



# **Adapting the Open Source Concept to Biotech Innovations**

Stephen M. Maurer  
Goldman School of Public Policy  
UC Berkeley



## 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



## Showstoppers

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



## What Do We Know About OS Software?

### 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



## Drug Discovery Pipeline: Opportunities

**Basic Research** } Open Science

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## 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

Basic Research

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Optimizing Targets

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Optimizing Lead Compounds

Process Development

Pre-Clinical Testing

Phase I Tests

Phase II Tests

Phase III Tests

Approval

Manufacturing

Phase IV Tests

Marketing & Distribution

} *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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} “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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Phase II Tests  
Phase III Tests  
Approval  
Manufacturing  
Phase IV Tests } Off Label Testing  
Marketing & Distribution





## 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

Finding Targets

Optimizing Targets

Finding Lead Compounds

Optimizing Lead Compounds

Process Development

Pre-Clinical Testing

Phase I Tests

Phase II Tests

Phase III Tests

} Clinical Testing

Approval

Manufacturing

Phase IV Tests

Marketing & Distribution



## 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



INFOSYS 296A-2: Open Source Development  
And Distribution of Digital Information  
Nov. 14, 2005

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