Training the Next-Gen Workforce for the Life Sciences Industry

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Susan Baxter
Executive Director, California State University Program for Education and Research in Biotechnology (CSUPERB)

CSU The California State University
PROGRAM FOR EDUCATION AND RESEARCH IN BIOTECHNOLOGY (CSUPERB)

Outline

- What is the Life Sciences Industry?
  - How is it related to the computer sciences and information technology?
  - What are trends in the Life Sciences Industry?

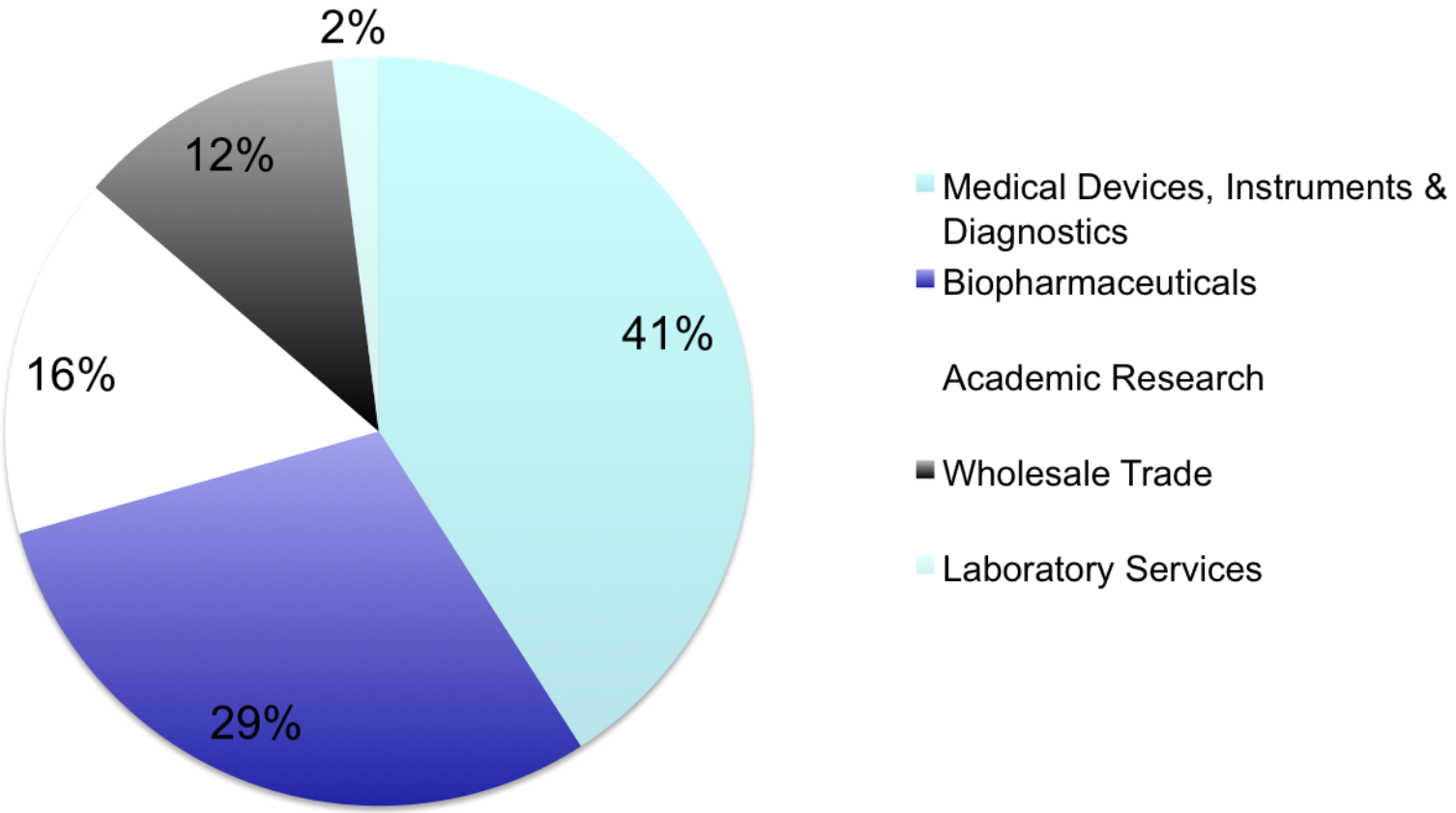
- CSU strategies to prepare California's workforce for life sciences careers

California's Life Sciences Industry

- 274,000 jobs (2008)*
- One in six biomedical jobs nationwide are in California*
- Federal stimulus package targeted "**biotechnology"** as a 'high-growth' sector in 2009-2010 and pundits have labeled it "recession-resilient"
  - Other 'high-growth' sectors to watch: **health information technology** and **wireless health**

**2010 California Biomedical Industry Report, California Healthcare Institute and PriceWaterhouseCoopers. Between 2006 and 2016, the Bureau of Labor and Statistics projects that STEM occupations will grow by 21.4 percent (US Bureau of Labor and Statistics)*

California Life Science Industry Facts (2010)

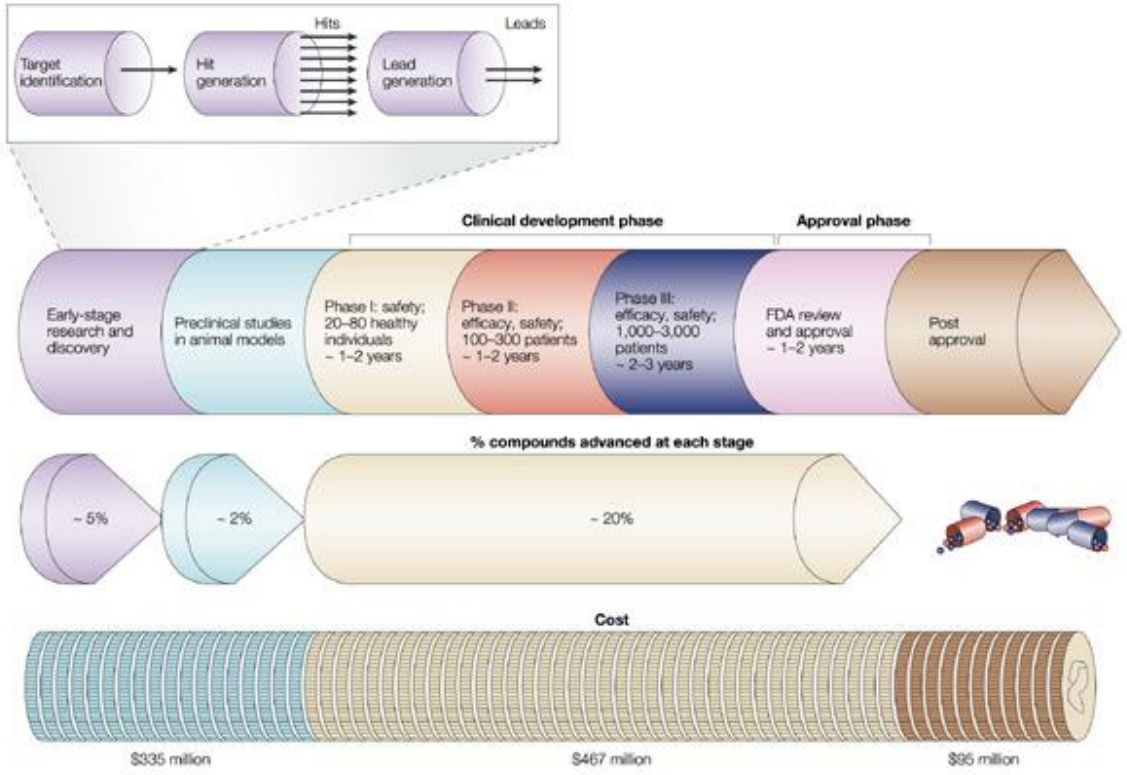


** 2010 California Biomedical Industry Report, California Healthcare Institute and PriceWaterhouseCoopers*

Examples of jobs

- 87 of 350 jobs advertised by California companies (3/25/10) include the keyword “computer” at BIOCOM Career Center
- 175 California healthcare jobs advertised at CareerBuilder.com that include keywords “IT” and “computer” and “software”
- Depending how close you are to patients, the regulatory environment may or may not be important
- Depending on how close you are to the market, the quality aspects of your job may or may not be important

Sample product development pipeline: pharmaceuticals



"The journey from initial concept to a marketed drug is a long one, and is statistically more likely to end in failure than success. The average time for a drug to reach the market is around 12-15 years, and only 1 in 5,000 compounds screened in early-stage discovery successfully makes it through to market, although both figures vary dramatically with disease area."

**Cost data in US (Year 2000) $ from Driscoll, Nature* Rev. Drug Discov. 2, 369-378 (*2003*)

Example Ad from a Product-Oriented Life Sciences Company

Software Quality Assurance (SQA) Engineer
Posted on: 6:01 PM, Friday, March 19, 2010

The SQA Engineer will lead all aspects of the development of high-quality, FDA compliant, clinical laboratory software for Company X products. The SQA **Engineer will work directly with Company X project teams**, as well as Marketing, Lab Operations, Quality Assurance and Regulatory Affairs to understand and document software requirements. The SQA Engineer shall have a **business-minded approach**; proposing software strategies that support the business and product goals. The SQA Engineer will source developers and oversee the development of the application, including writing verification and validation protocols and participating in testing. Travel estimated less than 10%.

Requirements

- BS in Computer Science, Engineering, or other technical field.
- Certified Software Quality Engineer (CSQE) desirable.
- 6+ years experience with software development and software quality assurance in **FDA regulated environment**.
- Knowledge of 21CFR11, Design Control, FDA and ISO requirements and guidance for medical device software.
- Proven experience with validation of custom, configured, and off-the-shelf software.

Example Ad from a "Discovery" based Life Sciences Company

Bioinformatics Software Engineer

Posted on: 2:44 PM, Monday, March 15, 2010

We seek a software engineer/analyst who is a self-starter that can **solve problems creatively, communicate effectively, and collaborate well** with project leaders, team members, and customers. The ideal candidate can work both autonomously and in a team to design, implement, and support software applications for biological sequence analysis, genomics and metagenomics.

Responsibilities:

•Design, develop, and maintain software through the **full product life cycle**
•Create both development and end user documentation
•Monitor daily operations and troubleshoot problems
•Develop data analysis and reporting capabilities
•Perform integration work with current enterprise applications
•Promote and develop communication with IT to integrate information systems with the needs of the R&D organization
•Provide **creativity** and technical leadership

Qualifications:

•Bachelor's or Master's degree in Computer Science, Software Engineering, Bioinformatics, or related discipline
•3 to 5 years post-graduate research experience
•Strong knowledge of a variety of programming and scripting languages: **Perl, Python, JAVA, C++, Shell Scripting in Linux and Windows environments**
•Strong knowledge of relational databases and database design: MS SQL Server
•Working experience with cluster computing and job scheduling: Platform LSF
•Working experience with network management and monitoring tools
•Excellent verbal, written and interpersonal communication skills

“Reducing meaningful use criteria a good move”

From Healthcare IT News (Feb. 17, 2010):

“The meaningful use workgroup, which reports to HHS' Health IT Policy Committee, recommended a reduction in the number of measures providers would need to meet in order to qualify for federal incentive funds under Centers for Medicare & Medicaid Services (CMS)…..

……..David Blumenthal, MD, head of Office of the National Coordinator (ONC), said as late as a few weeks ago that he wants to "stretch" the healthcare community but not "break" it with regard to providers being able to meet the measures….

……When large healthcare systems, which are far down the path of having interoperable Electronic Medical Records (EMR), say that it will be tough to meet all Stage 1 requirements, you have to pause and take a hard look at the proposed measures.”

Patty Enrado blogs daily at EHRWatch.com
http://www.healthcareitnews.com/blog/reducing-meaningful-use-criteria-good-move

Example Ad from a Health IT services provider

This position is open as of 3/22/2010.

Architect - Data Warehouse Architect - SQL - Oracle - ETL - Oracle – Data Warehouse - Data Modeling

We are an international organization in the Clinical / Healthcare industry that has offices in over 160 countries with 9,000+ employees worldwide! Currently we are **expanding in our Southern California** office and are looking to hire an Enterprise Data Warehouse Architect! If you love doing data modeling and data warehouse design than this is the role for you!

What you need for this position:
- 5+ years of Data Warehouse architecture experience
- Expert knowledge of SQL Server 2005/2008 and Oracle 9i/10g
- Expert data modeling skills, including physical and logical model design
- Strong experience implementing ETL concepts and tools
- Experience analyzing source system structures and mapping them to target data warehouse schemas

What you'll be doing:
- Leading the design and development of our data warehouse from scratch
- Extracting data from multiple sources, including Oracle and SQL Server databases
- Architect all data warehouse components, including tool integration strategy, data staging, movement and aggregation, etc
- Mentor junior staff

Healthcare - Health Services, Pharmaceutical, Chemical

Example ad from a healthcare provider

Job Snapshot Location: Some City, CA
Employee Type: Full-Time
Industry: Healthcare - Health Services
Manages Others: No
Job Type: Information Technology Engineering
Relocation Covered: No
Post Date: 3/25/2010
Description

SOFTWARE ENGINEER
Some City Community Hospital seeks a Software Engineer with a Bach in Physics, Comp Sci, or equiv and five years of exp designing, developing, debugging, and deploying large business software applications. **Mail resumes** to XXXX.

Los Angeles Times 2010-03-25

Digital/Wireless Health on the horizon?

The Burrill Consumer Digital Health Meeting
March 22, 2010 - March 23, 2010
The San Francisco Airport Marriott
Burlingame, CA

"In the not too distant future, nearly all of healthcare will be digitized. Mindful of the coming changes, Burrill & Company, in association with the University of Illinois, Mayo Clinic, Pfizer and Google, is for the first time holding The Burrill Consumer Digital Health Meeting **to help prepare the life sciences community** for this new era.

Learn how PDAs and smartphones will become personal healthcare assistants capable of receiving vital signs and even body fluid samples for analysis and transmittal of results. Wherever patients are in the world, they will be able to connect with their physicians. And their doctors, in turn, will be able to practice medicine virtually anywhere and at anytime, with instant access to the information and systems they need—right at their thumbs."

High Growth Sector: Life Sciences

- By definition, a moving target
- Lines blurring between biotechnology, pharmaceuticals, medical devices, diagnostics, healthcare
- Many sectors, many domains
- Highly regulated industry
- Private and public employers – small and large, for profit and non-profit
- Pharma/biotech: Long product development lifecycles (~ 10-20 yrs)
- Average salaries ($75,000)*
- 2003 National Science Foundation (NSF) report indicates only 12% of US college graduates took science and engineering jobs – barely changed from a decade earlier

**2010 California Biomedical Industry Report, California Healthcare Institute & PriceWaterhouseCoopers*

Common themes underlie the practice of biotechnology today

Innovators, Entrepreneurs

Creative individualism, focus and persistence

Interdisciplinary, collaborative team work

Evolving communities of interest, education and practice

Agile, change-driven project management

Inference and deduction based on large data sets (math + computers + science)

Long time frames & “profound uncertainty and risk”*

**Pisano, Harvard Business Review, Feb2006*

How do we educate the life sciences workforce of the future?

Job Ads and Chancellor's Executive Board Industry Advisors emphasize:

"excellent organizational, analytical, problem solving skills required….

Work independently but contribute to project team environment….

Excellent written & oral communication, strong computer skills…"

How do we educate the life sciences workforce of the future?

Two Main Strategies (in addition to offering relevant subject area degrees):

1. Make sure students have access to and opportunities to work as part of a **team-based research project** (can be faculty-led research on a CSU campus OR in industry or government lab settings)

1. **Partner with industry** to respond to workforce needs
    1. Develop new (mostly post-baccalaureate) layers for the CSU curriculum
    2. Design new programs

I. Lessons Learned in the Laboratory

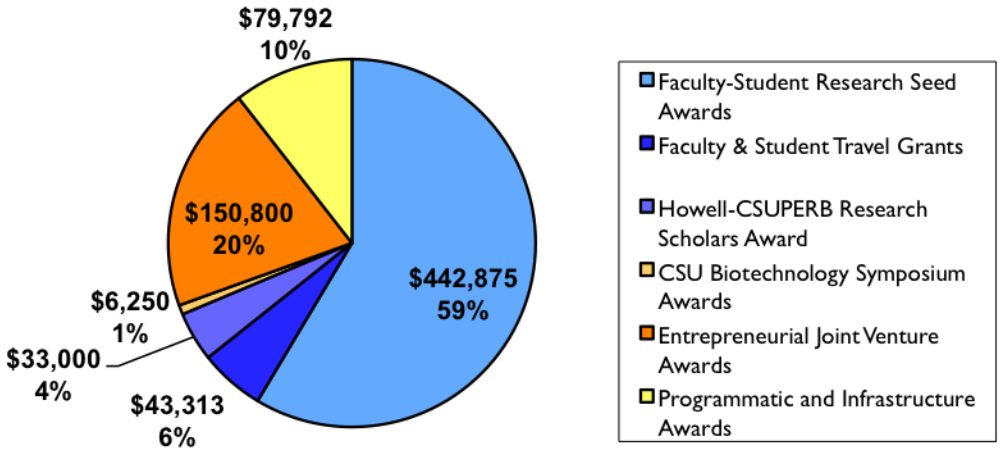
- **Full-time research project experiences are critical**
  - Hands-on (expertise building)
  - Immersion (successes and mostly failures)
  - Enthusiastic faculty & mentors
  - Peer lab-mates

- **Undergraduate research is an active learning strategy linked to recruitment and retention in STEM fields**
  - 30% of students with >12 months of research experience reported they expect to obtain Ph.D (….or continue STEM careers), compared to 13% and 8% with 1-3 or zero months

I. Learning Outcomes for Next Gen Life Sciences Research & Development

- Fundamental understanding of mechanisms
- Problem solving skills for discovery
- “Measure, Mine, Model and Manipulate”
- Integrate and iterate experiment and **computation**
- Move and communicate smoothly through multiple worlds and cultures (= @ the interfaces)
- Comfortable with **technology**

1. CSUPERB Grants & Awards Budget Supports Student-Faculty Collaborative Research



The 2009-2010 CSUPERB Strategic Plan put an emphasis on support for faculty-student collaborative research within the CSU in order to create new opportunities for professional development for both groups. 69% of the CSUPERB grants and awards budget went to these programs.

2. Workforce Development: Public-Private Partnerships are Critical

"..by.. 2020, the California economy will require that **75 percent of the workforce have some college education….**" (*1*)

Today 80% of the life sciences industry research and development workforce in California is made up of professionals at the masters' degree level or lower.*(2)*

1 - Public Policy Institute of California, "Just the Facts: California's Future Economy," September 2006.
2 – Peters & Slotterbeck, "Under the Microscope: Biotechnology Jobs in California," California Employment Development Department (updated June 2005).

2. Workforce Development: Public-Private Partnerships are Critical

Series of Congressional Science & Technology hearings on STEM preparation in last month highlighted:

- Lack of funding and incentives for “firm-level” programs*
- States/regions need programs to spur innovation culture and capital
- Find ways to combine disciplinary depth with interdisciplinary training and research opportunities

*Boosting Productivity, Innovation, and Growth Through a National Innovation Foundation, ITIF & Brookings,

2. Ongoing workforce training projects

- Biocompass website launched (Fall 2009): www.biocompass.org
- "C-LAB" project in Los Angeles Region – developing two project management certificates (Quality Assurance and Clinical Trials Management)
- Two new Department of Labor grants to consortia led by SDSU and SJSU (clinical laboratory sciences, quality assurance, project management, etc.)
- Participation on statewide planning summits on Health IT (2009) and California Healthcare Workforce Association (CHWA)
- Transition to Industry" workshops in San Diego and San Francisco, partnering with biotechnology industry associations (BIOCOM and BayBio)
- Statewide jobs survey, partnered with Radford, BIOCOM and BayBio
- Increasig focus on Health IT and Biofuels in 2010/2011

2. Industry-responsive curriculum projects

- Professional Science Masters (PSM) programs system-wide
  - 17 pertain to topics we've discussed today
  - PSM programs are characterized by industry partnerships, internships, real-world case study focus, and team projects
  - Programs responsive to life sciences industry workforce needs, especially in product, process and regulatory development
- Post-baccalaureate and graduate level courses and certificates
  - Regulatory Affairs
  - Project Management
  - Quality Assurance
  - Clinical Trials Management
  - Clinical Laboratory Sciences
  - …Health IT (coming)

Summary

- Find and provide inspiration as early as possible
- Get full-time, hands-on laboratory experience (build skills)
- Do team science and get involved in research and development projects
- Get support from peers and mentors
- Improve access by providing full time support
- Learn “translational” and “innovation” and “entreprenueurial” vocabularies

Challenges remain:

How do we scale this to all CSU students interested in STEM careers?

The CSU is committed to partnering with other educational systems and the biotechnology industry to develop California’s workforce at all degree levels.

CSUPERB's mission is to develop a professional biotechnology workforce by mobilizing and supporting collaborative California State University (CSU) student and faculty research, innovating educational practices, and responding to and anticipating the needs of the life science industry.

- Provide grant funding
- Sponsor real-world research experiences
- Organize the annual CSU Biotechnology Symposium
- Drive industry-responsive curriculum development
- Serve as liaison between CSU and government, philanthropic, educational, and biotechnology industry partners

www.calstate.edu/csuperb

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www.csubiocompass.org