Drug Discovery and the Pharmaceutical Industry

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The Pharma Value Chain

Gene Sequencing  Target ID  Target Validation  Lead Discovery  Pre-Clinical  Clinical Phase I  Clinical Phase II  Clinical Phase III  Manufacturing  Distribution

Drug Discovery  Animal Studies  Clinical Tests  Commercialization
Gene Sequencing

- Human Genome Project
- Library of DNA sequences
- Pick a disease target
- Proteins or mRNA expressed or not
Target Validation

- Involvement of protein
- Understand pathways and interactions
Lead Discovery

- Evaluate leads
  - Replacing protein?
  - Anti-sense RNA
  - Antibodies
  - Stimulate protein synthesis
Pre-Clinical

- Animal Tests
  - Toxicity
  - Efficacy
Clinical Phase I

- Small group of healthy volunteers (10’s)
  - Safety
  - Toxicity
  - Sometimes use target group patients
  - Example of Gleevec (Chronic Myeloid Leukemia)
Clinical Phases II and III

- **Phase II**: (100’s) of patient population, **Phase III**: (1000’s) of patient population
- Determine
  - Efficacy
  - Dosage
  - Safety
  - Side Effects
Manufacturing/Distribution

- FDA Approval
- Scale up quantities
- Detailing, advertising, distribution
- Insurance company acceptance (Example of Vioxx)
Pharma Value Chain

- **Protein Logic**
  - Information

- **Locus Discovery**
  - Targets
  - Structural Biology
  - Drug Design
  - Assays/Screening
  - Chemistry

- **HALOS**
  - Hits
  - ADME/Tox
  - Animal Studies

- **DELSYS Pharmaceutical Corporation**
  - Leases
  - Delivery & Formulations
  - Clinicals

- **Orchid**
  - Genomics/Proteomics
  - Pathway & Disease Models
  - Protein Therapeutics

- **Vaccines, Gene Therapy,**
  - (Vaccines,
    - Gene Therapy,
    - Protein Therapeutics)

Costs:
- $1B
- $100M
- $10M
- $1M

Drugs:
- $1B

Leads:
- $100M

Hits:
- $10M

Targets:
- $1M
Time Scale
Benefits of Genomics

- Decreases Cost
- Decreases Time
Pharmaceutical Companies

http://www.duke.edu/web/soc142/team2/shifts.html
What’s the Industry Like Today?

- Time to develop a drug = 10 to 15 years
- Cost to develop a drug
  - 2006 = $1.3 billion
  - 2001 = $800 million
  - 1987 = $318 million
- Drugs and Biologics approved in 2008 = 31
- Only 2 out of every 10 marketed drug ever return revenues that match or exceed R & D costs
- This year, 2,900 medicines are currently in development
Bibliography

- www.phrma.org/files/PhRMA%202009%20Profile%20FINAL.pdf