

Chemical and Biomolecular Engineering JPW 2015

Mark J McCready
Professor and Senior Associate Dean

How things should be!

- Frank Sinatra, “World on a String”
- Too bad is not also:JGW
 - “Juniors’ Grandparent Weekend”

“World on a string”

- Let's make sure it is so.
 - Program quality and resulting graduates
 - Opportunities after graduation
 - tactical and strategic
- Just a few more thoughts...
 - sorry

Program quality

- When I used to talk with prospective students and their parents, I would talk about program quality in the following way...
 - Program excellence depends on
 - talented students,
 - talented faculty,
 - commitment by both to the educational enterprise

One measure of student talent!

	AL	BA	EG	SC
MEAN SAT CUM	1377	1361	1426	1400
MEDIAN SAT CUM	1400	1380	1440	1410

- These numbers have increased continually over time
 - We can see the difference
 - Sorry Chris!

Apparently, the students are willing to work!

CIFs!

Spring 2014

Engagement	
Intellectual Challenge	Time Studying Outside of Class
[Redacted]	
4.70 ± 0.10 ↑	10.70 ± 1.20 ↑
4.70 ± 0.10 ↑	10.70 ± 1.20 ↑
4.60 ± 0.10 ↑	7.20 ± 0.80 ↑
4.60 ± 0.10 ↑	7.20 ± 0.80 ↑

Fall 2014

Engagement	
Intellectual Challenge	Time Studying Outside of Class
[Redacted]	
[Redacted]	
4.90 ± 0.10 ↑	9.40 ± 2.00 ↑
4.60 ± 0.20 ↑	7.30 ± 1.40 ↑
[Redacted]	
4.60 ± 0.10 ↑	9.40 ± 1.10 ↑

CBE: 20258, 20260,
30355, 30357, 30367

Talented Faculty



**Dr. Salma
Saddawi- CBE
31358, Chemical
Engineering Lab I**



**Dr. Yingxi Zhu-
CBE 30356,
Transport
Phenomena II**



**Dr. Jeffrey
Kantor- CBE
30338 Chem
Process Control,
CBE 20255 Intro
to Chemical
Engineering**



**Dr. David
Leighton- CBE
30355, Transport
Phenomena I**



**Dr. William
Phillip- CBE
40443,
Separation
Processes**



**Dr. Joan
Brennecke- CBE
30367, Chemical
Engineering
Thermo II**



**Dr. Edward
Maginn- CBE
20260, Chemical
Engineering
Thermo I**



**Dr. Davide Hill-
CBE
20260/30367,
Chemical
Engineering
Thermo I,II**



**Dr. Jason Hicks-
CBE 40445,
Reactions
Engineering**



**Dr. Thomas
Degnan- CBE
40448, Process
Design**

CBE: 5 College “Teachers of the Year” between 2000 and 2010

Your Curriculum

OPTION "A" - STANDARD CURRICULUM

	FALL		SPRING	
FRESHMAN	MATH 10550, Calc I	4	MATH 10560, Calc 2	4
	CHEM 10171/11171	4	CHEM 10122	3
	EG 10111 Intro to Eng	3	EG 10112, Intro to EG	3
	Arts & Letters 1	3	PHYS 10310, Gen Phys 1	4
	University Sem-A&L 2	3	University Sem-A&L 3	3
		<u>17</u>		<u>17</u>
SOPHOMORE	MATH 20550, Calc 3	3.5	MATH 20580, Linear/ODE	3.5
	CHEM 10172/11172 Org 1 & Lab	4	CHEM 20273, Org 2	3
	CBE 20255 or CBE 30385, Intro to Chem/Bio Eng	3	CBE 20260, Thermo I	3
	PHYS 10320, Gen Physics 2	4	CBE 20258, Comp Methods	3
	A&L 4	3	A&L 5	3
		<u>17.5</u>	CBE 20290, Career Choices Eng	1 *Recommended
				<u>16.5</u>
JUNIOR	MATH 30650, Differential Eq	3	CHEM 30324, Pchem	3
	CHEM 30333/31333 Achem & Lab	4	CBE 30338, Chem Proc Control	3
	CBE 30355 or CBE 30357, Transport I or Biotransport	3	CBE 30356, Transport 2	3
	CBE 30367, Thermo 2	3	CBE 31358, Chem Eng Lab 1	3
	CBE 30361, Materials	3	A&L 6	3
		<u>16</u>		<u>15</u>
SENIOR	CBE 40443, Separations	3	CBE 40448, Process Design	3
	CBE 40445, Reaction Engineering	3	CBE Elective	3
	CBE 41459, Chem Eng Lab 2	3	Tech Elective	3
	CBE Elective	3	Advanced Science Elective	3
	A&L 7	3	A&L 8	3
		<u>15</u>		<u>15</u>

For next year

- In addition to Hicks, Phillip and Degan you will see:
 - New course in *Engineering Leadership*
 - Led by Diane Gulyas who has recent retired from a VP position at E. I. DuPont
- New electives:
 - Schaefer: *Energy, Economics and the Environment*
 - Degnan: *Industrial Chemical Processes*

Recent headlines

- Some headlines that caught my eye as a chemical engineer....

Electric fields deliver drugs into tumors

Tweet 81 Share 4.7k 8+1 16



Staff Writer

Email Robert

By Robert F. Service 4 February 2015 2:15 pm 2 Comments

Chemotherapy has been a mainstay of cancer treatment for decades. But most of these drugs are toxic to healthy cells, and others have a hard time penetrating tumors. Now researchers report that they've come up with a potential solution for both problems. They used electric fields to drive chemo compounds specifically into difficult-to-treat tumors in animals, dramatically increasing the drugs' concentration within the tumor and shrinking it.

Apple Building Solar Farm to Power California Operations

By BRIAN X. CHEN FEBRUARY 10, 2015 5:29 PM 35 Comments

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SAN FRANCISCO — Apple is going big on solar.

Timothy D. Cook, the company's chief executive, said at an investors' conference on Tuesday that



Go to Well Home

FOOD

Nutrition Panel Calls for Less Sugar and Eases Cholesterol and Fat Restrictions

By ANAHAD O'CONNOR FEBRUARY 19, 2015 2:47 PM 311 Comments



BUSINESS Andrew Scrivani for The New York Times and Barton Silverman/The New York Times

Companies Tiptoe Back Toward 'Made in the U.S.A.'

For years, the U.S. has ceded more and more of its manufacturing to low-cost corners of the global economy. Some firms now want to come home.



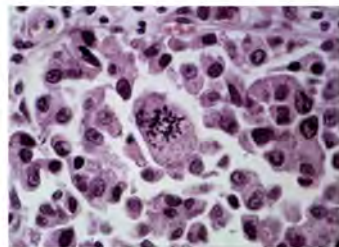
Kathryn Masterson and Jessica Butala discuss seat fabrics for a new car seat from the

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In the Way Cancer Cells Work Together, a Possible Tool for Their Demise

JAN. 29, 2015



A section of a malignant connective-tissue tumor seen under a microscope. DeAgostini/Getty Images

A tumor, as strange as it may sound, is a little society. The cancer cells that make it up cooperate with one another, and together they thrive.

Scientists are only starting to decipher the rules of these communities. But if they can understand how these cells work together, then they may be able to stop the tumor. "You can drive it to collapse," said Marco Archetti, a biologist at the University of East Anglia and at the Icahn School of Medicine at Mount Sinai.

HEALTH

Limiting Rest Is Found to Help Young Concussion Patients

By CATHERINE SAINT LOUIS JAN. 5, 2015

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More

Experts recommend that young people who have suffered a [concussion](#) get one or two days of rest at home, until symptoms start resolving, before gradually returning to school and [physical activity](#).

But scientific evidence to support this approach is sparse, and some doctors have recommended that young patients remain inactive for even longer periods after a [concussion](#).

Now a [randomized trial](#) has compared the approaches and found that among a group of patients ages 11 to 22, those with a concussion who were prescribed strict rest for five days by staff members of an emergency department actually reported more symptoms than those told to rest for one or two days. Recovery was also slower for the

Global needs

- The challenge to continually increase worker productivity
 - While still creating enough jobs for all...
- Cost effective healthcare
 - Also novel treatments that stem from how engineers do things or understanding that only (chemical) engineers have
 - microfluidics/transport phenomena, phase equilibria, heterogeneous catalysis... only chemical engineers.
- Fully exploit cheap/readily available energy.
 - To really make “sustainable” technologies work, we need better storage options.

Productivity

- Worker productivity increased by a factor of 7.5 during the 20th century
 - The increase in productivity allowed workers to have greater incomes and hence a better standard of living.
- How did this happen? perhaps people got bigger and stronger as a result of more nutritious diets and smarter living?
- Is there a way to normalize (i.e., *nondimensionalize*) this result?
 - Although not an exact measure of human vitality, the world record for swimming the 100 m was reduced by 38%.
- Thus, productivity did not increase because humans became more physically able
 - even as pumped up with 5 hour energy drink
 - or better management -- GM,... “middle management” has come and gone during this time
- It came from better technology developed by engineers and scientists and implemented by engineers
 - We must assure that this will continue!

Technology sectors for chemical engineers

- Here are some of the places that recent grads have gone....

Chemical Engineering

Employment

Organization	Job Title	Location	Additional Major
Accenture	Analyst	Chicago	IL
Accenture	Systems Integration Analyst	Chicago	IL
Accenture	Technology Consultant	Chicago	IL
Accenture	Technology Consultant	Houston	TX
Allscripts	Service Consultant	Raleigh	NC
Amazon	Pathways Program Manager	Columbia	SC
BP America	Central Process Engineer	Whiting	IN
BP America	Research Engineer	Naperville	IL
CDM Smith	Automation Engineer	Chicago	IL
Chicago Bridge & Iron Lummus Technology Inc.	Process Engineer Specialist I	Houston	TX
Cree	Chemical Engineer	Durham	NC
DC Energy	Analyst	Vienna	VA
Deloitte	Business Technology Analyst	Dallas	TX
Dow AgroSciences	Chemist	Indianapolis	IN
Dow Chemical	Improvement Engineer	Hahnville	LA
Epic Systems	Project Manager	Madison	WI
Epic Systems	Technical Services Analyst	Madison	WI
ExxonMobil	Process Engineer	Baton Rouge	LA
ExxonMobil	Process Engineer	Houston	TX

ExxonMobil	Upstream Engineering Computing Operations Management Leadership Program	Houston	TX
GE Aviation	Operational Management Leadership Program	Cincinnati	OH
GE Oil and Gas	Edison Engineering DP	Alexandria	LA
General Electric	Manufacturing Associate	Wilmington	NC
GlaxoSmithKline	Operations Analyst	Rockville	MD
Goldman Sachs	Chemical Engineer	New York	NY
Hiland Partners LP	Technology Consultant - Associate	Williston	ND
McGladrey	Member / Engineer	Columbus	OH
Natural Exotic Beverages, LLC	Nuclear Engineer I	Gaithersburg	MD
Newport News Shipbuilding	Intern	Newport News	VA
NovelMed Therapeutics	Chemical Engineer	Cleveland	OH
PPG Industries	Manufacturing Engineer	Pittsburgh	PA
Procter & Gamble	Process Engineer	Bear River City	UT
Procter & Gamble	Assurance Associate	Bear River City	UT
PwC	PIE II Engineer I	McLean	VA
Samsung Austin Semiconductor	Field Engineer Trainee	Austin	TX
Schlumberger	EDP Engineer	New Orleans	LA
SPX Flow Technology	Business Planner	Rochester	NY
Stryker Endoscopy	Environmental Consultant	San Jose	CA
Trinity Consultants	Chemical Engineer	Cincinnati	OH
UOP	2nd Lieutenant	Des Plaines	TX
US Marines	Student Auditor Candidate	Quantico	VA
US Navy	Associate Application Developer	Pensacola	FL
Valence Health		Chicago	IL
Veyance Technologies		St. Mary's	OH

Choosing a field

- Common industrial sectors for chemical engineers
 - Energy: (Old and new)
 - Chemicals (Commodity and Specialty)
 - Healthcare
 - “Business/financial support”
 - Consumer Products
 - Food processing, automobile manufacturing, electronic materials and device manufacturing...
 - “Materials”

“kinds” of jobs

Caution: *Experimental* slide

- Opening of Mahler's: Symphony #5
 - Imagine: an audience of 2000 people, 100 or more musicians on stage: Everyone is counting on you to be great!
 - Job to take only if you can imagine yourself doing nothing else!
- Opening of Tchaikovsky: Serenade for Strings:
 - Maybe a big audience, but you are one of 12 second violins
 - The part of your life that provides funds for the rest of your life

Additional destinations

Chemical Engineering (Cont'd)

Graduate or Professional School

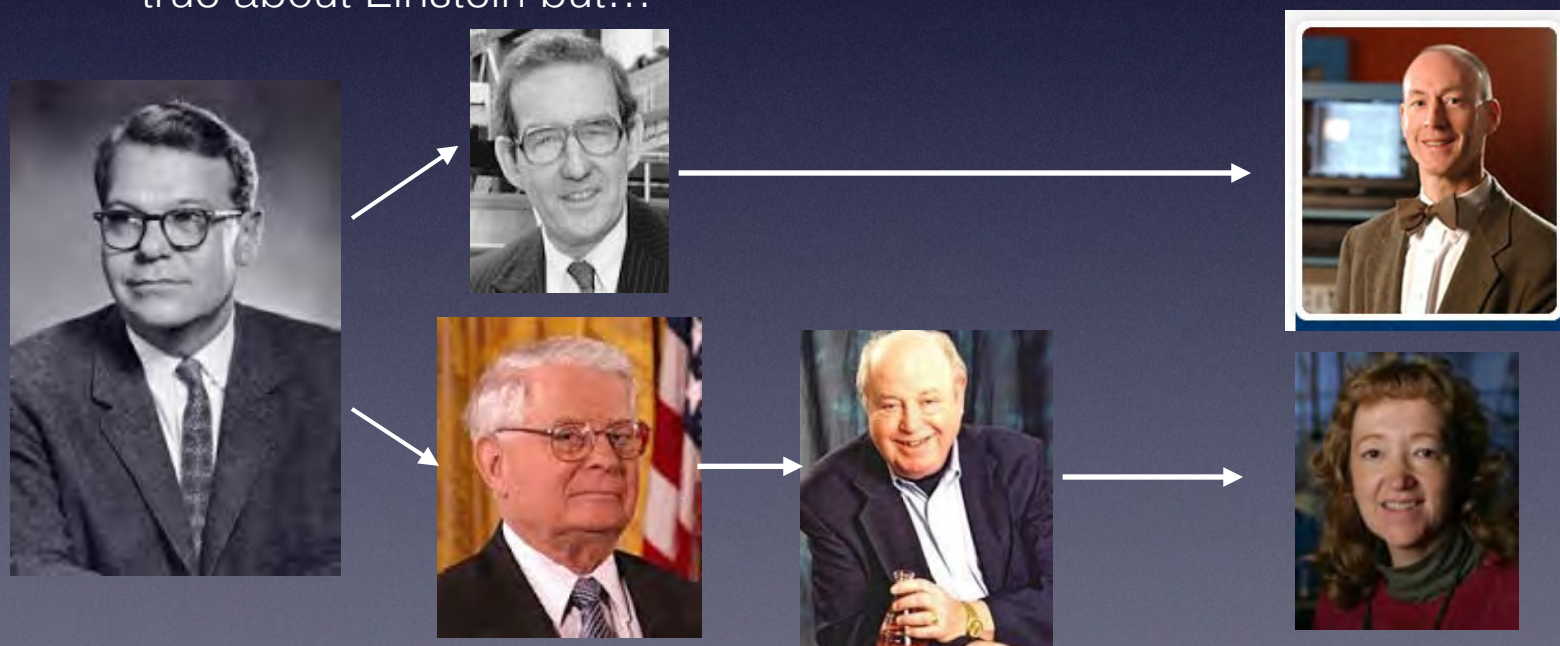
Organization	Field of Study	Location	Additional Major
Georgia Institute of Technology	Chemical Engineering	Atlanta	GA
Northwestern University	Biotechnology	Evanston	IL
Northwestern University	Chemical Engineering	Evanston	IL
Seoul National University	Chemical and Biological Engineering	Seoul	
Stanford University	Chemical Engineering	Stanford	CA
University of Akron	Integrated Biosciences	Akron	OH
University of California-Santa Barbara	Chemical Engineering	Santa Barbara	CA
University of Cincinnati Main Campus	Medicine	Cincinnati	OH
University of Colorado - Denver	Post-Bacc Preprofessional	Denver	CO
University of Notre Dame	ESTEEM Program	Notre Dame	IN
University of Notre Dame	Theology	Notre Dame	IN
University of Washington	Bioengineering	Seattle	WA
Duke University	Cell and Molecular Biology	Durham	NC

Service Plans

Organization	Location	Additional Major
Colorado Vincentian Volunteers	Denver	CO
Loretto Volunteer Program	St. Louis	MO
Peace Corps		

To Future grads

- For greatest success: Make yourself the best you can be
 - Take responsibility
 - Work on your weaknesses!
- Make a difference personally...
 - If Newton had never lived, nothing in the world would be different, may also be true about Einstein but...



It is OK to challenge accepted thinking!

- Some things we thought we knew:
 - Margarine was considered a health food
 - Left-handed people die sooner because of the hazards of the right-handed word
 - Stomach Ulcers are caused by stress
 - Plants absorb CO₂ and emit O₂
 - The adult brain has no capacity to regenerate itself
 - Komodo Dragons bit their prey and waited for them to succumb to bacterial infections
 - It is bad to eat eggs!

Mozart, Dickens?!!

- In contrast to Newton, Gauss, Einstein...
- No Mozart:
 - No *Don Giovanni*
- No Dickens:.... even more dire
 - No *A Christmas Carol*
- No Bach
 - No *Christmas Oratorio* (final chorus)!

Chemical Engineering

Class of 2016



72 students from 25 states and 5 countries.

