The State of Pharmaceutical Innovation

Bernard Munos
Founder
InnoThink Center For Research in Biomedical Innovation
Chicago
July 16, 2012
Outline

• The state of innovation
  • Facts about innovation
  • Where does innovation come from?
  • Priorities for returning innovation to drug R&D
The pharma industry faces a ‘Kodak moment’

Not enough innovation

Unaffordable innovation

Undistinguished innovation

Death spiral or transformation?
Pharma has **changed** the business model that made it great

The ‘old’ pharma model:

- Turning **cutting-edge discoveries** into **commercial products**
- and creating vast new markets and value for patients

Pharma now spends much of its time iterating on the same targets/scaffolds
Pharma no longer lives the values that made it great

• **Ethics:**
  - Pharma has paid about €20 bn in fines in last 20 years, **75% in last 5 years** (reimbursement fraud, kickbacks, off-label promotion, ghostwriting, falsification...)

• **Innovation:**
  - Not enough, marginal, unaffordable

• **Risk-taking:**
  - Fear to disrupt
  - Lots of breakthroughs waiting to be translated into something useful (synthetic bio, nanomed, tissue engineering, stem cells...)

• **Patient focus:**
  - Retrenchment from Rx areas (anti-infectives, neuroscience, cardiovascular)
  - Drug shortages
  - Pushing patients into bankruptcy
Pharma’s **triple** challenge

- More innovation
- Better innovation
- Affordable innovation
Outline

• The state of innovation

• **Facts about innovation**

• Where does innovation come from?

• Priorities for returning innovation to drug R&D
The innovation pathways

• High-risk, unconventional research
• Patient-oriented research
• User-driven innovation
• Disruptive thinking

(Assembly-line model)
Innovation does not scale

Pfizer’s trebling of R&D spending since 1999 has had no detectable impact on its rate of NME production
Innovation is **highly nonlinear**

- Innovation comes in **waves**
- **10-year** dry spells are not uncommon
- Long compound series are the exception, not the rule
- **34%** of drugs (for CNS) have a poorly understood mode of action
Outline

• The state of innovation
• Facts about innovation

• **Where does innovation come from?**
• Priorities for returning innovation to drug R&D
Where does high-value innovation come from?

- Breakthrough discoveries
- Creative scientists
- Open and networked culture
- Transformational leaders

Enabling factors:
- Diversity (cultural, ethnic, academic, age, etc)
- Cross-disciplinary, silo-free, equalitarian culture
- Few, fuzzy processes (adaptiveness)
- Multiple, diversified sources of financing
- Supportive authorities (policymakers, regulators)
- Intense competition
Breakthrough discoveries

• Breakthrough must be seen through the eye of the patient (user), not the scientist
  ➢ Gleevec is a breakthrough... so is Augmentin, Zocor, Aranesp, Humulin
  ➢ Lipitor is not a breakthrough

• Breakthrough discoveries can stem from novel research, shrewd clinical observations or the recombination of existing ideas

• Most science funding does not support highly innovative work
  ➢ Most public and private spending supports ‘regular science’, not novel original ideas
  ➢ Peer-review and committees foster compromises that do not reward boldness

• Alternatives?
  ➢ Need greater focus and selectivity, e.g., DARPA’s disruptive focus and milestone-driven approach (“Is this disruptive? Why?”); GSK’s Discovery Performance Units
Creative scientists

<table>
<thead>
<tr>
<th>The marginal innovator</th>
<th>The disruptive innovator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wants to grow and nurture existing markets</td>
<td>Wants to obliterate what’s there and replace it with something better</td>
</tr>
<tr>
<td>Seeks competitive advantage from greater efficiency</td>
<td>Seeks competitive advantage from changing the game</td>
</tr>
<tr>
<td>Improves and optimizes</td>
<td>Disrupts</td>
</tr>
<tr>
<td>Aligned with the organization’s goals</td>
<td>Orthogonal to the organization’s goals</td>
</tr>
<tr>
<td>Analytical, cautious</td>
<td>Intuitive, bold</td>
</tr>
<tr>
<td>Sticks to process and job description</td>
<td>Knows no boundaries</td>
</tr>
<tr>
<td>fits in</td>
<td>sticks out</td>
</tr>
<tr>
<td>Risk-averse, change-wary</td>
<td>Risk-taking, change-friendly</td>
</tr>
<tr>
<td>Seeks consensus</td>
<td>Never minds being alone</td>
</tr>
</tbody>
</table>

Source: adapted from Munos, Clin Pharmacol Ther, 2010 May;87(5):534-6

Disruptive and marginal innovators are different species separated by a chasm that must be bridged

The crazies, the misfits, the rebels, the troublemakers, the square pegs...
Open culture

• Innovation is a by-product of culture, not a by-product of organization, six-sigma, or anything else

• Principles and values, not processes, define a corporate culture
  ➢ A few powerful principles are worth more than many standard-operating-procedures

• Principles must value diversity and openness
Networked culture

• Networks are a powerful but underappreciated ingredient of innovation

• Local networks help get things done but can reinforce orthodoxies

• Global networks bring novel ideas into the fray

• Both are necessary
Transformational leaders

Corporate leaders who left the *most admired legacy* were also passionate de-facto **Chief Innovation Officers**

When it comes to innovation, bolder is better, and it starts at the top
Enabling factors

- diversity (cultural, ethnic, academic, age, etc)
- cross-disciplinary, silo-free, equalitarian culture
- few, fuzzy processes (adaptiveness)
- multiple, diversified sources of financing
- (supportive authorities (policymakers, regulators))
- (intense competition)
Outline

• The state of innovation

• Facts about innovation

• Where does innovation come from?

• Priorities for returning innovation to drug R&D
Priorities for returning innovation to drug R&D

- **Foster an innovation culture**: welcome the curious, passionate scientist; let boldness and vision drive decision-making; make it safe to be bold

- **Pick an innovation model that works**. Stop doing what doesn’t.

- **Forget blockbusters, chase breakthroughs**: don’t let sales forecast, NPVs and ROI steer you toward the **trap** of marginal innovation and commoditization

- **Build broad innovation networks**: no matter how big you are, most great ideas come from elsewhere

- **Focus on translating breakthrough science** that has the potential for creating vast new markets

- **Restrict clinical research to candidates that have the hallmarks of breakthroughs**, backed by compelling evidence

- **Speed innovation and save money**: embrace precompetitive collaboration; leverage open innovation models
Thank you!

Questions?
(bhmunos@stanfordalumni.org)