

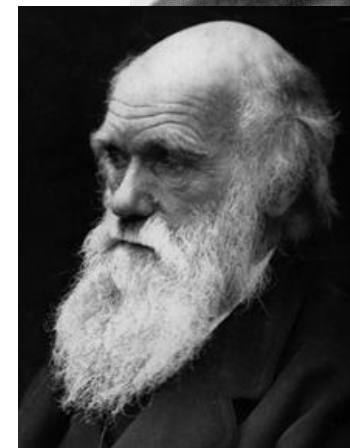
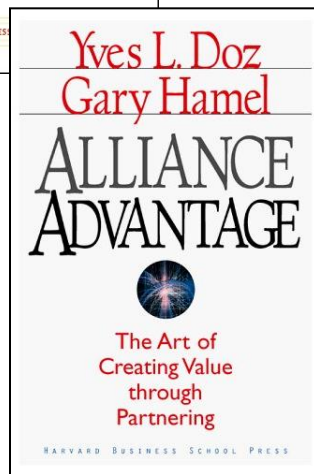


The business implications of Open Source Synthetic Biology

Woodrow Wilson International Center for Scholars
June 17, 2009

Mark Bünger, Research Director
Lux Research, Inc.

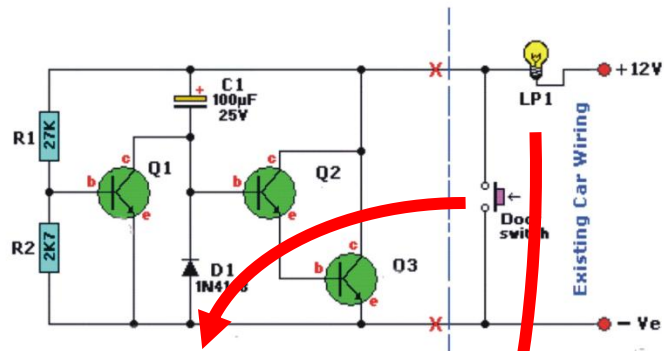
Open innovation: looking outside the company for ideas and technology



- Adapt to changes in the environment
- Survive through adversity
- Exploit new niches
- EVOLVE

Synthetic biology: standardizing biological parts to create predictable devices

Electronic circuit



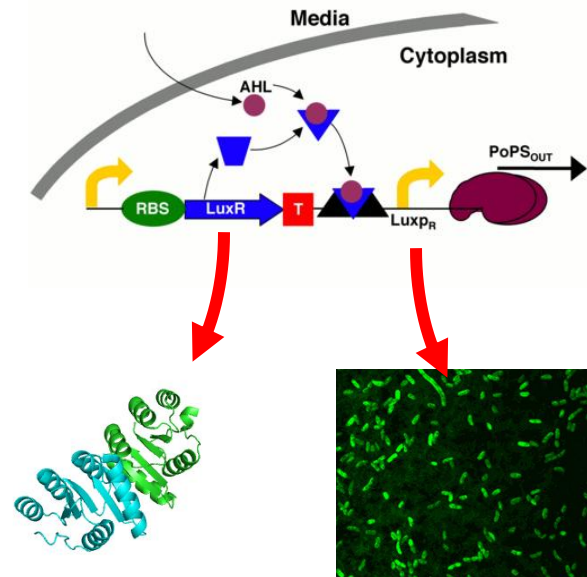
Switch



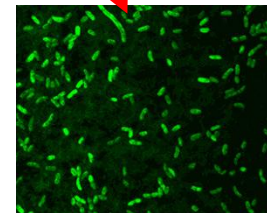
Light

- Standard parts
- Predictable input-output

Biological circuit



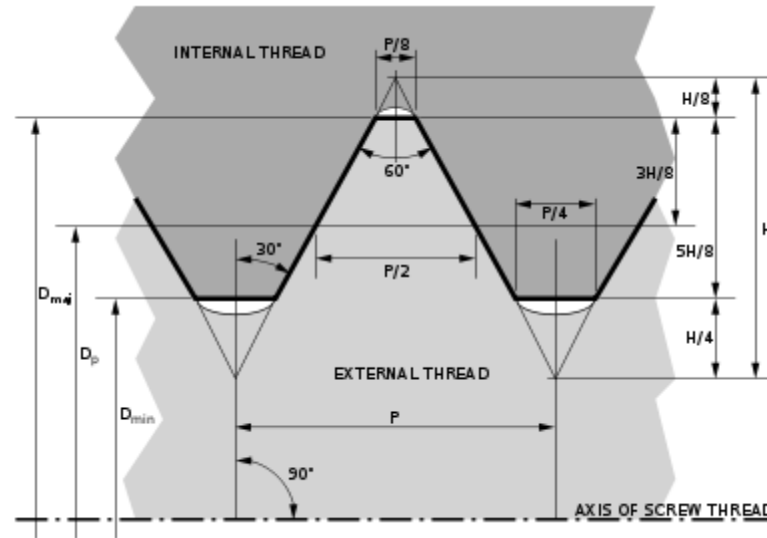
Switch



Light

- Standard parts
- Predictable input-output

All technologies (d)evolve into standards



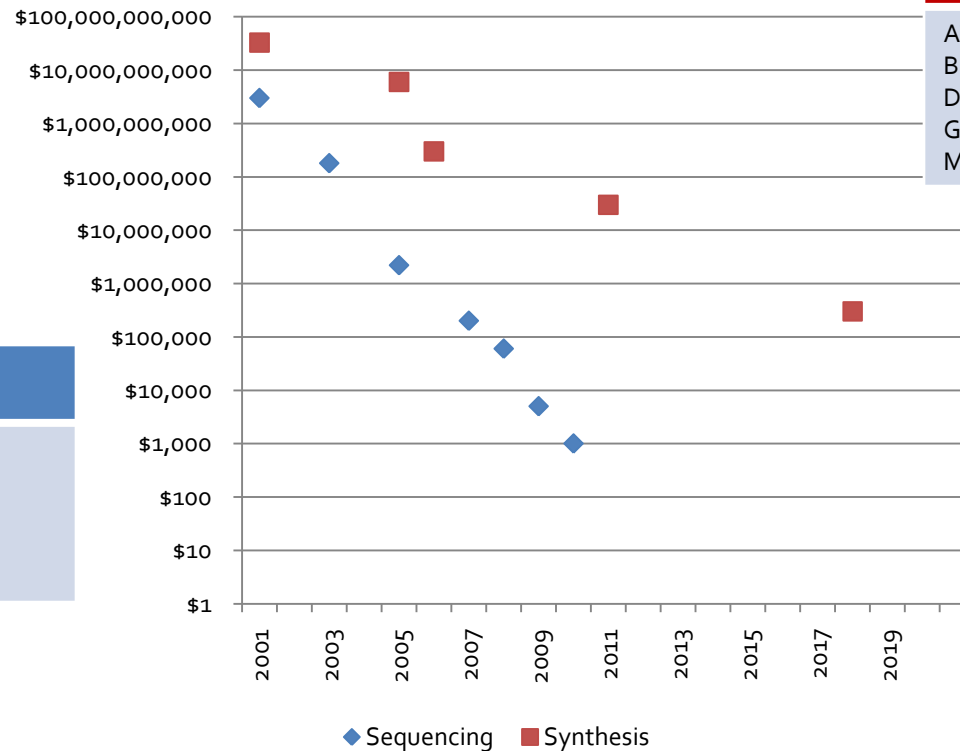
Proprietary systems
and unique works

Standards and
commodities

...so developers must keep moving ahead!

DNA sequencing and synthesis costs are rapidly declining, commoditizing genetic data

Cost to sequence or synthesize a human genome (3 billion bases)



Gene Sequencing Companies

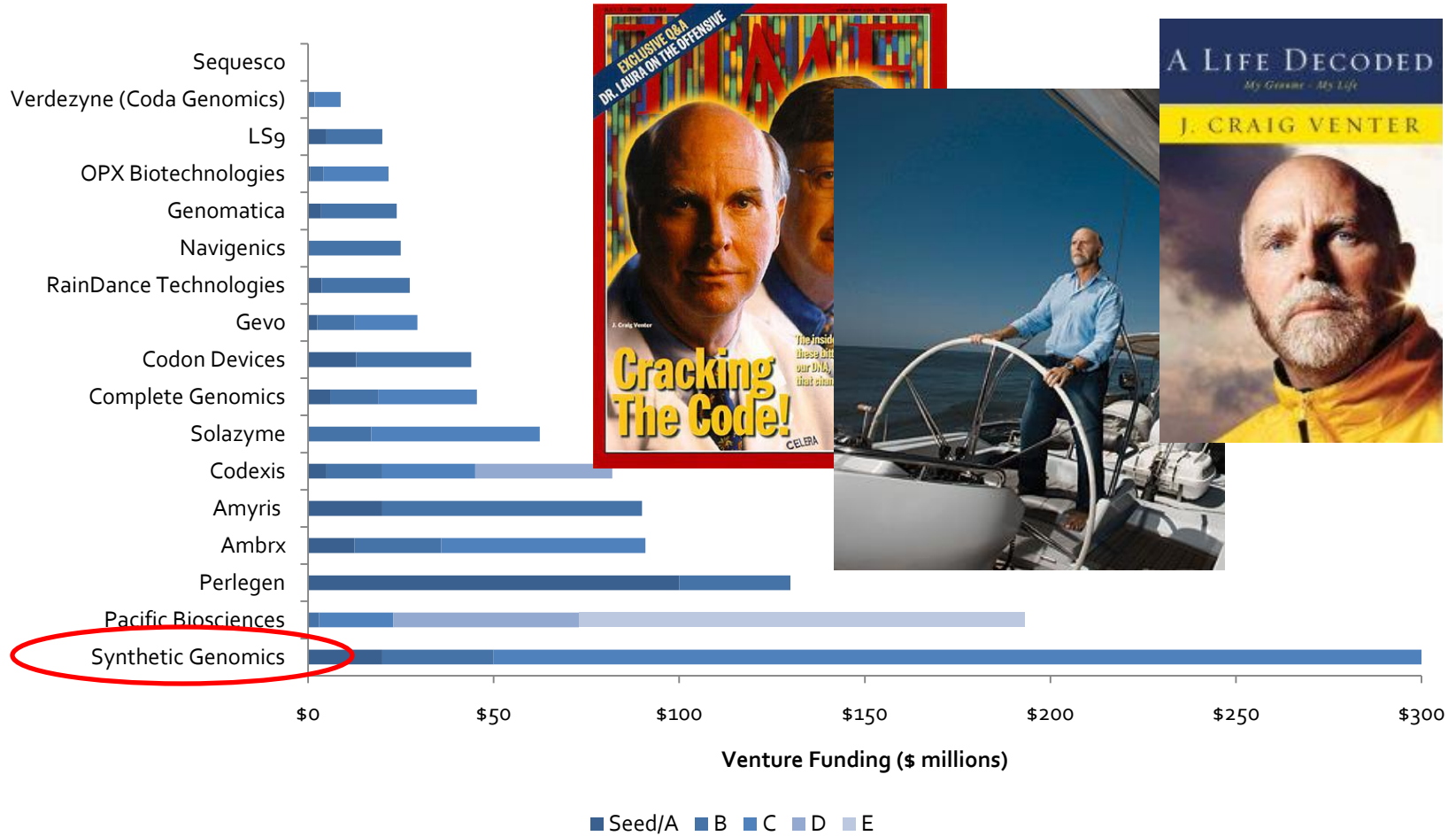
454 Life Sciences, Helicos Bio, Oxford Nanopore, Illumina, RainDance, Life Technologies, Pacific Biosciences, Complete Genomics, Visigen

Gene Synthesis Companies

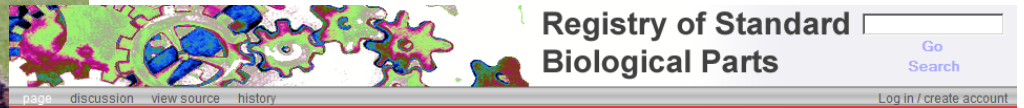
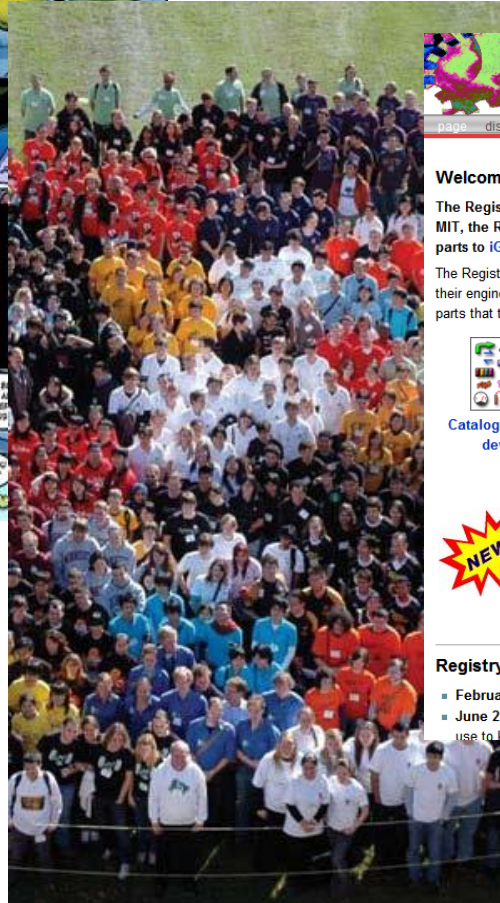
ATG:biosynthetics, Blue Heron Biotechnology, Codon Devices, DNA 2.0, febit synbio gmbh, GENEART, Sloning Biotechnology, Mr.Gene GmbH

Source: Lux Research

Synbio application companies have received more than \$1 billion in funding to date



IP: Open source biohacking or patented and corporate-owned?



Welcome to the Registry of Standard Biological Parts.

The Registry is a collection of ~3200 genetic parts that can be mixed and matched to build synthetic biology devices and systems. Founded in 2003 at MIT, the Registry is part of the Synthetic Biology community's efforts to make biology easier to engineer. It provides a resource of available genetic parts to iGEM teams and academic labs.

The Registry is based on the principle of "get some, give some". Registry users benefit from using the parts and information available from the Registry in designing their engineered biological systems. In exchange, the expectation is that Registry users will, in turn, contribute back information and data on existing parts and new parts that they make to grow and improve this community resource.



Catalog of parts & devices



Help



Users & groups
(Apply for an account)



DNA repositories

Registry tools

- Search parts (?)
- Add a part
- Send parts to the Registry
- Sequence analysis

Related resources

- iGEM
- The BioBricks Foundation



You'll notice some significant changes to for easier browsing of the available parts a notice that the documentation and help pages. The Registry of Standard Biological Parts free to edit and improve the pages further.

Registry news

- February 19, 2009: The Registry parts catalog has been
- June 2, 2008: We are considering releasing the Registry use to keep track of parts in our freezer boxes and plates



Which industries will be affected, when?

- **Should have done it yesterday:** companies making tools and instruments (Invitrogen/ABI, Illumina, Agilent, Thermo Fisher, GE)
- **No time like the present:** companies making potential molecular metabolites, like industrial chemicals, fuels, and pharmaceuticals (BASF, Bayer, Dow, DuPont, DSM, Pfizer, Merck, ExxonMobil)
- **Next up:** companies that use multicellular materials derived from plants and animals, like wood, paper, fruits, vegetables, milk, and meats – (Weyerhaeuser, Louisiana Pacific, Unilever, Cargill, Kraft, Nestle)
- **Years to go (but start to monitor):** devices, sensors, semiconductors, displays (Intel, Flextronics, IBM, Samsung, Hewlett-Packard)

"Open" questions

- Can patents, copyright, or trade secrets even protect something that anyone can read and copy?
- What effect will the ACLU lawsuit over Myriad's breast cancer gene patents have on synbio (and vice-versa)?
- Do notions of similarity really apply to genetic sequences?
- Is there a difference between patenting genes and patenting pathways?



Thank you / Q&A

Mark Bünger

Research Director

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About Lux Research

- Helps clients capitalize on science-driven innovation
- Clients on five continents, primarily large corporations
- Delivers value via weekly intelligence reports, semi-annual State of the Market reports, and analyst inquiry
- Subscription-based services in biosciences, energy storage, solar, water and nanomaterials
- Primary research methodology: Focus on proprietary interviews and site visits
 - > 1,400 interviews last year
 - Site visits in 18 countries
- Source proprietary ideas from Lux Research Network of execs + scientists
- Diverse, 40-person team; Ph.D scientists to market researchers



George W. Bush,
U.S. President

Josh Wolfe,
Director, Lux Research

21st Century R&D Act signing in Oval Office



LR Chairman
Peter Hebert
on CNBC



LR President Matthew Nordan testifying
before U.S. Congress