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Investing in innovative life science companies for patient benefit creating attractive returns for entrepreneurs and investors
Letter from the Chairman of the Novartis Venture Fund

Young sprouts thrive poorly in a garden exposed to harsh climate conditions. This is also true for young companies in the life science industry, where — as a consequence of the economic downturn of the last two years — venture capital has become more constrained, and new funds difficult to raise. Thus, many young firms have suffered, grappling with finding sufficient financial support to drive their projects from bench to bedside. Fortunately, the Novartis Venture Funds continue to support many of these projects with a long term investment strategy: more than 60 companies engaged in the development of new products and devices, platforms are presently supported by the Funds.

Limiting conditions however do not necessarily impede the creative and innovative minds. New ideas often emerge by crossing the conventional boundaries of knowledge and by challenging established concepts. As a case in point, the life sciences have continued to grow, and have found new allies in the fields of microtechnology and nanosciences, information technology and genomics, to name but a few. This year, the number of projects presented to the Novartis Venture Funds has been close to 1000, from which — through an efficient selection process — twelve investments, and this is a record, have been decided by the Fund, counterbalanced by 4 remarkably successful exits. The management team in Basel and Cambridge, and its executive director have to be commended.

The Novartis Venture Funds have been quite successful over the last two years and are considered today among the world’s largest corporate life sciences venture funds. How has this been achieved? As the overarching principle, we invest in innovative life science concepts only if they show a clear potential benefit to patients, creating simultaneously attractive returns for entrepreneurs, scientists and investors. This requires a clear strategic approach of the submitted projects according to stringent criteria, such as

- clearly defined, patient oriented objectives for the novel products
- unmet medical needs, new potential impacts
- understanding of the underlying pathogenic/therapeutic mechanisms
- well constructed pipelines with several options

- strong management and advisory board experience
- strong syndicate, well charted milestones

This approach has been clearly supported by the Advisory Board, which has to be thanked for its dedication. During these last 2 years, the Board has undergone some major changes: Prof. Antonio Borges, Managing Director at Goldman Sachs (London), has resigned from his post due to a re-orientation of his activities. We thank him warmly for his commitment to the Funds. Having reached
the retirement age, Dr. Raymund Breu, CFO at Novartis, will also leave our Board. Present since its creation in 1996, Dr. Breu has been invaluable to us with his thoughtful project analyses. We owe him a great deal, and wish him all the best for his future activities. We warmly welcome Jonathan Symonds, the incoming CFO of Novartis, with his remarkable professional experience.

In order to extend our scientific competences, we have asked two new experts to join our Board: Prof. C.A. Meier, presently Chairman of the Department of Medicine at Triemli Hospital in Zurich, will bring his enthusiasm and experience of clinical studies, and Prof. J.A. Hubbell, Professor at the Swiss Polytechnic Institute in Lausanne (EPFL) and an internationally recognized expert in Biomedical Engineering, will strengthen our competences in this domain, where we plan to become more active. We are looking forward to these new collaborations.

The Novartis Venture Funds have been very successful over the last two years, but where do we go from here? Many challenges lie ahead. Life sciences are joining the ever growing domain of complex systems, and new approaches will be necessary to understand the intricacies of human diseases. Research and development will therefore have to meet these new conceptual challenges. Simultaneously, state regulations are becoming more stringent. Finally, new large corporate funds are entering the competition. Harnessed as we are today, we believe nevertheless that the Novartis Venture Funds is ready to be a major player in the field of life sciences for the good of patients. In order to fulfill this mission, we will have to breach new frontiers, solicit the unthinkable and support the improbable among the young sprouts of the garden of life sciences.
Letter from the Chairman of the Novartis Option Fund

2009 was yet another difficult year for biotechnology company fund-raising. This challenge is exacerbated for early stage companies, the focus of the Novartis Option Fund. Despite this challenge the Novartis Option Fund established investments in three young highly innovative companies in 2009, Avila Therapeutics, Viamet Pharmaceuticals and Heptares Therapeutics. This brings the total number of Novartis Option Fund investments to eight since the first Novartis Option Fund investment in June of 2008 and, for the first time, includes an investment in a European company.

I wish to thank also the advisory board members for their support of the management team with scientific reviews and a visionary approach to novel early stage technologies.

The Novartis Option Fund’s unique approach to investment incorporating the purchase of a time-limited option to a company program with non-dilutive capital while the company retains its lead programs has proven to be well received in the biotechnology and venture capital community. The reception of the NOF is testament to the effectiveness of the Managing Directors in identifying and investing in innovative new companies’ pioneering novel approaches to drug design and development in areas of unmet medical need. Additionally, the value brought to the NOF portfolio companies through the optioned program and interactions with Novartis scientists is highly valued.

The Novartis Option Fund enters 2010 with strong momentum and acceptance in the industry. While much of the activity of the NOF will be focused on the development of its portfolio companies, the fund continues to seek to identify new early stage innovative companies for future investments.
Reinhard Ambros: Executive Director of the Novartis Venture Funds

We accomplished another year of substantial growth and Novartis BioVentures Ltd (Bermuda) currently holds more than USD 700 mio under management and is advised by investment teams based in Basel Switzerland and Cambridge, MA, USA.

In 2009 our portfolio increased by twelve new investments and now comprises over 60 companies, making the NVF one of the world’s largest and most active corporate biotech venture funds. Including the commitment of other investors, about USD 2 bn is currently invested in total into NVF portfolio companies.

We achieved four liquidity events over this year and are confident we will be able to maintain our superb performance in the next years.

Investment Philosophy

We invest in innovations which are strategic to the healthcare industry and continue operating as a financially driven corporate life science investor offering support to those companies which have the potential to lead the next innovation wave and explore new business areas that will be critical to patient care. The broad and deep experience of the fund management team will contribute to the success of our portfolio companies and we take an active role in nurturing and supporting our companies by having board representation and wish to maintain our reputations as a trusted and value-adding investor.

Investment Focus

Our primary focus will remain on the development of novel therapeutics and platforms. We enhance the therapeutic focus with investments in medical devices but also diagnostics or drug delivery systems. In our investments we look for unmet need and clinical impact, novel proprietary science and understanding of mechanism, management and board experience and capital efficiency in the program.

We prefer to have our initial investment at the earlier stage to build the company and follow with additional investment in pace with the company’s progress.
**Ablation Frontiers, Inc:** Medtronic acquired Ablation Frontiers in February 2009 for a total value of up to USD 425 mio plus potential additional payments if certain clinical milestones are met. Ablation has developed a family of devices to treat patients suffering from atrial fibrillation and cardiac arrhythmias. Ablation’s devices have received CE mark designation and are available commercially in Europe. They are also currently under review by the U.S. Food and Drug Administration (FDA). The Novartis Venture Fund led the Series C financing round in 2007. Steven Weinstein served on the board.

**ESBATech AG:** Alcon (NYSE: ACL) acquired ESBATech AG, a Swiss biotech company for a total value of up to USD 589 mio. Alcon will gain access to proprietary antibody fragment technology platform and phase I/II products for ophthalmologic use. Novartis Venture Fund was an early investor and has supported the company through its development.

**Swiss Pharma Contract AG:** Covance Inc. (NYSE: CVD), one of the largest drug development service companies, acquired Swiss Pharma Contract, a clinical research company based in Basel, Switzerland to expand its clinical pharmacology footprint in Europe. Novartis Venture Fund was an investor from the start of the company.

**Visiogen, Inc:** Abbott Laboratories acquired Visiogen for USD 400 mio in September 2009. Visiogen has developed the first dual-optic accommodating intraocular lens (IOL) for the treatment of cataracts and presbyopia. Visiogen’s Synchrony® accommodating IOL is a significant advancement in artificial lens technology. It is designed to mimic the eye’s natural ability to change focus (accommodation), delivering improved vision at all distances, potentially eliminating the need for glasses or contact lenses. Novartis Venture Fund led the USD 40 mio Series E investment this year. Steven Weinstein served on the board.
Alios BioPharma, Inc is a biotechnology company located in South San Francisco, California that is developing novel medicines that treat viral diseases by activating pathways in the innate immune system. Alios is pursuing the development of both protein and small molecule therapeutics, each addressing major commercial market opportunities. The Novartis Venture Fund co-led the USD 32 mio series A round. Campbell Murray serves on Alios’ board.

Avila Therapeutics, Inc is a drug discovery company developing a novel proprietary chemistry platform for the generation of new medicines that covalently bond to and silence disease-causing proteins. A pipeline of novel therapeutics is being developed for viral infection, cancer and autoimmune diseases. The Novartis Option Fund led the USD 30 mio series B round. Henry Skinner serves on Avila’s board.

Bicycle Therapeutics Ltd is a biotech company developing a novel phage-based platform technology to create a new generation of therapeutic peptides that combine the best features of small molecules and biopharmaceuticals. These novel peptides are highly specific and highly stable drugs, and overcome the weaknesses of previous generations of peptide based therapeutics. The Novartis Venture Fund was a founding investor. Anja König serves on Bicycle’s board.

Heptares Therapeutics Ltd is a new drug discovery company whose aim is to apply structural knowledge of G-protein coupled receptors (GPCRs) using the company’s proprietary StaR™ technology, to the design and development of its own drug molecules. The Novartis Option Fund co-led a USD 30 mio series A financing round. Anja König serves on Heptares’ board.

Intellikine, Inc is focused on small molecule drugs that target the PI3K/mTOR pathway for the treatment of cancer, inflammation and autoimmune disease. Intellikine closed a USD 15 mio series A extension round in July 2009 led by the Novartis Venture Fund. Markus Goebel serves on Intellikine’s board.

Opsona Ltd is a biotech company active in the field of innate immunity. The lead antibody (anti-TLR2) program is entering pre-clinical studies and is offering potential for new therapies against autoimmune and inflammation diseases. The Novartis Venture Fund co-led the EUR 21 mio Series B. Florent Gros serves on the board.

Oxagen Ltd is an Oxford-based biopharmaceutical company developing a pipeline of novel small molecule drugs that target key GPCRs to treat inflammatory and respiratory diseases. The lead program includes a first in class CRTH2 antagonist for the treatment of asthma and other respiratory
conditions. The Novartis Venture Fund led the USD 26.7 mio series C round. Anja König serves on Oxagen’s board.

Portaero, Inc is a Cupertino, CA based medical technology company developing a device for the treatment of chronic obstructive pulmonary diseases, in particular emphysema. The Novartis Venture Fund led the USD 12 mio Series B financing round. Steven Weinstein serves on Portaero’s board.

Pulmatrix, Inc is discovering a new class of host-targeted therapies that treat, prevent and help control a broad range of respiratory infections and progressive respiratory diseases. Pulmatrix’s innovative pathogen independent approach harnesses the airway and lungs own natural biophysical and host defense mechanisms, offering potential for individual therapies that treat serious respiratory diseases including influenza, rhinovirus, COPD, asthma and cystic fibrosis. The Novartis Venture Fund co-led the USD 30.2 mio Series B. Lauren Silverman serves on the board.

Tokai Pharmaceuticals, Inc is focused on developing new treatments for prostate cancer. The company’s lead drug candidate, TOK-001, is currently being studied in patients with castration resistant prostate cancer (CRPC) as part of the ARMOR clinical development program. The Novartis Venture Fund led the USD 22 mio Series C&D. Both Campbell Murray and Reinhard Ambros serve on the board.

Viamet Pharmaceuticals, Inc is focused on improving existing drugs through the development of metalloenzyme inhibitors through the application of a proprietary chemistry platform. The technology aims to optimize the metal binding component of low molecular weight inhibitors and improve the safety, efficacy and pharmacokinetics versus existing drugs. The Novartis Option Fund led the USD 18 mio Series B. Lauren Silverman serves on Viamet’s board.

Visiogen, Inc is an Irvine, CA based medical technology company developing the first dual-optic accommodating intraocular lens, the Synchrony. With over 14 million cataract procedures performed annually, and over 1 billion presbyopes worldwide, Visiogen is bringing a new world of vision to patients experiencing these two common ophthalmic conditions. Synchrony has received CE mark designation and has been available commercially in Europe since January 2009. It also is currently under review by the U.S. Food and Drug Administration (FDA). Novartis Venture Fund led the USD 40 mio Series E financing round. Visiogen was subsequently acquired by Abbott. Steven Weinstein served on the board.
Novartis Venture Funds makes investments through two distinct investment vehicles: the Novartis Venture Fund and the Novartis Option Fund.

The Novartis Venture Fund
The Novartis Venture Fund is a financially driven venture fund which makes equity investments in life sciences companies across biotech, medical devices and diagnostics. The venture fund is stage agnostic and engages in seed investments as well as later stage investments. The Novartis Venture Fund typically leads or co-leads a deal and plays an active role on company boards.

The Novartis Venture Fund was first established with CHF 100 mio in 1996 at the merger of Sandoz and Ciby Geigy and has since grown to more than USD 500 mio under management (out of a total of USD 700 mio), re-investing the returns generated, and without any additional cash injection from our LP, Novartis. We seek companies in the US and Europe that are truly innovative, have the potential to offer significant patient benefit, have excellent management and are capital efficient.

We continue our approach of larger focused investments and anticipate total investments up to USD 15–20 mio per company over its life, but it can be as little as 100,000 USD to get started. We will continue our activities to lead or co-lead investments further and remain open to participate in larger syndicates.

In 2009, the Novartis Venture Fund made investments in Alios Biopharma, Bicycle Therapeutics, Intellikine, Opsona, Oxagen, Portaero, Pulmatrix, Tokai Pharmaceuticals, and Visiogen.
The Novartis Option Fund was designed to provide an alternative financing vehicle. The mission of this fund is to seed innovative start-up companies during their earliest stages. The initial equity investment is coupled with an option to a specific therapeutic program giving early validation for the startup company's technology.

The Option Fund is structured to have a limited scope, that is, the subject of the option is not the main value driving program in the startup's pipeline. Rather the option is structured in such a manner as to provide the young company with the potential for an additional opportunity for success and must be consistent with the new company’s corporate development plans. Moreover, the option is limited in duration in order to maintain the full potential for the start-up company in the market. In addition to the non dilutive cash payment to secure an option to a specific program, license terms are negotiated at the time of investment and are based upon benchmarks deemed relevant for the stage of the asset at the time of option exercise.

The Option Fund has an initial size of USD 200 mio. The fund anticipates a total equity investment over the years of up to USD 20 mio per company. Investments are reviewed by a dedicated advisory board with a majority of external members, chaired by Dr. Spyros Artavanis-Tsakonas of Harvard Medical School. The focus of investments is on early stage, high risk/high return areas enabling the development of novel programs and technologies that may be complementary to Novartis’ research endeavors.

While we couple our investments with a limited option for Novartis, we are committed to build companies that will be attractive to many other life science partners in the biotech and pharma arena. Thus we finance in a syndicate along with other venture capitalists and our new financing model shall be to the benefit of all parties involved.

In 2009 the Option Fund made investments in Heptares Therapeutics, Viamet Pharmaceuticals and Avila Therapeutics.
The Novartis Korea Venture Fund – fostering growth in a burgeoning biotech industry

In 2008, Novartis Venture Funds created the Novartis Korea Venture Fund, a unique commitment to early stage investing in innovative life sciences companies. The NKVF investment vehicle is committing USD 20 mio in capital over a 5 year period, and is managed by Anja König and a local team in Seoul.

Investment activity

In 2009, Novartis Korea Venture Fund and OrbiMed’s Caduceus Asia Partners co-led a USD 6 mio Series A round investment in PharmAbcine, a specialized biotech company focused on the development of fully human therapeutic monoclonal antibodies for the treatment of cancer and inflammatory diseases. PharmAbcine had recently been selected as winner of the GATE project business plan competition, organized by Novartis Korea in collaboration with the Korea Health Industry Development Institute, Korea Trade – Investment Promotion Agency, Samsung Advanced Institute of Technology and McKinsey & Company. This investment brought together a unique international syndicate of investors. Dr. Jin-San Yoon, President and CEO of PharmAbcine remarked “Novartis Korea Venture Fund is a true pioneer in early stage financing in Korea. Through their leadership we were able to pull together a Series A with a high profile international syndicate. They contribute not just financing, but valuable expertise.”

Previously, Novartis Korea Venture Fund had invested in Neomics Co. Ltd. Neomics specializes in the development of novel diagnostics and therapeutics in oncology.

Looking to the future

We are looking forward to continue to work together with Korean and international partners to build innovative life sciences companies in Korea. Our mission is to create success for patients and investors.
## Pipeline Overview of Portfolio Companies

<table>
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<tr>
<th>Category</th>
<th>Pre-Clinical</th>
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<th>Phase II</th>
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## Therapeutic Area

### Company

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<td>Akebia Therapeutics</td>
<td>AKB-6548</td>
<td>HIF-PH inhibitor</td>
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<td>Avila Therapeutics</td>
<td>CX-222</td>
<td>Pan-ErbB inhibitor</td>
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<td>AVL-291</td>
<td>Btk inhibitor</td>
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<td>Catalyst Biosciences</td>
<td>CB 813</td>
<td>Factor VIII/hemophilia</td>
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<td>Cequent Pharmaceuticals</td>
<td>Ceq508</td>
<td>β-catenin /Familial Adenomatous Polyposis</td>
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<td></td>
<td>Cylene Pharmaceuticals</td>
<td>Quarfloxin</td>
<td>rRNA biogenesis inhibitor/carcinoid, neuroendocrine tumors</td>
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<td></td>
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<td>CX-4945</td>
<td>oral CK2 inhibitor</td>
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<td>CX-5011</td>
<td>oral CK2 inhibitor</td>
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<td></td>
<td>CX-6258</td>
<td>PIM1,2,3 inhibitor</td>
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<td></td>
<td>CX-5461</td>
<td>oral Pol I inhibitor</td>
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<td>GlycoMimetics</td>
<td>GMI-1070</td>
<td>Pan-selectin inhibitor /sickle cell disease</td>
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<td></td>
<td>Intellikine</td>
<td>INK128</td>
<td>TORC1/2 inhibitor</td>
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<td></td>
<td></td>
<td>INK1197</td>
<td>PI3Kα/γ inhibitor</td>
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<td></td>
<td>Neomics</td>
<td>NE0-01</td>
<td>AIMP1 modulator</td>
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<td></td>
<td>NE0-02</td>
<td>AIMP2-DX2 inhibitor</td>
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<td></td>
<td>Neovacs</td>
<td>VEGF Kinoid</td>
<td>Anticytokine vaccine</td>
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<td>Therapeutic Area</td>
<td>Company</td>
<td>Substance</td>
<td>MoA/Indication</td>
<td>Preclinical</td>
<td>PhI</td>
<td>PhII</td>
<td>PhIII</td>
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<td>Oncology, Hematology</td>
<td>Nereus Pharmaceuticals</td>
<td>NPI-0052</td>
<td>Proteasome inhibitor/Solid tumors, lymphoma multiple myeloma</td>
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<td></td>
<td></td>
<td>NPI-2358</td>
<td>Vascular disrupting/Solid tumors</td>
<td></td>
<td>●</td>
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<td></td>
<td></td>
<td>NPI-1342/1387</td>
<td>NFκB activation-regulator</td>
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<td></td>
<td>PharmAbcine</td>
<td>TTAC0001</td>
<td>VEGFR-2 mAb</td>
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<td>Polyphor</td>
<td>POL6326</td>
<td>CXCR4 inhibitors</td>
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<td>ProCertus</td>
<td>PrC-210</td>
<td>Radioprotector</td>
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<td></td>
<td>BioPharm</td>
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<td>ProDermaCel™, DermX, and OralX</td>
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<td></td>
<td>PTC Therapeutics</td>
<td>PTC299</td>
<td>VEGF inhibitor/Solid tumors</td>
<td></td>
<td>●</td>
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<td>S*BIO</td>
<td>SB939</td>
<td>HDAC inhibitor/Solid hematological tumors</td>
<td></td>
<td>●</td>
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<td></td>
<td></td>
<td>SB1518</td>
<td>Jak2 inhibitors</td>
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<td></td>
<td></td>
<td>SB1317</td>
<td>CDK/Flt3 inhibitor</td>
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<td></td>
<td>Tokai Pharmaceuticals</td>
<td>TOK-001</td>
<td>AR-antagonist/CYP17-inhibitor</td>
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<td>Respiratory</td>
<td>Oxagen</td>
<td>OC-459</td>
<td>CRTH2 inhibitor</td>
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<td></td>
<td>Polyphor</td>
<td>POL6014</td>
<td>serine protease inhibitors/COPD</td>
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<td></td>
<td>Pulmatrix</td>
<td>PUR003</td>
<td>cationic airway lining modulator (iCALM)</td>
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<td>Transplantation, Immunology</td>
<td>Covagen</td>
<td>COV01</td>
<td>anti-IL17 Fynomer</td>
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<td></td>
<td>Neovacs</td>
<td>IFNα kinase</td>
<td>IFN active immunization (polyclonal) for treatment of lupus</td>
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<tr>
<td></td>
<td></td>
<td>TNFα Kinoid</td>
<td>TNF active immunization (polyclonal) for treatment of Crohn's disease</td>
<td></td>
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<tr>
<td></td>
<td>NovImmune</td>
<td>NI-0401</td>
<td>anti-CD3 mAb</td>
<td></td>
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*All information derived from the respective companies website or companies public information.*
Seeking the best clinical solution

Our understanding of human physiology is more robust than our still emerging understanding of human biology. Some clinical needs are best served with a mechanical solution, rather than a pharmacological one, and this has been demonstrated over the last thirty years with remarkable medical progress in cardiology, vascular diseases, ophthalmology, and orthopedics. In the years to come, devices, drugs, and tissue engineering will all work together to better treat the patient, and the Novartis Venture Fund will look across the spectrum to find the best clinical solutions.

New diagnostic approaches will also change the clinical practice of medicine in years to come. Better understanding of pathways and genetic and biological markers, will enable more rapid and accurate diagnosis, allowing physicians to not only identify disease earlier, but also to identify the best therapeutic option given the stage of a disease.

The Novartis Venture Fund has invested in medical devices since its inception in 1996, but has recently focused its efforts on medical devices more keenly. Our device investments are led by Steven Weinstein in our Cambridge office. We currently have targeted 20% of our fund to medical device and diagnostic opportunities.

Our focus

In both diagnostics and medical device investments, the NVF looks for opportunities that can change the clinical practice of medicine and produce meaningful patient benefit. We look for underserved indications, or where a company’s technology enables a completely new treatment paradigm.

Our device investment strategy is stage agnostic, but we prefer opportunities where we can fund the largest question and/or challenge the company faces. We are happy to lead an investment, and invest in the United States and Europe.

Investment activity and recent portfolio

In 2009, we led the most recent financing of Portaero, an innovative approach to treating emphysema. We also led the last financing round of Visiogen, which has developed an innovative dual-optic accommodating intra-ocular lens for the treatment of cataracts and presbyopia. Visiogen was subsequently acquired by Abbott in September, 2009.

Our investments include:

**Ablation Frontiers**
Cardiac Arrhythmias
(Sold to Medtronic)

**Sonitus Medical**
Single Sided
Deafness, Tinnitus

**Diagnoplex**
Cancer Screening

**Symetis**
Aortic Valve

**NanoPowers**
Incontinence

**Visiogen**
Intra-ocular lens

**Portaero**
Emphysema
Aileron Therapeutics Inc.
Joseph A. Yanchik III, Cambridge, MA, US
www.aileronrx.com
Aileron Therapeutics is developing the first generation of peptide therapeutics directed at intracellular protein-protein interaction targets that are not addressable by current drug modalities. The company’s proprietary cell penetrating “Stapled Peptide” technology is being applied to generate breakthrough therapeutics for the treatment of cancer and other diseases. “Stapled Peptides” have the potential to become a major new class of drugs for intracellular and extracellular targets across therapeutic areas.

Akebia Therapeutics Inc.
Joseph Gardner, Cincinnati, OH, US
www.akebia.com
Akebia Therapeutics is developing novel small molecule therapies to ameliorate patient suffering caused by anemia or vascular disease. Akebia’s portfolio includes a broad array of enzyme inhibitors that specifically upregulate hypoxia inducible factor (HIF) and angiogenic mechanisms.

Alios BioPharma Inc.
Lawrence Blatt, San Francisco, CA, US
www.aliosbiopharma.com
Alios is discovering and developing novel therapeutic agents based on: small molecule activators of innate immunity antiviral pathways (RNase L activation), phosphate protected nucleotide prodrug chemistry, and glycoprotein-engineering of interferons (Glycoferon). This complementary group of platform technologies has the potential to generate distinct therapeutic products to treat serious viral infections such as chronic hepatitis B and C, HIV, respiratory viruses (e.g. pandemic influenza) and emerging viral diseases (e.g. SARS).

Ascent Therapeutics Inc.
Frederick Jones, Cambridge, MA, US
www.ascentrx.com
Ascent Therapeutics is developing Pepducin™ lipopeptides, novel molecules that exquisitely target the intracellular domains of G protein coupled receptors (GPCRs) to allosterically modulate GPCR signalling. Ascent has programs in oncology, inflammation, cardiovascular and GI disease.

Avila Therapeutics Inc.
Katrine Bosley, Waltham, MA, US
www.avilatx.com
Avila Therapeutics is a drug discovery company developing a novel proprietary chemistry platform – Avilomics™ – for the generation of new medicines that covalently bond to and silence disease-causing proteins. A pipeline of novel therapeutics is being developed for viral infection, cancer and autoimmune diseases.

Bicycle Therapeutics Ltd.
John Tite, Cambridge, UK
www.bicycletherapeutics.com
Bicycle Therapeutics is developing a platform technology to create a new generation of biotherapeutics combining features of small molecules and biopharmaceuticals to create highly specific and highly stable drugs. Bicycle Therapeutics is a spin-out from the Medical Research Council Laboratory of Molecular Biology, Cambridge, based on the work of the founding scientists Sir Gregory Winter and Prof. Christian Heinis.
BioRelix Inc.
Brian Dixon, New Haven, CT, US
www.biorelix.com
BioRelix discovers and develops antibiotics that target pathogens resistant to currently available drugs by using novel patented bacterial RNA targets called RiboSwitches™.

Catalyst Biosciences Inc.
Nassim Usman, South San Francisco, CA, US
www.catalystbiosciences.com
Catalyst creates novel catalytic biopharmaceutical products based on engineered human proteases with the aim to establish protease therapeutics as a therapeutic platform.

Cellerix SA
Eduardo Bravo, Madrid, ES
www.cellerix.com
Cellerix is a Madrid-based biopharmaceutical company that is developing innovative medicines with advanced clinical programs that are using stem cells of adipocytes origin, for the treatment of various indications including fistulas. The company is in phase III for an autologous approach and in phase II for an allogenic approach.

Cequent Pharmaceuticals Inc.
Peter Parker, Cambridge, MA, US
www.cequentpharma.com
Cequent is pioneering the development of novel therapeutics to prevent and treat a wide range of human diseases – from inflammation to cancer – based on the company’s proprietary TransKingdom RNA interference (tkRNAi) technology, which uses non-pathogenic bacteria as an engine to produce and deliver RNAi directly into cells. Cequent’s first products, now in pre-clinical and clinical development, are drug candidates targeting colon-cancer prevention and inflammatory bowel disease.

Covagen AG
Julian Bertschinger, Zürich, CH
www.covagen.com
Covagen develops protein therapeutics based on a novel protein engineering technology and on Fynomers, a novel protein scaffold.

Cylene Pharmaceuticals Inc.
William Rice, San Diego, CA, US
www.cylenepharma.com
Cylene is using its unique discovery platforms to design and develop small molecule drugs that selectively target cancer cells. Cylene’s Serine/Threonine kinase inhibitor platform has created inhibitors of CK2 and the PIM family of kinases.
private equity portfolio
continued

- **Destiny Pharma Ltd.**
  Bill Love, Brighton, UK
  www.destiny-pharma.demon.co.uk
  Destiny Pharma focuses on the treatment and prevention of microbial infections. It is developing products which are effective against hospital "superbugs" such as methicillin-resistant Staphylococcus aureus (MRSA).

- **Diagnoplex Biosciences AG**
  Stavros Therianos, Lausanne, CH
  www.diagnoplex.com
  Diagnoplex is leveraging its molecular platform capabilities to develop a colorectal cancer (CRC) screening test. Diagnoplex's non-invasive CRC test, named "COLOX", will be made available as a ready-to-use clinical laboratory kit.

- **Evolva AG**
  Neil Goldsmith, Basel, CH
  www.evolvabio.com
  Evolva evolves small molecule drugs using massively combinatorial gene libraries that drive chemistry-rich pathways. The pathways are bred in yeast and iteratively screened for function. Its Watchmaker\textsuperscript{®} generates molecules that are outside the scope of the traditional synthetic chemistry approaches. The company will soon engage in clinical trials in the areas of cardiovascular and anti-fungi.

- **Eyesense AG**
  Peter Herbrechtsmeier, Frankfurt, DE
  www.eyesense.de
  EyeSense develops an ophthalmic diagnostics system which can measure glucose levels without sampling blood. It is based on measuring the glucose in the interstitial fluid below the conjunctiva of the eye using a hand-held optical read-out device.

- **FoldRx Pharmaceuticals Inc.**
  Richard Labaudiniere, Cambridge, MA, US
  www.foldrx.com
  FoldRx develops small molecule therapeutics to treat diseases of protein misfolding and aggregation. Its pipeline is initially for hereditary amyloidosis and neurodegenerative diseases.

- **Forma Therapeutics Inc.**
  Steven Tregay, Cambridge, MA, US
  www.formatherapeutics.com
  Forma Therapeutics technologies enable screening, identification and characterization of small molecules that exhibit different binding modes. The technology applies peptides, protein or small molecules as ligands to probe/assay interaction sites and the implementation of high throughput screening assays for identification of novel small molecules for specific target sites in oncology and ID.

- **Genedata AG**
  Othmar Pfannes, Basel, CH
  www.genedata.com
  Genedata provides computational solutions for drug discovery and systems biology research with a combination of software products and professional services that have been developed in partnership with major pharma and biotech companies.

- **GlycoMimetics Inc.**
  Rachel King, Gaithersburg, MD, US
  www.glycomimetics.com
  GlycoMimetics develops small molecule drugs that mimic the functions of certain carbohydrates. The company's initial focus is on therapeutics to treat a variety of inflammatory conditions, including sickle cell disease, and an adjunctive therapy for use with antibiotics in the treatment of chronic Pseudomonas infections.
Heptares Therapeutics Ltd.
Malcolm Weir, London, UK
www.heptares.com
Heptares Therapeutics is a new drug discovery company whose aim is to apply structural knowledge of G-protein coupled receptors (GPCRs) to the design and development of its own drug molecules. HTL is a spin-out from the MRC Laboratory of Molecular Biology, Cambridge, based on the pioneering work of the founding scientists Richard Henderson and Chris Tate and of a wider group of MRC scientists, including Gebhard Schertler, and Ed Hulme of the National Institute of Medical Research.

Immune Targeting Systems Ltd.
Carlton Brown, London, UK
www.its-innovation.co.uk
Immune Targeting Systems is a London based vaccine company developing vaccines for mutating viruses. Its innovative synthetic T cell platform allows to develop novel vaccines for the prevention and treatment of major life-threatening viral infections of global impact, including pandemic and seasonal influenza.

Intellikine Inc.
Troy Wilson, San Diego, CA, US
www.intellikine.com
Intellikine develops novel oral small molecules in the PI3K/mTOR pathway with a focus on oncology and immunology.

LigoCyte Pharmaceuticals Inc.
Don Beeman, Bozeman, MT, US
www.ligocyte.com
LigoCyte Pharmaceuticals is focused on novel vaccines based on its proprietary virus-like particle technology platform. The lead project is a Norovirus and Influenza vaccine.

MerLion Pharmaceuticals Pte Ltd.
Tony Buss, Singapore
www.merlionpharma.com
Merlion Pharmaceuticals maintains one of the world’s largest and most diverse collections of natural product samples, and has an anti-infective compound in early clinical development.

MicroCHIPS Inc.
John T. Santini, Bedford, MA, US
www.mchips.com
MicroCHIPS develops devices for the controlled release of drugs and the elective exposure of biosensors using its patented reservoir array technologies.

Nabriva Therapeutics AG
David Chiswell, Vienna, AT
www.nabriva.com
Nabriva is a specialist antibiotic company with the objective of discovering and developing innovative antibacterials positioned to battle antibiotic resistance in Gram-positive and Gram-negative pathogens.

NanoPowers AG
Martin Horst, Lausanne, CH
www.nanopowers.ch
NanoPowers aims to develop artificial muscles for various implant indications. The Company has developed several animal proof of concepts, and is entering preclinical stages with devices aimed for the treatment of urinary and fecal incontinences.

Neomics Co. Ltd.
Chiuk In, Seoul, KR
www.neomics.com
Neomics develops novel therapeutics with applications in oncology and tissue regeneration.
Neovacs SA
Guy-Charles Fanneau de La Horie, Paris, FR
www.neovacs.com
Neovacs SA is a Paris based vaccine company pioneering the next generation of anti-body therapies against human cytokines with a novel active immunization approach. Its innovative platform is used to develop vaccine products that induce anti-TNFα, anti-VEGF and anti-IFNα polyclonal responses, and target broad pharmaceutical markets.

Nereus Pharmaceuticals Inc.
Kobi M. Sethna, San Diego, CA, US
www.nereuspharm.com
Nereus pursues untapped sources of chemical diversity which together with its expertise in marine microbiology and integrated technologies enabled the identification and development of two oncology drug candidates which are in clinical trials.

NovImmune AG
Jack Barbut, Geneva, CH
www.novimmune.com
NovImmune is a drug development company focusing on immune mechanisms targeted to inflammation. NovImmune has a portfolio of fully human therapeutic monoclonal antibodies in development.

Okairos AG
Riccardo Cortese, Basel, CH
www.okairos.com
Okairos is a Swiss based vaccine company, with a subsidiary in Italy, developing vaccines for mutating viruses. Its innovative viral adenovirus T cell platform allows to develop novel vaccines for the prevention and treatment of major life-threatening infections, including malaria and hepatitis C. The company has entered the clinical stage.

Opsona Ltd.
Mark Heffernan, Dublin, IE
www.opsona.com
Opsona is a drug development company, focused on novel therapeutic and preventative approaches to inflammatory and related diseases. Opsona has a pipeline of therapeutics in advanced pre-clinical development which modulate the innate immune system, including biologics and small molecules that are targeting TLR-2 and Nalp-3. The company has signed some significant partnering and collaborative deals, such as with Wyeth.

Oxagen Ltd.
Mark Payton, Oxford, UK
www.oxagen.co.uk
Oxagen is a drug discovery and development company specializing in inflammation with a first in class CRTH2 antagonist program in inflammatory and respiratory diseases.

Paratek Pharmaceuticals Inc.
Thomas Bigger, Boston, MA, US
www.paratekpharm.com
Paratek is engaged in the discovery and commercialization of new anti-infectives based on novel tetracycline structures that allow for antibacterial and anti-inflammatory properties.

PharmAbcine
Jin San Yoo, Seoul, KR
www.pharmabcine.com
PharmAbcine develops fully human therapeutic monoclonal antibodies for the treatment of cancer and inflammatory diseases. PharmAbcine is a spin-out from Korea Research Institute of Bioscience & Biotechnology (KRIBB).
Phenomix Corporation
Laura Shawver, San Diego, CA, US
www.phenomixcorp.com
Phenomix is a drug discovery and development company focused on proven targets in large markets. The company's lead drug candidate, Duto-gliptin, is in Phase III testing as an orally available treatment for type II diabetes.

Polyphor AG
Jean-Pierre Obrecht, Allschwil, CH
www.polyphor.com
Polyphor delivers syntheses of focused libraries of small molecules and epitope mimetic proteins of high purity and in substantial quantity and performs lead optimization, utilizing rapid parallel synthesis production. In parallel, Polyphor develops its own drugs and has a drug candidate for hematopoietic stem cell transplantation in clinical trials.

Portaero Inc.
David Plough, Cupertino, CA, US
Portaero is a medical technology company developing a device for the treatment of chronic obstructive pulmonary diseases, in particular emphysema.

ProCertus BioPharm Inc.
Paul M. Weiss, Madison, WI, US
www.procertus.com
ProCertus aims to discover and develop products that will protect cancer patients against chemotherapy- and radiotherapy-induced dermatological and gastrointestinal side effects.

Proteostasis Therapeutics Inc.
Greg Licholai, Cambridge, MA, US
www.proteostasis.com
Proteostasis is discovering and developing novel small molecule therapeutics designed to control the body's protein homeostasis, or Proteostasis Network. The Proteostasis Network maintains the body's natural balance of proteins, thereby providing protective effects from various disease states. These novel therapies are designed to treat multiple genetic and degenerative disorders associated with deficiencies of the Proteostasis Network, such as Alzheimer's disease, emphysema, Huntington's disease, and type II diabetes.

PTC Therapeutics Inc.
Stuart Peltz, South Plainfield, NJ, US
www.ptcbio.com
PTC Therapeutics is a biopharmaceutical company focused on the discovery and development of orally administered, proprietary small-molecule drugs that target post-transcriptional control processes.

Pulmatrix Inc.
Robert Connelly, CEO, Lexington, MA, US
www.pulmatrix.com
Pulmatrix is discovering a new class of host-targeted therapies that treat, prevent and help control a broad range of respiratory infections and progressive respiratory diseases. Pulmatrix's innovative pathogen independent approach harnesses the airway and lungs own natural biophysical and host defense mechanisms, offering potential for individual therapies that treat serious respiratory diseases including influenza, rhinovirus, COPD, asthma and cystic fibrosis.
private equity portfolio
continued

- **S*BIO Pte Ltd.**
  Jan-Anders Karlsson, Singapore
  www.sbio.com
  S*BIO joined our portfolio as a former Chiron investment. S*BIO is a drug discovery company with a small molecule approach to cancer targets.

- **Sonitus Medical Inc.**
  Amir Abolfathi CEO, San Mateo, CA, US
  www.sonitusmedical.com
  Sonitus Medical is developing innovative medical device products to treat hearing disorders.

- **Symetis AG**
  Jacques Essinger, Lausanne, CH
  www.symetis.com
  Symetis is developing a catheter-mediated delivery system on the beating heart to insert stented mechanical valves for application in cardiac valve replacement.

- **SynphaBase AG**
  Arthur Bodenmueller, Pratteln, CH
  www.synphabase.ch
  SynphaBase offers custom-synthesis of life science intermediate products obtained by synthetic and bioorganic methods, including chiral building blocks, amino and hydroxyl carbonic acids and peptides/glycopeptides.

- **Tepha Inc.**
  Simon Williams, Lexington, MA, US
  www.tepha.com
  Tepha's proprietary technology utilizes genetic engineering to produce bioabsorbable polymers, known as polyhydroxyalkanoates (PHAs). Potential products range from medical devices, such as surgical patches, sutures and ligaments to cardiovascular stents and drug delivery systems.

- **Tokai Pharmaceuticals Inc.**
  Seth Harrison, Cambridge, MA, US
  www.tokaipharma.com
  Tokai develops best-in-class therapies for hormone-dependent growth disorders. The company’s lead program is a proprietary small molecule Specific Androgen Receptor Modulator/Lyase Inhibitor (SARM/LI) for Castration Resistant Prostate Cancer (CRPC).

- **Trellis Bioscience Inc.**
  Stote Ellsworth, South San Francisco, CA, US
  www.trellisbio.com
  Trellis Bioscience is a private biotechnology company leveraging its proprietary CellSpot™ technology to deliver higher quality therapeutic monoclonal antibodies. The company has programs in infectious disease and oncology.

- **Viamet Pharmaceuticals Inc.**
  Robert Schotzinger, Morrisville, NC, US
  www.viamet.com
  Viamet discovers and develops “best-in-class” small-molecule inhibitors of validated metalloenzymes via an innovative and proprietary metal-binding, using their trade mark Metallophilic Technology.
Prof. Francis Waldvogel
Chairman
Former Chairman of the Board of the Swiss Federal Institute of Technology, University of Geneva, Switzerland

Prof. Michel Aguet
Director of the Swiss Institute for Experimental Cancer Research (ISREC) and the “Molecular Oncology” National Center for Competence in Research, School of Life Sciences at EPFL

Prof. Jeffrey A. Hubbell
Professor and Director of the Institute of Bioengineering, and Professor of the Institute of Chemical Sciences and Engineering, EPFL

Prof. Jean-Marie Lehn
Nobel Prize Winner for Chemistry, Collège de France, Paris, Université Louis Pasteur, Strasbourg, France
Prof. Christoph A. Meier  
Chief, Department of Internal Medicine and Specialties, Triemli Hospital Zurich, and Associate Professor, Medical Faculty, University of Geneva

Dr. Trevor Mundel  
Head of Global Development, Novartis Pharma

Dr. Raj Parekh  
General Partner at Advent Venture Partners, London, UK

Jonathan Symonds  
Chief Financial Officer (CFO) of Novartis and member of the Executive Committee of Novartis (ECN)
Prof. Spyros Artavanis-Tsakonas
Chairman
Department of Cell Biology, Harvard Medical School, Boston, USA

Prof. Joan S. Brugge
Chair of Department of Cell Biology, Harvard Medical School, Boston, USA

Prof. Daniel Louvard
Director of Research, Institut Curie, Paris, France

Prof. Hidde Ploegh
Professor of Biology, Massachusetts Institute of Technology. Member, Whitehead Institute for Biomedical Research

In addition the following people are supporting the Novartis Option Fund Board:
Dr. Trevor Mundel, Global Head of Development, Novartis Pharma; Anthony Rosenberg, Global Head of Business Development & Licensing, Novartis Pharma; Dr. Charles Wilson, Global Head of Strategic Alliance, NIBR; Dr. Reinhard Ambros, Head of Novartis Venture Funds
Reinhard Ambros
Global Head of Novartis Venture Funds. He was Managing Director of the Novartis BioVenture Fund in the USA. Previously, he worked with Novartis Corporate Finance where he held the position of Head of Group Strategic Planning for several years. He was responsible for post merger integrations at Novartis Corporate M & A and was global head BD & L cardiovascular and metabolic diseases at Novartis Pharma. Earlier in his career he had global leadership positions for key drug development projects at Novartis and Roche. He trained as a pharmacist, Ph.D. in medicinal chemistry and pharmacology and focused postdoctoral training in clinical pharmacology. Board seats include Cylene, Forma, Genedata, MicroCHIPS Symetis and Tokai.

Markus Goebel
joined as Managing Director of the Novartis Venture Funds in Cambridge, MA, USA. Previously he worked as head Pharma Corporate M&A and head Nervous System BD&L Pharma. An M.D. by training and certified, amongst others, in Haematology/Oncology he worked for Farmitalia Germany and later held several positions in R&D, Marketing and Strategy at Roche headquarters before joining Novartis. Markus Goebel received an M.D. and a Ph.D. from the Ludwig Maximilian’s University in Munich and an MBA from Henley. Markus serves on the boards of Intellikine, LigoCyte and Trellis, and works with FoldRx.

Florent Gros
joined the Novartis Venture Fund in 2007 as Managing Director. He brings over 15 years of senior Intellectual Property, licensing and entrepreneurial experience, gained at Nestlé, Aventis and Novartis, particularly in biologics and vaccine areas. Florent has a Biotechnology Engineering Degree (France), with diploma thesis made at Glaxo-Vaccine (Belgium). He also holds European and French patent law degrees, as well a Masters in Private Law. Board seats include Immune Targeting Systems, Nanopowers, Neovacs and Opsona, and works with Cellerix, Evolva, NovImmune and Okairos.

Anja König
joined as Managing Director in 2007. She is active in Switzerland and Europe and also responsible for expanding the fund’s presence to Asia Pacific. Prior to joining Novartis she was an Associate Partner at McKinsey and Company, a global consultancy, where she worked with companies in health care, pharmaceuticals and biotech in the US, Europe and Emerging Markets. Anja König is a scientist by training and holds a Ph.D. in physics from Cornell University. Anja serves on the boards of Bicycle, Covagen, Diagnoplex, Heptares, Nabirva and Oxagen, and works with Destiny, MerLion, Neomics, PharmAbcine, Polyphor and S*BIO.
Campbell Murray

joined as Managing Director in 2005. Prior to joining the fund, he worked at the Novartis Institutes for BioMedical Research as the director of special projects. Campbell is a New Zealand trained physician, Kauffman Fellow and holds an MBA from Harvard Business School and an MPP (public policy) from the John F. Kennedy School of Government where he was a Knox Fellow and Rotary Ambassadorial Scholar. Campbell serves on the boards of Aileron, Akebia, Allos BioPharma, BioRelix, ProCertus BioPharm and Tokai Pharmaceuticals and as an observer on the board of MicroCHIPS and Tepha.

Lauren Silverman

is a Managing Director of the Novartis Option Fund. Prior to joining NVF she was Global Head of Oncology Research Operations for Novartis. Previously, Lauren spent much of her career in BD & L, first at OSI Pharmaceuticals and later at Pfizer. Lauren was also a Director of Strategic Alliances and Head of Cell Biology where she led multiple research teams after having been a founding scientist of Cadus Pharmaceuticals. Lauren was a postdoctoral fellow at Memorial Sloan Kettering Cancer Center and Princeton University and earned her Ph.D. in molecular biology from the University of Utah. Current board seats include Ascent, Proteostasis, Cequent, Viamet, and Pulmatrix.

Henry Skinner

is a Managing Director of the Novartis Option Fund. Prior to the Novartis Venture Funds he worked as Executive Director and global head Strategic Alliances, Therapeutics and head Strategic Alliances, Technologies at the Novartis Institutes for Biomedical Research. Prior to joining Novartis he was CEO of SelectX Pharmaceuticals and President and CEO of NeoGenesis Pharmaceuticals, which was acquired by Schering-Plough. He was also Director of Technology Acquisitions for Pharmacia & Upjohn and Director of Business Development at Lexicon Genetics. He was a postdoctoral fellow at Baylor College of Medicine and earned his Ph.D. in Microbiology and M.S. in Biochemistry from the University of Illinois. Henry serves on the board of Avila.

Steven D. Weinstein

joined the Novartis Venture Fund in 2006 as a Managing Director. Prior to Novartis, Steve spent five years at Prism Venture Partners, where he focused on medical devices. Steve started his venture career in 1999 as a Kauffman Fellow with Mid-Atlantic Venture Funds. As an entrepreneur and CEO, he raised angel funds to buy the assets of a defunct distribution business out of bankruptcy, and then successfully rebuilt the business over the next five years. Steve holds an MBA with distinction from the University of Michigan Business School and a BS in mechanical engineering from Columbia University. He has led the investments and serves/d on the board of: Ablation Frontiers (acquired by Medtronic), Portaero, Sonitus Medical, and Visiogen (acquired by Abbott), and works with Catalyst Biosciences and GlycoMimetics.
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