UC San Diego

JACOBS SCHOOL OF ENGINEERING

Corporate Affiliates Program

Welcome
CAP Executive Board
Thursday, February 7, 2019

CAP Chairman and Vice Chairman

Nik Devereaux

Director of Software Engineering
Viasat

GB Singh

Director of Engineering
Solar Turbines

Welcome

UC San Diego
JACOBS SCHOOL OF ENGINEERING
Corporate Affiliates Program

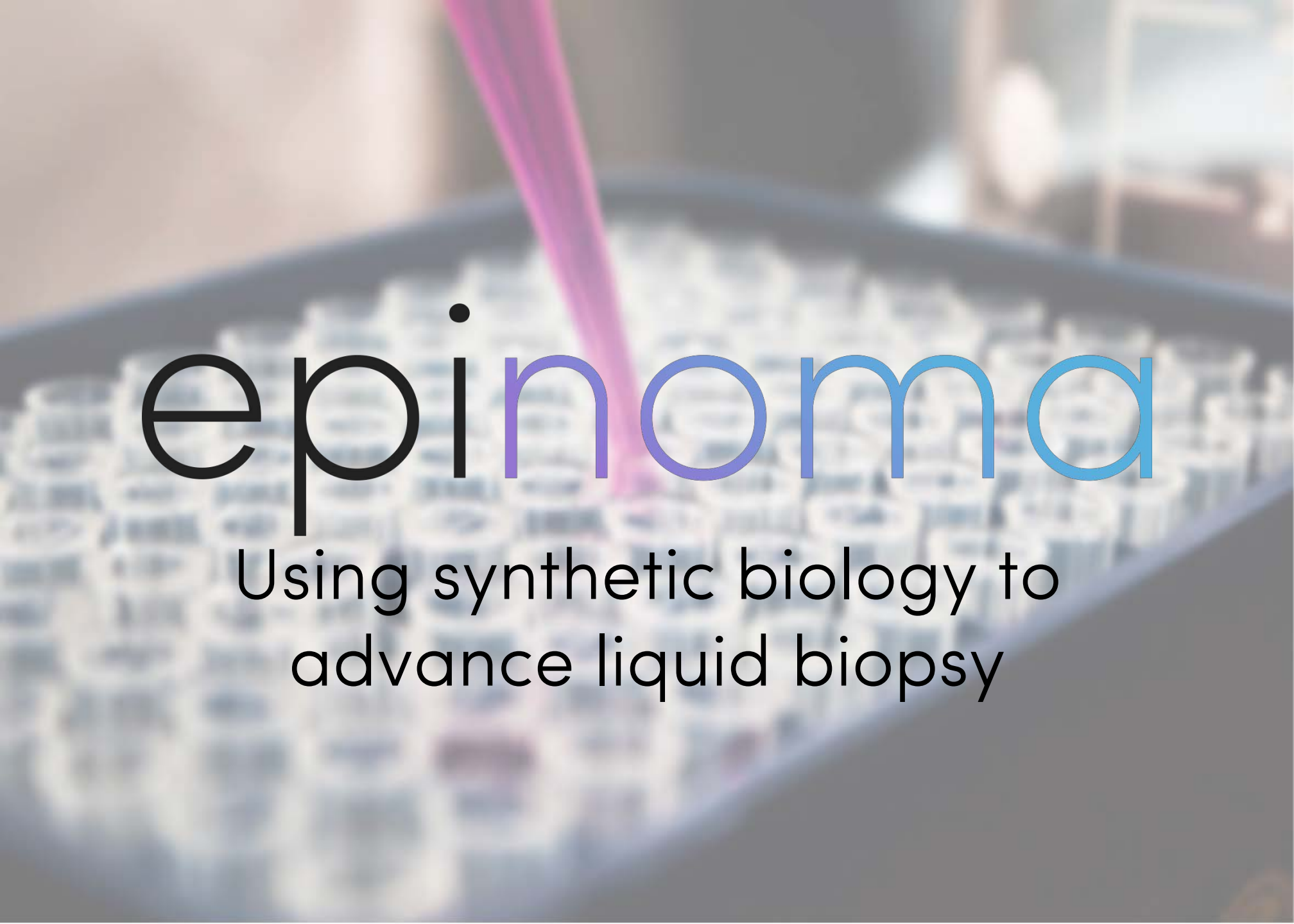
Welcome New CAP Executive Board Vice Chairman

GB Singh
Director of Engineering
Solar Turbines

- Over 20 years of technical and executive leadership experience in Oil & Gas, Power Generation, Gas Turbines, Automation and Manufacturing
- Experience managing large international teams across multiple countries
- CAP Executive for Solar Turbines since 2016
- Executive focal for Team Internship Program (TIP), Cooperative Education (Co-op) Program, and Systems Engineering Subcommittee

Welcome New CAP Partners

Honda R&D Americas


epinoma
Using synthetic biology to
advance liquid biopsy

Meeting the team

epinoma

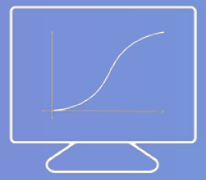
Wetlab

Zhijian Li, 4th year, Analytical Chemistry

Ruiyuan Zhang, 4th year, Biochemistry

Anser Abbas, 4th year, Chemistry

Claire Luo, 3rd year, Cell Biology



Computational Modeling

Ishan Goyal, 4th year, Bioinformatics

Platform Design

Kunal Patel, 3rd year, CS

Marin Cross, 3rd year, Cell Bio

Business Development

Varun Govil, 3rd year, Biotech

Advised by Dr. Kang Zhang, M.D., Ph.D

A closer look at cancer diagnostics

Tissue specimen analysis

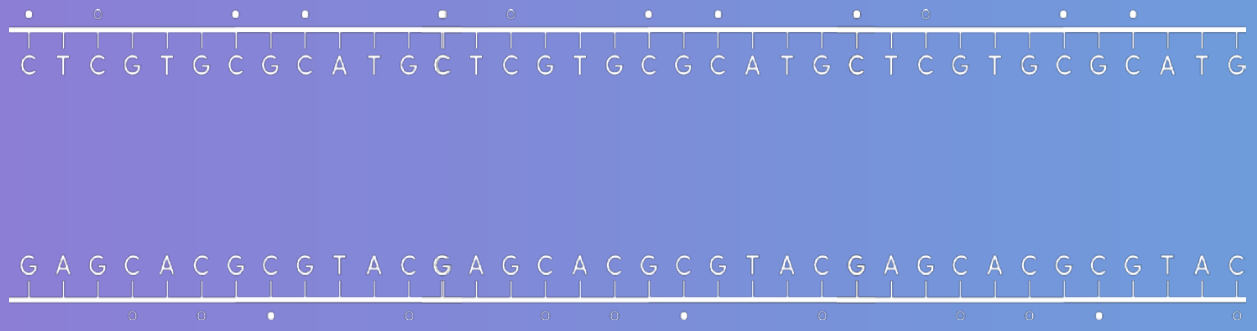
Next-generation sequencing

Primary pain points:

1. Inaccurate because of focus on alterations to genetic code
2. Invasive and inherent risk of damage to organs as well as chance of spreading
3. Expensive

A new vision of harnessing the epigenome

Focusing on promoter methylation as a consistent diagnostic metric



Liquid biopsy

ctDNA, CTCs, miRNA

Why ?

Largely modified methylation patterns in DNA differentiates from cancer diagnostics

Stability and frequency

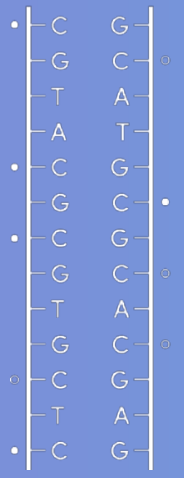
Easily accessed through bodily fluids

Linked to the earliest indicators of tumor generation in the body

Identifying key bottlenecks

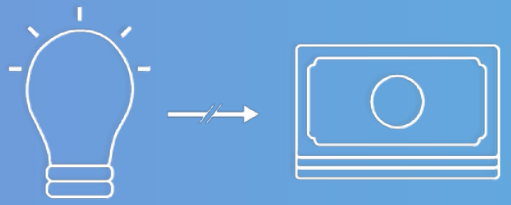
Technical challenges

1 Low diagnostic accuracy



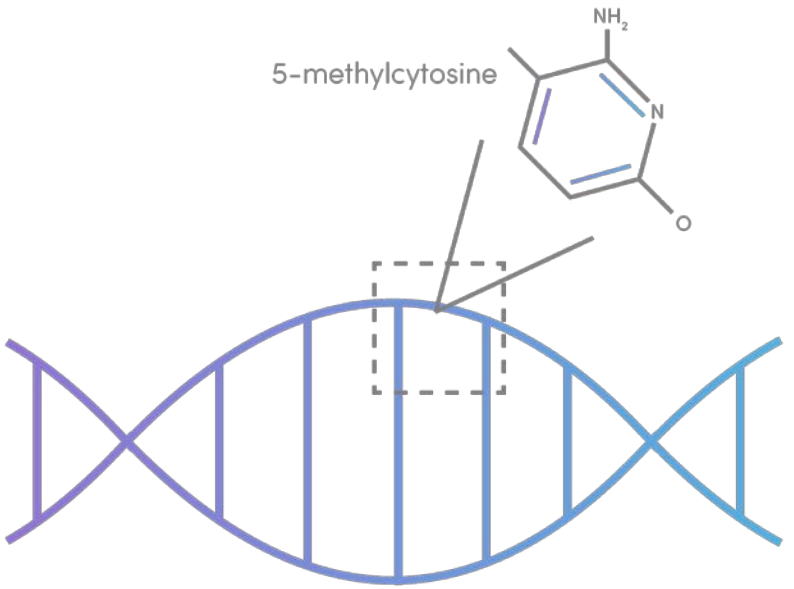
2 Difficulty in finding biomarkers

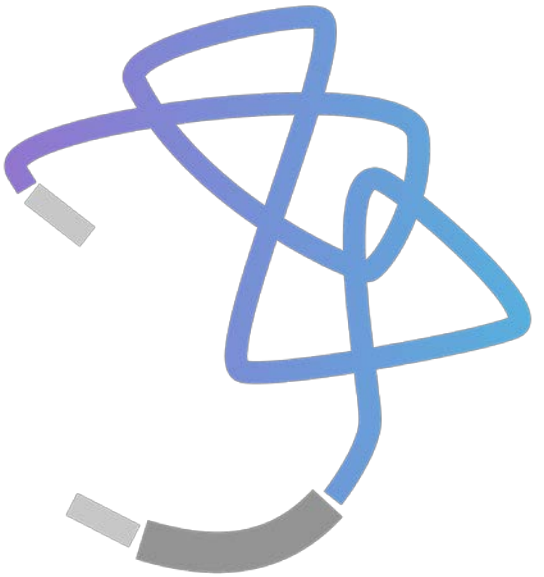
Non-technical challenges



3 Unsustainable business models

Applying principles of synthetic biology to our design

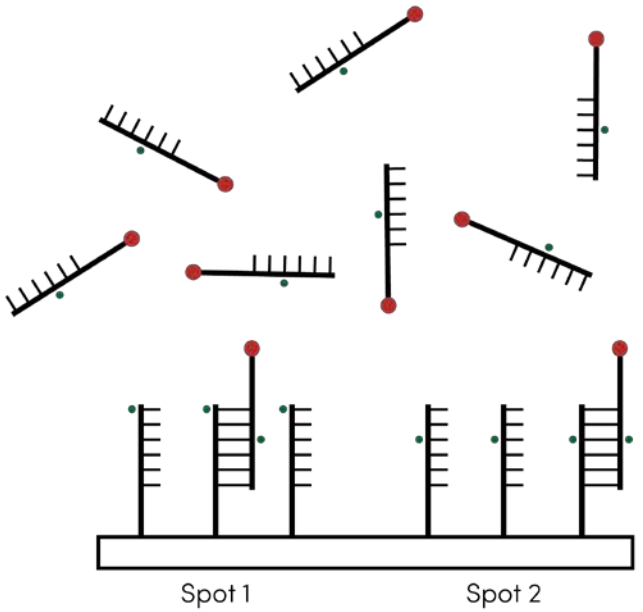




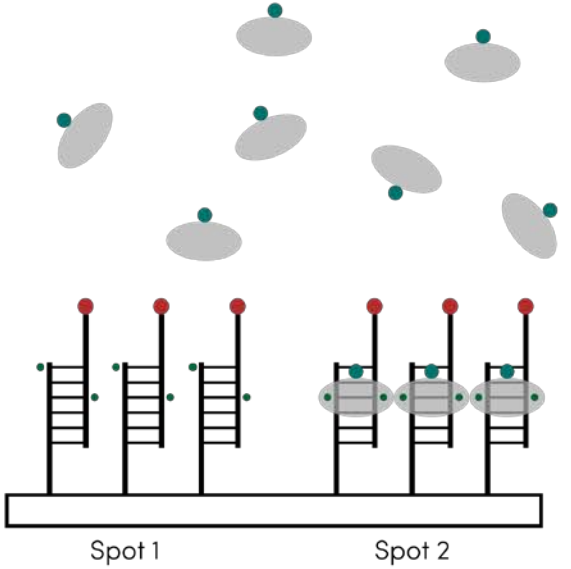
Methyl-binding domain protein

Applying principles of synthetic biology to our design

Step I – target DNA hybridization

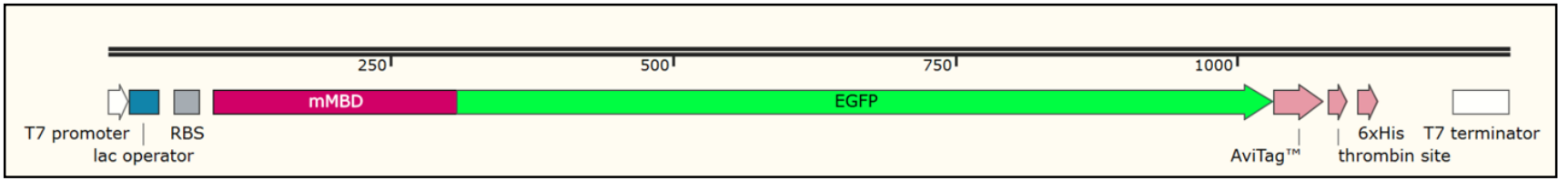


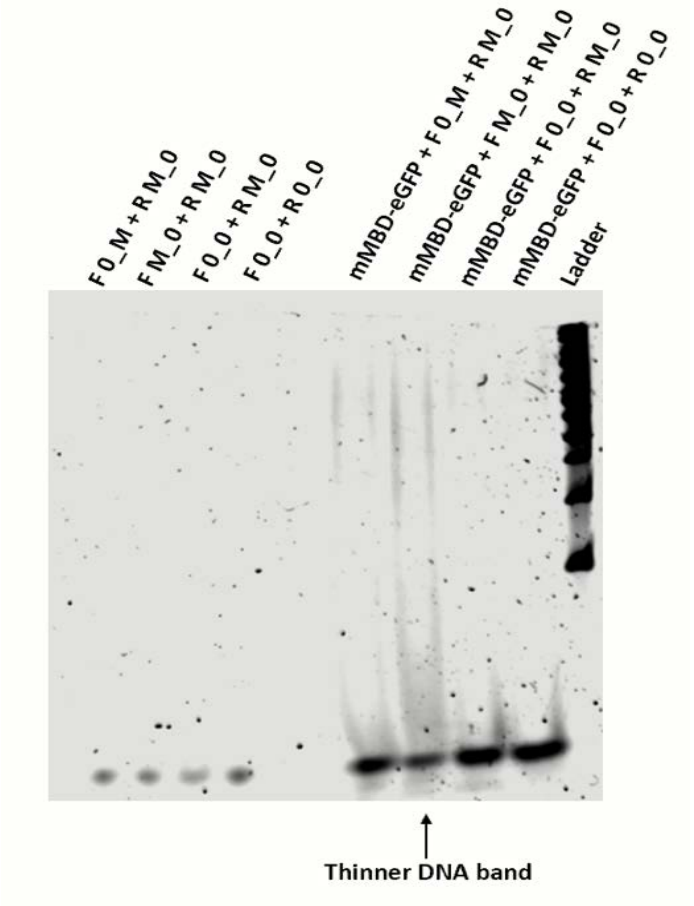
Step II – MBD binding



Baseline validation of our MBD-GFP circuit

Basic mMBD construct

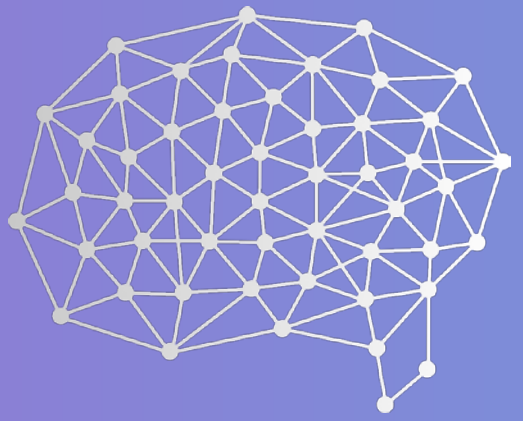




Challenges we faced

1. We could not proceed without a tool to determine clinically relevant methylation CpG sites
2. We needed a way to ensure the specificity of our design

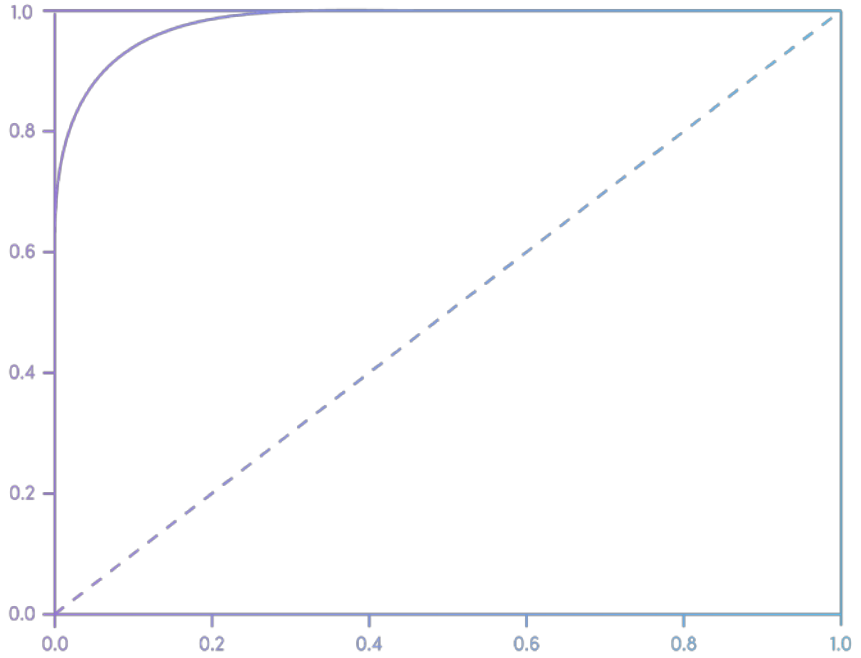
Using supervised machine learning for biomarker discovery



Benefits

1. Leverage existing datasets to generate meaningful (statistically significant) biomarkers
2. Enhance the utility of new and existing methylome data
3. Generate disease-specific insights that can lead to more effective treatments

Algorithm selection: Random Forest



Key Statistics

1. Accuracy 94.99%
2. Sensitivity 94.34%
3. Specificity 95.98%

	Negative Test	Positive Test	Total
Disease Absent	167 (TN)	7 (FP)	174 (TN + FP)
Disease Present	15 (FN)	250 (TP)	265 (FN + TP)
Total	182 (TN + FN)	257 (FP+TP)	439

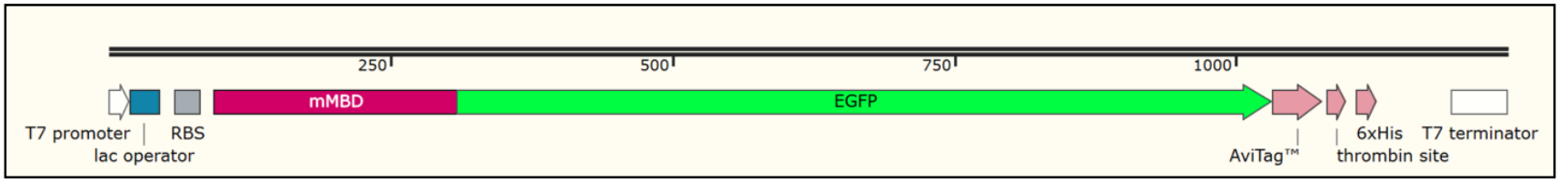
Expanding our biomarker discovery tool

9 new overlapping biomarkers

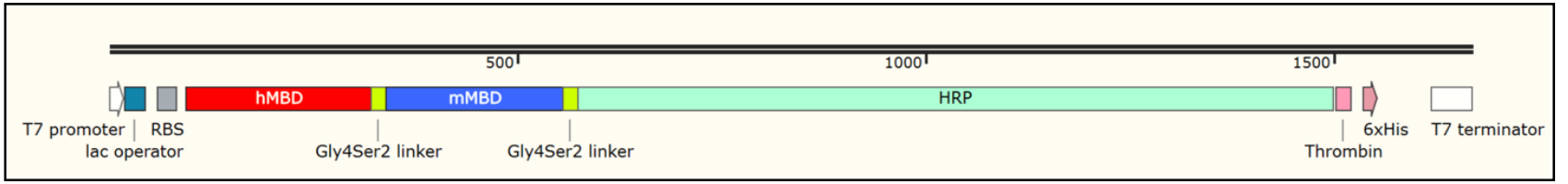
Guiding our wetlab design → Expanding our work for other methylome data

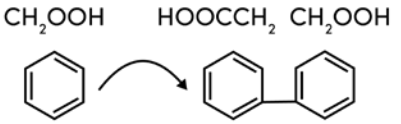
Optimizing our genetic construct

Basic mMBD construct

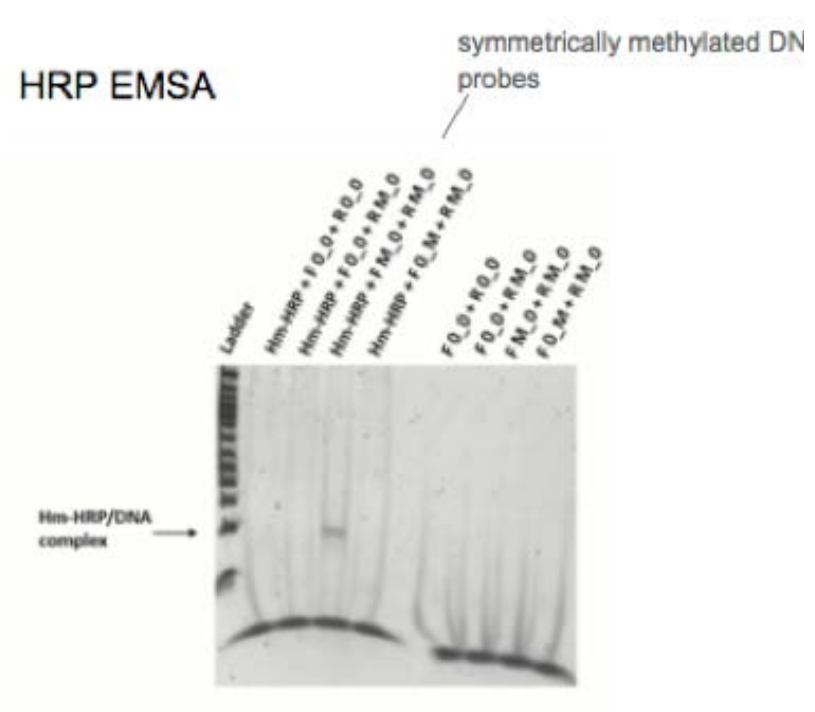


HRP-optimized construct

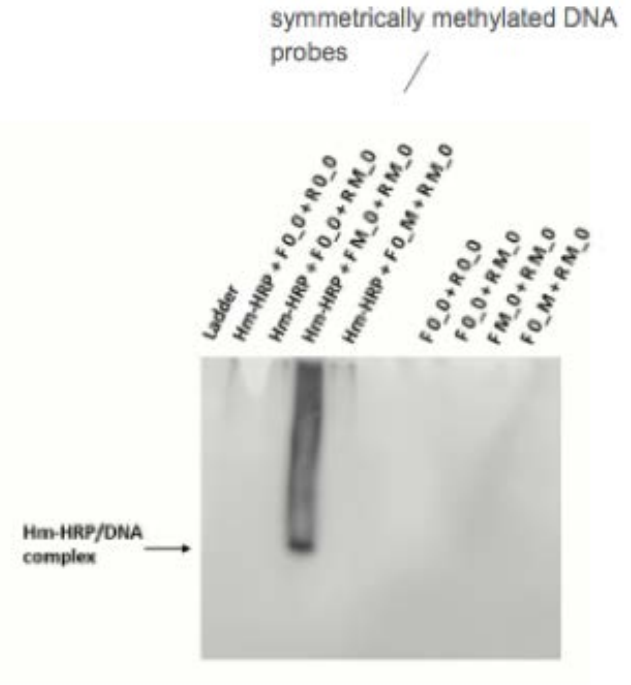




hmHRP Validation

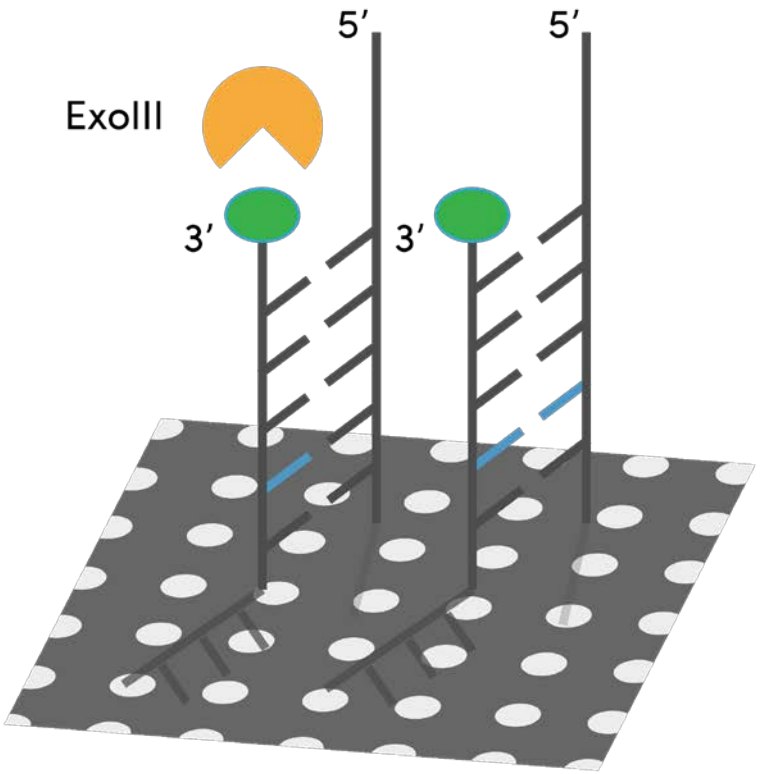


1

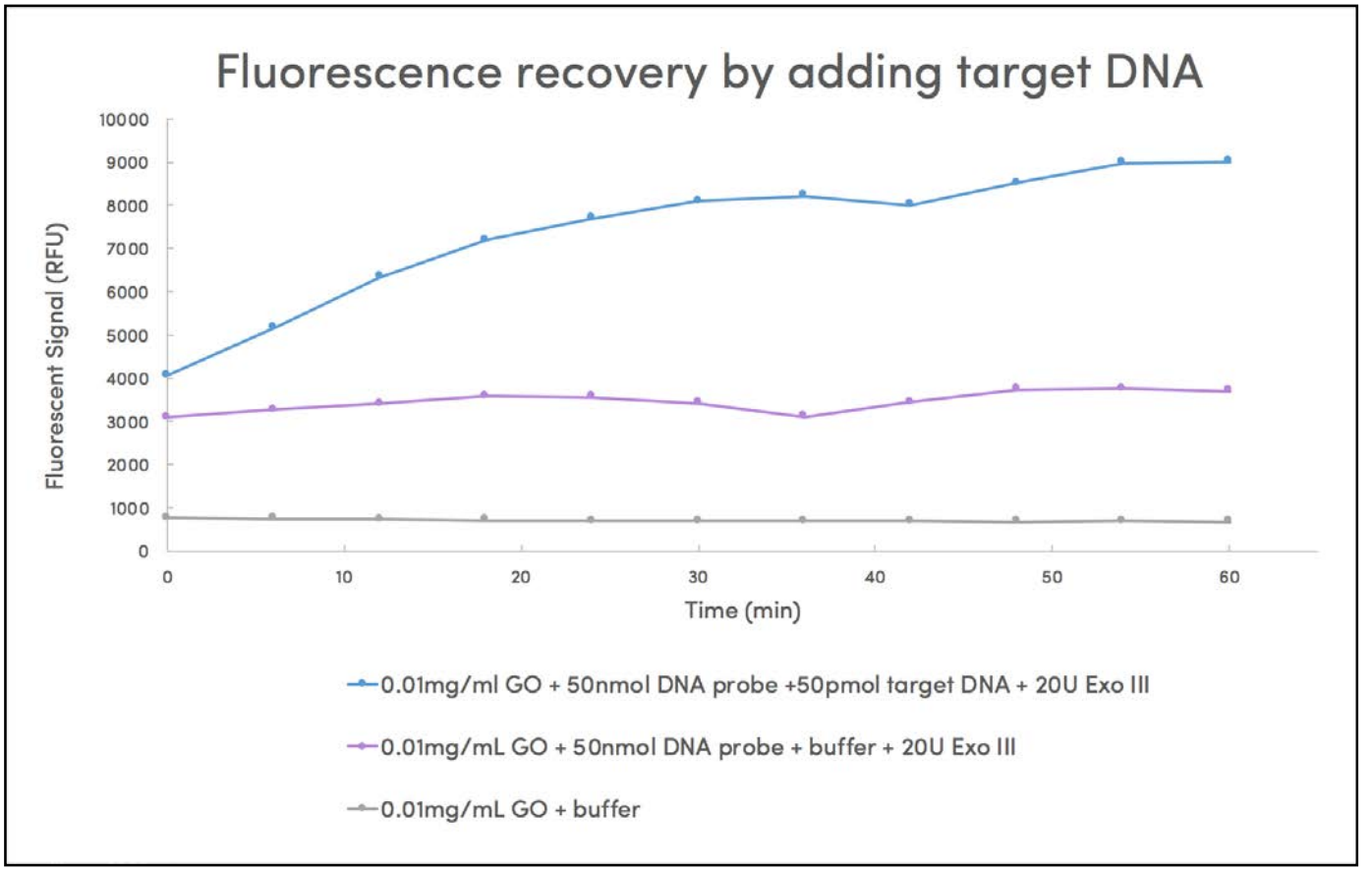


2

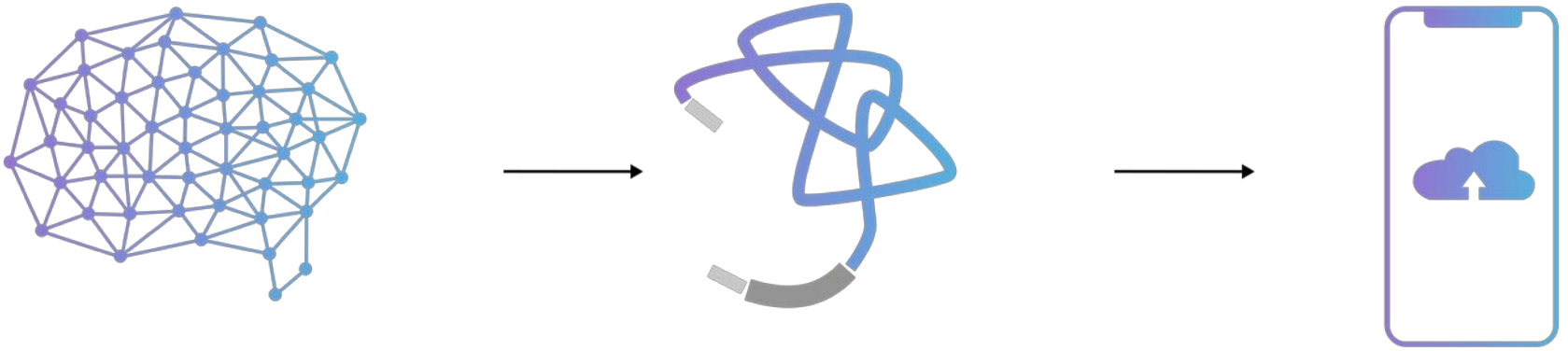
Fluorescence recovery

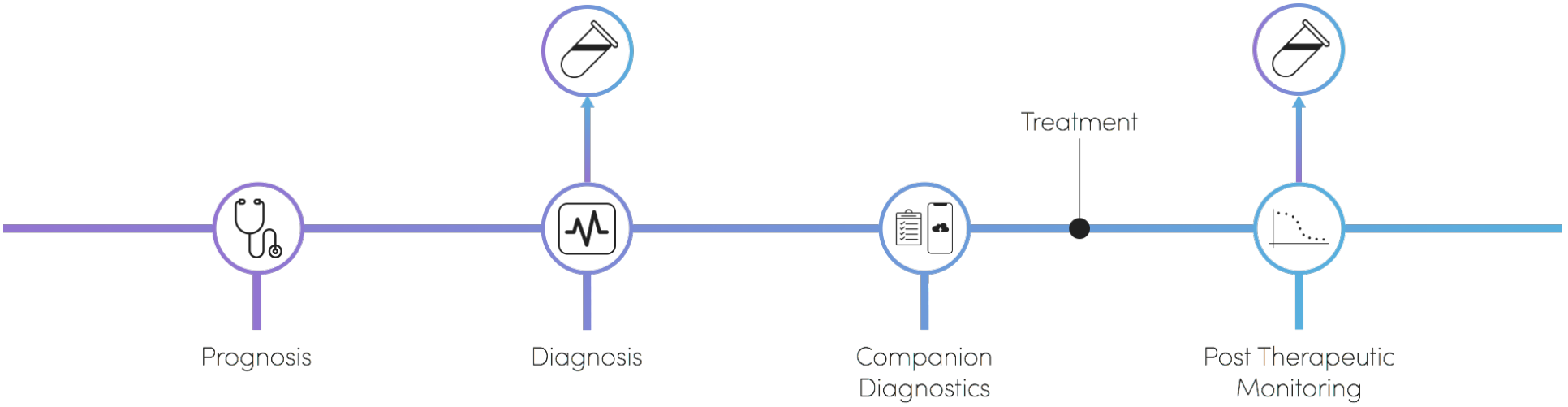


Fluorescence recovery



Understanding the Epinoma workflow





Developing product lifecycles

Early screening

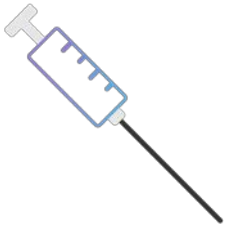
1. Doctor - patient consultation
2. In Silico Design for Diagnostic Design
3. Getting input sample
4. Performing Sample Purification and Assay Analysis
5. Secure, safe communication of medical data
6. Planning the path forward

Post-therapy response

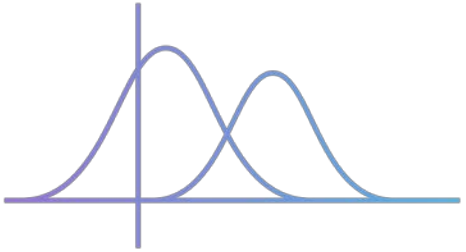
1. Evaluate treatment effectiveness
2. Repeated blood draws
3. Health tracking

Creating a value proposition for Epinoma

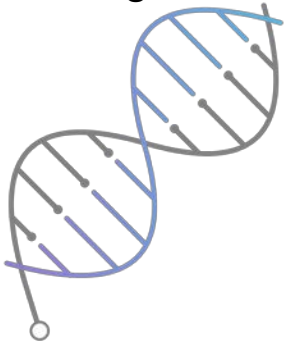
1. Non-invasive detection



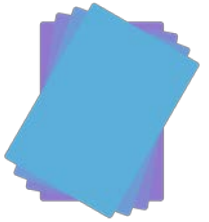
2. High diagnostic accuracy



3. Eliminating chemical analysis



4. Versatility in application



5. Smartphone-equipped

6. Reasonable price point

Summing up our achievements

- ✓ Collaborating with La Verne for summer meetup and Interlab help
- ✓ Incorporated a novel paradigm for IHP and conducted over 20+ interviews
- ✓ Constructing and validating multiple BioBricks for Registry
- ✓ Using ML to construct a biomarker discovery tool and guide our wetlab design

First iGEM team to:

- ✓ Adopt a paradigm that focuses on epigenetic alterations for cancer
- ✓ Develop a modular framework for cancer diagnostics based on epigenetics
- ✓ Characterize BioBricks that express MBD and detect hypermethylation
- ✓ Interact with major VC firms and get a project testimonial
- ✓ Largest amount of money given to an iGEM team for future development ($100,000 from TATA Institute of Genetics and Society)

DEAN'S BRIEF

Albert P. Pisano

Dean, Jacobs School of Engineering

Securing Excellence

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Unprecedented 5 year Milestones

2014 2015 2016 2017 2018

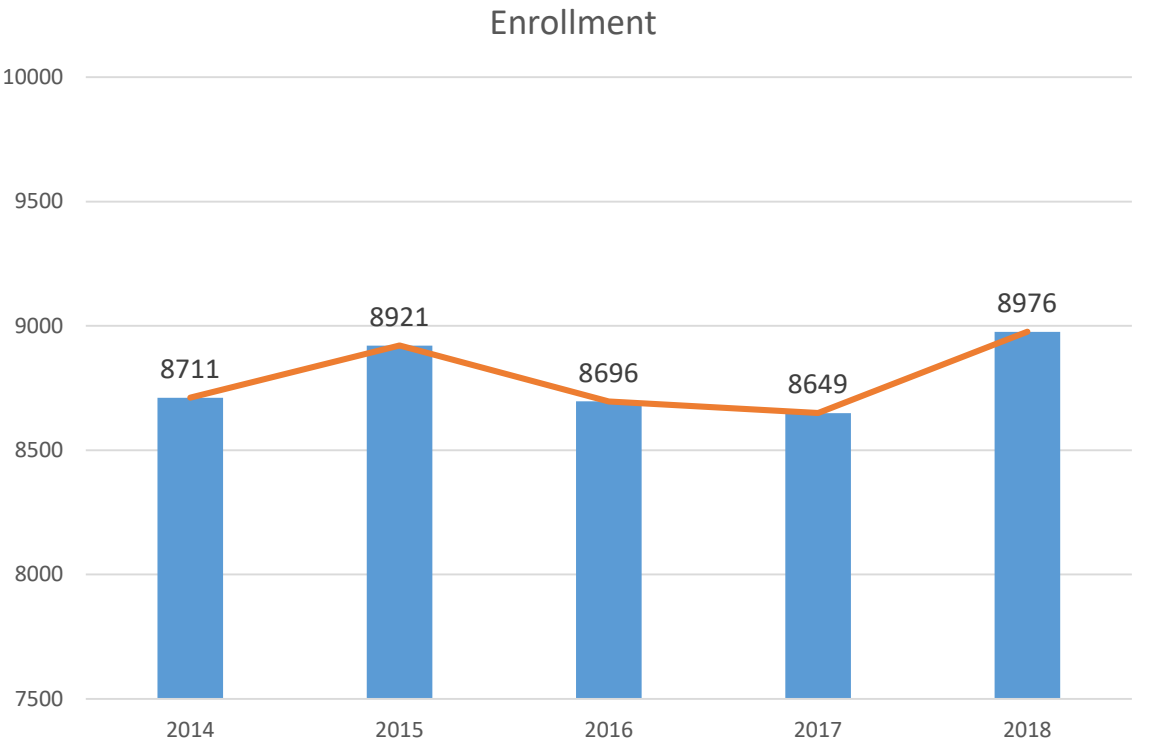
Jacobs School of Engineering
Diversity & Inclusion



- #2 in the nation for awarding engineering bachelor's degrees to women
- 24% female engineering students (national average 17%)
- 26% increase in underrepresented student populations from 2014-2018
- 27 new female faculty from 2014-2018

Jacobs School of Engineering 2014-2018: Student Enrollment

- Largest public engineering school in California
- Masters enrollment to increase
- 90% freshman retention



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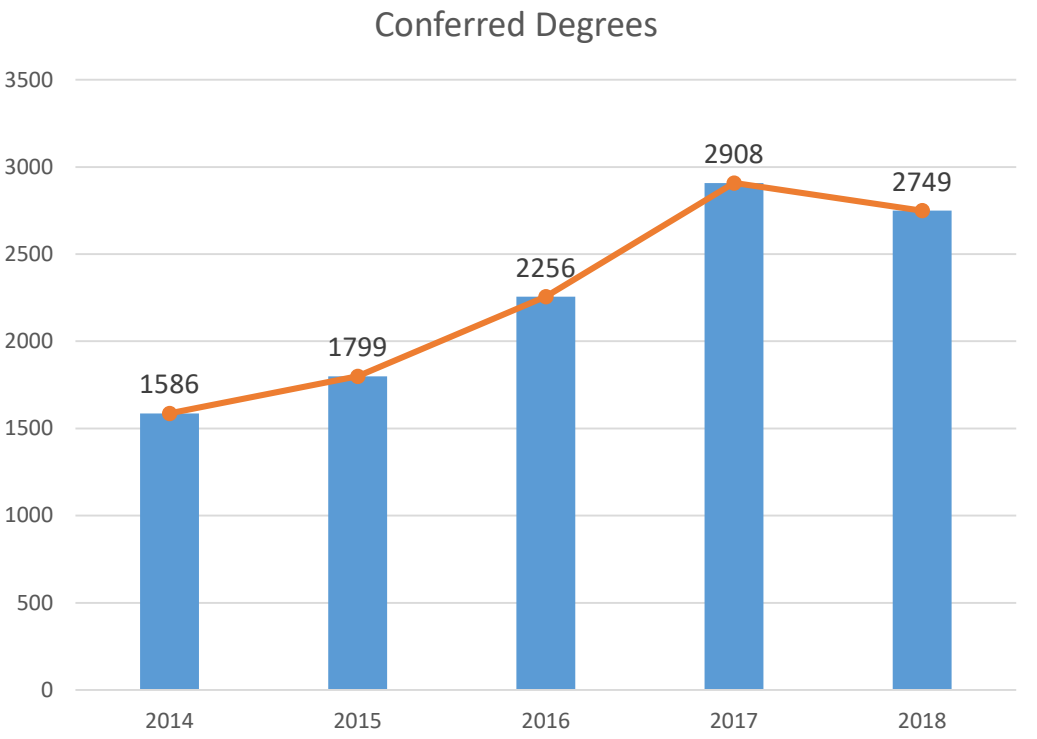
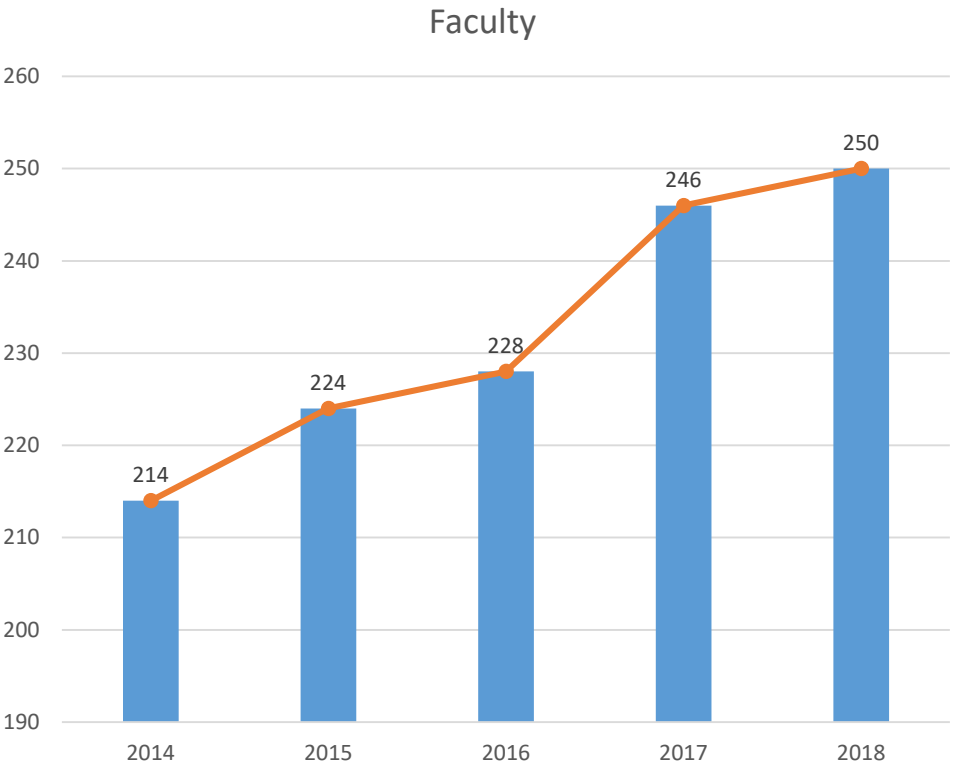
Jacobs School of Engineering 2014-2018: Degrees Awarded

- #1 engineering bachelor's degrees awarded in California
- #2 engineering bachelor's degrees awarded to women
- #3 engineering bachelor's degrees awarded overall



Jacobs School of Engineering 2014-2018: Faculty Hiring

- 91 faculty hired over 5 years; 17% increase since 2014
- Student-to-faculty ratio improving
- Increased number of teaching faculty



	Current	Goal
Undergrad/Faculty	25/1	21/1
MS/Faculty	7/1	10/1
PhD/Faculty	6/1	6/1

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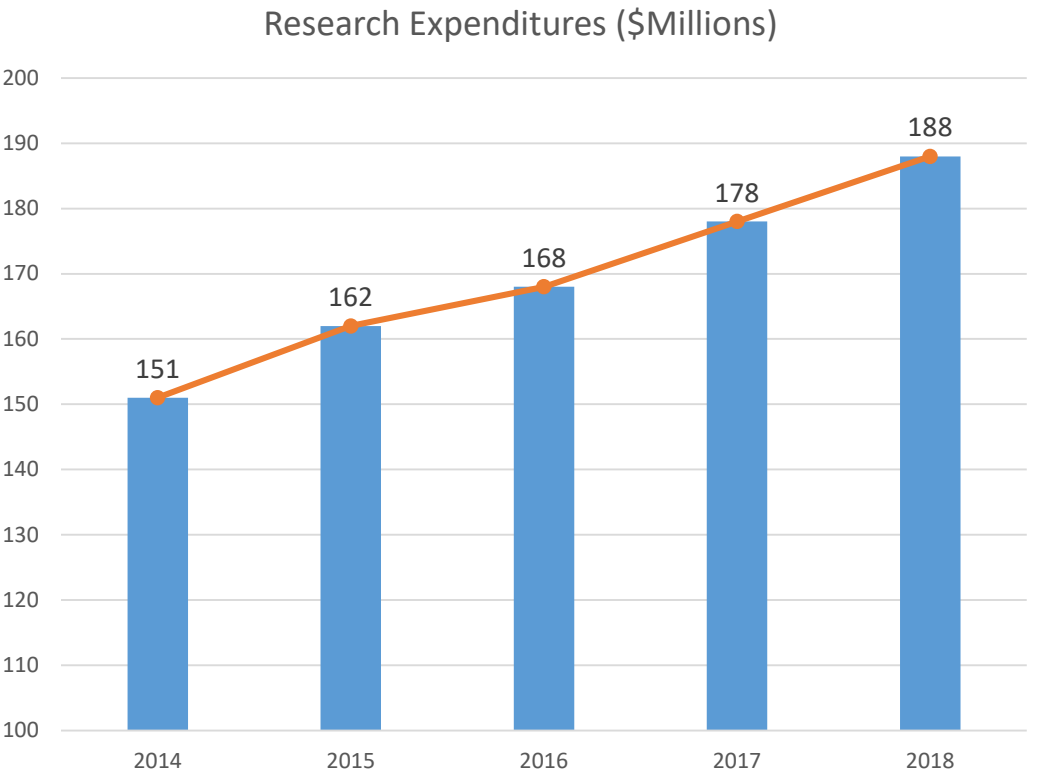
Jacobs School of Engineering 2014-2018: Research Expenditures

- #1 for Research Expenditures in nation per faculty member
- Increased of $37M since 2014; 24% growth
- $56M industry-funded research in 2018
- 13 industry-sponsored centers and institutes launched in 5 years



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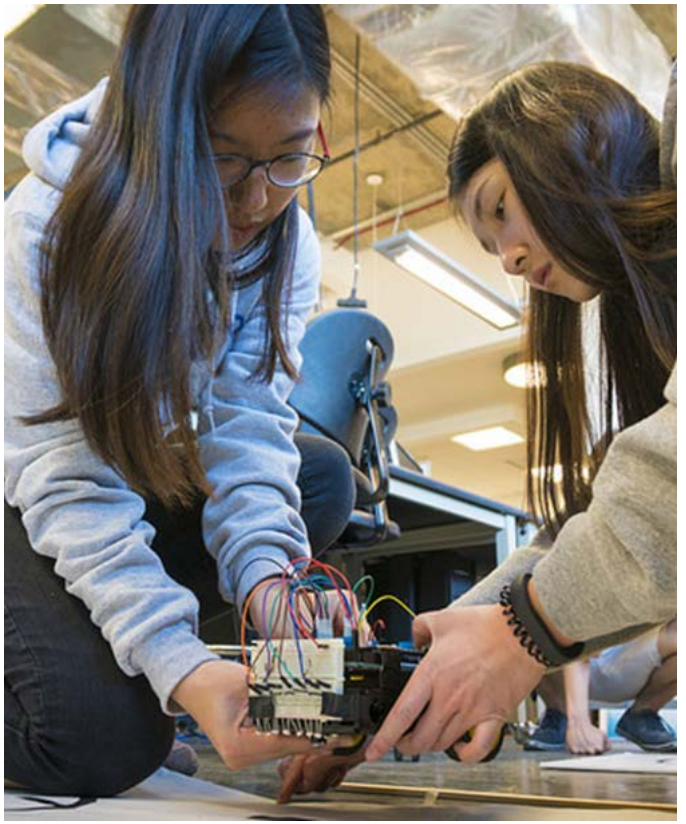
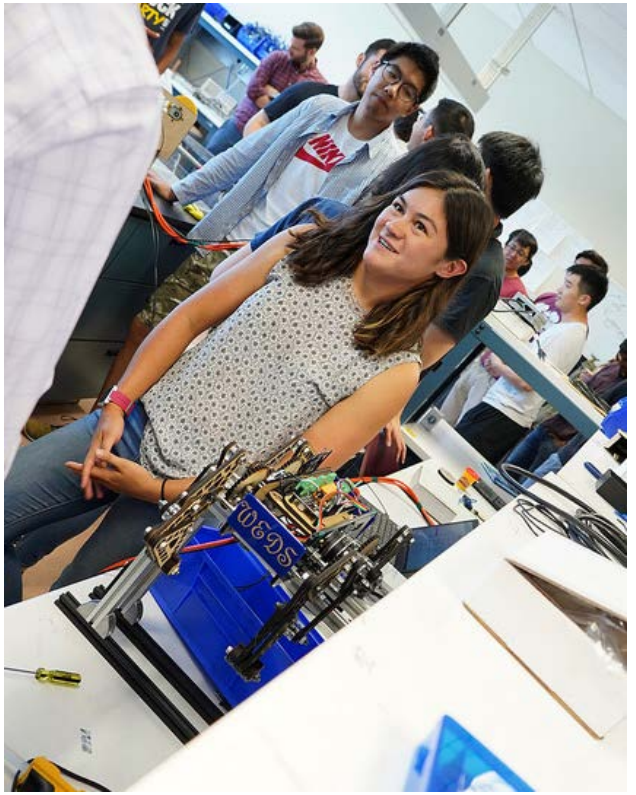
Looking forward: 2019 and Beyond



- **Jacobs School Strategic Plan**
- **Franklin Antonio Hall**
- **Cooperative Education (Co-op)**
- **Systems Engineering**

2013 Jacobs School Strategic Plan



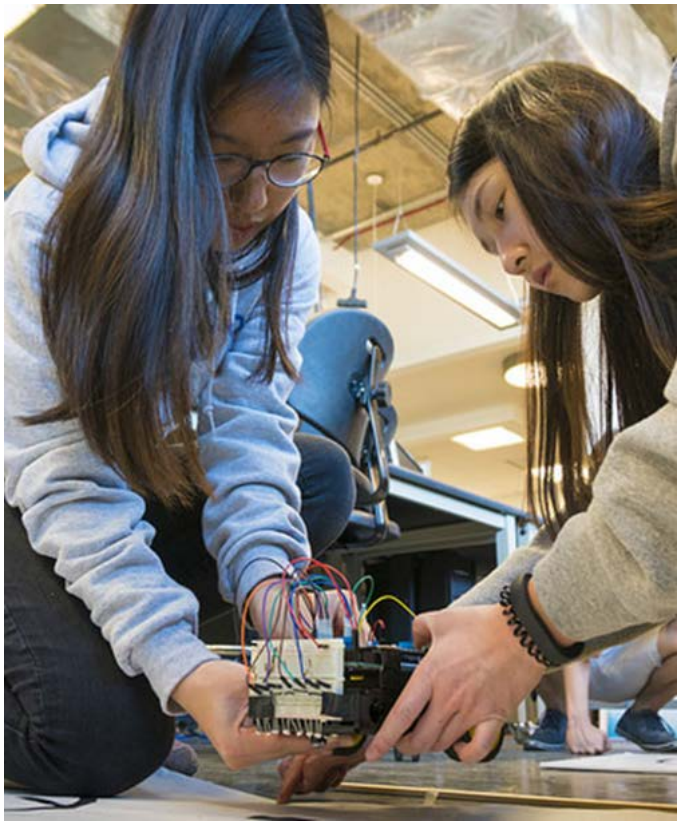
Goals focused on course corrections to enable and sustain excellence for Top 10 “readiness”

- Attract and improve retention of URM and women faculty/researchers
- Right-size the Student to Faculty ratio to enhance quality of education and increase research productivity
- Increase quality and competitiveness of the undergraduate program while improving efficiency
- Increase interdisciplinary research and foster collaboration with industry
- Secure excellence and enhance reputation

Jacobs School Strategic Plan: 2019-2023

- What is the correct asymptotes for Jacobs School (faculty, students, footprint)?
- What are the research and education themes of the future that we should be investing in now?
- How can we drive relevance by recoupling engineering to the basic sciences?
- How can we build holistic strategic partnerships with key industry collaborators?
- How can we instill in our students the systems thinking, leadership and ethics required in tomorrow's increasingly complex world?
- How can we foster systems-level research and innovation?
- How should we respond to changing culture among our students, and trends in higher education?
- What does "excellence" and "relevance" mean to individual faculty?

Looking forward: 2019 and Beyond



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Franklin Antonio Hall

Opening 2021

- Regents approval secured
- Groundbreaking: Fall 2019
- Completion Target: Winter 2021
- New renderings

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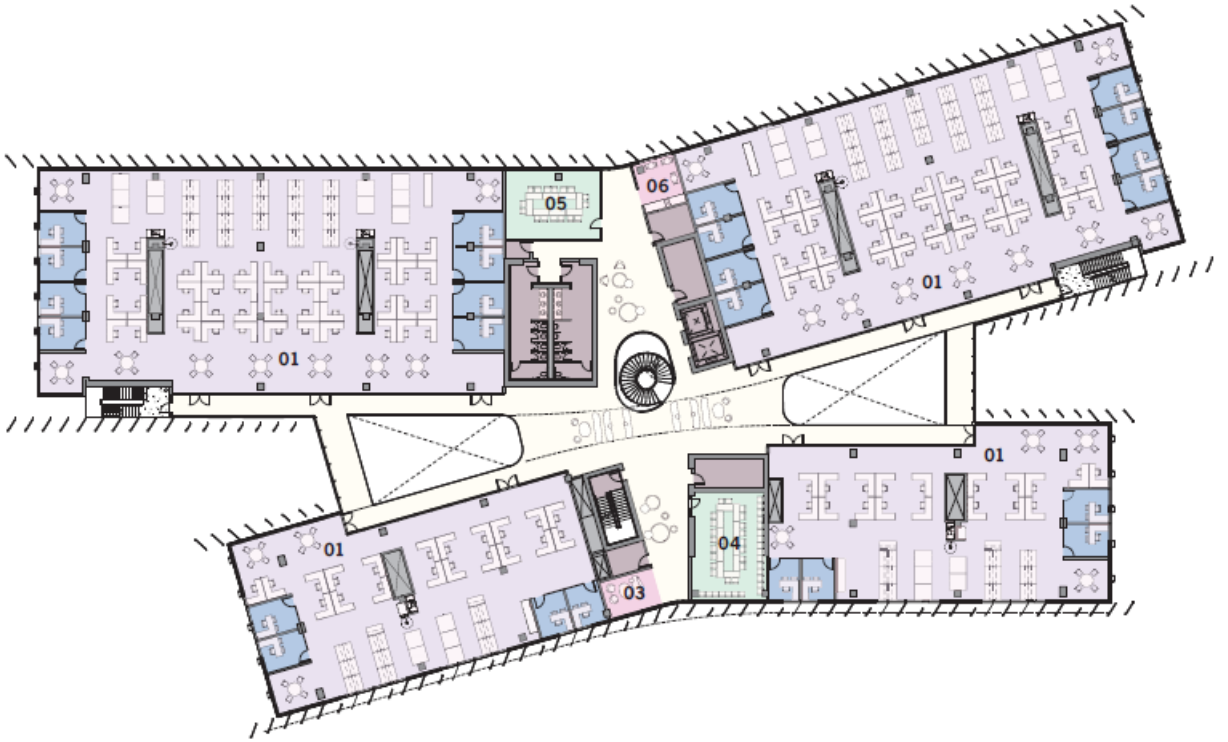
FLOOR PLAN / LEVEL 1

01 Collaboratory
02 Student Makerspace
03 Lounge
04 Medium Meeting
05 Small Meeting
06 Kitchen
07 Cafe
08 Learning Innovation Studio
09 IGE
10 Classroom
11 Terrace
12 Executive Outreach
13 Large Meeting
14 Light Well
15 Loading Dock

Assembly
Learning Innovation Studio
Research
Office
Collaboration
Food Service
Circulation
Building Service
Support

FLOOR PLAN / TYPICAL UPPER LEVEL



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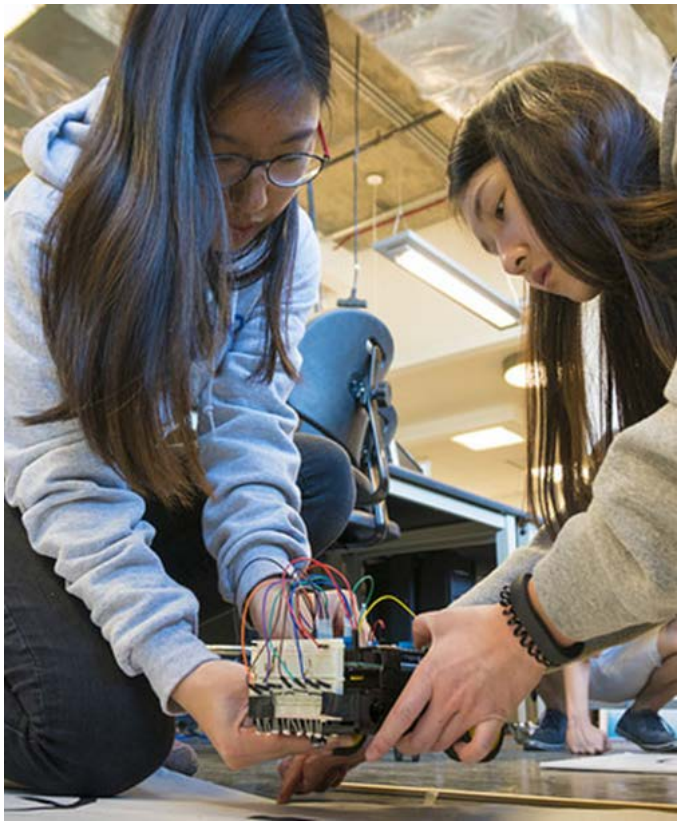
Looking forward: 2019 and Beyond



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Jacobs School Co-op Pilot Launched

- Students work full-time for 5-6 months
- First in the UC System
- Pilot to run July-December 2019
- Over 450 student applicants

Thank you to our participating CAP Partners

ATA ENGINEERING, INC.

brain corp

Instrumentation Laboratory
A Werfen Company

intuit

Solar Turbines
A Caterpillar Company

teradata.

ThermoFisher SCIENTIFIC

Viasat

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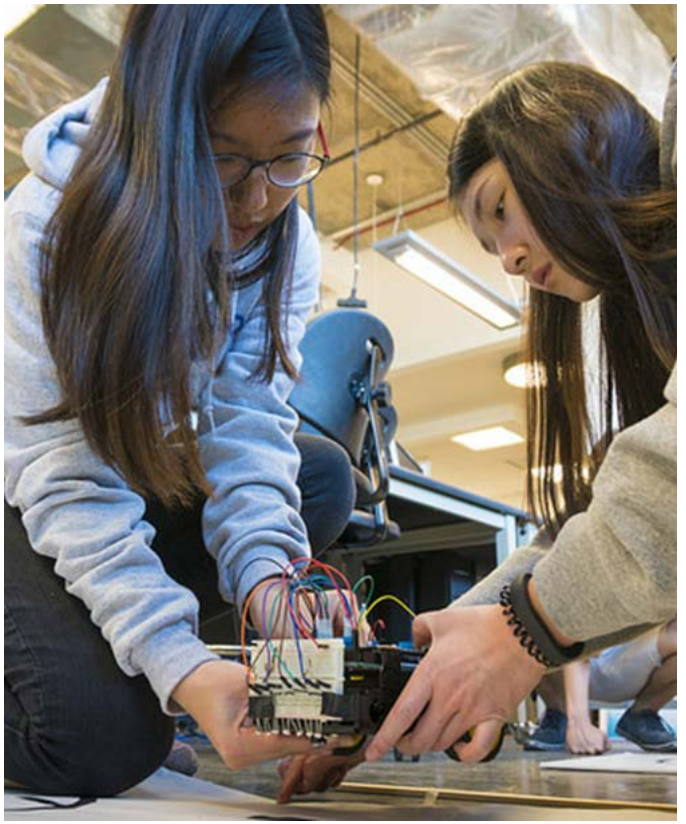
Looking forward: 2019 and Beyond



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Jacobs School of Engineering
Systems Engineering Initiative

H. Alicia Kim

Professor, Structural Engineering

Co-chair, Jacobs School Systems Engineering Faculty Committee

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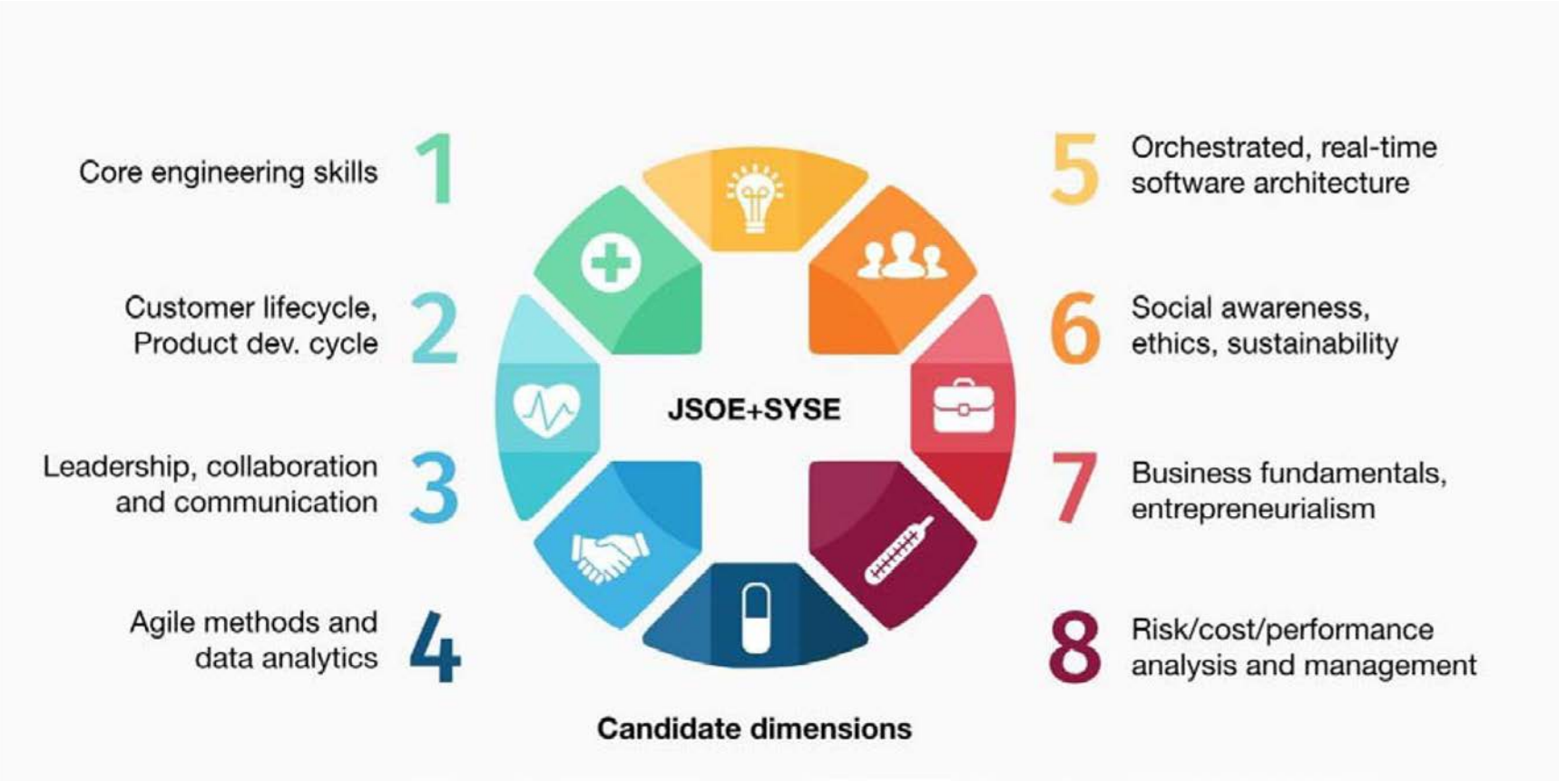
Systems Engineering White Paper

Addresses:

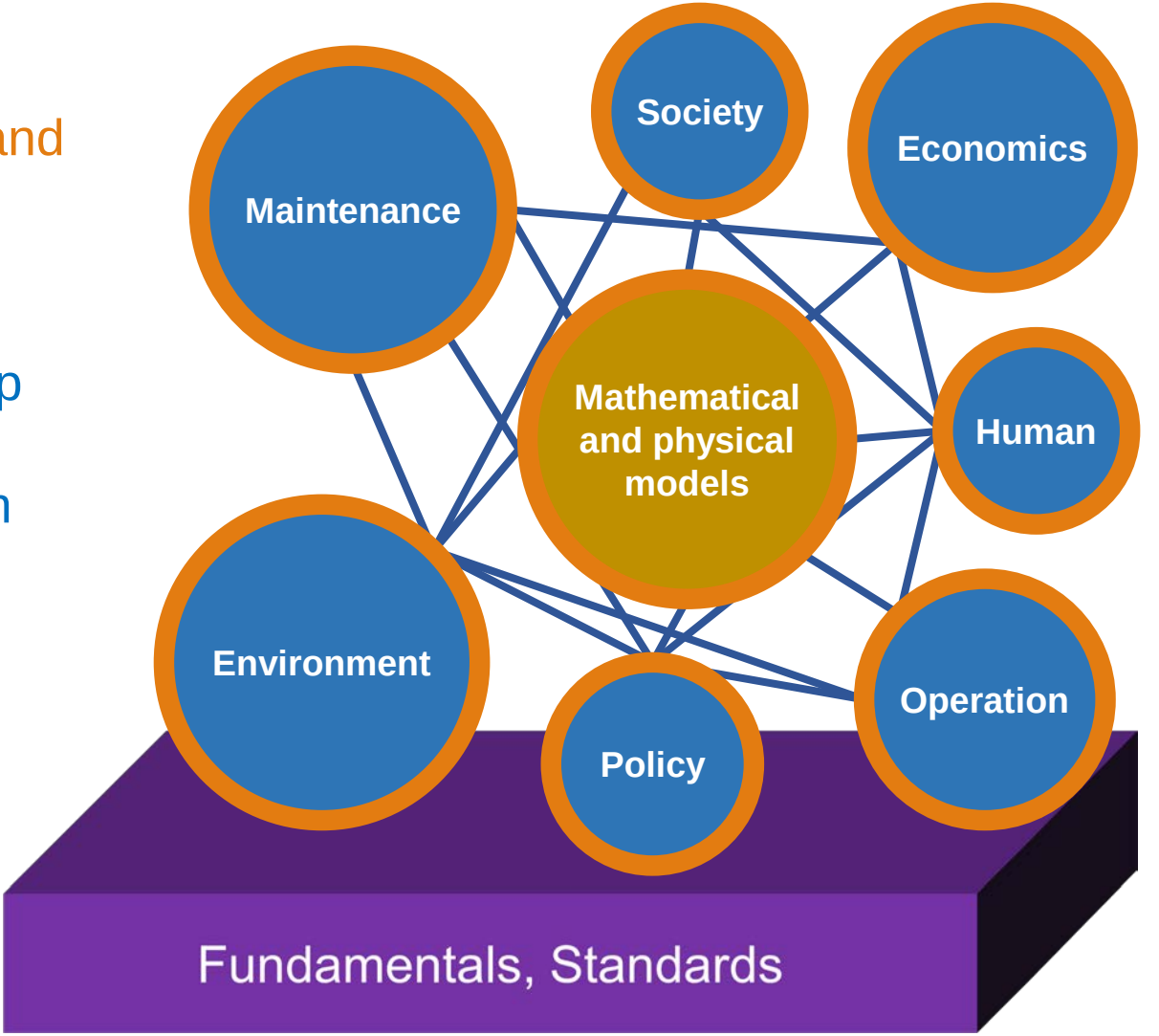
1. Identification of the needs: Study of the case studies from our corporate partners
2. Unique selling point of UCSD program: Study of 12 programs in top engineering schools
3. Program recommendation
4. Course curricula
5. Research to support the program in the future

Skills in Systems Engineering Curriculum



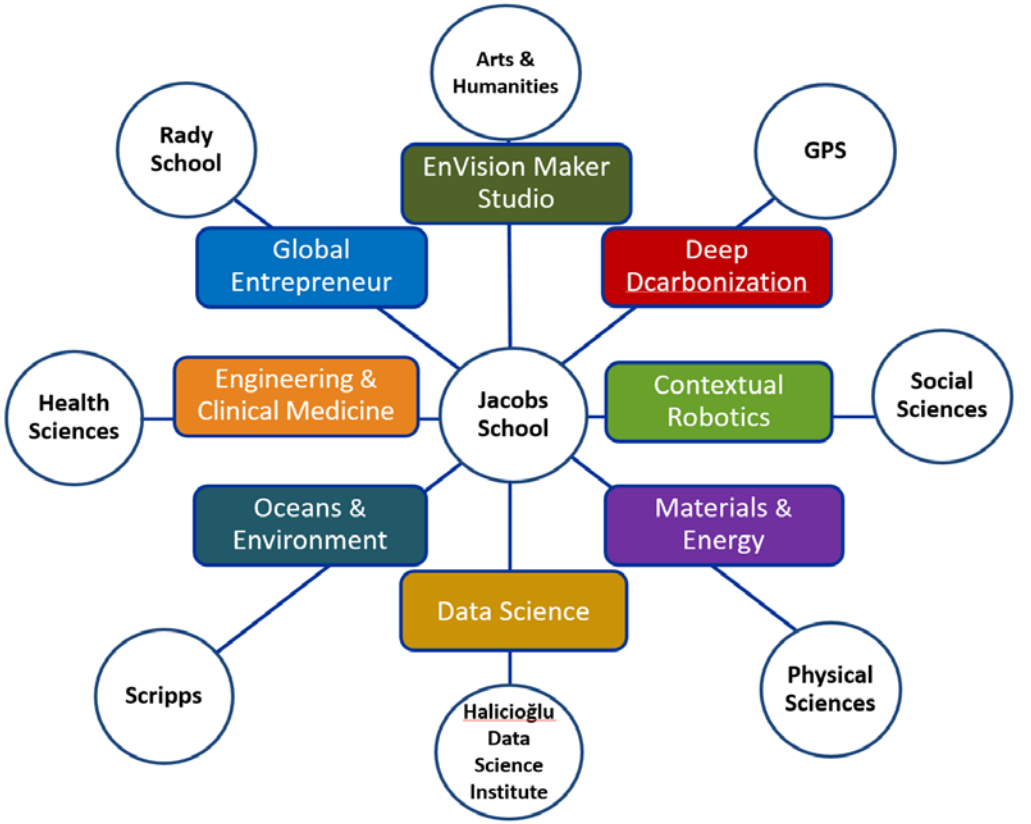
Multidisciplinary Research

1. Disciplinary: requirements and modelling
   - Modelling
   - Data analytics
2. Interdisciplinary: relationship
   - Optimization
   - Uncertainty quantification
   - Multiscale
   - Multifidelity
3. Integration
   - Mathematics
   - Computing



Existing Expertise

- Engineering
- Mathematics
- Data Science and Analytics
- Machine and Deep Learning
- Human-centered Design
- Business and Management
- Practical Ethics
- Arts and Humanities
- Global Policy and Strategy



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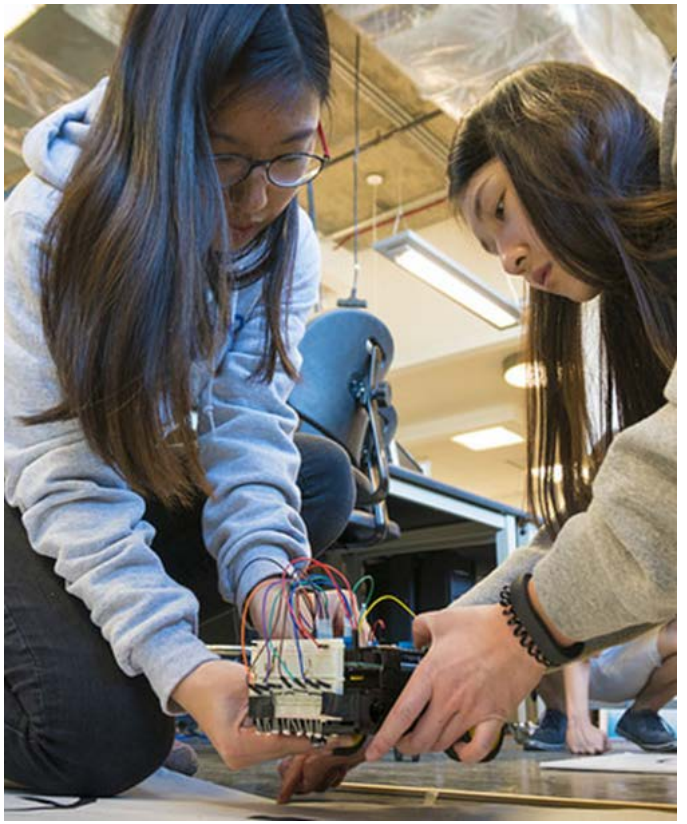
Faculty Hiring: Open Search

- Appointable in multiple departments
- Computational methods for multiphysics, multiscale and multifidelity analysis and optimization of interconnected systems
- Engineering with societal/ethical/business consideration
- Human-technology relationship
- Uncertainty propagation and quantification in complex systems design
- Designing systems at scale
- Analysis, control and design optimization of complex systems
- System design at scale
- Data-analytics and machine learning for complex systems engineering

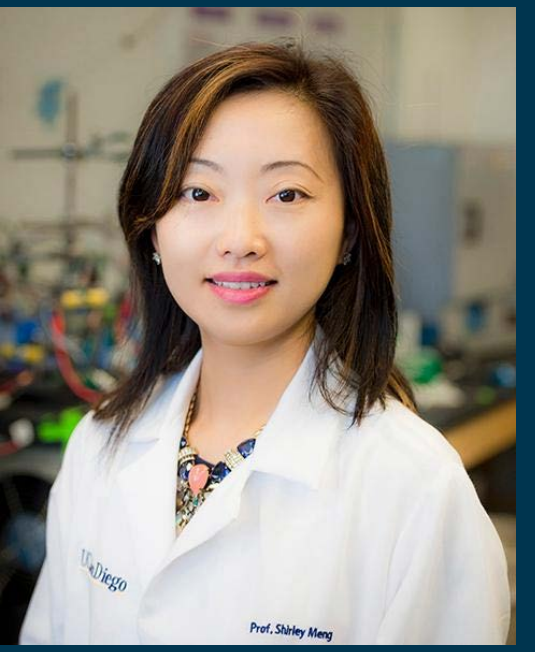
Looking forward: 2019 and Beyond



- **Jacobs School Strategic Plan**
- **Franklin Antonio Hall**
- **Cooperative Education (Co-op)**
- **Systems Engineering**

Questions, Comments?

Faculty Presentation



Shirley Meng

Professor, NanoEngineering

Director, Sustainable Power and Energy Center

Impact of Sustainable Power & Energy Research

UC San Diego
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Corporate Affiliates Program

UC San Diego

Sustainable Power and Energy Center

Founded in 2015

Y. SHIRLEY MENG
Director, Sustainable Power & Energy Center
Professor, NanoEngineering

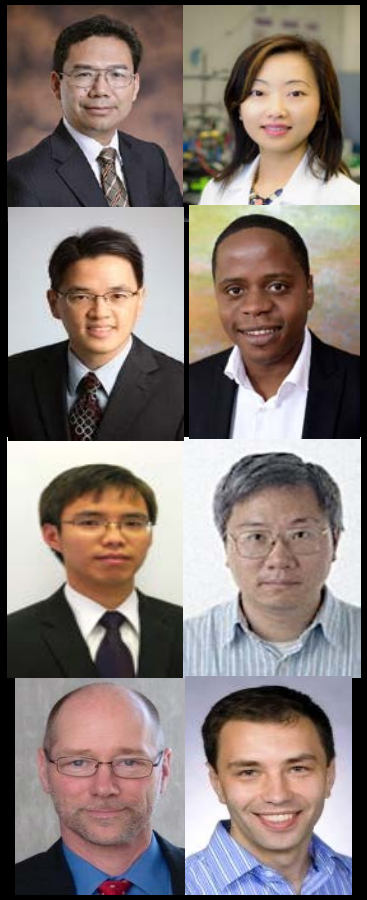
CAP Executive Board Meeting

Feb. 7, 2019
Qualcomm Board Room

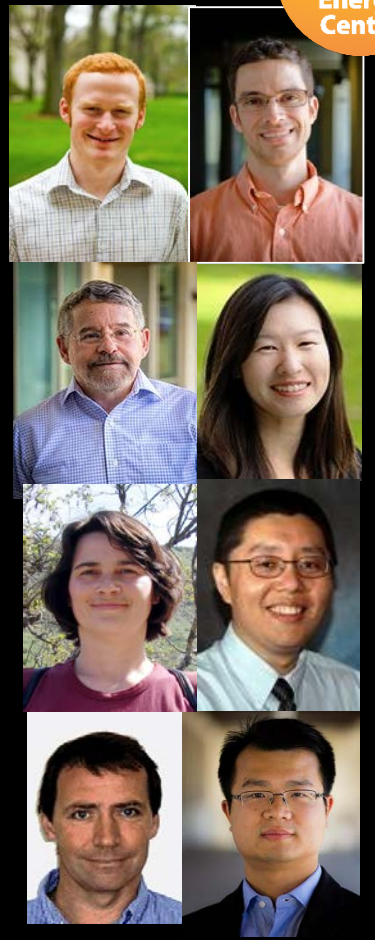
"Freedom from Fear of Harsh Nature –
When environment welters, human must persist with power"

Societal Impact of Energy Research

Sustainable Power and Energy Center



- LONG LIFE LOW COST BATTERIES for EV and Grid Storage
- BETTER CONTROL FOR BATTERIES
- NEW ENERGY MATERIALS DEVELOPMENT
- ENERGY EFFICIENCY DEVICES
- WEARABLE SOLAR AND PRINTABLE BATTERIES
- THERMOELECTRICS and SOLAR THERMAL
- SUPERCAPACITORS AND FUEL CELLS
- ENERGY DEVICES PROTOTYPING & FIELD TEST



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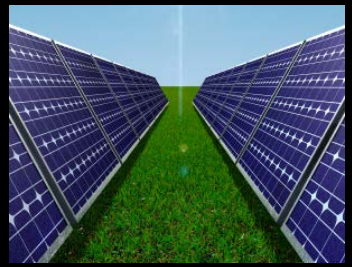
Areas of Focused Applied & Basic Research

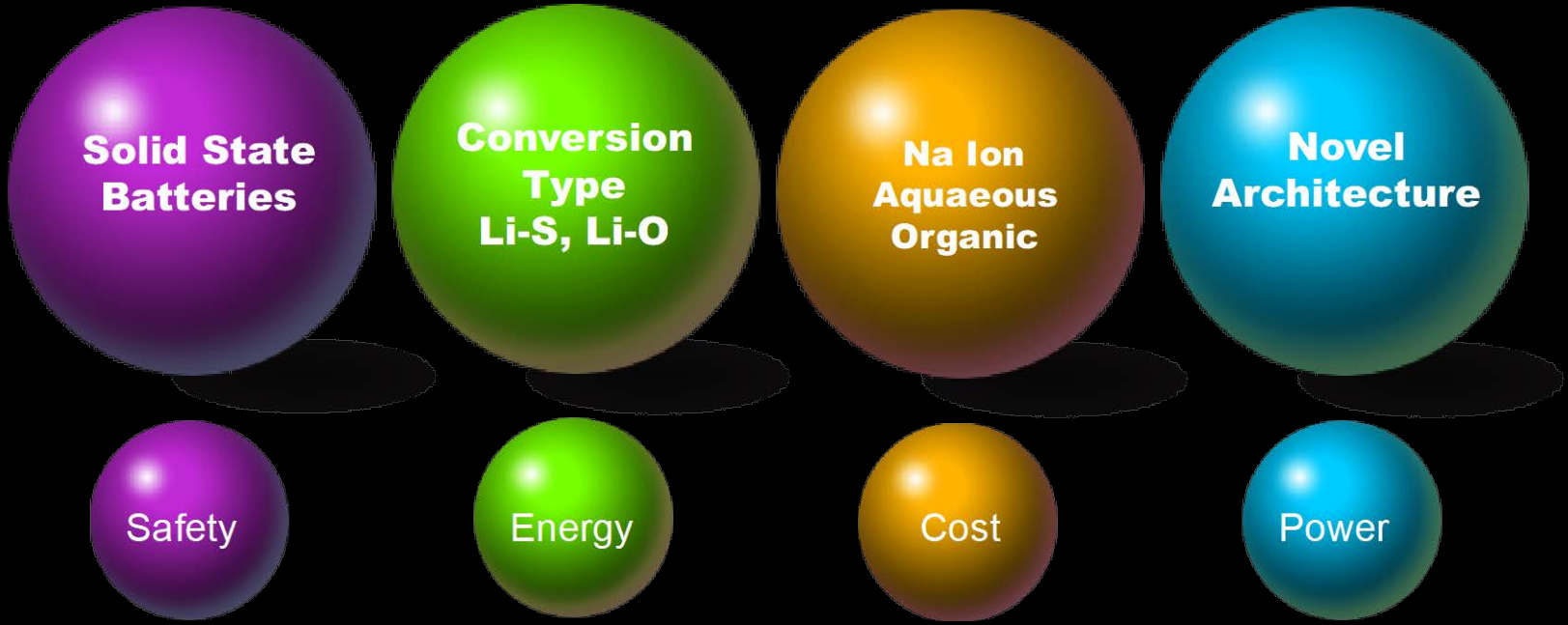
Low power
Safety
Format/Flexibility

High power
High energy
Cycle life (10 years)



System cost (US$50/kWh)
Reliability (20 years)

Priority Research Directions in Electrochemical Energy Storage



High energy batteries that never catch fire?

Batteries last more than 30 years?

Batteries can be 100% recycled?

Batteries that can be charged full in 5 minutes?

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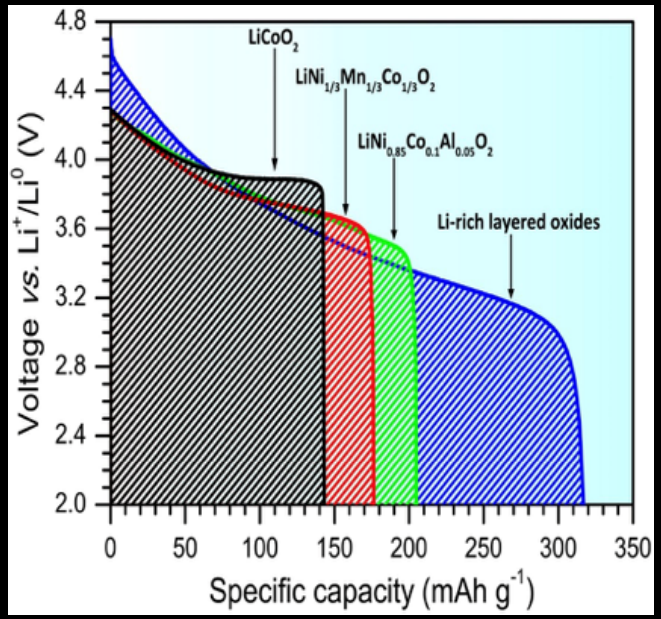
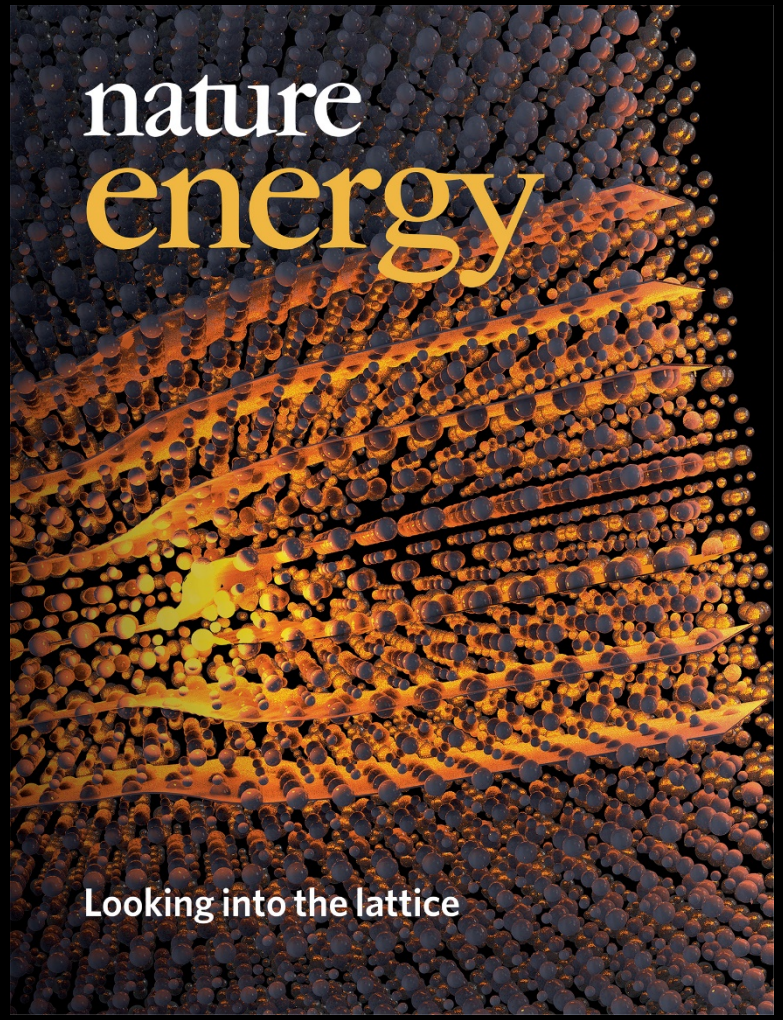
ENERGY STORAGE -





Shpyrko & Meng Groups UCSD

Cover Story of Nature Energy 2018

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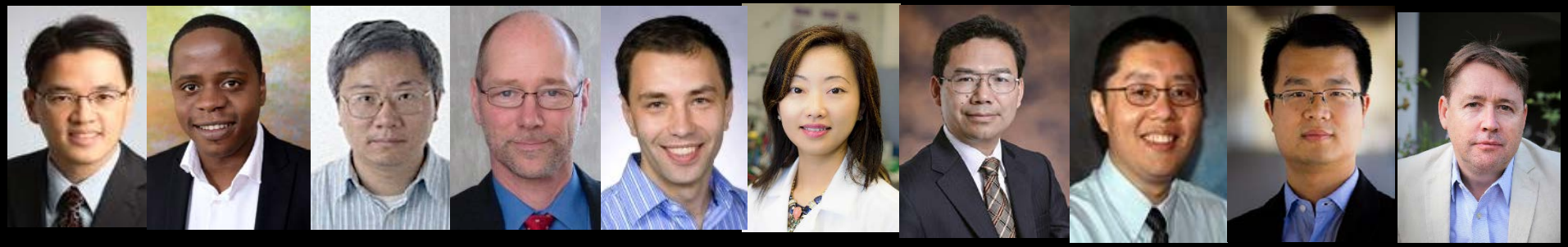
Sodium Ion Batteries for Future Grid Storage

Batteries of the future made with salt - Science Nation

From Atom to System



Ong Pascal Luo Sailor Shpyrko Meng Liu Qiao Chen Elliott

Computation Modeling

Materials processing
Novel Materials

Characterization

Devices

Safety

Recycling

Economic analysis

Sustainable Power and Energy Center

A Bridging Platform

UC San Diego

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CAP BUSINESS

William W. Dyer

Director, Corporate Affiliates Program, Jacobs School of Engineering

CAP Business

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Corporate Affiliates Program

Jacobs School Corporate Affiliates Program

ECE Design Competition

Call for:

1) CAP Partner Sponsors
2) CAP Executive Mentors
3) CAP Executive Judges

More information:
ece.ucsd.edu/design-competition

Schedule

		Student/Patient-Caregiver meetings	Feedback from Patient-Caregiver
January 14, 6-8pm	**Info. Session**		
January	Design Process Training		
February 1	**Team Registration**		
February	Problem Understanding & Solution Exploration	Feb. 6: Support group meeting Feb. 16: Meet & greet	Feedback from Patient & Caregiver
March 2-3	**First Design-a-Hack-a-thon**		Feedback from Mentor, Patient & Caregiver
March	Prototype Development	TBA	Feedback from Patient & Caregiver
April 6-7	**Second Design-a-Hack-a-thon**		Feedback from Mentor, Patient & Caregiver
April	Prototype Development	TBA	Feedback from Patient & Caregiver
May	Prototype Development	TBA	Feedback from Patient & Caregiver
June 1	**Competition**		

Feb. 1: **Team registration at http://ece.ucsd.edu/design-competition**
March 2-3: First Design-a-Hack-a-thon
April 6-7: Second Design-a-Hack-a-thon
June 1: Competition

Still Accepting TIP Projects!

TEAM INTERNSHIP PROGRAM 2019

WHAT

Project-based paid internship, 2-5 pre-screened students

WHEN

Recruitment starts NOW - Interns start Summer 2019

HOW

Email us to gather talent requirements and project goals

Together, Industry and Education Drive Innovation

UC San Diego
JACOBS SCHOOL OF ENGINEERING
Team Internship Program

Rocio de Lis
Assistant Director, Corporate Affiliates Program
Talent Programs
mdelis@eng.ucsd.edu

RESEARCH EXPO 2019

THURSDAY, APRIL 18 – 1:30–6:00PM – UC SAN DIEGO

Come to Research Expo 2019 and experience leading-edge engineering and computer science research. Talk tech with graduate students.

200+ GRAD STUDENT POSTERS

2:00 – 4:30PM

Meet graduate students who match your company's technology roadmaps and workforce needs.

LIGHTNING TECH TALKS

2:30 – 3:30PM

Twenty-minute faculty talks. Get industry-relevant research highlights from world-renowned Jacobs School faculty.

RECRUITMENT HOUR

3:30 – 4:30PM

Recruit students, talk research, and enjoy refreshments.

NETWORKING RECEPTION

4:30 – 6:00PM

Connect with engineering faculty, students and alumni. Meet a broad spectrum of industry professionals. Best poster awards.

CAP Partner Sponsorship

Distinguished Judge Invitations for CAP Executives

Targeted Graduate Student Recruitment Opportunities

JacobsSchool.ucsd.edu/re

Admission: $100

ASML

Viasat

Lawrence Livermore National Laboratory

leidos

UC San Diego | EXTENSION

Center for Extreme Events Research

UC San Diego
JACOBS SCHOOL OF ENGINEERING

CEER INTENSE Short Courses

Interdisciplinary Networking and Training in Engineering and Next-generation Simulations and Experiments

COURSE 1

Introduction to Meshfree Methods: Fundamentals and Application

COURSE 2

Topology Optimization for Additive Manufacturing

COURSE 3

Advanced Composites for Aerospace Structures: Analysis, Manufacturing and Design

COURSE 4

Joining of Composite Structures

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For other information, please visit
http://ceer.ucsd.edu/events/2019/short-course

All Upcoming Opportunities

February 15, 2019	Structural Engineering Research Showcase
February 22, 2019	An Evening with the Jacobs School at Google (Mountain View)
February 27-28, 2019	International Microbiome Conference
February 28, 2019	Halicioğlu Chair in Computer Architecture: Hadi Esmaelizadeh
March 3-8, 2019	International Battery Association 2019 Meetings
March 14, 2019	Center for Microbiome Innovation Summit
March 22, 2019	Center for Extreme Events Research Summit
April 18, 2019	**Jacobs School Research Expo**
May 30-31, 2019	Center for Visual Computing Retreat
June 6, 2019	**Spring CAP Executive Board Meeting**

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Thank You CAP Executive Board!

Next Board Meeting: June 6, 2019