Adapting the Open Source Concept to Biotech Innovations

Introduction

A Limited Menu of Incentives
Complex Inventions
Information Goods

The “Open Source Biology” Idea
Rhetoric
Where Things Stand
What Might Be Possible
What Might Be Useful
An Intelligent Rational Design Approach

Showstoppers

What Do We Know About OS Software?
What Do We Know About Drug Discovery?
Candidates
Mechanics

Main Objection:
Developing Drugs is Costly

Other Objections:
Competition With Patent Incentives
Researcher Incentives
Scientific Feasibility
Copyright vs. Patents
What Do We Know About OS Software?

### Incentives
- **Ideology**
- **Education and Signaling**
- **Own-Use**
  - For Hobbies
  - For Work
  - For Employer
- **Complementary Goods & Services**
- **Standards Wars**

### Advantages
- (Donated Labor)
- Price of Information
- No Agency Problems

### Disadvantages
- Inadequate Incentives?
Drug Discovery Pipeline: Opportunities

Basic Research
Finding Targets
Optimizing Targets
Finding Lead Compounds
Optimizing Lead Compounds
Process Development
Pre-Clinical Testing
Phase I Tests
Phase II Tests
Phase III Tests
Approval
Manufacturing
Phase IV Tests
Marketing & Distribution

Basic Research → Open Science
Opportunities: Open Science

Examples
- BioPERL
- HGP, SNP Consortium, HapMap, AfCS.

Traditional Academic Incentives
- Signaling, Own-Use, Ideology, Education.

Showstoppers
- Physics Precedents
  - Big Science (cf. AfCS)
  - Virtual Experiments (PDG, TOI)

Is It Open Source?
- HapMap License

Drug Discovery Pipeline:
Opportunities

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\( \text{In Silico Biology} \)
Opportunities: In Silico Biology

Example
Tropical Disease Initiative

Basic Argument
- DNA ~ Software
- Disease ~ Bugs
- Drugs ~ Patches

Collaboration Mechanics
- On-Line Forums for Each Candidate
- Using Databases to Do Science
- Philosopher Kings

Opportunities: In Silico Biology

Incentives
- Education, Signaling, Ideology

Advantages
- Donated Labor
- Lower R&D Costs
  - The SNP Consortium Problem
- Lower Manufacturing Costs
- Transparency
Opportunities: *In Silico Biology*

Showstoppers
- Competition With Patents
- Social & Scientific Doubts

Would it Work for Rich Nation Diseases?
- Competition With Patents
- Inadequate Incentives?

BIOS/Bioforge

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Drug Discovery Pipeline: Opportunities

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- Phase I Tests
- Phase II Tests
- Phase III Tests
- Approval
- Manufacturing
- Phase IV Tests
- Marketing & Distribution

} “Wet” Chemistry & Biology
Opportunities:
Wet Chemistry & Biology

Examples
Tropical Disease Initiative
Yochai Benkler Proposal

Incentives & Advantages ~ In Silico Discovery

What are the Limits?

Is Funded Open Source an Oxymoron?
Big Science Grants

Drug Discovery Pipeline:
Opportunities

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Optimizing Targets
Finding Lead Compounds
Optimizing Lead Compounds
Process Development
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Phase I Tests
Phase II Tests
Phase III Tests
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Phase IV Tests
Marketing & Distribution

} Off Label Testing
Opportunities: Off-Label Testing

Examples
Von Hippel Proposal

Incentives
Ideology, Education, Signaling

Feasibility
Costs are Already Paid For
Competition With Patents

Advantages
Transparency

Drug Discovery Pipeline: Opportunities

Basic Research
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Optimizing Targets
Finding Lead Compounds
Optimizing Lead Compounds
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Pre-Clinical Testing
Phase I Tests
Phase II Tests
Phase III Tests
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Phase IV Tests
Marketing & Distribution

Clinical Testing
Opportunities: Clinical Testing

Examples
(None)

Incentives
Ideology, Education, Signaling, Complementary Goods

Feasibility
Patents Support OS

Advantages
Transparency

Opportunities: Synthetic Biology

Making DNA to Order
Standardized Parts?

Incentives:
Own Use, Education, Signaling Complementary Goods Standards Wars

Advantages:
Open Standards and Competition Antitrust National Security
Mechanics

What’s Wrong With the Public Domain?
The Consumer Sovereignty Argument
The Capturing Argument

GPL’ing Molecules
Patents vs. Copyright
Filing & Enforcement Costs, License
Law Uncertainty, Patent Misuse?

Embargos
Legal Entities
Patent Pools

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