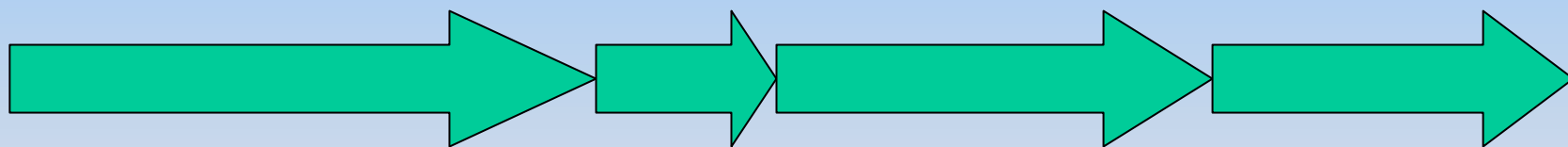
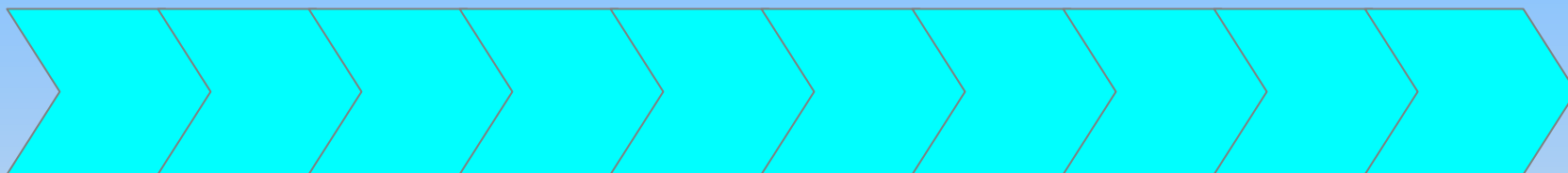


Biotech and Pharmaceuticals: Show Me the Money!

Doug Kalish
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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 Manufac-turing Distribution



Drug Discovery

Animal
Studies

Clinical Tests

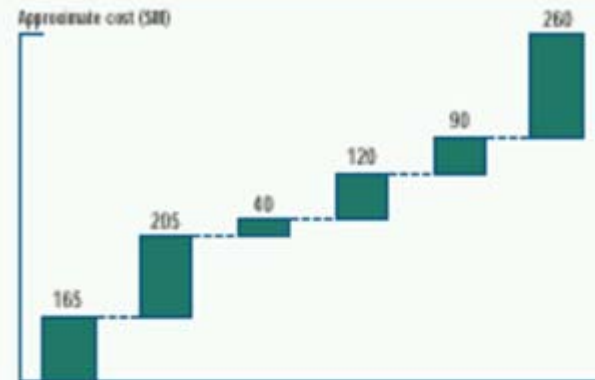
Commercialization

Drug R&D Takes Time and Money...

EXHIBIT 2 DRUG R&D IS EXPENSIVE AND TIME-CONSUMING

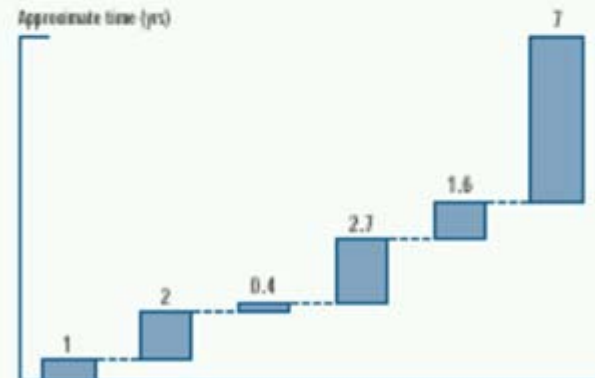
Cost: \$800 million total

Approximate cost (\$M)



Time: 14.7 years total

Approximate time (yrs)

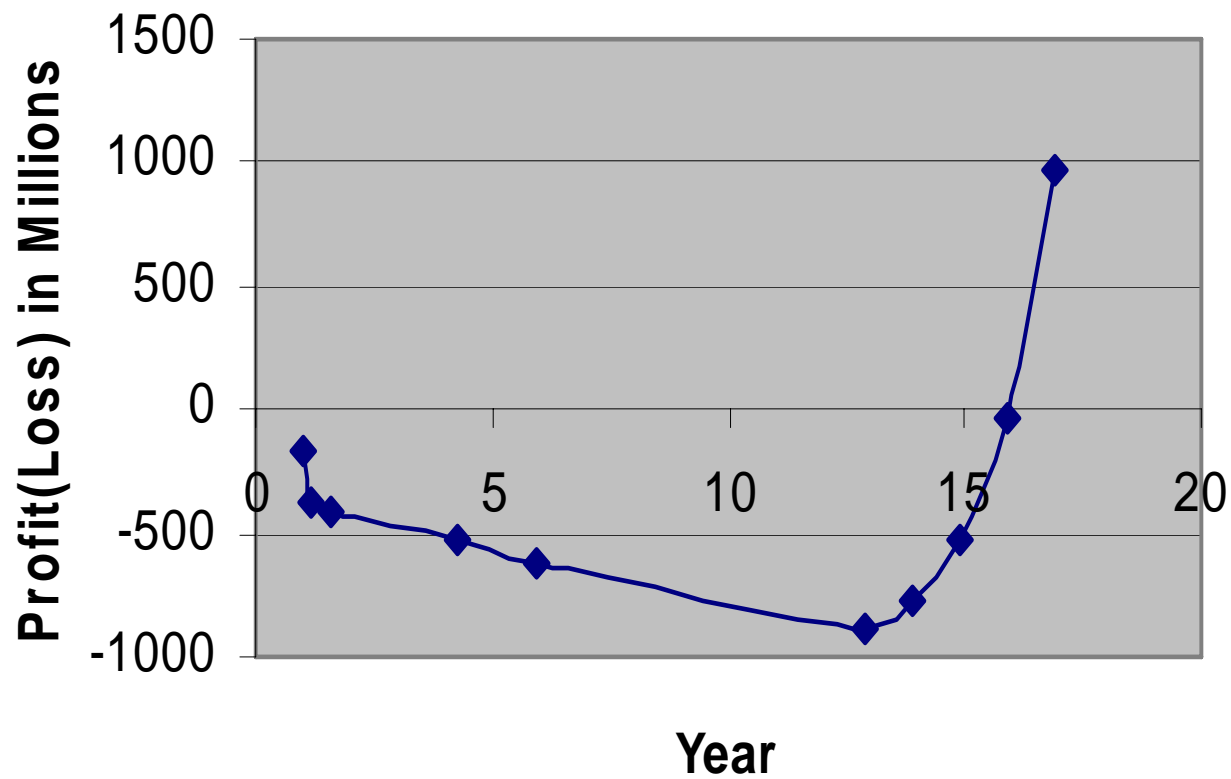


Source: BCG analysis; industry interviews; scientific literature; public financial data; Lehman Brothers; PAREXEL'S Pharmaceutical R&D Statistical Sourcebook 2000.

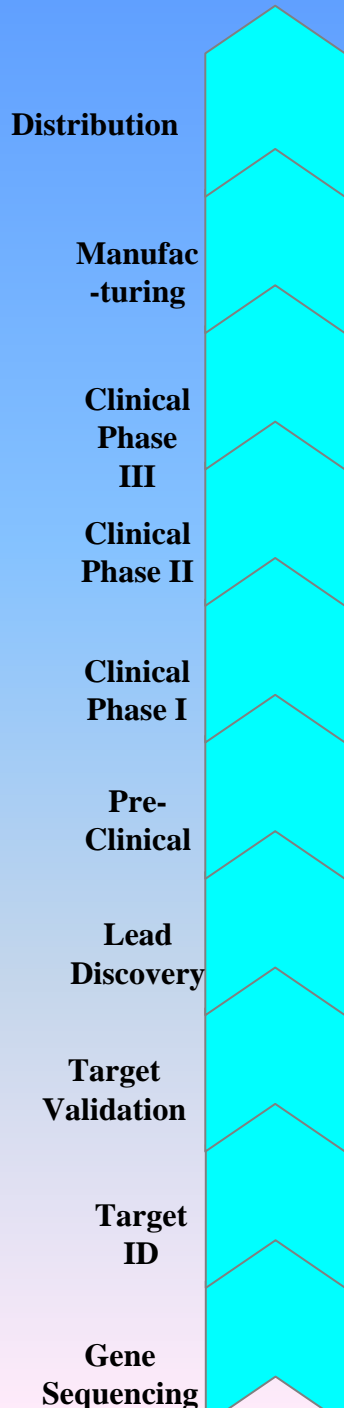
Note: Cost to drug includes failures. Target identification includes initial experiments that companies may have outsourced to academic research institutions.

Drug R&D Takes Time and Money...

Cumulative Profit/Loss per Year



Styles of Industry Integration

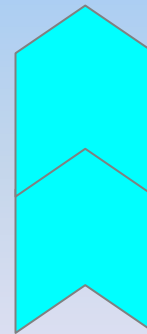


Vertical

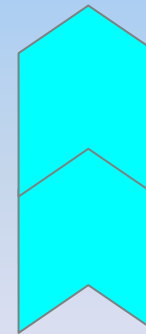
Horizontal

Lead Discovery

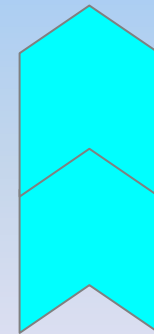
Target Validation



Drug 1



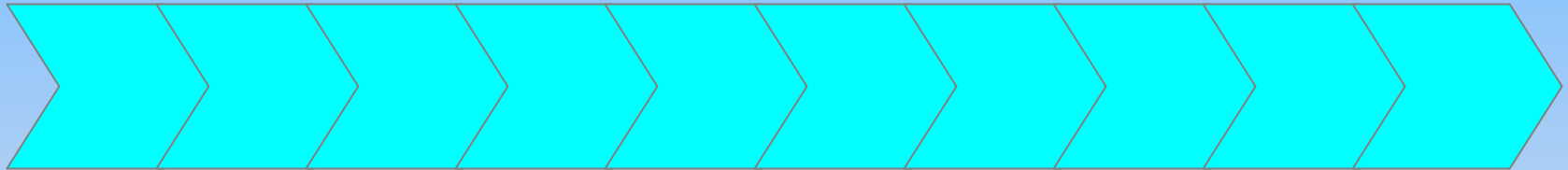
Drug 2



Drug 3

Big Pharma's Coverage of the Value Chain

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



Bayer, Pfizer, Schering-Plough, Glaxo Smithkline, etc.

Other Factors Promoting Vertical Integration

- **Sunk Costs: Intellectual Property Rights and R&D Expenditures**
 - Endogenous, Firm-level strategic
- **Sunk Costs: Regulatory Requirements**
 - Exogenous (beyond control of the firm)
- **Economies of Scale**
 - Average costs fall as more output is produced
- **Economies of Scope**
 - Total cost of producing two outputs together is less than cost of producing them separately

Also, Companies are Motivated to Vertically Integrate When

- IP is not well protected
- IP transaction costs are high (negotiating, specifying, monitoring, enforcing)
- IP is not easily defined and the uses aren't clear
- The partners are not equal in 'power'
- There are many intangibles in the IP (know-how, culture, etc.)

Reasons for Partnering

- Shoring up product portfolios by acquiring products and late-stage development candidates (Genzyme+Celtex, Chiron+Pathogenesis)
- Discovery Alliances (Curagen+Bayer, Millennium+Aventis)
- Harvesting fallen fruit (Reliant, Jones Pharmaceuticals)
- Shared risk (Joint Ventures) (Elan, Abgenix)
- Global reach

Importance of Biotech Alliances

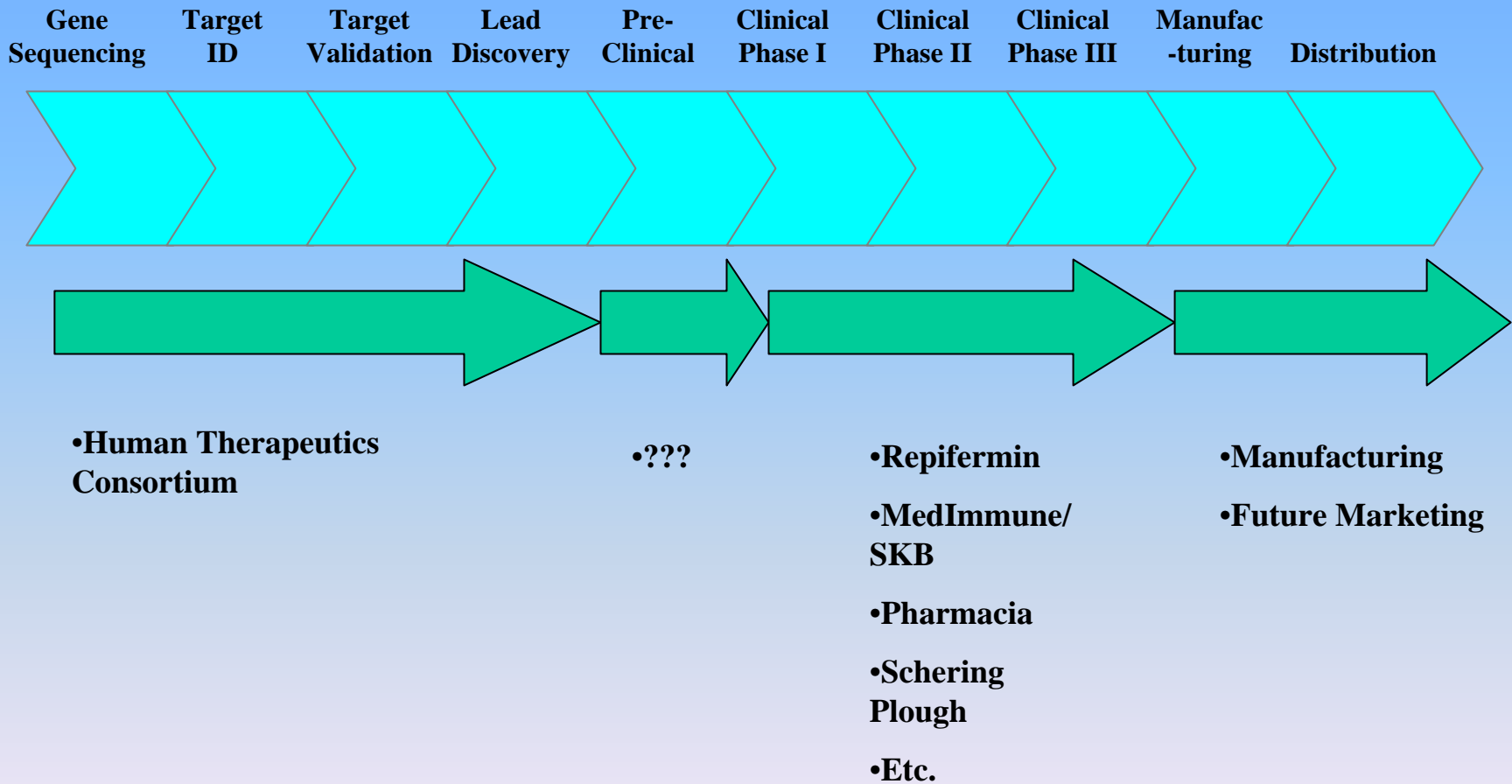
Small Companies

- Access to Funding (>50%)
- Of \$7.2B in 1H01 sales of biotech products, 90% developed via alliances

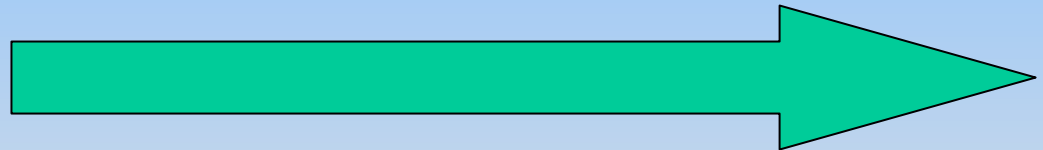
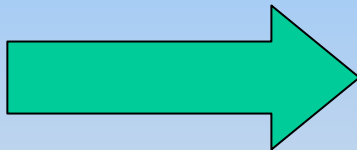
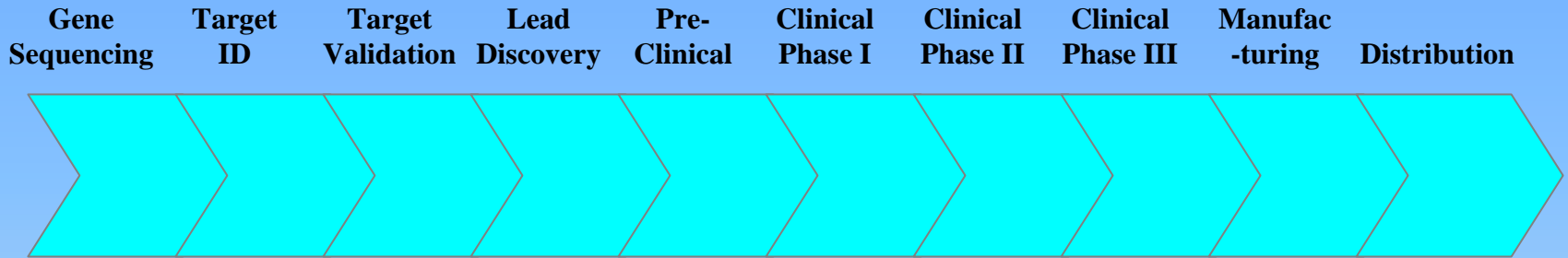
Large Companies

- In-licensing responsible for 53% of J&J Pharm revenues in 2000 (up from 29% in 1996)
- 55% of J&J In-licensing revenues comes from alliances
- By 2002, 45% of pharma revenues from in-licensing

Human Genome Sciences (External)



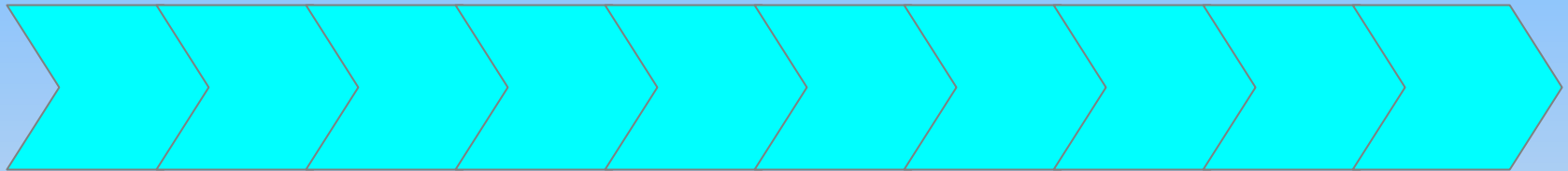
MorphoSys



- Roche
- Schering Plough
- Bayer
- Biogen

Xoma's Coverage of the Pharma Value Chain

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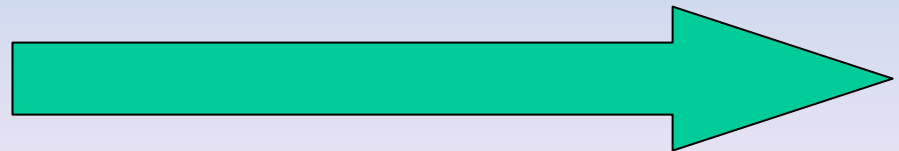


Core
Business

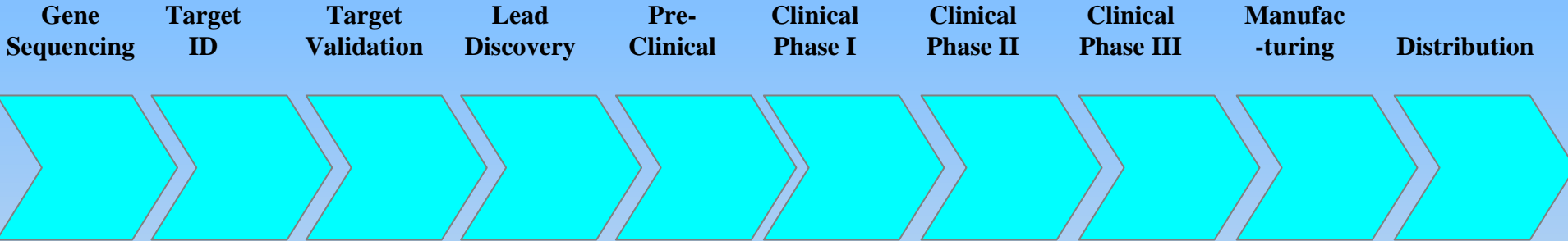


Partners

Baxter, Genentech



Problems of Disintegration?



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