New Nano-Medicine Cancer Drugs: Business & Technology Overview

The War Against Cancer & Nano-medicine

John & the Tale of Two Treatments

Three Key Innovations:
- Drug delivery
- Virtual biotech startups
- Computational Modeling

The War Against Cancer Continues
1971 → 2001 → 2012

Development cost & time

10M new cases per year

Cost of Development
- Earlier: 250M
- Now: 1.5B

Time to Market
- Earlier: 10 Yrs
- Now: 15 Yrs

NCEs
- Earlier: ~40
- Now: ~30

Most Blockbuster Patents expire in next 2-5 years
Promise of Nanotechnology in Medicine & Cancer Treatment

Nanomedicines—already 30+ cancer drugs on the market

Global Race for $70B Nano-Biopharmaceuticals market...

Nano-particles for Cancer
John is a cancer drug trial volunteer

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How to kill the tumor without endangering the patient?

Problem: Major side-effects in 90+ FDA-approved chemo-therapy drugs

Solution: 10x better safety & efficacy with “programmed” nano-engineered DDS

TNP=Targeted polymeric NanoParticles= “smart bombs for cancer tumors”
1st Generation: Nano-scale the drugs

2nd Generation: Nano-scale the DDS

3rd Gen: Nano-engineer the DDS for precise targeting & 10x efficacy

3rd Gen Human Trials April 2012: BIND-014 MIT Langer & Harvard Med Farokhzad

Apr 2012 First Targeted Nano-particle Drug in Human Clinical Trials
BIND-014 goal: Taxane
Target: PSMA
Payload: Docetaxel
Development path: 505(b)(2)
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CFD=Computational Fluid Dynamics

CFD was game-changing: 10x accuracy, 10x speed at 1/10th the cost...

Edisonian Trial & Error: Animal experimentation

Moore's Law & exponential learning curve: Physico-chemical characterization, computational fluid, nanoparticle dynamics and membrane interaction.

Strong IP protection of novel nanobio-materials with mechanism design.
4th Gen: “Virtualize” the nano-engineering of drug delivery

Key Innovations:
- CFD Nano Micro Computational Characterization
- Nano-drug delivery development
- Virtual biotech startup business model—highly capital efficient

Nano-Computational Characterization for faster analysis of mechanisms during development

Value to Users: Shrinking tumors with fewer chemo-therapy side effects
- 12M new cancer patients/yr, 8m die annually
- 90+ chemo-therapy drugs are FDA approved but are dose-limited for safety & side-effects
- Drugs costly due to R&D costs of $354M/drug.
Value to Corporate Partners: 2x Faster & 10x Safety and Efficacy

- Use FDA-approved chemo drugs + well-known antigens
- Screen & analyze 100+ DDS nanoparticles

Cut 6 yrs of time getting to Phase III review of 73 candidates, with 31% unsafe and 57% ineffective...

Atlas Ventures: A model LLC Structure for rapid commercialization & funding

**Corporate Limited Partners:**
1. Pharmaceutical Company
2. Consumer Healthcare
3. Med Imaging Company
4. Life Sciences IT Company

**Subsidiaries C-Corp Startups:**
1. Lung Cancer DDS
2. Brain Tumor CNS DDS
3. Imaging

Each C-Corp start-up in the portfolio is a virtual nano-medicine Build-to-Buy

**BIND BioSciences**
- 2007 $4.7M debt financing
- 2010 $12.4M Series C
- 2011 $47.25M Series D
- 2012 First Human Trials
- $85.2M in Funding

**Computational Virtual Startup**
1. Computational Lab 50%
   a. Large cluster-1000CPUs
   b. Facilities Setup
   c. Utilities 1000/mth
2. Lab Personnel 25%
   i. Computer administrator
   ii. 3 computational dynamics postdocs
3. Benchmarking Lab 25%
   a. MRI and Digital MRI file mgt system
   b. small microfluidics lab setup
   c. Microscopes & optical tables

TNP Programming Lab = $2M/year Operating Expenses
Virtual Build-to-Buy Approach: Licensing or M&A in 2-3 years

2011 had 35 Big Exits with $8B Upfront Paid

2000-2010 Healthcare IRR 7.4-15%

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New Nano-Medicine Cancer Drugs: Key Takeaways

Nano-engineered drug delivery systems are key advance in War Against Cancer

Like smart-bombs, these DDS can target tumors making John’s cancer treatment 10x more effective

Three Key Innovations: 4th gen Nano Drug delivery

Virtual biotech startups
Computational Modeling

Session 2 ECOM 6030 Web 2.0 Strategy

Professor Amy Shuen