

**Arthur D Little**

# Overview of Biotechnology Sector and Business Models

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- 1** **Biotechnology Sector Overview**
- 2 Business Models
- 3 Key Partnering Trends

## Biotechnology boomed during the 1980s as a result of confluent forces

### Technology Breakthroughs in BioSciences

- 1973: First DNA genetic engineering techniques
- 1975: First monoclonal antibody
- 1977: First expression of human gene in bacteria
- 1982: First biotech product in the market (Humulin)

### Capital Market Appetite for Biotechnology

- Booming of Venture Capital
- Changes in pension fund regulations allowing more speculative investments

**BIOTECHNOLOGY**

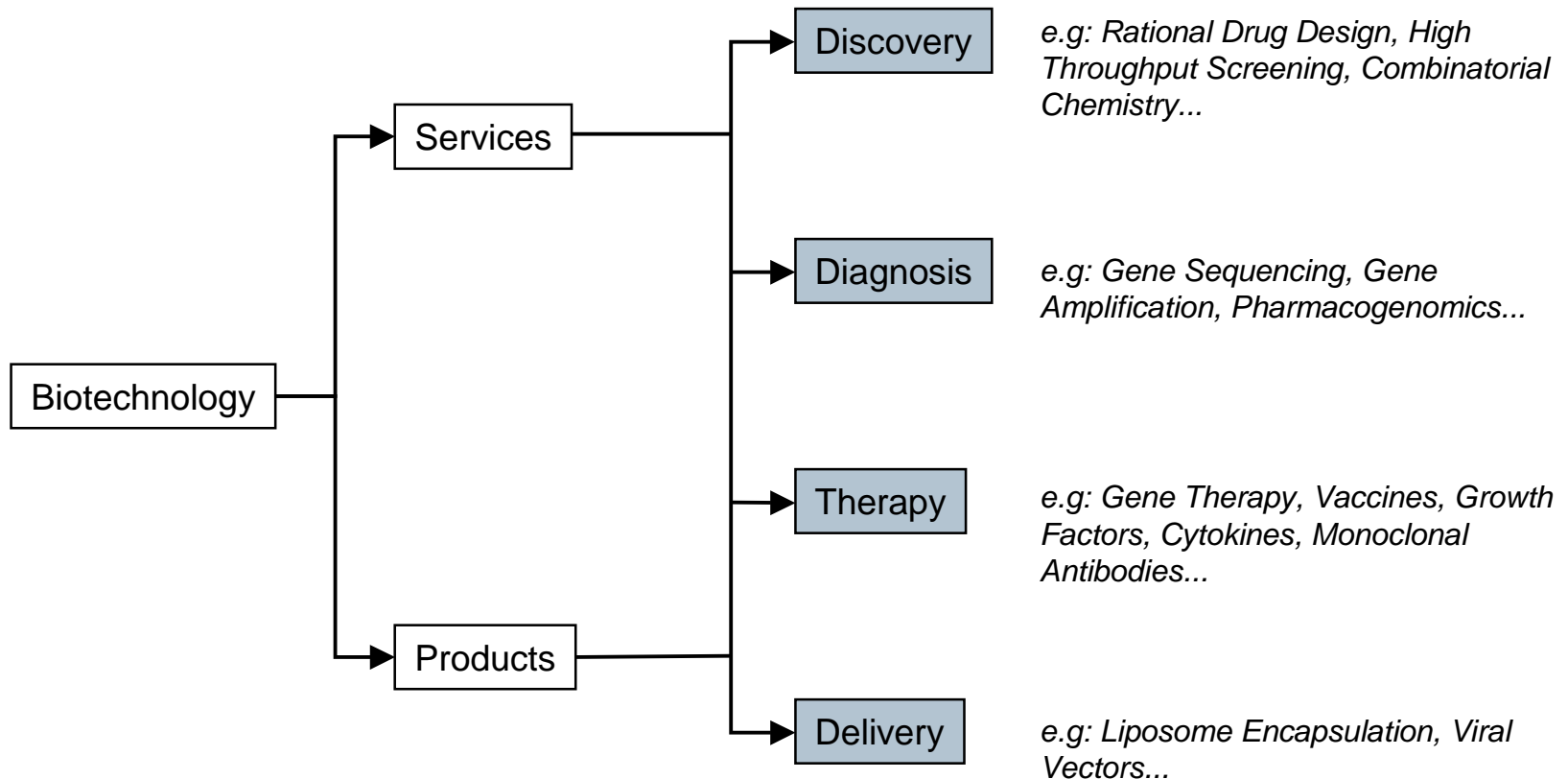
### Cultural Shift Towards Entrepreneurial Business Models

- The bureaucratic nature of pharmaceutical R&D
- “Open-door” practice allowing academics to dedicate a portion of their work to outside activities

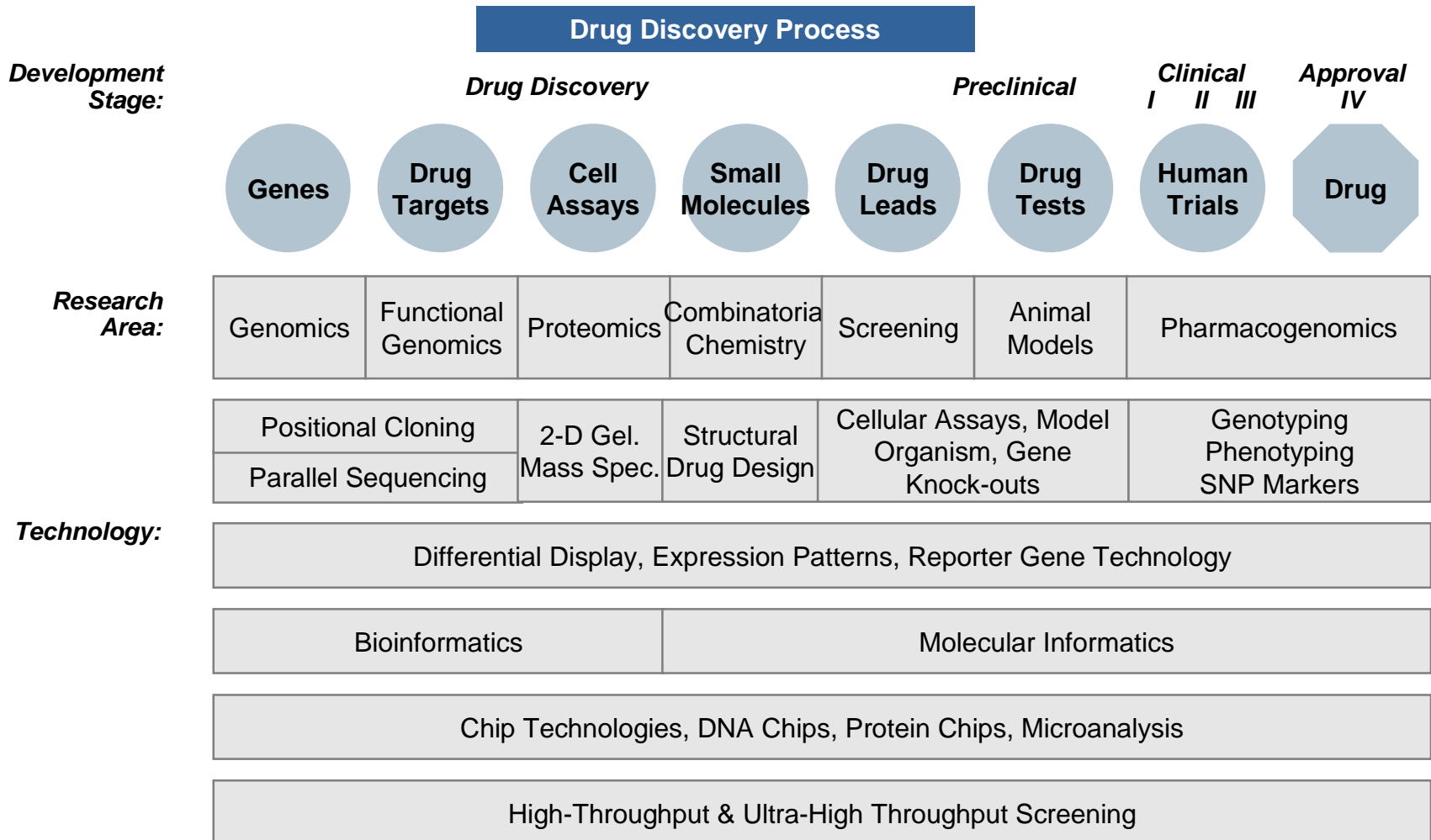
### Favorable Government Policies

- Increased government funding of medical research
- Technology transfer policies under the Reagan administration

# Biotechnologies have enabled the commercialization of products and services with a wide range of applications



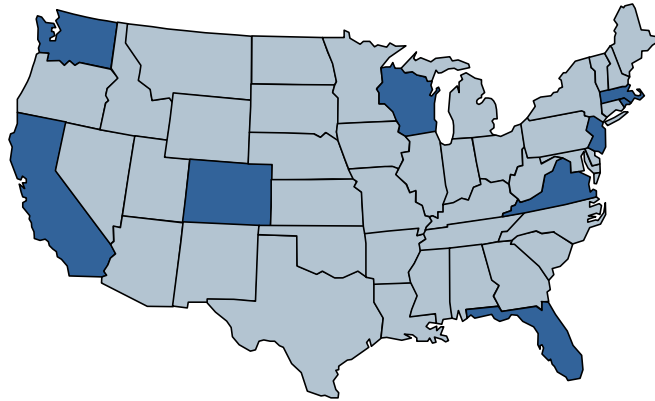
The impact of biotechnologies is evident across the entire drug discovery development and production process



Sources: Arthur D. Little

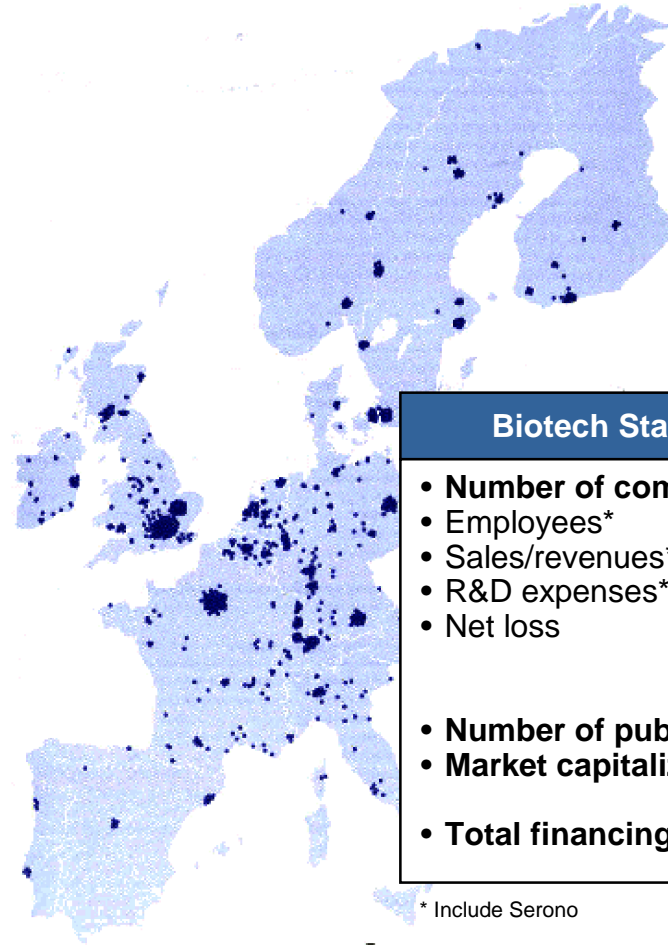
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### Biotechnology is now an important industry both in US and European markets



Biotech Statistics USA (2002)	
• Number of companies*	1466
• Employees*	194,600
• Sales/revenues*	€ 33.6 bn
• R&D expenses*	€ 20.5 bn
• Net loss	€ 11.6 bn
• Number of public companies	318
• Market capitalization	€ 190 bn
• Total financing	€ 8.6 bn

\* Only entrepreneurial companies accounted



Biotech Statistics Europe (2002)	
• Number of companies*	1878
• Employees*	82,124
• Sales/revenues*	€ 12.8 bn
• R&D expenses*	€ 7.6 bn
• Net loss	€ 4 bn
• Number of public companies	102
• Market capitalization	€ 21 bn
• Total financing	€ 1.2 bn

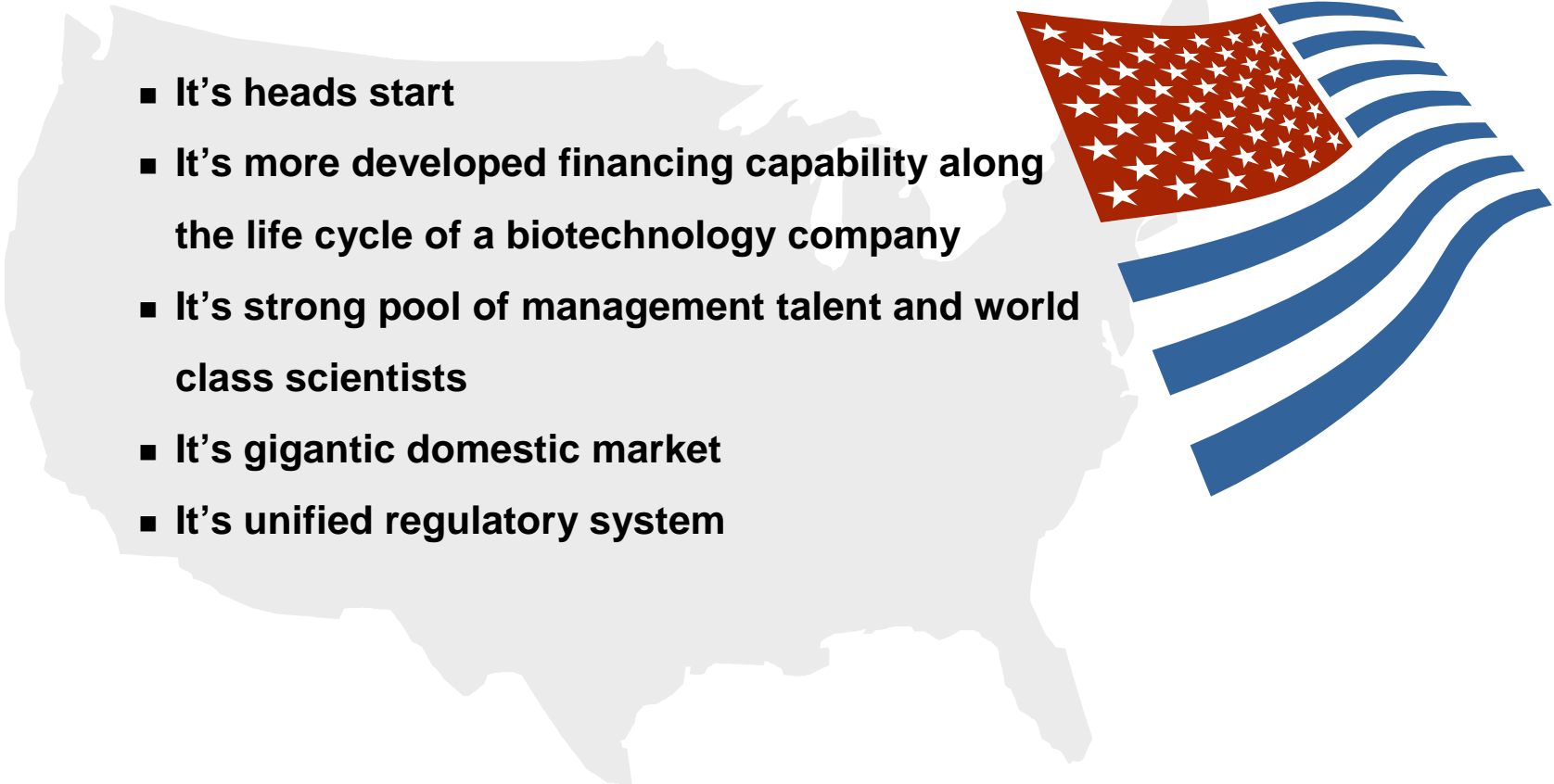
\* Include Seroon

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## Several factors have enabled the US to take a strong hold on the industry



Contributing factors

- 
- It's heads start
  - It's more developed financing capability along the life cycle of a biotechnology company
  - It's strong pool of management talent and world class scientists
  - It's gigantic domestic market
  - It's unified regulatory system

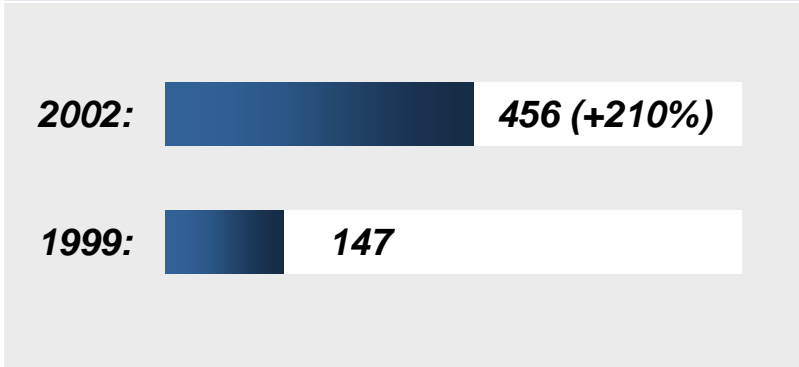
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Several parameters indicate that European biotech is on the move

The European biotech industry

European biotech pipeline\*

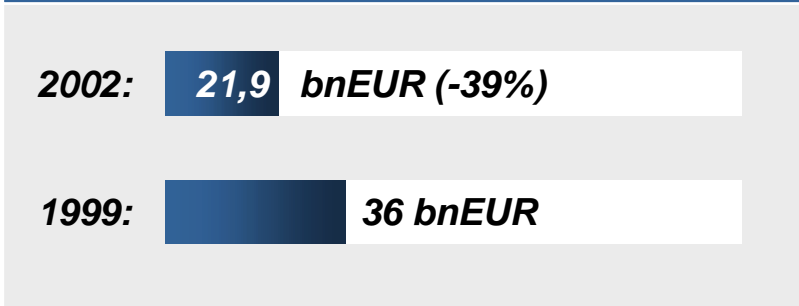


Company survival index\*

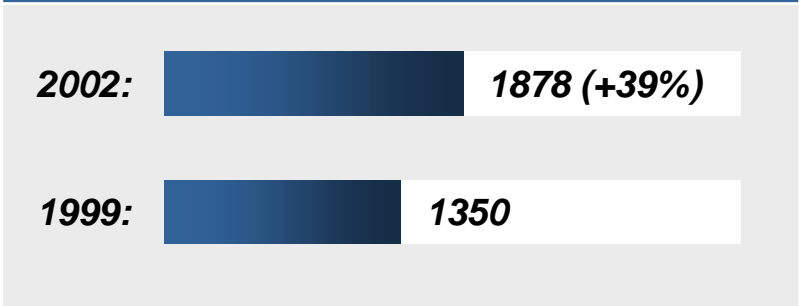
% of total no of companies

Years cash	2001:	1999:
>4	48%	46%
1-4	36%	34%
<1	16%	20%

Market capitalization\*



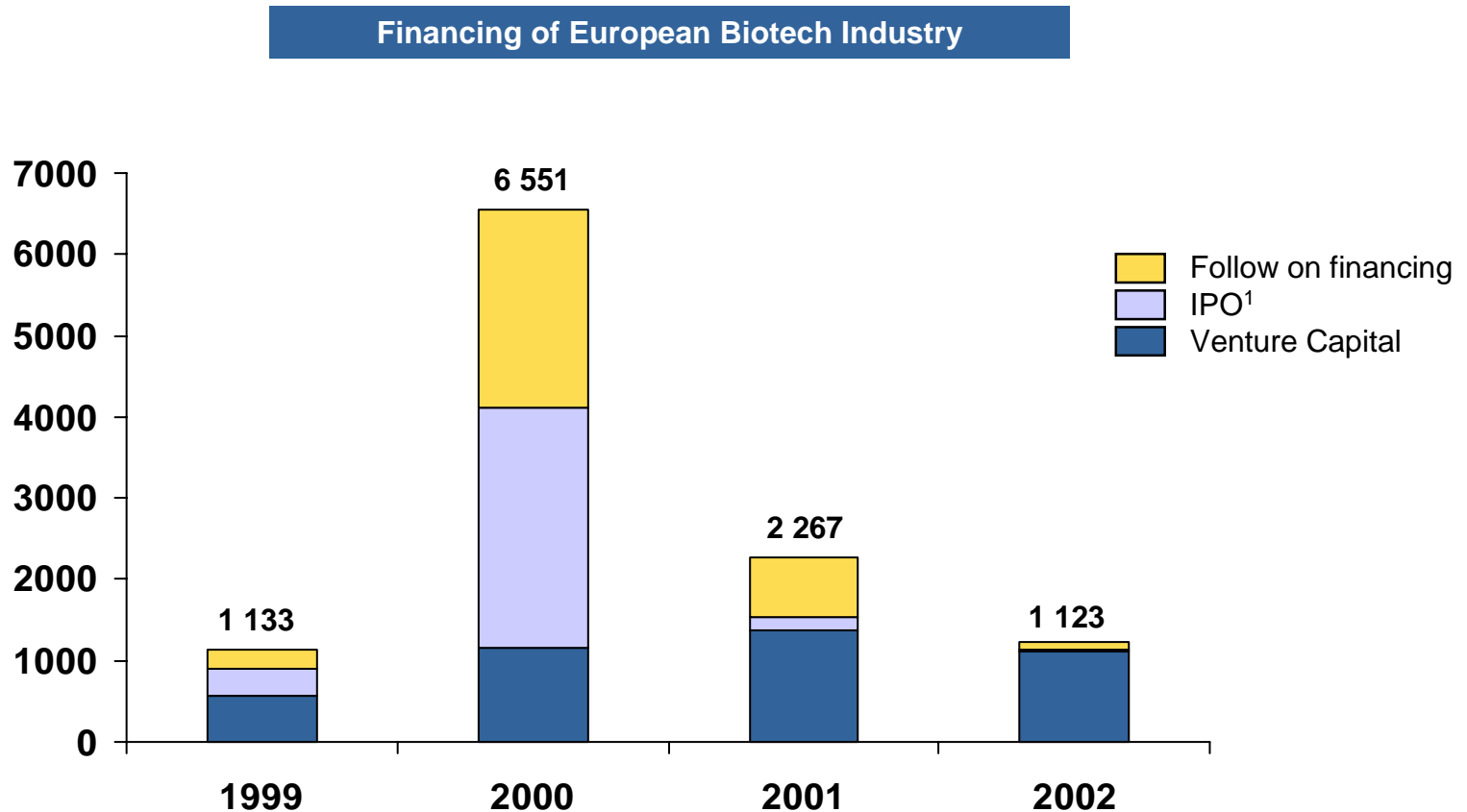
Number of biotech companies



\*European public companies

## 1. Biotechnology Sector Overview Cash position

After a very good financing year for Biotech industry in 2000, the market conditions were depressed in 2001 and 2002



1: Initial Public Offering

Source : Recombinant Capital, Arthur D. Little Analysis

## 1. Biotechnology Sector Overview Increasing number of intra-biotech alliances

### This context has contributed to the Biotech industry consolidation

#### Selected mergers and acquisitions involving European companies in 2002

#### *Drivers*

Gain critical mass

Reduce exposure to risk

Integrate vertically or horizontally

Company	Acquired or merged company	Value (€M)
Johnson & Johnson	Tobotech-Virco	306
Berna Biotech (Switzerland)	Rhein Biotech (Switzerland)	246
Versicor	Biosearch Italia Spa (Italy)	226
Serono (Switzerland)	Genset (France)	100
Bio-Technology General Corp (US)	Akso Nobel	96
deCODE Genetics (Iceland)	Medichem Life Sciences (US)	80
Modex (Switzerland)	IsoTis (Netherland)	42
Quiagen (Netherlands)	Geno Vision (Norway)	27
Proteome Sciences (UK)	Xzillion Proteomics (Germany)	18

*Sources:* Arthur D. Little

# Roadmap

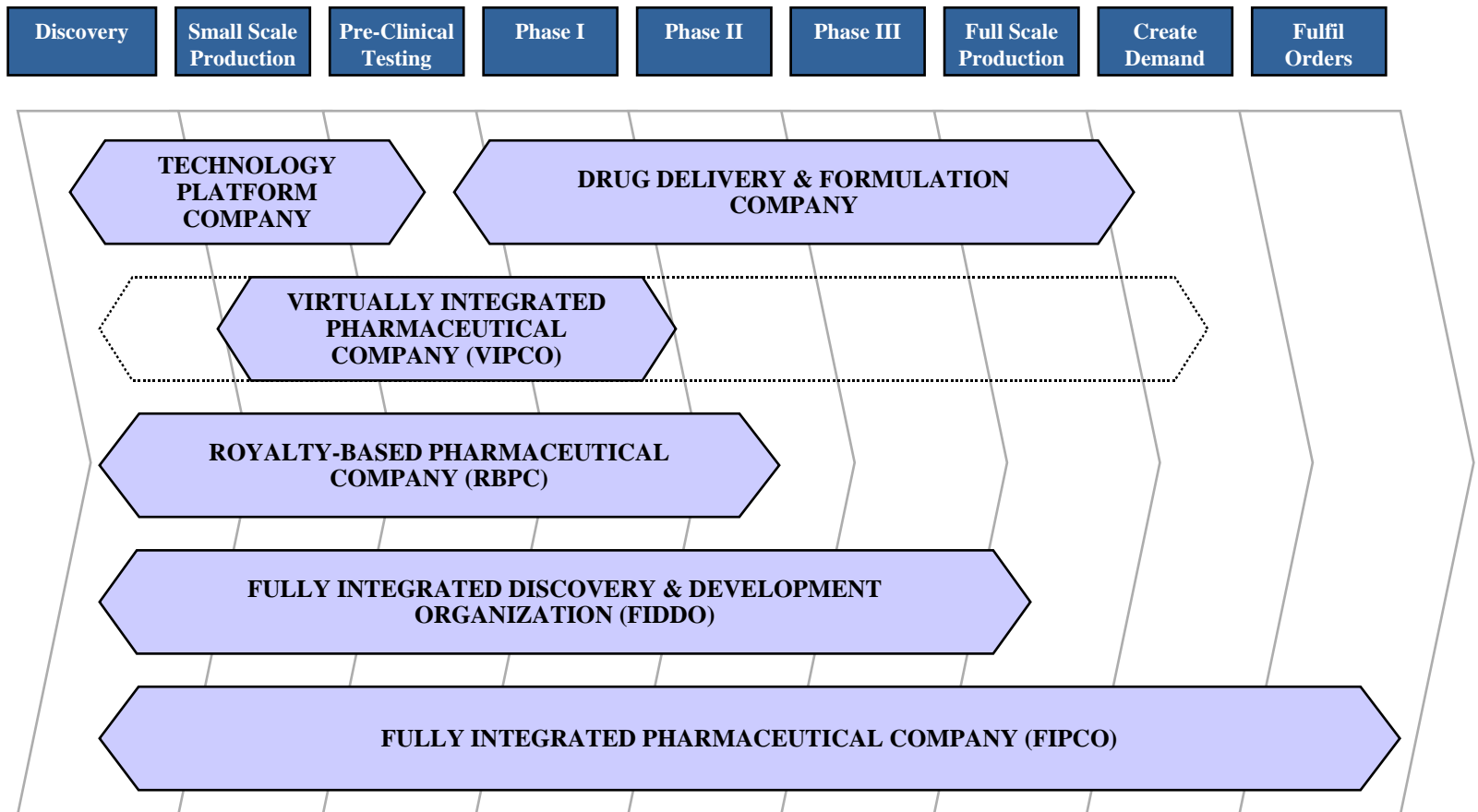
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### **The road to success for an entrepreneur in biotechnology is long and challenging**

- 1 Risk and complexity of a biotech medical development
- 2 Raising of sufficient capital while keeping control of the enterprise
- 3 Access to adapted technical and managerial resources and needed competencies (clinical trials, regulatory,...)
- 4 Production of biological products (e.g. recombinant proteins)
- 5 Alliance management
- 6 Patent and regulatory constraints and uncertainties (e.g. cell and gene therapy)

To address these challenges, Biotechnology companies pursue different strategies according to the level of risk they wish to assume

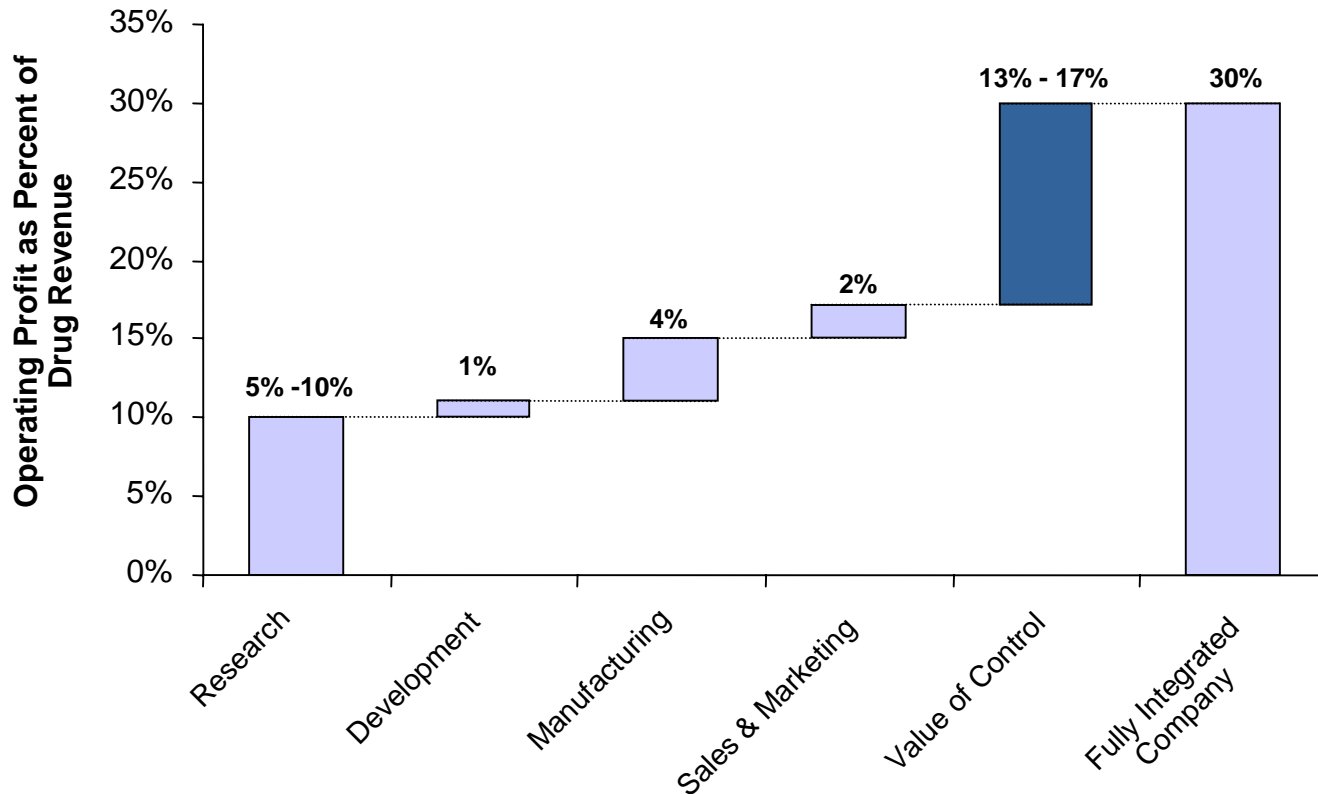


Sources: Arthur D. Little

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**Long-term value in biotechnology is created by owning and marketing novel, patented products which serve unmet needs**

**Sources of Profit for Fully-Integrated Biopharmaceutical Companies**

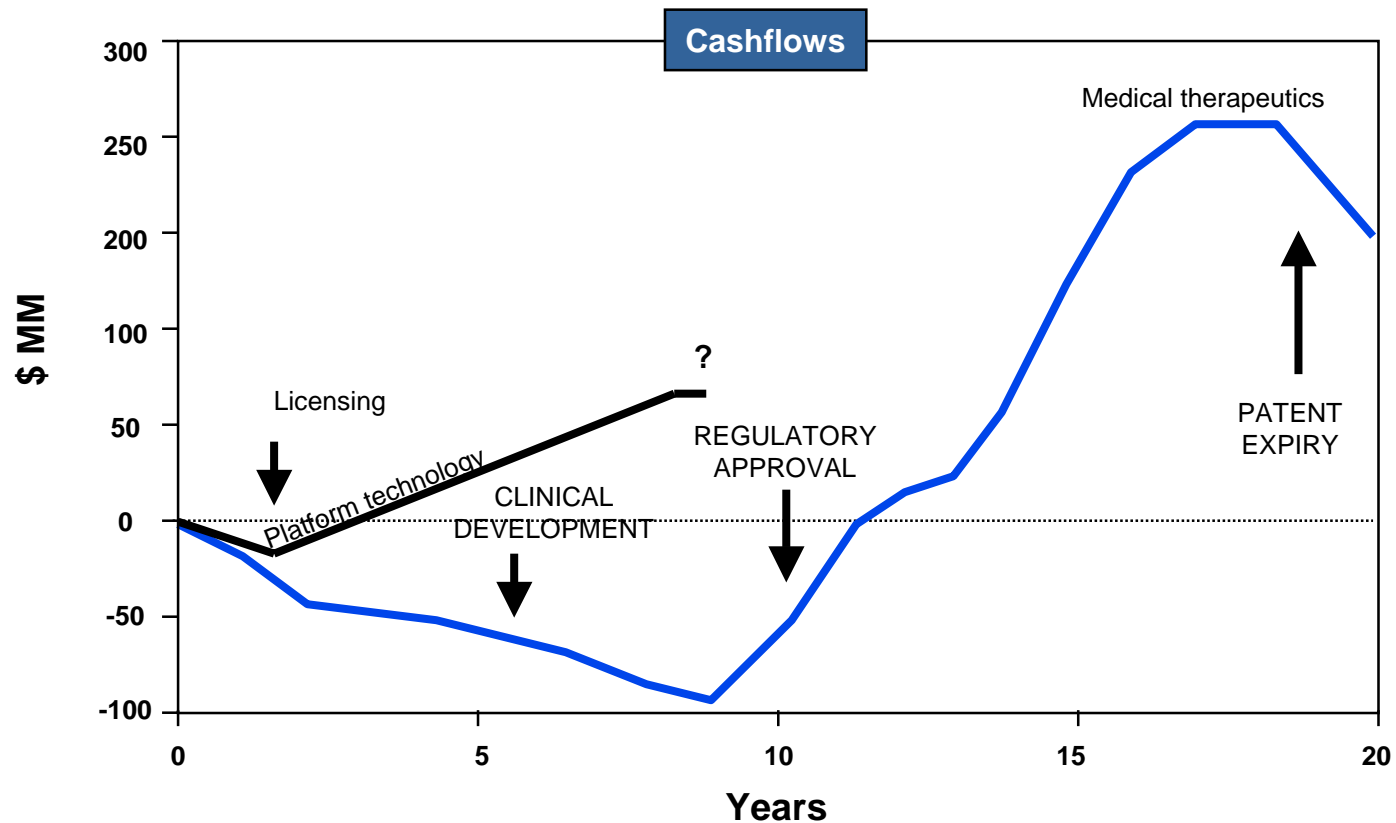


Sources: Arthur D. Little. Analysis

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But, investors must think long-term and make significant, sustained investments with FIPCO business models...

platform technologies make faster returns

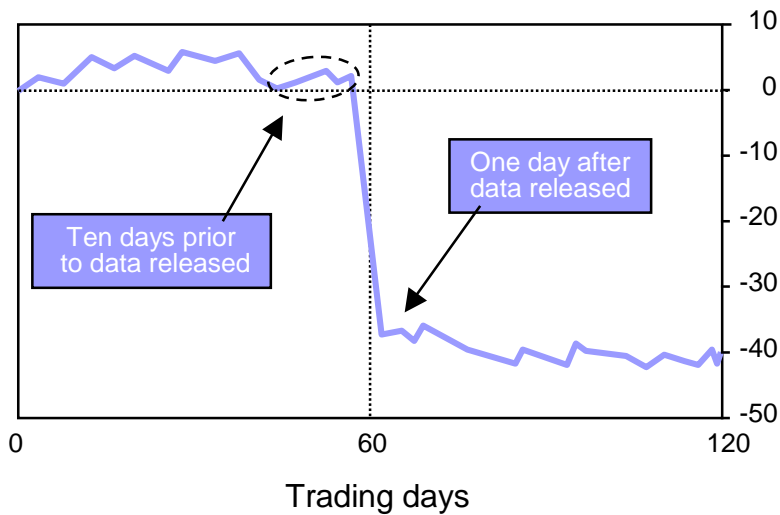


Sources: Arthur D. Little. Analysis

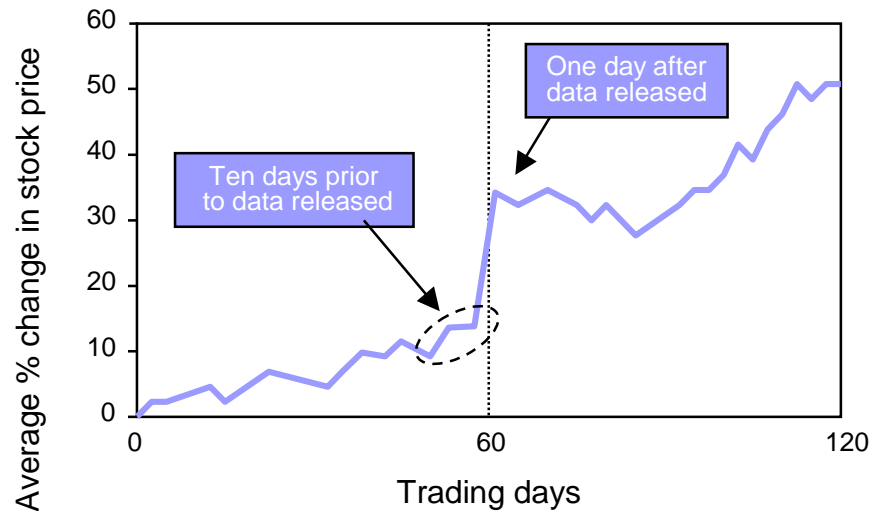
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... and accept risks on stock price related to data of clinical trials

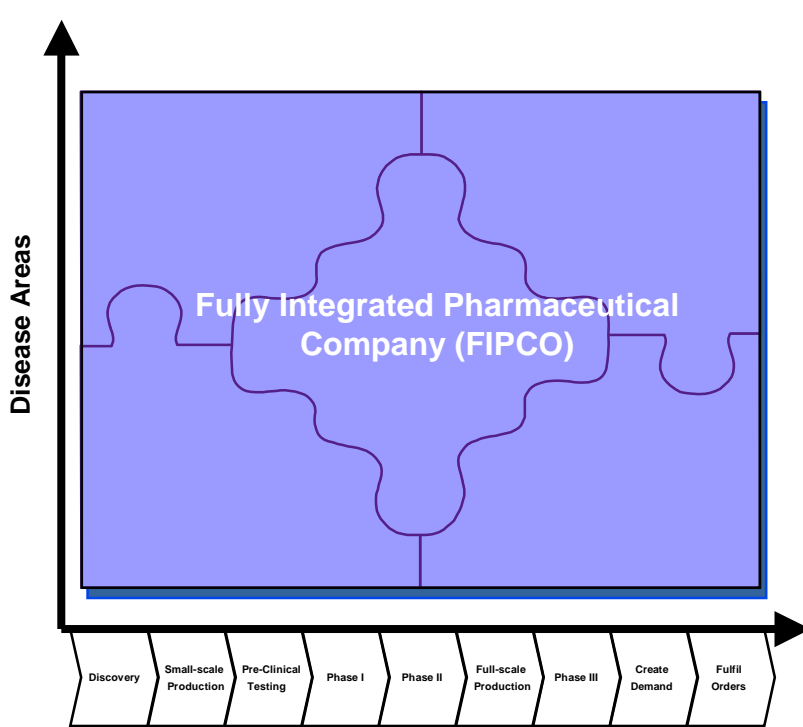
Pivotal trial failures (34 companies)



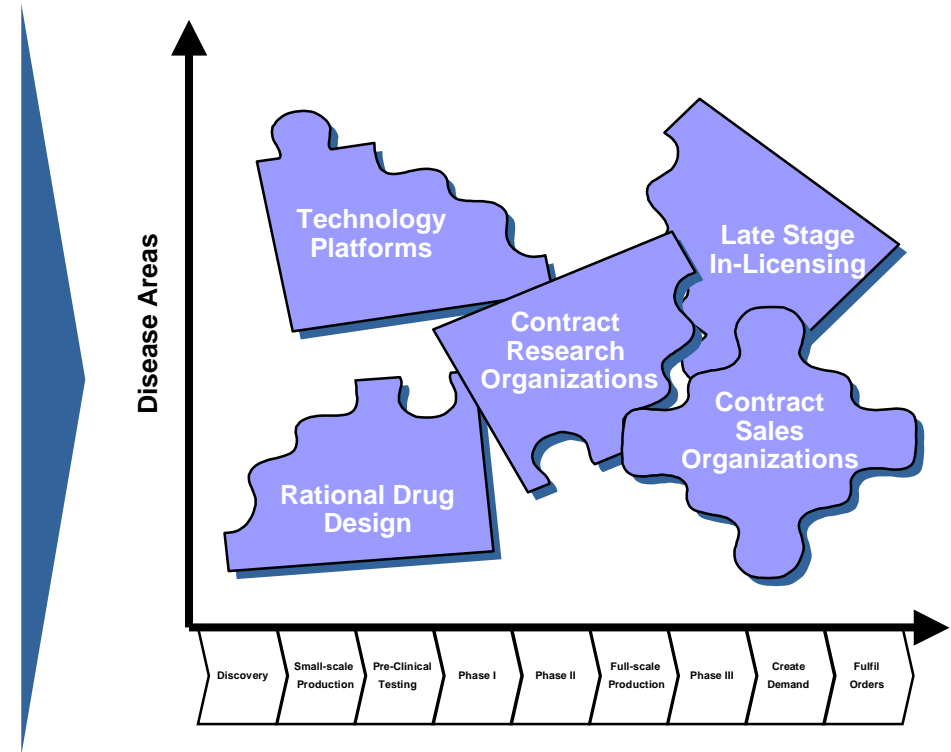
Pivotal trial successes (19 companies)



The emergence of biotech business models targeting all stages of the value chain has contributed to the evolution of the traditional pharmaceutical value chain



The Biopharmaceutical Value Chain



The Biopharmaceutical Value Chain

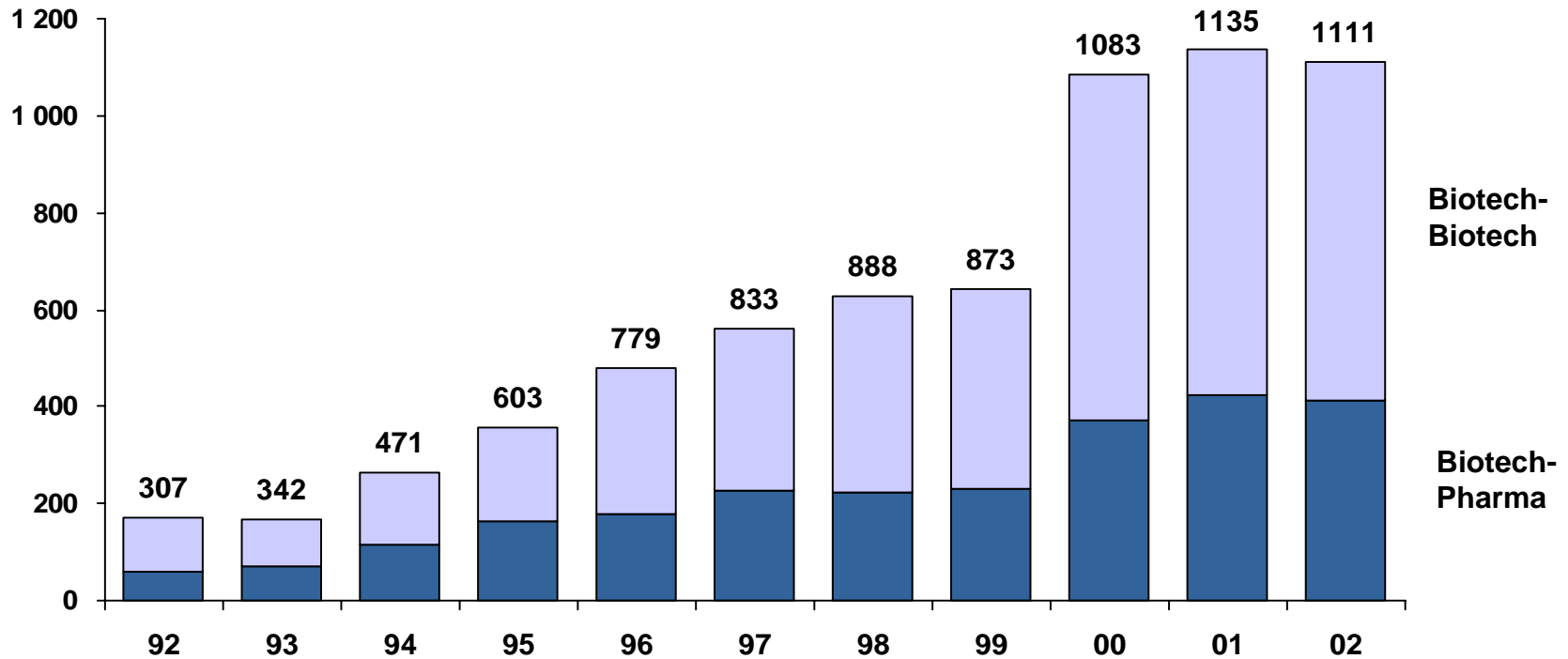
# Roadmap

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**Growth in the biotech industry is still supported by a strong collaborative environment ...**

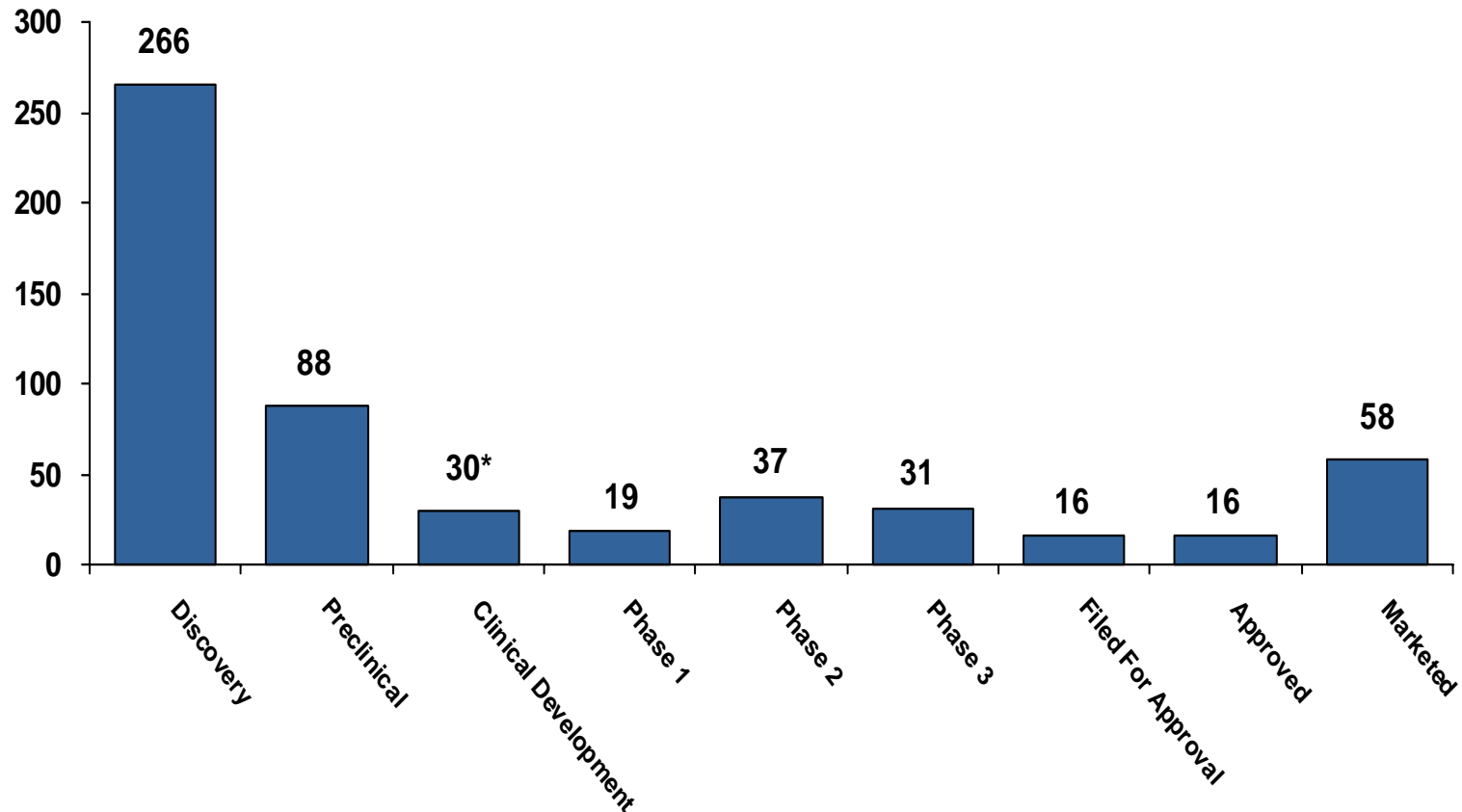
**Number of Biotechnology Alliances (1992-2000)**



Source : Recombinant Capital, Bioworld Financial Watch, Arthur D. Little Analysis

... with the majority of alliances being formed in early stages

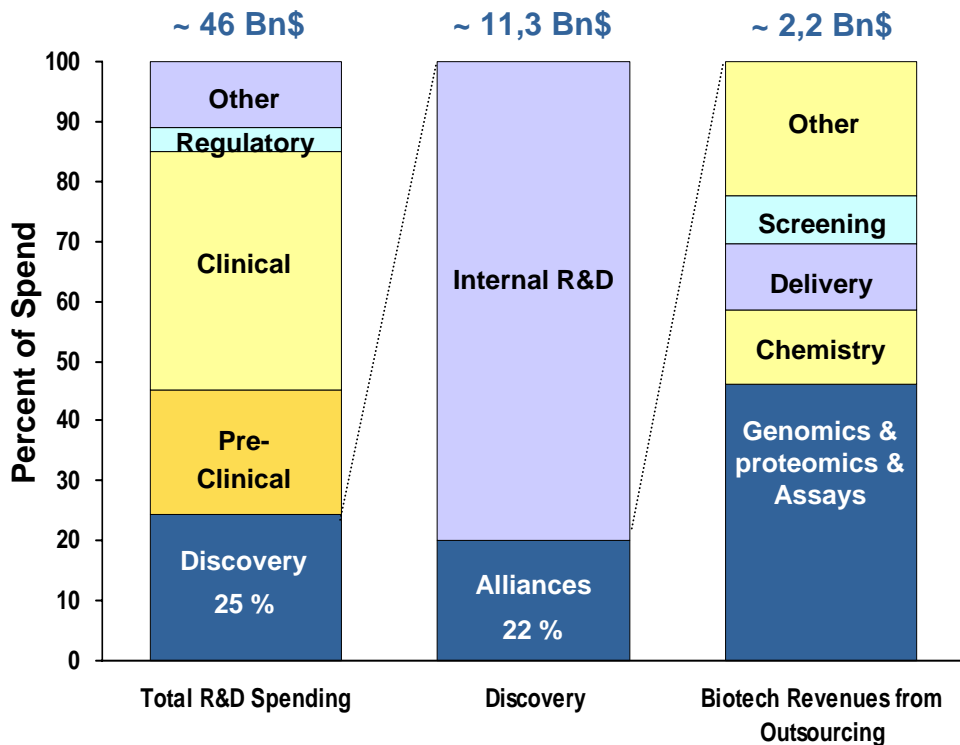
**Alliances by Development Phase at Deal Closing  
(July 2001- June 2002)**



\*Includes deals that have a product in an unspecified phase of clinical development  
Source : Windhover's Strategic Transaction database, Arthur D. Little Analysis

# Biotech revenues from discovery alliances represented around \$2,2 bn in 2001

**Global Pharmaceutical Company R&D Spend (2001)\***

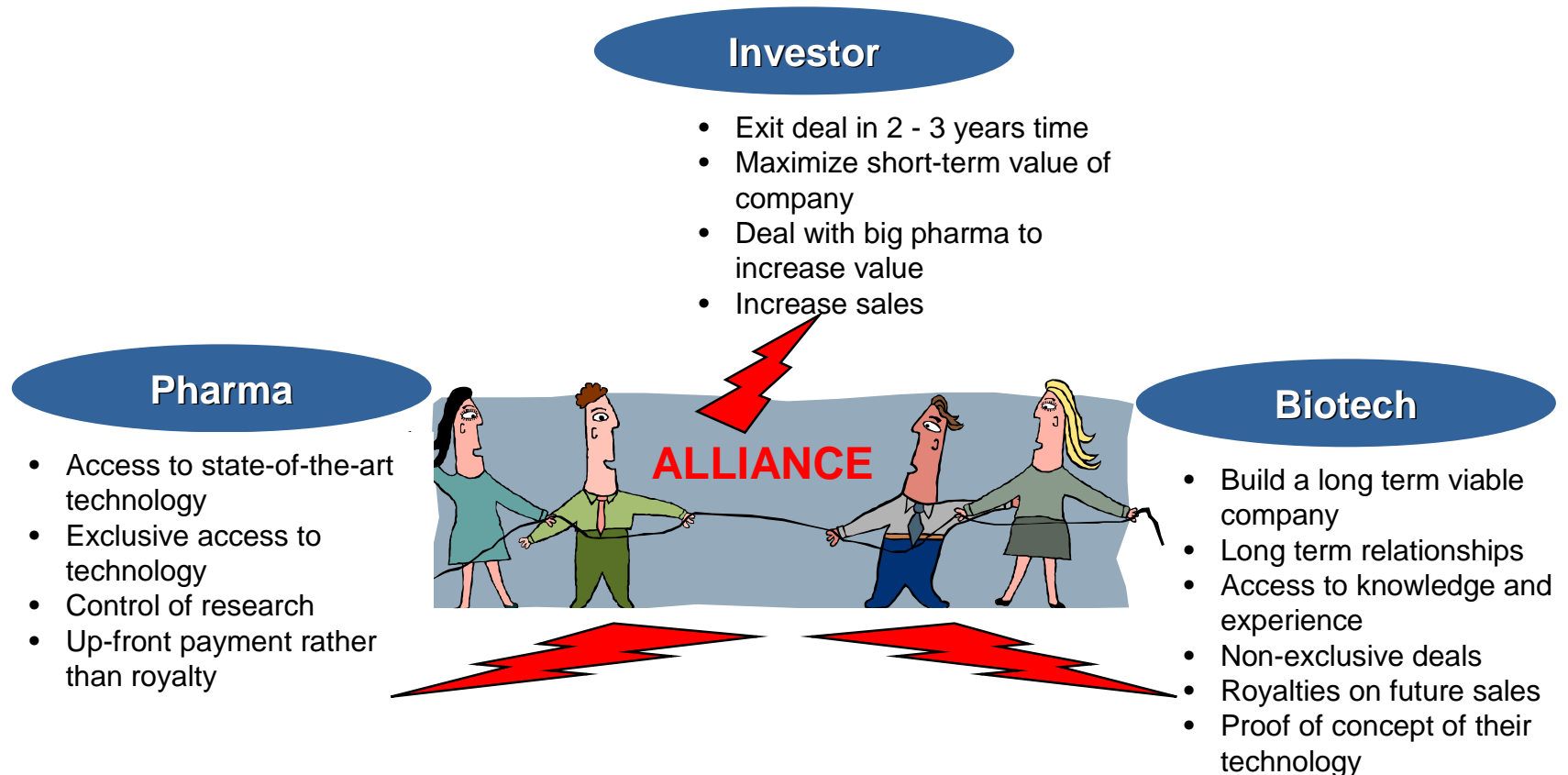


- Approximately 20% of a pharmaceutical company's R&D budget typically goes towards discovery
- External biotech research represents approximately 20% of pharmaceutical discovery R&D budget or 5% of total R&D spending

Note : \* Data includes top 100 biotechnology firms by alliance revenues  
 Source : Parexel's Pharmaceutical R&D Statistical Sourcebook 2000; Med Ad News; Recap.com; Arthur D. Little

## But players in an alliance can have diverging interests which make them inherently challenging

*Strategic alliances getting them done getting them to work*



### **Biotechnology is an opportunity for entrepreneurs**

- Biotechnology will be a key driver of innovation in Healthcare
- Pharmaceutical companies will play a role in the development of biotechnologies in the future but nature of collaborations are not completely stabilized
- French context is favorable
- To create a start-up in Biotechnology is challenging but can contribute to value generation for society (products for unmet medical needs) for founders and for other key contributors (financial investors, universities,...)