“The Global Biotech Industry: Challenges & Opportunities”
Michael S. Rosen
Rosen Bioscience Strategies
Greetings from Chicago!

Beaches Yes!
Pharma Beginnings!

Bogota – 1974
“Selling Drugs in Colombia”
Patients Around The World!
World Challenges
Biotechnology: A Science or A Culture?

First 20 years

Drugs

Agriculture

Last 20 years

Nanotechnology

Last 15 years

Biofuels

Now and Future

Cleantech

Science 45 year old industry

Biology vs. Chemistry
Biotechnology: The Science & the Culture

Innovation

The Culture
Challenging Status Quo

University/Hospital/Research Center

The Science

Patient/Disease

Biology

Teams
## The First Biotech Companies

<table>
<thead>
<tr>
<th>Company</th>
<th>University</th>
<th>Year</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>CETUS</td>
<td>California - Berkley</td>
<td>1971</td>
<td>Interferon-B, IL-2, agro</td>
</tr>
<tr>
<td>Genentech</td>
<td>California - San Francisco</td>
<td>1976</td>
<td>TPA</td>
</tr>
<tr>
<td>genex</td>
<td>Princeton, NJ</td>
<td>1977</td>
<td>Aspartame</td>
</tr>
<tr>
<td>Biogen</td>
<td>MIT/Harvard/Geneva/Zurich</td>
<td>1978</td>
<td>Interferon-A</td>
</tr>
<tr>
<td>AMGEN</td>
<td>Chicago</td>
<td>1980</td>
<td>EPO</td>
</tr>
</tbody>
</table>
Biotechnology Today: A Global Industry

Number of Companies = ~6,000

U.S. 1,700
Europe 2,000
Canada 300
Latin America 300
Asia >1500
Biotechnology: the first 40 years

More than 800 new drugs in clinical trials for 300 diseases:

- Alzheimer’s
- Heart disease
- Multiple Sclerosis
- Parkinson’s
- Cancer
- Other Central Nervous System
- Gastroenterology
- Endocrinology
## Biotechnology: Industry Metrics - 2014

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>REVENUE</strong></td>
<td>$123.1 B</td>
</tr>
<tr>
<td>R&amp;D EXPENSE</td>
<td>$35.4 B</td>
</tr>
<tr>
<td>NET INCOME</td>
<td>$14.9 B</td>
</tr>
<tr>
<td>MARKET VALUE</td>
<td>$1,063.4 B</td>
</tr>
<tr>
<td>Number of Publicly-Traded</td>
<td>714 B</td>
</tr>
<tr>
<td>Companies</td>
<td></td>
</tr>
</tbody>
</table>

Note: Above only includes pharma business in U.S., Canada, Europe & Australia.
Global Drug Biotech Clusters

U.K. - U.S. - Germany

Canada - Scandinavia - India

Israel - China - Japan - Australia
Top Cities for Biotech in the U.S.
Global Pharma Market

$1.28 - $1.310 trillion in 2018 (CAGR 4-7%)

- **U.S.** $480 B, 5-8%
- **Brazil** $46 B, 9-12%
- **Western Europe (5 Countries)** $197 B, 1-4%
- **Russia** $30 B, 7-10%
- **Japan** 120 B, 1-4%
- **China** $185 B, 10-13%
- **India** $31 B, 9-12%
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<table>
<thead>
<tr>
<th>Rank</th>
<th>Company</th>
<th>2014 Sales - B</th>
<th>% Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Novartis</td>
<td>$47.1</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>2</td>
<td>Pfizer</td>
<td>$45.7</td>
<td>&lt;5%</td>
</tr>
<tr>
<td>3</td>
<td>Roche</td>
<td>$39.1</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Sanofi</td>
<td>$36.4</td>
<td>&lt;2%</td>
</tr>
<tr>
<td>5</td>
<td>Merck</td>
<td>$36.0</td>
<td>&lt;4%</td>
</tr>
<tr>
<td>6</td>
<td>Johnson &amp; Johnson</td>
<td>$32.3</td>
<td>+15%</td>
</tr>
<tr>
<td>7</td>
<td>GlaxoSmithKline</td>
<td>$29.6</td>
<td>&lt;11%</td>
</tr>
<tr>
<td>8</td>
<td>AstraZeneca</td>
<td>$26.1</td>
<td>+1%</td>
</tr>
<tr>
<td>9</td>
<td>Gilead Sciences</td>
<td>$25.5</td>
<td>127%</td>
</tr>
<tr>
<td>10</td>
<td>Takeda</td>
<td>$20.4</td>
<td>+7%</td>
</tr>
<tr>
<td>11</td>
<td>Abbvie</td>
<td>$20.2</td>
<td>+8%</td>
</tr>
<tr>
<td>12</td>
<td>Amgen</td>
<td>$19.3</td>
<td>+6%</td>
</tr>
<tr>
<td>13</td>
<td>TEVA</td>
<td>$18.4</td>
<td>0</td>
</tr>
<tr>
<td>14</td>
<td>Lilly</td>
<td>$17.3</td>
<td>&lt;18%</td>
</tr>
<tr>
<td>15</td>
<td>Bristol-Myers Squibb</td>
<td>$15.9</td>
<td>&lt;3%</td>
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## Global Pharma Market

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<tr>
<td>16</td>
<td>Bayer</td>
<td>$15.5</td>
<td>+4%</td>
</tr>
<tr>
<td>17</td>
<td><strong>Novo Nordisk</strong></td>
<td><strong>$15.3</strong></td>
<td>+3%</td>
</tr>
<tr>
<td>18</td>
<td>Astellas</td>
<td>$14.1</td>
<td>+4%</td>
</tr>
<tr>
<td>19</td>
<td>Boehringer Ingelheim</td>
<td>$13.8</td>
<td>&lt;12%&gt;</td>
</tr>
<tr>
<td>20</td>
<td>Actavis</td>
<td>$13.1</td>
<td>+51%</td>
</tr>
<tr>
<td>21</td>
<td>Otseuka</td>
<td>$11.3</td>
<td>+1%</td>
</tr>
<tr>
<td>22</td>
<td>Daiichi Sankyo</td>
<td>$10.4</td>
<td>&lt;14%&gt;</td>
</tr>
<tr>
<td>23</td>
<td><strong>Biogen Idec</strong></td>
<td><strong>$9.4</strong></td>
<td>+41%</td>
</tr>
<tr>
<td>24</td>
<td>Baxter</td>
<td>$8.8</td>
<td>+6%</td>
</tr>
<tr>
<td>25</td>
<td>Merck KGaA</td>
<td>$7.7</td>
<td>&lt;9%&gt;</td>
</tr>
</tbody>
</table>
Sales of $373.9 Billion: + 13.1%
- Spending on **New Innovative Treatment Options** at Higher Prices
- **New drugs**: contributed $20.3 billion (new hepatitis C treatments)
- **Obamacare**: added almost 16 million new patients into healthcare system
Key U.S. Pharma Trends in 2014/15

- **Solvaldi for Hep. C** – reaches $10 B in 1 year (Gilead - top 10 pharma companies)

- **FDA**: approves 51 new drugs vs. 42 in 2014: 6 biotech drugs.
  - First new biosimilar approved: Novartis’ filgrastim (Amgen’s Neupogen)

- **IPO market**: 61 (2015) vs. 72 in 2014

- **M&A Increase**: $18.2 B in biotech
  - Big Pharma continues to struggle with patent expirations
  - Lack of R&D Productivity
Biotechnology/Pharma Dilemma

Global Sales & Distribution

Innovation

New Products

Research University

Small Molecules Chemistry

Large Molecules Biology

Rigid Management R&D Failures

Lack of Global Scale
The FDA: The Global Regulatory Office?

Offices in:

- **China**: Shanghai and Beijing
- **Mexico, Chile, Costa Rica**
- **India**: >200 FDA-approved manufacturing facilities
- **UK**
- **Belgium**
Key Issues for Big Pharma Companies

- Need for New Products due to Patent Expiration in U.S. and Europe:
  - Loss of $160 billion in sales by 2015
  - Driving M&A: 31 deals for $18.2 billion
Key Trends in the U.S. Healthcare Market

- Accelerated Aging of Population (over age 65):
  - U.S. (“Baby Boomers”), Europe, Japan & China
  - Increased spending on medical care
    - 80% of Person’s Healthcare costs after Age 65

- Many diseases still unconquered:
  - Cancer, Alzheimer’s, Diabetes
    - Diabetes in Emerging Markets: India, Brazil, Middle East
    - New Diseases: ZIKA Virus

- Growth of Personalized Medicine
  - Herceptin for Breast Cancer (Her2Neu gene)

- Role/Growth of Diagnostics
Accelerating U.S. & Europe Entry Capabilities

Outsourcing

- Contract Research Organizations (CRO’s)
  - Clinical
  - Preclinical (Efficacy/Toxicology)
  - Regulatory

- Contract Manufacturing Organizations (CMO’s)
  - API
  - Finished Formulations

- Contract Sales Organizations (CSO’s)
  - Sales Force
  - Marketing
  - Physical Distribution
Case Study: A Spanish Biotech Company

- **Started:** 1980’s - spinout of Harbor Branch Oceanographic Institute (J&J family)
- Licensed drugs from universities
- **Expertise:** Marine Biology and Natural Products Chemistry
- **Unknown outside Spain!!!!**
- **Focus on New Drugs from Marine Organisms:**
  - Cancer
  - HIV (Pasteur Institute)
  - Malaria (Univ. of Geneva)
  - Immunosuppressives (Harvard)
- **Boston office:** early 1990’s
- **U.S. CEO in 1995:** IPO and partnering
- **Refocus on Cancer** in mid-1990’s
Case Study: A Spanish Biotech Company

- **Creation:** International Oncology Advisory Board
- **Participation:** International Cancer Medical Meetings/publication of papers
- **First Partnering Deal:** Bristol-Myers Squibb

- **Decision to Outlicense:** U.S., Latin America, and Asia, but to market directly in Europe
- **Deals with:** Johnson & Johnson, TAIHO Oncology

- **Approved in Europe:** 2007
- **Approved by FDA:** for Ovarian cancer and sarcomas: 2015

- >500 employees
- 10 more cancer drugs in development
Conclusions

- Biotech Pharma will continue to be a “growth business” for next 35+ years in U.S., Europe, Japan and now China due to:
  - Aging populations
  - “Old” Diseases needing improved therapy & New Diseases (ZIKA)
  - Globalization of industry

- Increased Role of BRIC Countries:
  - R&D site for infectious & other diseases
  - Clinical trials (naïve patients)
  - Manufacturing