canada (n=10) and West Coast United States (n= 9).

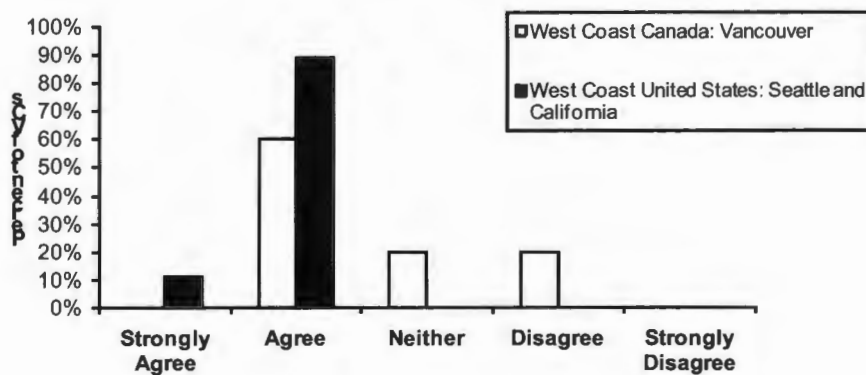


Figure 26. Valuation Techniques used by Venture Capitalists to evaluate Life Science Investment Opportunities. West Coast Canada (n=10) and West Coast United States (n= 9).

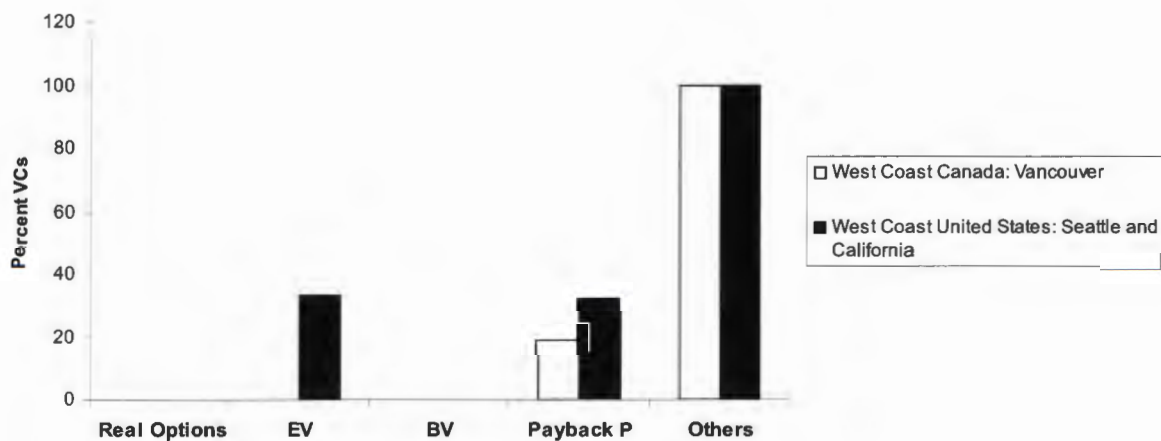


Figure 27. Valuation Methods found to be most useful by Venture Capitalists evaluating Life Science Investment Opportunities. West Coast Canada (n=10) and West Coast United States (n= 9).

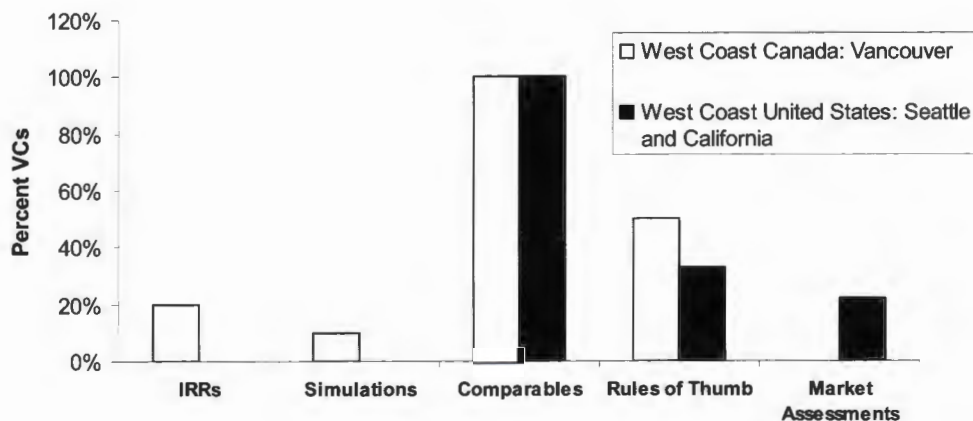


Figure 28. Percentage of Venture Capitalists who agreed that Current Valuation Methods are adequate when evaluating Life Science Investment Opportunities. West Coast Canada (n=10) and West Coast United States (n= 9).

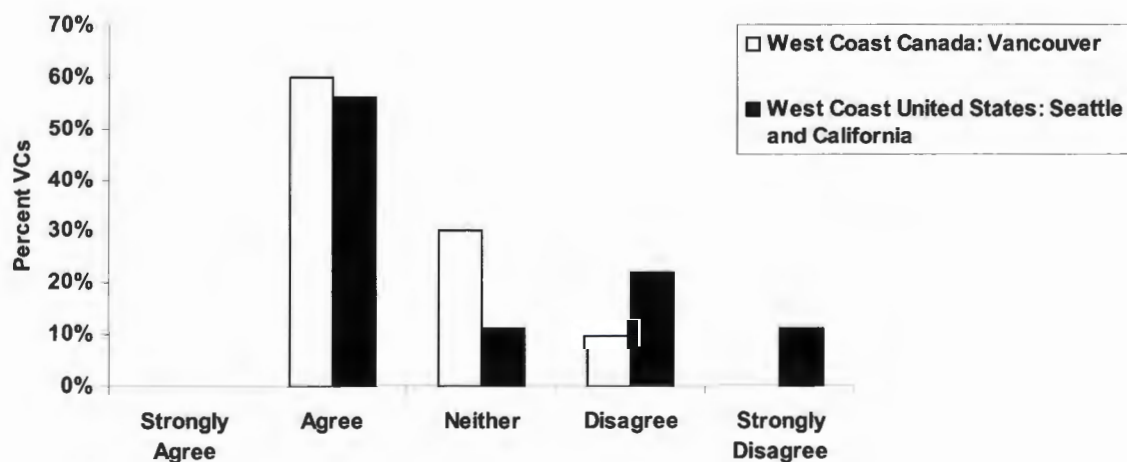


Table 4. Respondent comments: adequacy of current Life Science Investment Opportunity valuation methods. Comment was not required for this Likert Scale Question (n=8).

West Coast Canada: Vancouver – 4 respondents' comments.	
Neither Agree nor Disagree	Comparables are the only really good ones for life science
Agree	Use what we have and this is all we have.
Agree	Different ways--start to finish --- models --- strategy for ensuring that pieces are not left out - conception models and road maps for moving forwards
Agree	More for a sanity check-absolutely imperfect- supply and demand dependent- but it is important to use the numbers as a form of check and balance; sanity. Depends on the market variables.
West Coast United States: Seattle and California – 4 respondents' comments.	
Agree	comparables---sanity check
Disagree	Not enough solid valuation methods to use that can predict the uncertainty that is experienced when assessing proposals
Neither Agree nor Disagree	Only things we have at this time.
Agree	These are the ones that we have and I have been using for the past 10 years. Truly it is about what people are willing to pay and supply and demand.

Respondents were asked about investment choices and direct selection preferences. Almost 100% of the all the respondents either strongly agreed or agreed that past investment choices influenced future investment choices (Figure 29). When respondents were asked whether they tended to select investment opportunities that were related to their educational/work background, 63% of the respondents (12/19) either strongly agreed or agreed (Figure 30). When asked about whether they tended to choose/select investment opportunities that were similar to past successes over those proposals that were not, 60% of all respondents either strongly agreed or agreed, and 30% neither agreed nor disagreed (Figure 31). Interestingly 75% of the United States respondents either strongly agreed or agreed, whereas 40% of the Canadian respondents simply agreed. Also, 40% of the Canadian respondents neither agreed nor disagreed. Three (3) of the Canadian respondents mentioned that they chose this category because it was easy to become “biased” and complacent with respect to this type of decision making and that it was important to “*keep one’s eye on the ball to changing variables*”. When respondents were asked whether life science investment opportunities were more difficult to assess than other types of investment opportunities (e.g. high-tech proposals), 30% of Canadian respondents agreed whereas 60% of United States respondents agreed (Figure 32). Overall 52% of the respondents either strongly agreed or agreed. Interestingly 60% of the Canadian respondents neither agreed nor disagreed. Respondents were also asked whether Venture Capital experience/expertise is positively linked to successful investment selection (Figure 33). Of all the respondents, 90% either strongly agreed or agreed. United States respondents strongly agreed compared to Canadian respondents who simply agreed.

Figure 29. Percentage of Venture Capitalists who agreed that Past Investment Choices Influenced Future Investment Choices. West Coast Canada (n=10) and West Coast United States (n= 9).

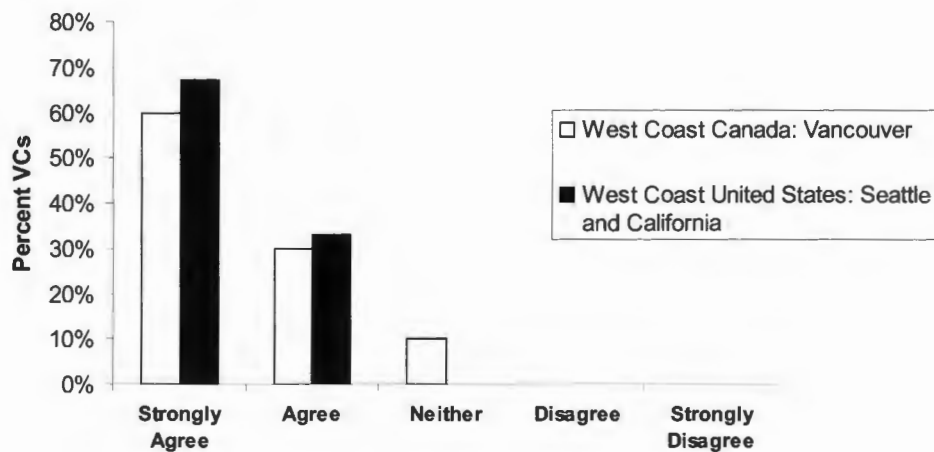


Figure 30. Percentage of Venture Capitalists who agreed that they tended to select Life Science Investment Opportunities related to their educational background over opportunities that were not related. West Coast Canada (n=10) and West Coast United States (n= 9).

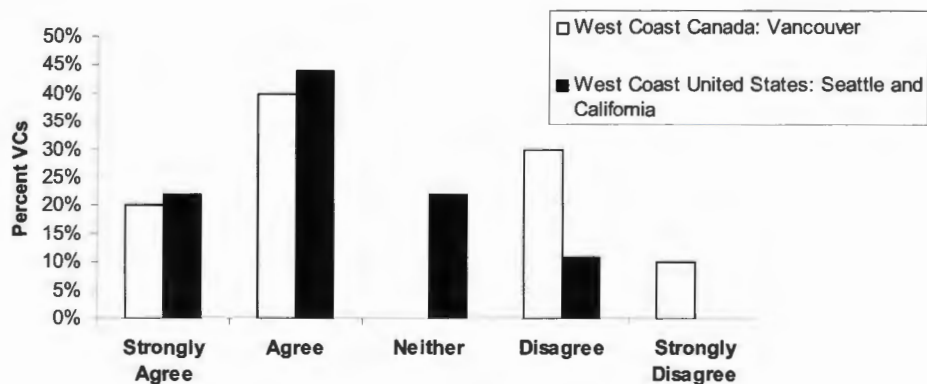


Figure 31. Percentage of Venture Capitalists who agreed that they tended to select Life Science Investment Opportunities similar to past successes over those which are not. West Coast Canada (n=10) and West Coast United States (n= 9).

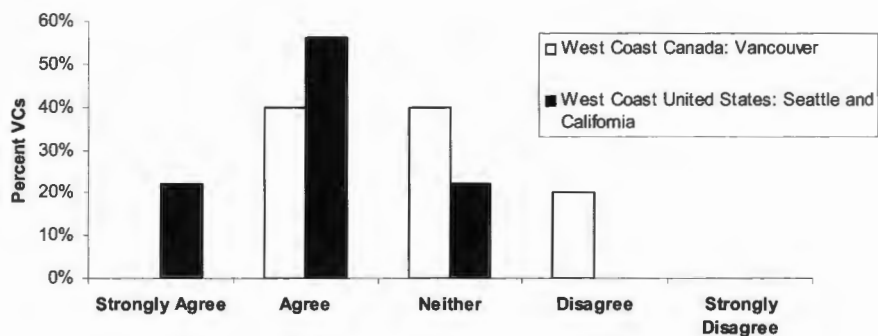


Figure 32. Percentage of Venture Capitalists who agreed that Life Science Investment Opportunities are more difficult to assess than other types of Investment Opportunities. West Coast Canada (n=10) and West Coast United States (n= 9).

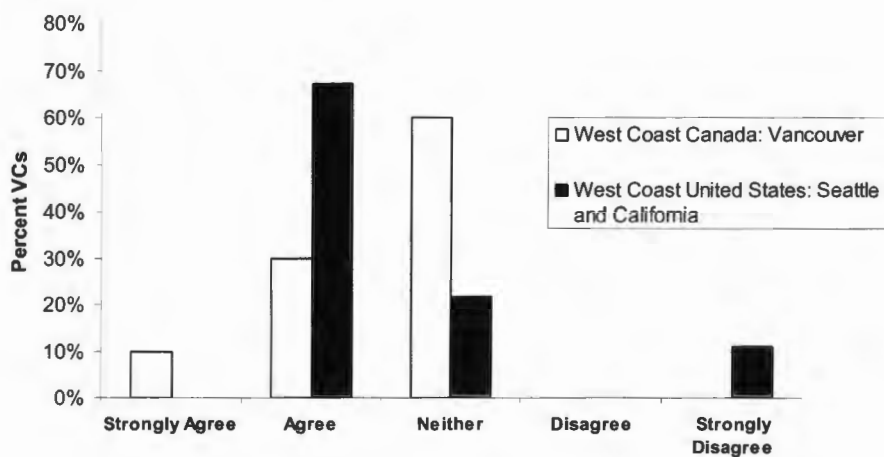
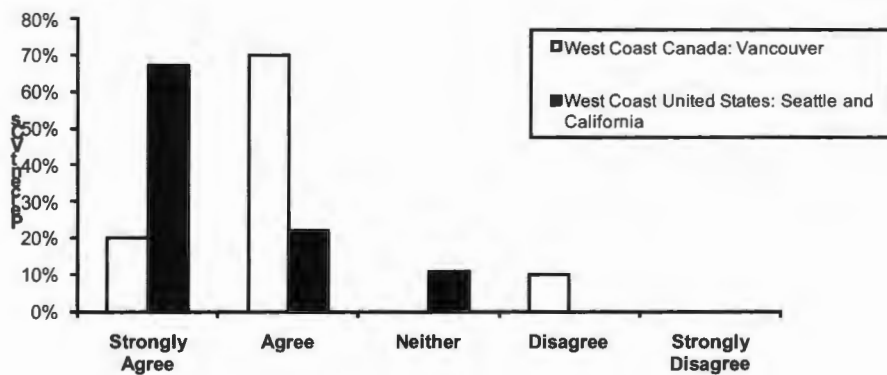


Figure 33. Percentage of Venture Capitalists who agreed that Venture Capital expertise/experience is positively linked to successful investment selection. West Coast Canada (n=10) and West Coast United States (n= 9).



Respondents were asked what overall hurdle rate of return they expected from successful life science investments, where successful was defined as being better than average. The responses were varied, ranging from 10% to 1000% rates of return, but the majority (70%) of the respondents replied that a hurdle rate of 30%-70% was a reasonable return to expect. When asked what proportions of their investments they expected, in the long run, to reach a successful exit, the typical response was "*all of them, of course*". When asked what realistic proportion of their investments reached a successful exit, the majority of the respondents replied that between 10-30% of their investment were successful, with approximately 50% of investments giving minimal returns. See Table 5 and 6 for comments.

Table 5. Canadian respondents' comments with respect to the expected Hurdle Rate of Return and the proportion of investments expected to reach a successful Exit (respectively).

West Coast Canada: Vancouver Respondents (n=10)	
1	Hurdle Rate: 40% minimum
	75% expect
	30% reality: target IRR
2	Hurdle Rate: 30% minimum
	30% ---- 100% for really successful
3	Hurdle Rate: We have a hurdle rate of return of between 30-60% depending on the project.
	10% big wins; 20% craters-failures; 20% modest to little returns; 40% considered average.
4	Hurdle Rate: 30% for Portfolio or 25x per individual project
	25% successful-making lots of money.
5	Hurdle Rate: Multiples of 5-10 times or 25%; but have received multiples of 24 times; 272%; XXX best deal has been 270% IRR.
	2/10 - 20% success; would like 3-4/10 or 30-40% ...but not reality.
6	Hurdle Rate: 30% - internal rate of return.
	20-60-20; therefore 20% should be successful
7	Hurdle Rate: Minimum 40% IRR
	20%
8	Hurdle Rate: 30%- blended --- IRR 50%
	15%
9	Hurdle Rate: 35% return on investment. Set by IRR target.
	All of them of course. Out of the 18 companies that we have invested in--3 have been outright failures.
10	Hurdle Rate: 3 times- endpoint--300% add in time constant.
	20%

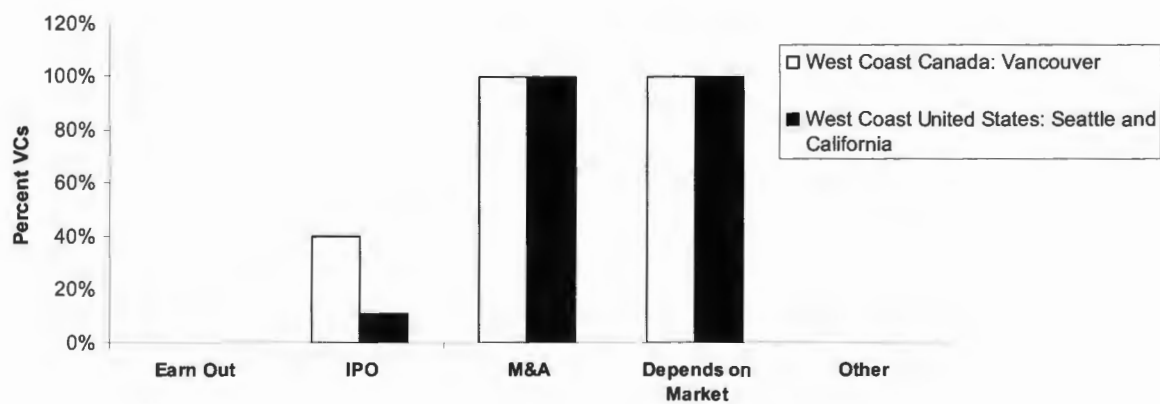
Table 6. United States Respondents' comments with respect to the Expected Hurdle Rate of Return and the proportion of investments expected to reach a successful Exit (respectively).

West Coast United States: Seattle and California Respondents (n=9)	
1	Hurdle Rate: Not able to answer that
	25%
2	Hurdle Rate: 30% later---60-70% early stage
	All of them - but realistically 20%
3	Hurdle Rate: 11X/ 3X--- 4-5X
	All of them--90% in the past few years; 10% realistically
4	Hurdle Rate: To make money - 30%
	Of course you hope for all of them; realistically 10%
5	Hurdle Rate: 3x-300%
	30-50% in the past few years-----20% realistically
6	Hurdle Rate: IRR 30% and above for biopharmaceutical; 3x for other types such as devices.
	80% in the last 4 years
7	Hurdle Rate: 2-3x
	Rule of thumb -10%-20% ;25%
8	Hurdle Rate: High multiple ; cash on cash return
	2-3 out of 10 will succeed; 5-6 will be average or break even; 2 will fail
9	Hurdle Rate: 3-6x
	50%

Respondents were asked what they considered as the most desirable exit route for life science investments (Figure 34). All respondents, 100%, replied that M&A had been, in the recent past, the most desirable route of choice. All respondents also commented that exit routes depended on market conditions, highlighted by four (4) of the United States respondents who explained that because M&A and IPOs depended on market conditions and interest rates, exit routes were continuously changing. Four (4) of the 40% of the Canadian respondents considered IPOs as desirable exit routes, but only 10% of the United States respondents found this route desirable. With respect to IPOs, two (2) of the United States respondents commented that they considered them more as a refinancing option than an exit route. General comments were directed towards the stock market volatility in technology stocks, the length of time it took for an IPO financing period, the paying off of underwriters and generally the long waiting game of getting one's money back out of the market. As one of the United States respondents mentioned:

"IPOs are one big headache right now, because of the market swings and the uncertainty. A lot of the bigger pharmaceutical companies are currently searching for technology to augment their pipelines and therefore there are still lots of opportunities for M&As"

Figure 34. Most desirable Exit Routes for Life Science Investments. West Coast Canada (n=10) and West Coast United States (n= 9).



The respondents were also asked how long they expected to wait in order for an investment to return capital (Figure 35). The majority of the respondents (90%) replied within two categories: 3-5 years and 5-7 years, with four of these respondents replying 3-7 years. Interestingly, 50% of Canadian respondents, after picking a specific time range for investment, were willing to wait longer than 7 years. This was not the case with the United States respondents. Respondents were asked what they thought were some of the key challenges Venture Capitalists had in terms of selecting life science opportunities to invest in. The responses were compiled into six main categories: financial efficiency challenges, management team challenges, technological evaluation challenges, opportunities availability challenges, future trends and risk challenges and finally deal processing/negotiation challenges (Figure 36). Of note, the main challenge was management teams (12 responses), technological evaluation (9 responses), opportunities availability and future trends and risks (7 responses each). Canadian respondents (4 responses) were also concerned with deal processing/negotiation challenges. With respect to opportunity availability challenges, these were more pronounced with the Canadian respondents than the United States. The United States respondents were more concerned about future trends and unforeseen risks than the Canadian respondents. For a complete list of all respondents comments please peruse Figure 36 and Table 7.

Figure 35. Venture Capitalist's expectations for Time Period between Initial Investment to Capital Return. West Coast Canada (n=10) and West Coast United States (n= 9).

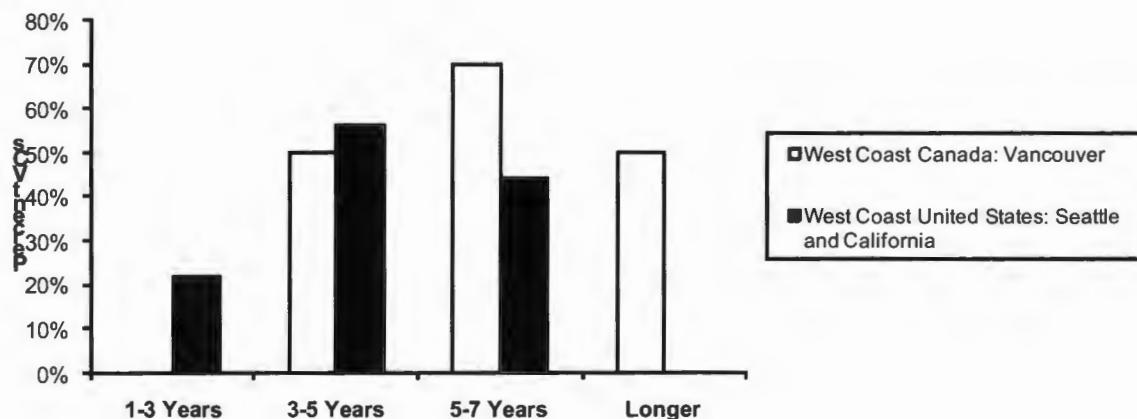


Figure 36. Key Challenges in selection of Life Science Investment Opportunities by Venture Capitalists. West Coast Canada (n=10) and West Coast United States (n= 9).

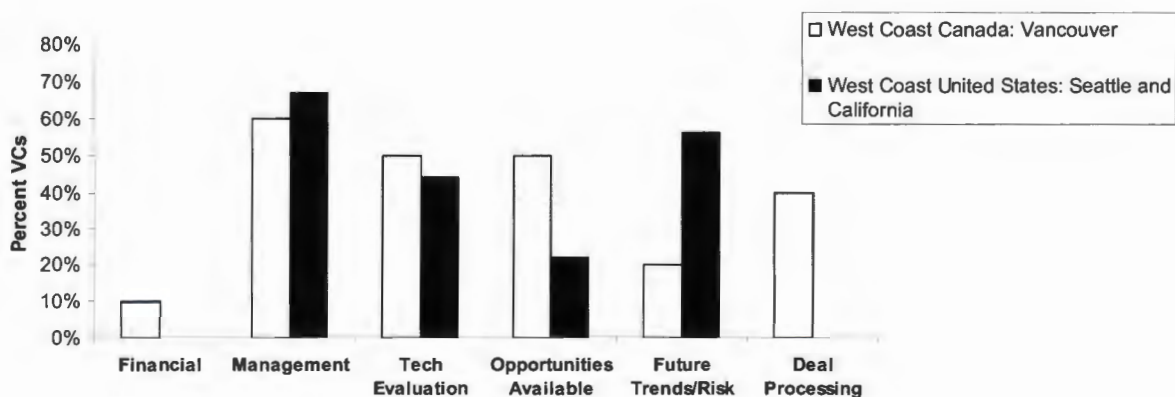


Table 7. Respondents' comments with respect to the Key Challenges in terms of Selecting Life Science Investment Opportunities.

West Coast Canada: Vancouver Responses (n=10)	
1	1. Independence, experience of management team: are they experienced in medical and clinical understanding and timelines. 2. Ability to attract the talent and build good management teams for companies who will be or are part of the fund portfolio- how does one attract good management; acting almost like a recruitment agency; 3. Valuating the probability of management to execute on agreed upon timelines.
2	Evaluating management and assessing people qualifications; Evaluating the technology and finding an expert that can assist with evaluation---and then the overall evaluation.
3	People--especially people that are not experienced. Also cash efficiency--some firms are managed inefficiently and expensively.
4	Limited deal float-limited opportunities available.
5	Understanding future trends; understanding financing plan and attracting good management teams, opportunities available.
6	Processing of deals: the deal is not truly closed until final closure occurs. This is a frustrating time because everyone is nervous and there could be potential last minute scuttles if for instance there is a syndication pull-out or fund oversubscription. Another important point is getting everyone onto the same page and agreement w.r.t. a proposal-this can be very challenging sometimes: both externally and internally.
7	Creating deal flow attractiveness; capability of assessing the technology-diligence- external expertise-to have the ability to process things to a decision point and move from there.
8	Science, data, people; competing forces; goal posts shifting constantly.
9	Understanding the technology and the risks that are involved with the technology--this can be very difficult. There are also a lot of challenges with IP and a lot of grey areas. Understanding the development pathways of the technology and clinical program that it should be involved with can only be truly conducted using trusted management teams who are proficient and have experience.
10	Finding good opportunities.
West Coast United States: Seattle and California Responses (n=9)	
1	Nuances between the similar technologies and gauging what makes one technology better than another one.
2	Evaluation and finding appropriate management teams
3	The quality of the management team is the most important challenge.
4	Unmet medical needs-regulatory environment - uncertainties
5	Risk- the unsolvable risks that cannot always be predicted for. Risks are hard to mitigate.
6	Management; IP; market size- risk reward profile.
7	Finding the right technologies to invest in; finding good opportunities; science is hard; regulatory and scientific risks etc; management. Guessing right on the science; addressing all the risks and issues and watching the ball to see where it is rolling into the future.
8	Finding a good management team. Then the next is clinical and regulatory risk and strategy; then getting your money worth.
9	Good people are the most challenging to find and then the obtaining of good technology.

Respondents were asked whether they would or would not invest in a difficult to understand life science investment opportunity. The majority (90%) of United States respondents strongly agreed/agreed compared to Canadian respondents, who agreed 60% of the time. Of note, 30% of the Canadian respondents disagreed (Figure 37).

Two questions were asked with respect to success rate and capital expenditures required when developing life science from the concept stage to market (Figure 38 and 39). These questions were asked to gain further insight on the debate of why so many life science initiatives may fail. Both the Canadian and the United States respondents appeared mixed in their opinions but Canadian respondents had a large minority that disagreed (30% and 40% respectively). Comments given by Canadian respondents include: *"...I am highly suspicious of the statistics that surround these numbers."*; *"We have assisted in helping very virtual and small companies become established, companies that have not had to pay large infrastructure costs etc."* Comments, on the other hand, that were given by United States respondents include: *"When taking into account the huge infrastructure costs and the large data banks that are filled with unsuccessful molecules and entities, then yes I agree to both of these questions."*; *"I believe that these numbers have most probably been very well researched and highlight the rarity of success within the life sciences, particularly in biopharmaceuticals."*

Final comments were asked of the respondents. Only nine (9) of the respondents commented. Table 8 gives the range of these comments.

Figure 37. Percentage of Venture Capitalists who would not invest in a difficult to understand Life Science Investment Opportunity. West Coast Canada (n=10) and West Coast United States (n= 9).

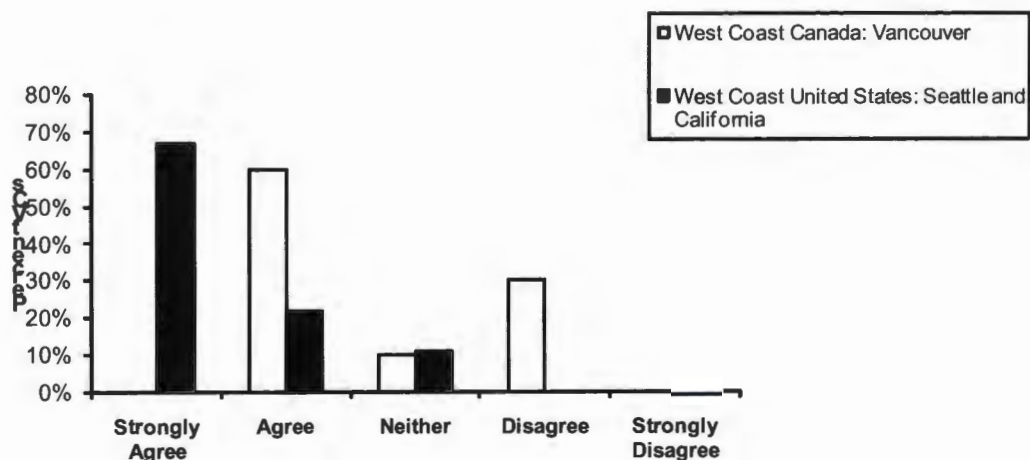


Figure 38. Percentage of Venture Capitalists who agreed that the success rate of Life Science Commercialization is one in 10,000 molecules (Including Failures). West Coast Canada (n=10) and West Coast United States (n= 9).

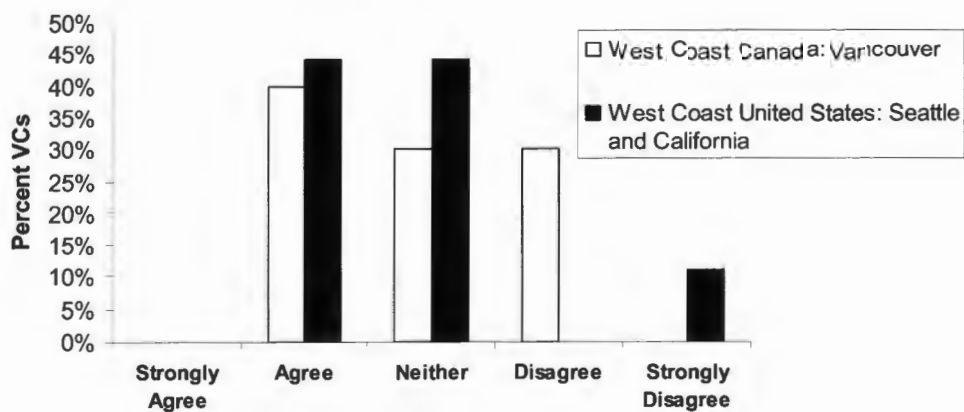


Figure 39. Percentage of Venture Capitalists who agreed that Life Science Development Costs (Biotechnology), from concept to market, are close to \$800 million USD. West Coast Canada (n=10) and West Coast United States (n= 9).

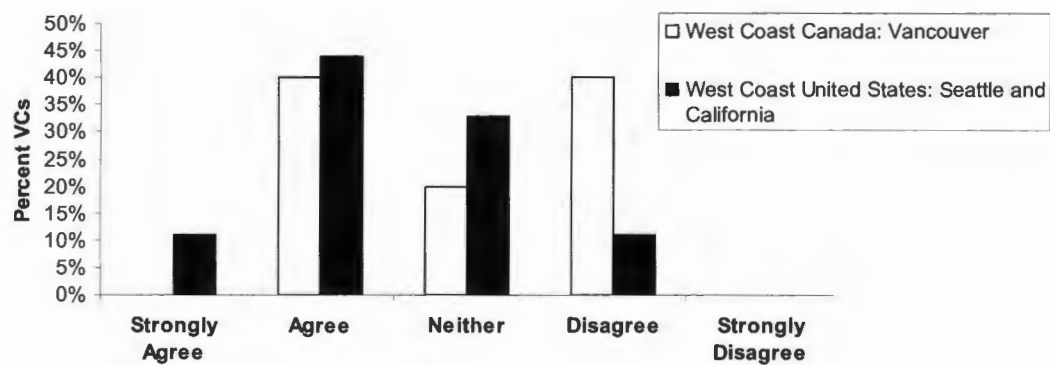


Table 8. Final Comments from Respondents (n=9).

West Coast Canada: Vancouver Responses (5)	
1	When someone approaches VCs with a prospective proposal, timing is everything. A big problem with new management teams is the lack of relationship building that occurs when setting up initial companies; these relationships with VCs need to be nurtured. Future commitments to a proposal/company are not given and that is not because VCs don't want to commit, but because they can't due to other priorities or fund criteria. If a VC does not know where a company is going/heading with respect to future initiatives, it is hard to request the VC to be a backer.
2	Canadian VCs tend to invest in earlier rounds of financing than US VC---US will generally invest in later stages and rounds.
3	People like to invest in what they are comfortable with because they have to have hands on experience and sit on the majority of boards. VC needs to know what is going on.
4	The importance of people can not be underestimated.
5	In order for me to be interested in a proposal I need to see that the company has demonstrated that there is a clear development pathway. I need to see the plan and clinical strategy, even if this is only a pre-clinical staged company. I would like to see the draft label of the lead product and how it is going to be marketed and to whom. I like platform technology or a product pipeline---no one-trick ponies.
West Coast United States: Seattle and California Responses (4)	
1	We are not a traditional venture firm. For one, our goal is to combine investor returns with positive social impact. To this end, we are only interested in opportunities which possess both of these traits. Specifically, we seek discovery-oriented, preclinical therapeutics companies founded by senior scientists with excellent research credentials. We are not interested in devices, services, or diagnostics. Typically, the entity will already have been incorporated and will have licensed the founding scientist's technology (or have an option to license contingent on funding). The company may have raised some angel money, but usually no substantial institutional money. We are looking to invest up to a few million dollars to start, with the ability to invest substantially more over time.
2	The maximum amount of investment into any company is capped at \$50-100 million USD.
3	It would be fantastic to have a study done on VCs with respect to board dynamics and HR issues focusing in on management teams and how experience, trust and competence creates success.
4	Virtual start-up companies are the best with maybe 5 employees-big pharma are interested in companies with robust phase II data and entering strongly into a phase III trial. In a sense the small companies are not being folded; they are becoming entities like outsourced research companies where the new technology is being fostered and handed off to the big pharma. Sometimes a small biotech will be lucky to enter a niche market and then boom from there; such as Genentech did as well as Amgen did. Mostly though first player status pays the biggest.

CHAPTER SIX – Discussions and Conclusion

6.1 Discussion and Implications of the Study: Decision Making Process for Investment Selection

First research question:

1) Are there specific life science investment strategies and criteria that Venture Capitalists seek?

From the study results and relating back to the literature discussion of the basic venture capital model and the roles that Venture Capitalists perform, it was found that there indeed are very specific life science investment strategies and criteria that Venture Capitalists use and seek. Fried and Hisrich's (1994) model of Venture Capital investment decision making process with inputs for Baeyens *et al.*, (2005) seems to be very much so, the model of choice, with specific focus on life science technologies targeted, preferred stages of development chosen, geographical location and minimum, maximum investment required to exit.

Interestingly, the United States respondents, as opposed to the Canadian respondents, of the study were more strongly inclined to agree that these strategies and criteria are used and focused upon, especially with respect to investment amount required. Canadian respondents had a much broader spectrum of replies.

Geographical location, the nearness of the actual development of the investment opportunity, was found to be important. As one United States respondent mentioned, he was not concerned where a technology or investment opportunity came from, but rather that the technology or investment could be established and developed near him, making it logistically easier for him to monitor. This brings into account the importance of monitoring by the Venture Capitalists. All of those interviewed were active monitors of their investment

portfolios, whether indirectly or directly as board members. As discussed earlier in the literature section, Venture Capital monitoring has been directly linked with the successful development of the investment, in particularly within the life science industry where the development timelines are both intricate and lengthy. Therefore selection of investment opportunities that logistically favour the ease of monitor is not surprising.

There were four specific screening criteria discussed, including financial criteria, market size, intellectual property (technology) and management. Whereas all these screening criteria were agreed to as to their importance, management team characteristics were the overwhelming response choice by both Canadian and United States respondents as being the number one aspect that was sought after. Management experience and the ability to work with selected management were also found as being the number one challenge with respect to having successful opportunity development. This implies, and agrees with the peer reviewed literature, that management characteristics are almost more important than the actual technology itself. As one United States respondent commented:

"It is easier to get to an opportunity exit with an experienced management team than with a management team that has little to no experience. I'd prefer to work with a poor technology that is being developed by an experienced management team any day over an incredible stellar technology that has an inexperienced management team. I have seen many stellar technologies fail because of inexperienced management teams."

The same respondent further elaborated that even though the major concern was with management, he felt that *"this was truly a non issue as I can always place my own management team into the driving seat when necessary"*.

Technology was the strong second strategy choice of the United States respondents, but surprisingly not the overall focus of the Canadian respondents who responded that stage of the technology was more important. One of the United States respondents mentioned that his most pressing difficulty was finding interesting and novel technologies that could be nurtured.

There was a strong sense of passion detected by most of the respondents with respect to investing into life science technologies, especially ones that promised solutions to unmet medical needs. This implies that even though management teams are considered the most important trait of success of any investment, Venture Capitalists are also passionately focused on the technology that is being invested in and almost appear to have internalized their role as one of searcher for technological solutions, particular within the unmet medical needs arena. Of course, innovative technologies within an area that needs technological answers also carry a wealth of business possibilities.

Another aspect of technology selection criteria was the focus on technology as intellectual property. Intellectual property is what the Venture Capital firm invests in and it is understandable that such intangible assets should be considered important. Therefore it is not surprising that all the respondents of the study felt that assessing the technology opportunity at hand, in terms of its value as an intellectual property, was extremely important.

An interesting aspect with respect to selection was noted with the screening question of rejecting opportunities that represented unclear regulatory risks. The United States respondents fully agreed that these types of opportunities should not be pursued because they increased risk. Canadian respondents, however, did not concur. There was disagreement

from the Canadian respondents who felt that such risks were always either present or could be mitigated. The complete reverse, however, was found with respect to rejecting opportunities that carried negative public opinion. The majority of United States respondents disagreed that these technologies should be rejected and the majority of Canadian respondents agreed that they should. These two questions may have honed in on the investment environment that these two groups operate within as well as the stakeholders involved. Canadian respondents probably had much higher stakeholder risk with negative public opinion because of their government mandates, whereas United States may have felt that regulatory environments and key opinion leaders carried much higher cause for concern when considering whether a technology was worth pursuing.

When taking into account the time frame in which the respondents sought to gain results and capital from their investments, United States respondents sought results on a shorter timeline span than Canadian respondents and were less flexible to expanding agreed upon timelines. This can be reflective, again, of the investment environment of the various respondents interviewed as well as perhaps the cultural differences of the two countries. A number of the Canadian respondents represented funds that were supported by the government of Canada. In these types of funds there was much less emphasis on when return on capital investment should be expected and as one of the respondents commented: "*these are patient investment funds*". Patience was not an aspect reflected by the United States respondents and most of the respondents interviewed from United States did not access capital from government sources.

Patience and tolerance, however, are two important characteristics required in life science technology development and investment. Years are required before an investor may see a

return. It was found that the results from the interviews correspond with the literature that periods ranging from three (3) to seven (7) years were the ideal time ranges sought by investors. However this does not reflect the true timelines of life science technology development already mentioned, in particular within the therapeutics arena where fifteen (15) years is not an unusual development time span. How do the Venture Capitalists move the technologies that they invest in, into the next stages of development? It was assumed that as soon as the life science technology is developed to a certain phase, exit strategies were pursued that would allow that technology to go to the next level of development. From the interviews it was found that M&A had been, in the recent past, the exit route of choice. This was concurred with by both the Canadian and the United States respondents. IPOs had been considered an exit route in the late 1990s but were no longer considered as such by most of the United States respondents. The United States respondents were particularly against the IPO method as an exit route, exclaiming that such routes were “...*a pain in the butt...*” and “...*only a way of driving a person insane...*”

Interestingly, though it was not a route of choice by Canadian respondents, four Canadian respondents mentioned that they were considering IPOs as an important option for raising capital. This sentiment was also expressed by one of the United States respondents who stated that IPOs should be considered as another venue for raising important investment capital, but not as an exit route. This may appear as semantics on the part of the Venture Capitalists, but it is important to note that while IPOs may present difficulty for the Venture Capitalists with respect to exiting an investment quickly and smoothly, IPOs do provide the opportunity for Venture Capitalists to continue their investment in a technology that is believed in, an investment that may require a longer timeline to bear profit.

6.2 Discussion and Implications of the Study: Return on Investment and Financial Valuation

The second research question:

2) Do Venture Capitalists use specific valuation methods to identify investment opportunities that they fund? If yes, what processes and methods do they use to select investment opportunities?

In order to survive as a Venture Capital firm, the investments that are made must make viable returns on investment that allow for both future capitals to be raised as well as for the survival of the Venture Capital firm. From the interviews with the Venture Capital respondents, there did not appear to be a clear opinion on what the returns should be. The ranges were anywhere for 10% to 1000% returns, but by taking the average of the answers, a range of 30-70% was achieved, which concurs with the literature expectations. It is possible that these broad ranges simply imply that with the high investment risk involved with respect to life sciences portfolios, the actual average returns may vary drastically from company to company depending on individual company success rates, current portfolios held and past investments of new and innovative technologies. As one of the respondents commented: *"the investment is worth as much as the market is willing to pay for it at the time; no more and no less."*

From the literature, it was discussed that many financial valuation techniques and models can become unpredictable when used with novel and early stage technology investment opportunities. This is especially the case with investment opportunities that have long timelines, unforeseen risks associated with them and no revenue flows for many years (Berlin 1998; Elango *et al.*, 1995; Fried and Hisrich, 1994; Sahlman 1990). The results from the

semi-formal interviews give trends and comments that support this literature opinion. The United States were extremely adamant that Discounted Cash Flows (DCF) were less than useless for assessing life science investment opportunities, including medical device investments. One of the respondents mentioned that DCFs were “...*like making astrology predictions.*” It was surprising that 40% of Canadian respondents neither agreed nor disagreed that DCFs were useful, giving no opinion at all.

With respect to other valuation methods, simulation models appeared to be equally despised by the United States respondents as with the DCFs, but Canadian respondents gave broader base responses with 30% either strongly agreeing or agreeing that this type of technique was useful for predictions of investment worth. This may reflect that Canadian respondents have been using these models, finding some aspects of them useful. P/E multiples, were met with a broad response by all respondents, suggesting that this technique was most probably used as a comparator of what capital markets thought investment shares were worth rather than a direct measurement of what a specific technology was worth.

Qualitative financial techniques, however, were the techniques of choice used for evaluation. Again this is in line with the literature discussed previously. Comparators and comparables were unanimously mentioned by all respondents in the study where techniques such as Rules of Thumb and qualitative market assessments were stated as extremely useful. When asked whether current financial techniques were useful and beneficial, at least 50% of all the respondents agreed that they were. Generally the comments reflected the sentiment that even though these techniques were far from perfect, they were the only ones available and they provided a “*sanity check*” for what the investment opportunities may be worth. Qualitative

techniques most probably allow the investors to achieve a sense of what a similar investment is worth compared to similar technologies from the recent past. This type of comparison would give a sense of confidence to the Venture Capitalists that they are, hopefully, not paying too much. Comparable assessments can, in a sense, be almost perceived as similar to real estate: completely dependent on what the market can bear and what a certain type of asset is worth at the time. The only difference being that the assets involved are mostly highly intangible life science technologies. In fact that is exactly what one of the respondents clearly stated with respect to the valuation methods used: *"These [valuation methods] are the ones that we have and I have been using them for the past ten years. Truly it is about what people are willing to pay; supply and demand"*.

With such types of valuation techniques used, it is not surprising, either, that Venture Capitalists request such high returns on investment. Comparably, the assessments are at best extremely subjective, requiring much cross referencing with past performance as well as competitor deals that may or may not depict similar circumstances. This in turn increases the risks. Comparables, where they are flexible and most probably the best to be used within these conditions, they do not begin to address the risks of information asymmetries that are associated with novel technologies.

6.3 Discussion and Implications of the Study: Risk, Perception Risk and Information Asymmetry

The third research question:

3) Are Venture Capitalists susceptible to perception risks such as information asymmetries, when choosing life science investment opportunities?

The potential risks of information asymmetries are, as discussed in the literature review, huge with respect to any novel investment opportunity within the life sciences. It is a matter first of all of being able to understand the technologies and a matter of whether information relayed by the founder/management of the technology can be trusted.

Trust and knowing someone from past experience, therefore, is a bit like hedging the bets against information asymmetry, protecting oneself against too much risk. It is to the point where management team qualifications can almost be considered as a valuation technique used for assessing the worth of the actual technology. With both the support of the literature as well as from the semi-formal interviews held, it appears that Venture Capitalists indeed operate using perception risks in a manner to mitigate the risks of possible information asymmetry, in this case the perception risk being the choice of management teams. Among respondents, the experience level of the management team was considered the number one criteria for investment selection. If the management team or founder was unknown or inexperienced, respondents commented that they were more likely not to pursue the opportunity. As one of the respondents commented:

“Understanding the technology and the risks that are involved with the technology – this can be very difficult. There are also a lot of challenges with IP and a lot of grey areas. The development pathways of the technology and clinical programs can only truly be conducted using trusted management teams who are proficient and have experience.

In fact, from the intense focus that the respondents gave to the selection of trusted management teams it would seem that Venture Capitalists may perceive the possibility of information asymmetry risk as the highest possible risk with respect to life science

investments. As discussed in the literature section, this type of adverse selection may in turn increase unforeseen risks, or perhaps worse, select out novel life science technologies that may have huge impacts on unmet medical needs and lucrative investment benefits. Focus on management team selection can possibly impede the path to the development of new and novel technologies simply because an experienced management team may not be familiar with or have an adverse opinion against a certain technology. There are many examples where failed technology prototypes have created preconceived opinions for the future of those same technologies such as in the case of antisense technologies, protoxins, and medical devices such the initial cardiac stents and retractable needles. In these cases, regulatory guidelines were usually confusing and unclear, increasing the risk of possible development failure (Evans and Nikhil, 2003; DiMasi, 2003; Bains, 2004; Angell, 2004). Respondents were asked whether they felt it was important to reject investment opportunities that had unclear regulatory guidelines and risks using examples such as the ones just stated. Interestingly a majority of respondents from the United States agreed outright, but the majority of Canadian respondents either did not choose to agree or disagree or simply disagreed.

Even though the mitigation of information asymmetries is important, there needs to be recognition of the types of risk this mitigation may entail. Experienced management teams may develop foregone conclusions in thinking that they know what types of technologies are worth pursuing and which are not. There are many historical examples where life science technologies that eventually had some of the largest impact on the medical world, as well as being financially rewarding, were initially shelved and ignored by experienced management. This can be reflected in life science drug technologies such as Herceptin, Prozac and Viagra,

present day blockbuster drugs, which were all placed on the laboratory shelf and almost forgotten in part because of management decisions (Angell, 2004; Bains, 2004; DiMasi, 2003; Evans and Nikhil, 2003)

Aspects of this study, however, point directly to the vigilance of Venture Capitalists. When asked the importance of excluding investment opportunities that are difficult to scientifically understand, 50% of all the respondents disagreed. One respondent from the United States stated:

“One can always get assistance from key opinion leaders and other scientists. Novel technologies are not always easy to understand.”

This gives some evidence that some of the respondents in this study were not willing to reject technologies on the pure fact that they were not immediately understood. But it does highlight again the reliance of opinions from trusted managers. There was much emphasis placed on investment selection with respect to technologies by both study groups and especially from the respondents in the United States. How technology selection directly links to management team selection, as well as how the deciphering of difficult to understand technologies is achieved, was not directly studied. Comments, however, did give some insight where one respondent from Canada noted that:

“...sitting down with the founding scientist is important to build a relationship, but also to get a handle on the technology. But it takes time to develop a trusting relationship and that is not always easy.”

6.4 Discussion and Implications of the Study: Education & Experience Leading to Adverse selection & Overconfidence

The forth and final research question:

4) Are Venture Capitalists qualified to make investment decisions on new life science investment opportunities?

Specifically:

4a) What are the educational and direct industry experience levels of Venture Capitalists?

4b) Does amount of education and/or experience have an effect on which life science investment opportunities are chosen?

4c) Does a life science investment choice influence future life science investment choice?

From an educational point of view, both the Canadian and United States respondents have high levels of education with the lowest level being an undergraduate university/college level degree and the highest being the level of PhD or MBA. Canadian and United States respondents have similar amounts of years of experience with respect to working in Venture Capital. The Canadian respondents, however, appear to have remained in the same initial Venture Capital firm they began whereas the United States respondents had worked for several firms over the course of their careers. An interesting aspect was that Canadian respondents also had less, average direct work experience with the life science sector before they worked as Venture Capitalists compared to the United States respondents. In this aspect it may be conceivable to state that Canadian respondents may be at a disadvantage with respect to having insights into the workings of the life science sector.

In order to assess whether Venture Capitalists are qualified with respect to investing in life science opportunities, it is important to understand whether amount of education and/or experience have an effect on which life science investment opportunities are chosen. This links to the possibilities of overestimating one's own knowledge and ability in making the correct decision (Griffin and Vary, 1996). Zacharakis and Shepherd, (2001) suggest that if a person relies fully on his/her "knowledge", then overconfidence in the legitimacy of the final decision is linked with the amount of education or "knowledge" that person has. When the direct question of whether respondents tended to select opportunities related to their educational background over those that did not, the majority of respondents concurred that this was indeed so. This would assume that many of the respondents depended directly on their educational background to assist them with understanding and choosing investments. It also suggests that there is possibility for overconfidence to be established with respect to the decisions that are made, as discussed in the literature review. This type of overconfidence can be problematic because it impedes the Venture Capitalist's ability to perceive investment opportunities for what they truly are (Zacharakis and Shepherd, 2001).

It has been shown, however, that while Venture Capitalists may be susceptible to overconfidence in investment choices, they also vary about the decisions that they make (Zacharakis and Shepherd, 2001). Cognitive research literature has shown that the more information that is gathered, the more confidence is given to the final decision made (Zacharakis and Meyer, 2000). However, from the study conducted by Zacharakis and Shepherd (2001) they found that the link of overconfidence with respect to huge amounts of information was weak with respect to the Venture Capitalists that they studied. This somewhat concurs with this study, where it was found that even though a majority of the

respondents agreed that they relied on their past education, comments also suggest that individuals dealt with challenges posed by having too much information, one being company meetings where technology opportunities were discussed as well as gaining opinions from key opinion leaders to sort through large amounts and varied information. It therefore would appear that the amount of individual education and information was not always enough to establish confidence. The confidence that was gained from the opinions of experienced and trusted industry leaders, scientists and management is alluded to as being a much stronger motivator for selecting or rejecting an opportunity. The extent, to which these other individuals were used to assist with technology assessment, was not measured directly in this study. As to the perception risks that may occur with too little educational background and experience, as discussed by Shepherd *et al.*, (2003) and Franke *et al.*, (2006), it may be that the respondents who disagreed that they selected opportunities based on their educational background, made efforts to gain advice from trusted and experienced scientists, management and key opinion leaders - trusted individuals who were related to a particular technology being assessed. This, again, is difficult to measure from this study.

In this study past investment choices were found to be associated with future investment choices. This relationship can be perceived as a way that the respondents (90%) used experience and selection as a method to spread risk within their investment portfolios (Amit *et al.*, 1998; Patzelt *et al.*, 2006). Patzelt *et al.*, (2006) argued from their results that this would assume that their respondents and Venture Capitalists as a whole would be considered passive investment selectors, selecting purely on a diversification strategy. Venture Capitalists are indeed far from passive, having substantial influences over which opportunity is chosen and the direct management responsibilities that they take with their portfolios. As

agreed by Patzelt *et al.*, (2006) past investment choices most likely influence future investment choices due to the possible synergies that may be achieved either through working with familiar founders, management and or the technology itself. This suggests that overconfidence may play a large role in investment selection and reflects back on the question of information asymmetries, management selection and perception risks.

Cognitive theory states that positive experience can play an overemphasized role in decision making (Baron 2004; Griffin and Vary, 1996). Zacharakis and Shepherd (2001) discuss the act of optimistic overconfidence which is the tendency to overestimate the possibility that an outcome will occur based on the positive experiences of the past. The authors further discuss that when making decisions based on positive experiences in the past there is a likelihood of investment committing resources without thoroughly considering additional information. In this study, the United States respondents firmly agreed (70%) that past successful experience did influence their future choices, whereas only 40% of the Canadian respondents agreed. Interestingly 40% of the Canadian and 20% of United States respondents neither agree nor disagree. When asked why they chose to neither agree nor disagree, three of the Canadian respondents stated that they were concerned with possibilities of adverse selection and overconfidence that didn't add value, but instead initiated "...*taking the eye of the ball*". This implies that adverse selection and overconfidence does exist, in particular with respect to making future choices using experience from the past, and that at least some of the Venture Capitalists were aware of these risks.

Risk and adverse selection was linked with the comprehension of new and novel technologies was explored. As stated in the literature review, life science technologies are rated as some

of the most intricate and difficult to understand out of all other types of technologies (Baeyens *et al.*, 2006; Evans and Nikhil, 2003; Lockett *et al.*, 2002). If the life science technologies are difficult to understand there may be increased overconfidence in choosing technologies that are either familiar from past experience or ones that are comparatively easier to understand than others. With respect to whether Venture Capitalists feel that life science investment opportunities are more difficult to understand than other types of technologies, it was found that a majority of the United States respondents agreed. This would suggest that there is definitely an awareness of the difficulties in understanding the intricacies involved with life science technologies. A cautious approach was perceived by the response from the Canadian respondents who, with a majority, neither agreed nor disagreed. This caution may be reflective as to what other types of technologies could be compared with life science technologies. As one of the Canadian respondents mentioned:

"Life science technologies are difficult to assess, but whether they are more or less difficult to assess than other technologies, I simply don't know because I don't work in those other fields."

But as one of the United States respondents stated:

"Having worked in a broad range of technologies in the past, I can definitely state that life science technologies are much more intricate to understand. Human being's biological systems are extremely complex. Trying to understand technologies that aim to repair medical conditions within such complexity can create multitudes of unimaginable reactions, contemplations which give me many sleepless nights."

Reflecting back on criteria and selection methods used by Venture Capitalists, it was suggested in the literature review that if Venture Capitalists used specific models and

processes, then investment opportunity selection would possibly become more rationalized than intuitive (Zacharakis and Meyer, 2000). This in turn would decrease the possibilities of perception risks and adverse selection. From the respondents' comments in this study, valuation techniques and models that are presently available were felt to be ineffective when used as a way to compare such novel and early stage technologies. If new models can be created that allow for the use of comparables and flexible risk levels, then perhaps investment assessment may become more rational. Another area that needs scrutiny, as suggested by Shepherd and Zacharakis (2002), is the use of tools that assess past successes and failures in an analytical format. These tools, however, tend to focus on specific situations that may not be very pertinent to new situations and thus become another form of comparables. As to models that attempt to predict the future, many of these are dependent on future cash flow predictions, predictions that simply cannot realistically be made until much later stages of a life science technology development.

6.5 Discussion and Implications of the Study: International Difference in Venture Capital & Opportunity Selection Criteria – An Observational Inference

This study was a comparative study that interviewed Venture Capitalists from the Canadian West Coast and the United States West Coast. Whereas specific portfolio differences and stage of technology were not researched, selection behaviours were. From the study there were some interesting differences that imply that investment behaviour and risks are perceived quite differently between the two countries with respect to life science investment. United States respondents were less apt to agree that public opinion mattered in investment decisions than the Canadian respondents were. Where this most likely reflects the investment climate and portfolios that are held by the Venture Capitalists, it may also be a reflection on different value systems of the two countries. Furthermore, risks such as

regulatory risks were perceived more strongly by the United States respondents than the Canadian respondents, reflecting that perhaps governmental risks and legal liability are more strongly linked to choice in the United States than in Canada. This observation would also support the Manigart *et al*, (2000) discussion on how culture, legal and governmental systems affect the behaviours of investors within a particular country.

United States respondents were found to invest outside their geographic region at a significantly higher rate than Canadian respondents. This international difference may be reflective of the funds that were held by the Venture Capitalists. Investment funds may have had particular mandates of investing money into specific areas. This was certainly the case with Canadian respondents, where a number of the companies interviewed had government mandates to invest in technologies from British Columbia. This could be conceived as extremely limiting for Venture Capital industry in Canada if this is a common trend. Where this type of investment behaviour does support local life science industries, it also prevents capital markets and competition from occurring. The fact that almost 80% of United States respondents stated they invested in Asia and Europe compared to 5% of Canadians, suggests that perhaps there may be important investment opportunities being missed by the Canadian Venture Capital industry, especially with respect to life science.

Another trend that was noticed was that United States respondents were more focused on financial criteria of investment opportunities than Canadian respondents, whether that consisted of minimum or maximum investment required to exit or the time duration to gain a return on investment. This implies that United States respondents may be more concerned with getting a return on investment, and Canadian respondents are perhaps more patient.

With respect to life science technologies that take a long time to develop, perhaps Canadian respondents can be perceived as being more conducive in nurturing their investments. But perhaps United States respondents can be perceived as being investors that want to make a living.

When in conversation with the respondents during the interviews, passion for their life science portfolios was noted equally from both countries. Comments regarding their board responsibilities, times spent making presentations as well as giving advice to their portfolio companies gave an insight into the large monitoring roles that Venture Capitalists provide. I was intrigued, however, by the difference in past life science experience levels between the Canadian and United States respondents. This could be reflective on the mere fact that the United States is where life science technologies first began their development through the support of the Venture Capital industry and simply, United States respondents have had more time to gather previous life science experience, especially via biotechnologies and medical devices. However, this was not directly researched and needs to be further studied.

The two last questions posed in the questionnaire focused on the broad topics of success rate of life science technologies and one specifically on biotechnologies and their cost of development. These questions were asked mainly to gather general opinion about the life science research and development, but also to obtain a sense of whether there were attitude differences between Canadian and United States respondents. The only difference between the two countries with respect to these questions lay in the fact that a large minority of the Canadian respondents disagreed to both questions.

Why Canadian respondents should disagree can only be assumed from the comments that two of the respondents gave; that being that they had not personally seen the enormous lack of success rate and huge amounts of infrastructure costs that may have been experienced in the United States. At this time, even though Vancouver is a vibrant community in life science technology development, it is also a small and young community compared to areas in the West Coast of United States where large life science companies specializing in biotechnology and general drug development, medical devices as well as contract research organizations exist (Audretsch, 2001). This youth of the West Coast Canadian life science community may be, in essence, what largely distinguishes the two Venture Capital respondent groups the most.

6.6 Conclusion

If Venture Capitalists can only invest in a specific number of portfolio investments, it is crucial that the investment opportunities chosen are those that are most likely to succeed. The potential of Venture Capital rejection of early stage, novel life science investment opportunities due to perception risks, whether due to information asymmetry, adverse selection or overconfidence, may pose a large problem for new life science ventures that are trying to raise capital. It may not only limit Venture Capitalists from picking highly successful projects that can create wealth for its shareholders, but perhaps more importantly, limit what technology, in particular life science technology, that can be pursued and developed.

With the support from the literature review as well as from the direct results of the semi-formal interviews, there is supportive evidence that Venture Capitalists who operate in the

life sciences sector use specific selection criteria, such as management teams and geographic region, and that these investors rely on valuation techniques, particularly market assessments and comparables.

As a whole, the Venture Capitalists who were interviewed can be conceived as qualified in making life science investment decisions. This is particularly the case where education and experience is considered. Of course, this opinion is dependant entirely on the individual Venture Capitalist. Where education is one measurement of qualification, it is not always a direct measure of the actual type of work that a person ends up doing. Whether one type of education is better than another, was not measured and beyond the scope of this study. With respect to experience, it again would depend on the level and type of experience that is/was practiced and whether it is pertinent to the future act of doing something else.

It would appear from this study that Venture Capitalists are or can be susceptible to adverse selection and overconfidence during investment opportunity selection. It also appears that adverse selection may occur as a way of reducing other types of risk such as the potential for information asymmetry. Whether adverse selection and overconfidence, as well as to what degree of each, make a Venture Capitalist unqualified as a life science investment selector, requires research linking directly to investment success with past opinion and investment choice; research that needs to be performed in future studies.

As a final note, there does appear to be interesting differences between the two comparator groups. Canadian Venture Capital investors interviewed tended to present themselves as cautious investors, concerned with ethics and moral issues as well as selectors of criteria and techniques. The United States investors, on the other hand, were more concerned with

choosing investments for the sponsorship of important innovation to create wealth, searching internationally if required. Disregarding the various motives and differences, however, I found that all respondents were equally passionate about what they did and how they had sponsored innovation and productivity through business development.

6.7 Limitations of this Study

There were several limitations in this research study, where the first and intentional one was the scope of this study: that being West Coast Canada and United States. The results that were found and discussed may only be conducive to the region of study and thereby signify geographical and regional effects only.

The next most important limitation was sample size of respondents. Special effort was made to directly interview the respondents mainly because previous literature research noted that this would be the method choice when interviewing senior level Venture Capitalists. This method also greatly reduced the amount of individuals that could be interviewed in a specific period of time.

Venture Capital interviews were spread over a greater period of time than first anticipated. This was due to the very busy schedules of the Venture Capitalists interviewed. Financial markets and conditions may have changed during this period and some and may have led to skewed results with respect to which financial valuation methods and exit opportunities Venture Capitalists preferred.

Most of the Venture Capitalists interviewed were currently employed as Venture Capitalists. Only two of the respondents had previously been Venture Capitalists, but were not presently

working as such. This biased the sample size towards successful Venture Capitalists and may have influenced the answers that they gave, particularly to the questions that were used in the discussion of perception risks and overconfidence.

6.8 Recommendations for Future Research

From the observations and results of this study as well as the comments received from respondents, further research into both the dynamics and the potential problems with management teams is required. Since management teams are specifically selected for and are such an integral part of the development of life science technologies, it is important to understand what management contribute and how they interact with the Venture Capital investors that they, in a sense, work for. This would allow a more complete comprehension of the value added with respect to selection based on management team. Some research has been started in this area, including Higashide and Birley (2002).

Furthermore study into the understanding of avoidance of information asymmetry through the selection of management teams as well as consequences of these relationships, need to be additionally explored. Some interesting recent work has already been started within this area including Parhankangas and Landstrom (2006).

Further study into the direct linkages of education and experience levels with investment success rate should also be pursued. As well, the understanding of overconfidence, how it is measured, whether it truly is a risk, and whether overconfidence is an asset or liability for Venture Capitalists, needs to be measured directly against Venture Capitalists' life science portfolios. Overconfidence may lead to adverse selection, but it may also be a process that allows for initiation to take place to create future wealth and productivity.

REFERENCES

Peer Reviewed Literature Articles, Reports and Books

1. Amir-Aslani, Arsia and Syoum Negassi. (2006) *Is technology integration the solution to biotechnology's low research and development productivity?* Technovation. Volume 26, 573-582.
2. Amit, Raphael, James Brander and Christoph Zott. (1998) *Why do Venture Capital Firms Exist? Theory and Canadian Evidence.* Journal of Business Venturing. Volume 13, 441-466.
3. Angell, Marcia. (2004) *The Truth About the Drug Companies: How they deceive us and what to do about it.* Random House, New York. Pg 3-261.
4. Audretsch, David B. (2001) *The Role of Small Firms in U.S. Biotechnology Clusters.* Small Business Economics. Volume 17, 3-15.
5. Baeyens, Katleen, Tom Vanacker and Sophie Manigart. (2006) *Venture capitalists' selection process: the case of biotechnology proposals.* International Journal of Technology Management. Volume 34, 28-46.
6. Bains, W. (2004) *Failure rates in drug discovery and development: will we ever get any better?* Drug Discovery World. Fall, 9-18.
7. Baron, Jonathan. (2004) *Cognitive Biases, Cognitive Limits, and Risk Communication.* Journal of Public Policy & Marketing. Volume 23 (1), 7-13.
8. Baron, Robert A. (2006) *Opportunity Recognition as Pattern Recognition: How Entrepreneurs "Connect the Dots" to Identify New Business Opportunities.* Academy of Management Perspectives. Vol. 20; Pgs 104-119.
9. Baron, Robert A., and Thomas B. Ward. *Expanding Entrepreneurial Cognition's Toolbox: Potential Contributions from the Field of Cognitive Science.* Entrepreneurship Theory and Practice. Winter, 553-573.
10. Baum, Joel A.C. and Brian S. Silverman. (2004) *Picking winners or building them? Alliance, intellectual, and human capital as selection criteria in venture financing and performance of biotechnology startups.* Journal of Business Venturing. Volume 19, 411-436.
11. Berlin, Mitchell. (1998) *That Thing Venture Capitalists Do.* Business Review: Federal Reserve Bank of Philadelphia. Jan/Feb, 15-26.
12. Bishop, Karen and Robert D. Nixon. (2006) *Venture Opportunity Evaluations: Comparisons between venture capitalists and inexperienced pre-nascent entrepreneurs.* Journal of Developmental Entrepreneurship. Volume 11, 19-33
13. Bruton, Garry D., and David Ahlstrom. (2003) *An institutional view of China's venture capital industry explaining the differences between China and the West.* Journal of Business Venturing. Volume 18, 233-259.

14. Busenitz, Lowell W., James O. Fiet and Douglas D. Moesel. (2004) *Reconsidering the venture capitalists' "value added" proposition: An international learning perspective*. Journal of Business Venturing. Volume 19, 787-807.
15. Campbell, Katherine. (2003) *Smarter Ventures: A Survivor's Guide to Venture Capital Through the New Cycle*. Financial Times Management Press.
16. Champenois, Claire, Dirk Engel and Oliver Heneric. (2006) *What kind of German biotechnology start-ups do venture capital companies and corporate investors prefer for equity investments*. Applied Economics. Volume 38, 505-518.
17. Coombs, Joseph E., Ram Mudambi and David L. Deeds. (2006) *An examination of the investments in U.S. biotechnology firms by foreign and domestic corporate partners*. Journal of Business Venturing. Volume 21, 405-428.
18. Cumming, Douglas J., and Jeffrey G. Macintosh. (2000) *The Determinants of R&D Expenditures: A Study of the Canadian Biotechnology Industry*. Review of Industrial Organization. Volume 17, 357-370.
19. Danzon, Patricia M. (2005) *Productivity in pharmaceutical biotechnology R&D: the role of experience and alliances*. Journal of Health Economics. Volume 24, 317-339.
20. DiMasi, Joseph A., Ronald E. Hansen and Henry G. Grabowski. (2003) *The price of innovation: new estimates of drug development costs*. Journal of Health Economics. Volume 22, 151-185.
21. Dimov, Dimo P. and Dean A. Shepherd. (2004) *Human capital theory and venture capital firm: exploring "home runs" and "strike outs"*. Journal of Business Venturing. Volume 20, 1-21.
22. Dittrich, Dennis A.V., Werner Guth, and Boris Maciejovsky. (2005) *Overconfidence in Investment Decisions: An Experimental Approach*. The European Journal of Finance. Vol. 11., No.6. Pgs 471-491.
23. Edwards, M.G., Murray F. and R. Yu (2003) *Value Creation and sharing among universities, biotechnology and Pharma*. Nature Biotechnology. Vol. 21, 618-624.
24. Elango, B., Vance H. Fried, Robert D Hisrich and Amy Polonchek. (1995) *How Venture Capital Firms Differ*. Journal of Business Venturing. Volume 10, 157-179.
25. Evans, Anne G. and Nikhil P. Varaiya. (2003) *Anne Evans: Assessment of a Biotechnology Market Opportunity*. Entrepreneurship: Theory and Practice. Fall, 87-105.
26. Fetterhoff, Terry J. and Dirk Voelkel. (2006) *Managing open innovation in biotechnology*. Research Technology Management. Volume 49, 14-18.
27. Forlani, David and John W. Mullins. (2000) *Perceived Risks and Choices in Entrepreneurs' New Venture Decisions*. Journal of Business Venturing. Vol. 15. Pgs 305-322.
28. Franke, Nikolaus, Marc Gruber, Dietmar Harhoff, and Joachim Henkel. (2006) *What you are is what you like—similarity biases in venture capitalists' evaluations of start-up teams*. Journal of Business Venturing. Volume 21, 802-826.

29. Fried, Vance H. and Robert D. Hisrich. (1994). *Toward a Model of Venture Capital Investment Decision Making*. Financial Management. Volume 23, No. 3, 28-37.
30. Garedella, L.A. Edison. (2004) *Selecting and Structuring Investments: The Venture Capitalist's Perspective*. Venture Fund, CFA Reading.
31. Gregoire, Denis A., Pamela S. Barr and Dean A. Shepherd. (2006) *Opportunity Acknowledgement as a Cognitive Process of Alignment: Evidence from Verbal Protocols*. Academy of Management Proceedings: Best Conference Paper. Pgs B1-B6.
32. Griffin, D.W., and Varey, C.A. (1996). *Towards a consensus on overconfidence*. Organizational Behavior and Human Decision Processes. Volume 65, No.3, 227-231.
33. Hair, Joseph F Jr., Arthur H. Money, Philip Samouel and Barry Babin., (2003) *Essentials of Business Research Methods*. John Wiley & Sons; Leyh Publishing, LLC.
34. Higashide, Hironori and Sue Birley. (2002) *The consequences of conflict between the venture capitalist and the entrepreneurial team in the United Kingdom from the perspective of the venture capitalist*. Journal of Business Venturing. Volume 17, 59-81.
35. Higgins, Robert C. (2004) *Analysis for Financial Management*. McGraw-Hill/Irwin. New York, NY. 158-159.
36. Le Bas, Christian and Fabienne Picard. (2006) *Models for allocating public venture capital to innovation projects: lessons from a French public agency*. International Journal of Technology Management. Volume 34. 185-198.
37. Lockett, Andy, Gordon Murray and Mike Wright. (2002) *Do UK venture capitalists still have a bias against investment in new technology firms?* Research Policy. Volume 31, 1009-1030.
38. MacMillan, I.C., R. Siegal, and P.N. Subba Narashimha. (1985). *Criteria used by venture capitalists to evaluate new venture proposals*. Journal of Business Venturing. Volume 1, 119-128.
39. MacMillan, I.C., L. Zemmann and P.N Subba Narashimha. (1987). *Criteria distinguishing successful from unsuccessful ventures in the venture screening process*. Journal of Business Venturing. Volume 2, 123-137.
40. Manigart, Sophie, K. DeWaele, M. Wright, K. Robbie, P. Desbriere, H.J. Sapienza and A. Beekman. (2000). *Venture capitalists, investment appraisal and accounting information: a comparative study of the USA, UK, France, Belgium and Holland*. European Financial Management. Volume 6, No. 3., 389-403.
41. Manigart, Sophie, K. DeWaele, M. Wright, K. Robbie, P. Desbriere, H.J. Sapienza and A. Beekman. (2002). *Determinants of required return in venture capital investments: a five-country study*. Journal of Business Venturing. Volume 17, 291-312.
42. Maurer, T.J. and H.R. Pierce. (1998) *A comparison of Likert scale and traditional measures of self-efficacy*. Journal of Applied Psychology. Volume 83, 324-329.

43. Merkle, R.C. (1999). *Biotechnology as a route to nanotechnology*. Trends in Biotechnology. Volume 17, No. 7, 271-274.
44. Mullins, John W., and David Forlani. (2005) *Missing the boat or sinking the boat: a study of new venture decision making*. Journal of Business Venturing. Volume 20, 47-69.
45. Parhankangas, Annaleena and Hans Landstrom. (2006). *How venture capitalists respond to unmet expectations: The role of social environment*. Journal of Business Venturing. Volume 21, 773-801.
46. Patzelt, Holger, Dodo zu Knyphausen-Aufseß, and Ilona Arnoldt. (2006). *How do venture capitalists spread risk by diversification within specialised life science portfolios?* Int. J. Technology Management. Volume 34, 105-125.
47. Pharma Ventures. (2005) *Pharmaceutical Deal Structures: The Essential Manual for Deal Makers*. Pharma Ventures Ltd. Magdalen Centre. Oxford Science Park, Oxford OX4 4GA, UK.
48. Rawlins, M.D. (2004). *Perspectives: cutting the cost of drug development*. Nature Publishing Group. Volume 3, 360-364.
49. Rousu, Mathew C. (2004). *Estimating the public value of conflicting information: the case of genetically modified foods*. Land Economics. Volume 80, 125-135.
50. Sahlman, William A. (1990). *The Structure and Governance of Venture-Capital Organizations*. Journal of Financial Economics. Volume 27, 473-521.
51. Shepherd, Dean A., Richard Ettenson and Andrew Crouch. (2000). *New venture strategy and profitability: a venture capitalist's assessment*. Journal of Business Venturing. Volume 15, 449-467.
52. Shepherd, Dean A., Andrew Zacharakis, and Robert A. Baron. (2003). *VCs' decision processes: Evidence suggesting more experience may not always be better*. Journal of Business Venturing. Volume 18, 381-401.
53. Shepherd, Dean A. and Zacharakis, Andrew L. (2002). *Venture capitalists' expertise: A call for research into decision aids and cognitive feedback*. Journal of Business Venturing. Volume 17, 1-20.
54. Shoemaker, P.J. (1990). *Are risk-attitudes related across domains and response modes?* Management Science. Volume 36 (12), 1451-1463.
55. Starr, Chauncey. (1969). *Social Benefits versus Technological Risks*. Science. Volume 165, 1232-1238.
56. Yoshikawa, Toru, Philip H. Phan and Jonathan Linton. (2004). *The relationship between governance structure and risk management approaches in Japanese venture capital firms*. Journal of Business Venturing. Volume 19, 831-849.
57. Zacharakis, Andrew L. and Meyer, G. Dale. (2000). *The potential of actuarial decision models: can they improve the venture capital investment decision?* Journal of Business Venturing. Volume 15, 323-346.

58. Zacharakis, Andrew L. and Shepherd, Dean A. (2001). *The nature of information and overconfidence on venture capitalists' decision making*. Journal of Business Venturing. Volume 16, 311-332.

Internet Sources (In order as used in report):

59. Earth Summit:

<http://www.cbd.int/convention/articles.shtml?a=cbd-02>

60. FDA:

<http://www.fda.gov/cdrh/>

61. Wikipedia Venture Capital:

http://en.wikipedia.org/wiki/Venture_capitalist

62. The Venture Capital Marketplace On-Line:

<http://www.vcaonline.com/resources/glossary/index.asp>

63. Global Direct Investment Solutions:

<http://www.gdi-solutions.com/areas/events/bio.htm>

64. Wikipedia: Likert Scale Information:

http://en.wikipedia.org/wiki/Likert_scale

65. Bridgeway Career Development:

<http://www.bridgewaycareer.com/seattle-venture-capital.htm>

66. Resources for Entrepreneurs:

<http://www.gaebler.com/California-venture-capital-firms.htm>;

67. B.C Science and Technology Resources:

<http://www.vef.org/web/resources.asp#3>

68. National Venture Capital Association:

<http://www.nvca.org/>

69. Intellectual Property Office Canada:

http://strategis.ic.gc.ca/sc_mrksv/cipo/cp/copy_gd_protect-e.html

70. United States and Trade Office for Intellectual Property:

http://usinfo.state.gov/ei/economic_issues/intellectual_property.html

APPENDICES

Appendix A: Questionnaire

Life Science Investment Proposal Evaluation

Section A – Background

Interviewee Name & Title:

Date of interview:

Company/Organization Name:

City:

Phone:

Email:

Gender:

Male

☐

Female

☐

1. Please describe your responsibilities in this company/organization w.r.t. life science opportunity evaluation.
2. How long have you worked with your current company/organization?
3. How many years have you evaluated opportunities as a VC?
4. What is the level of education that you have completed (please check all applicable)

A. HIGH SCHOOL GRADUATE DIPLOMA	<input type="checkbox"/>
b. Technical/Professional School graduate diploma	<input type="checkbox"/>
c. University/College undergraduate degree	<input type="checkbox"/>
d. University level graduate degree: Masters	<input type="checkbox"/>
e. University level graduate degrees: PhD	<input type="checkbox"/>
f. Masters of Business Administration (MBA)	<input type="checkbox"/>

5. Have you worked in a life science company?

YES: ☐

NO: ☐

If yes, how many years and in what capacity:

6. Does your company invest/operate in areas outside of your geographic region?

YES: ☐

NO: ☐

If 'Yes'; please enter location(s):

City(s)

Province(s)

State(s)

Country(s)

Section B – Life science Proposal Evaluation

Proposal Assessment

7. When screening life science investment opportunities, your strategy/company strategy

a. Is to focus on specific types of life science industries (drug/devices etc.)

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

b. Is to focus on specific types of life science technologies (small molecules, antisense, stem cell therapeutics)

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

c. Is to focus on specific disease indications (cancer, diabetes etc.)

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

d. Is to focus on a preferred stage of technology development (research, early stage versus late stage development)

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

e. Is to focus on the geographical location of the proposal/company.

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

f. Is to focus on the minimum and/or maximum investment required to exit.

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. What is/was the main investment strategy (ies) of your company/organization when screening life science proposals?

9. During Initial Screening Phase of a life science investment proposal:

- a. Financial criteria are important (Estimated potential proposal worth through financial assessments?)

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- b. Potential market size criteria are important.

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- c. Intellectual Property (IP) is important.

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- d. Management Team and skill are important.

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10. It is important to exclude investment proposals that have unclear regulatory guidelines and risks (e.g. some biotechnologies: liposomes, antisense or protoxins).

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

11. It is important to exclude investment proposals that carry negative public opinion (e.g. foetus stem cell research; genetically modified organisms, nanotechnologies).

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12. It is important to exclude investment proposals that are scientifically difficult to understand.

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Valuation Methods

13. Discounted Cash Flow (NPVs,) is a good valuation method for life science proposals.

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

14. Simulation models such as Monte Carlo (Crystal Ball) are good valuation methods for life science investment proposals.

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

15. Multiples such as Price/Earning Multiples are good valuation methods for life science investment proposals.

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

16. Technology market value assessments such as for disease indications are good qualitative valuation methods for life science investment proposals.

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

17. What other valuation techniques are used? Other

A. REAL OPTIONS	<input type="checkbox"/>
b. Enterprise Value	<input type="checkbox"/>
c. Book Value	<input type="checkbox"/>
d. Payback Period	<input type="checkbox"/>
e. Other	<input type="checkbox"/>

18. Which valuation methods have you found most useful?

19. Current valuation methods are adequate in evaluating life science investment proposals.

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

20. Past investment choices influence future investment choices.

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

21. You tend to select investment proposals that are related to your educational/work background over those that are not.

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

22. You tend to select investment proposals that are similar to past successes over those that are not.

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

23. Life science investment proposals are more difficult to assess than other proposals.

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

24. VC experience/expertise is positively linked to successful investment proposal selection.

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section C – Final Comments

25. What hurdle rate of return do you expect from successful investment?
26. What proportion of your investments do you expect (in the long term) will reach a successful exit?
27. What is the most desirable exit route?

A. EARN-OUT	<input type="checkbox"/>
b. IPO	<input type="checkbox"/>
c. M&A	<input type="checkbox"/>
d. Depends on Market Conditions	<input type="checkbox"/>
e. Other (Please name)	<input type="checkbox"/>

28. How long does a VC expect to wait for a successful investment to return capital?
29. What are some of the key challenges for VCs in terms of selecting a life science investment proposal? Please describe.
30. You would not invest in a difficult to understand life science investment proposal.

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

31. Do you agree that the success rate of life science (particularly biotechnologies) from lab-bench to commercialization is 1 in 10 000 (including failures).

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

32. Do you agree that the costs associated with life science development, in particular biopharmaceutical development, from Concept stage to Market is close to 800 million USD (includes failures, infrastructure etc.)?

STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

33. Is there anything else about life science investment proposals that you would like to add?