NETWORK IMMUNOLOGY

Network Immunology is a biotechnology company developing a novel preventive therapy with validated applications to cancer and autoimmune diseases. The company has strong pre-clinical experimental results for the prevention of breast cancer and for the prevention of inflammatory bowel disease.

Business Summary: Network Immunology is developing antibody-based therapies for cancer and inflammatory diseases. Our lead candidate, NII-001 targets breast cancer and inflammatory bowel disease (IBD), an autoimmune disease that impacts 1.5 million people in North America. We have obtained proof-of-concept in a mouse model of breast cancer and in a mouse model of IBD using essentially the same drug. The underlying science is based on over 40 years of research on immune network theory conducted by Dr. Geoffrey W. Hoffmann. The company strategy is to develop NII-001 through to completion of a Phase I clinical trial and exit upon sale to Pharma.

Financing to Exit: The company seeks $4M to complete pre-clinical studies and a Phase I human trial. Management expects that upon successful completion of the Phase I trial, an exit for investors in the form of acquisition/licensing will be available.

Problem: Current preventive treatments for cancer include mastectomies for persons genetically predisposed to develop the disease. Prevention of autoimmunity is mainly by lifestyle changes including exercise and dietary changes. Current inflammatory treatments target specific molecules or cell receptors and suppress the entire immune system, making patients susceptible to infections. There is no precedent for a preventive technology that prevents both cancer and autoimmune disease.

Solution: Based on immune network theory, a systems-level understanding of the immune system, NII-001 comprises two antibodies that are complementary to each other, like two adjacent pieces of a jigsaw puzzle. Each of these antibodies stimulates a distinct population of immune system cells called T cells, and the two stimulated populations are likewise complementary to each other, and mutually stimulate each other, taking the immune system to a new state that has been shown to be resistant to the development of both cancer and autoimmunity. The technology has been validated with proof-of-concept studies in a mouse model of breast cancer and a mouse model of IBD.

Business Model: Network Immunology is focused on the development of NII-001 through to successful completion of Phase I clinical trial, at which time the company will exit by way of sale to Pharma. Two comparable company exits in the autoimmune space that were struck between Phase I and Phase II, suggest an asset value range of between $85M and $125M upfront, plus milestones and royalties. Time to completion of the Phase I study is expected to be 3 to 4 years.

Network Immunology Inc.
www.networkimmunology.com
Location: Vancouver, BC, Canada
Industry: Biotechnology

Company Stage
Preclinical

Financial Snapshot
Previous Capital Raised: $1,100,000

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Network Immunology is a biotechnology company developing a novel preventive therapy with validated applications to cancer and autoimmune diseases. The company has strong pre-clinical experimental results for the prevention of breast cancer and for the prevention of inflammatory bowel disease.

Management: Our Chief Scientist and founder Dr. Hoffmann is the world's leading authority in the field of immune network theory and has published extensively in this field. Our CEO, Dr. Edwin Gershom, has made significant contributions to strategy and business development, connecting with industry KOLs for over 4 years. Previously, he managed preclinical and clinical projects and business development for a contract research organization. George Hoffmann (Managing Director) and Chris Ross (Controller) are also active in management.

Target Market: The autoimmune/inflammatory disease marketplace supports a number of high-priced blockbuster drugs. Current drug for autoimmune diseases include Humira (AbbVie), Remicade (Janssen) and Enbrel (Amgen). The three are among the top five-selling drugs worldwide with collective sales of more than $30B in 2014. This market success drives continued interest in the area.

Potential Acquirers / Licensors: In terms of exit strategy, there is a strong appetite for Pharma to acquire early stage assets which have demonstrated proof-of-concept. Network Immunology is specifically developing NII-001 with companies such as AbbVie, Biogen, Janssen, Merck, Shire, Amgen and Takeda in mind.

Strategic Pharma Partnering: With respect to exit strategy, we will continue to cultivate Pharma's interests in NII-001 as we complete Phase I and generate early signals of efficacy results, before progressing to Phase II. There is a significant opportunity to engage them during further pre-clinical research and Phase I clinical trials to maximize their interests in the asset.

Competitive Advantages: Our competitors are targeting specific molecules and suppressing the immune system. NII-001 is specifically designed to stabilize the immune system, based on our understanding of immune system as network. The patent for Remicade is expiring in 2018 and biosimilars will be entering soon. We have strong patent protection and the nature of our science working with the immune system as a whole would make entry of biosimilars difficult.

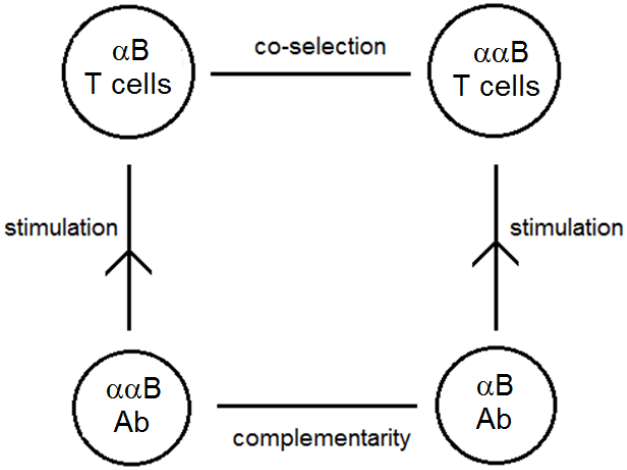
Exit: Valuation upon successful Phase IIa study results is projected to be in the range of $60M-$100M based on market comps (Roche/Adheron $105, Lilly/Hanmi $50M, Biogen/Mitsubishi Tanabe $60M, and Celgene/Inception IBD $40M). We have engaged with Pharma, as well as VCs to determine the interest in therapeutic assets in this space. Ongoing relations with these parties and development of their interest during further pre-clinical work and upon completion of Phase I will be critical. Alternatively, a financing partner may opt to take the product further along the development pathway, in which case the company could attain a significantly higher valuation within five to six years.

Drug: NII-001

NII-001 will be marketed for the prevention of cancer in heathy persons who are genetically at risk of developing cancer. We have shown that the technology works in proof of principle experiments in healthy mice. The focus is on preventing cancer because that is more clearly an unmet need than is, for example, the prevention of inflammatory bowel disease (IBD).

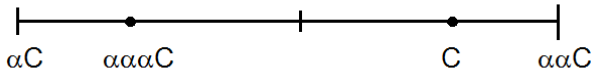
The drug will be a pair of monoclonal antibodies. At this stage we have completed a proof of principle experiment in which we used polyclonal antibodies. It will be straightforward to produce monoclonal antibodies with the same specificities.

NII-001 stimulates the T cell repertoires of the adaptive immune system. It consists of antigen-specific plus complementary antiidiotypic antibodies. The mechanism of action is shown in the figure below, where the Greek letter α is an abbreviation for “anti-” and Ab is an abbreviation for antibody. Here B is a vertebrate, αB is anti-foreign and ααB is anti-anti-self.

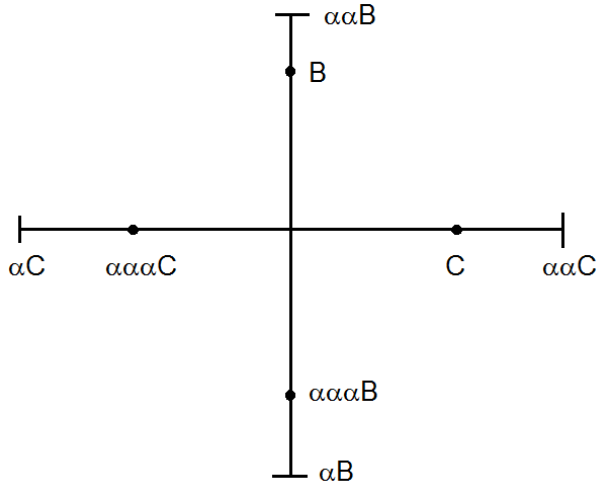


The ααB antibody stimulates αB T cells and the αB antibody stimulates ααB T cells. Co-selection (mutual selection) of the αB T cells and the ααB T cells follows, taking the system to a new stable steady state in which there are elevated levels of these two T cell populations.

An untreated person C has an immune system that has a one-dimensional shape space defined by αC and ααC T cells. Anti-anti-self lymphocytes (ααC) are complementary to both anti-self (αC) lymphocytes and anti-anti-anti-self (αααC) lymphocytes. Anti-self lymphocytes are also complementary to self-antigens (C). Here anti-anti-self lymphocytes and self-antigens are on the right of the origin of the shape space axis, while the complementary anti-self and anti-anti-anti-self lymphocytes are on the left side.



The figure below shows the two dimensional shape space of a vertebrate that has been treated with suitable antigen-specific (anti-B) plus antiidiotypic (anti-anti-B) antibodies. The B shape space axis is the same as the C shape space axis and is orthogonal to the C space shape axis.



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Autoimmune mice and aging mice are known to make anti-anti-self antibodies. The same will be true for autoimmune and aging persons. This means antibodies are being made in a region of shape space (at ααC for the person C) that is dominated by anti-anti-self T cells in young and healthy persons. The production of these antibodies shows that an immune system with a single shape space axis is inherently unstable on a time scale of greater than sixty to ninety years, and this is believed to be the reason people normally live to only that age. It is expected that treating C with ααB antibodies plus αB antibodies results in C having two shape space axes as shown above, and makes the immune system more stable.

We have shown in mice that an immune system with two shape space axes is more stable than an immune system with only one shape space axis. For example, this treatment prevents inflammatory bowel disease in a mouse model. We have also shown that we can induce specific transplantation tolerance to a mouse B in a mouse C by treating it with αB plus ααB antibodies. This is again due to changing the mouse from having a single shape space axis to having also the second shape space axis. The anti-anti-self T cells in the treated mice have the coordinates (ααC, ααB). The production of anti-anti-self antibodies (a key marker of old age) will likewise be stably inhibited in a person treated with αB plus ααB antibodies and hence having a second shape space axis.