

Graduate Studies

*Lehigh University
Department of Chemical
and Biomolecular
Engineering (ChBE)*

January 11, 2021

Lehigh ChBE Graduate Studies

- **Welcome**
Prof. Mayuresh Kothare
Professor and Department Chair
- **Overview of Ph.D. and on-campus Master's Programs**
Prof. Mark Snyder
Associate Professor and outgoing Director of Graduate Studies
- **Overview of Distance Education Master's Programs**
Prof. Jonas Baltrusaitis
Associate Professor and Director of Distance Graduate Studies
- **Panel Discussion**
Prof. Mayuresh Kothare
Prof. Mark Snyder
Prof. Jonas Baltrusaitis
Prof. Elsa Reichmanis
Prof. Israel Wachs
Prof. James Hsu



Webinar agenda

Lehigh University
***Department of Chemical
and Biomolecular
Engineering (ChBE)***

January 11, 2021



Welcome to CHBE at Lehigh University



An internationally recognized program in Chemical and Biomolecular Engineering that combines excellence in interdisciplinary research with rigorous and experiential education to prepare future leaders in academia, industry and government

100 Years

1903-2003

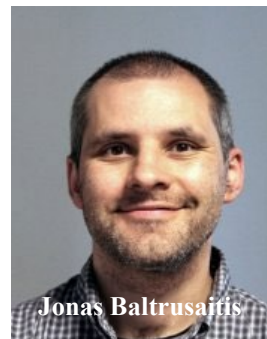
of Chemical Engineering at Lehigh University



Chemical and Biomolecular Engineering Faculty



Angela Brown



Jonas Baltrusaitis



Hugo Caram



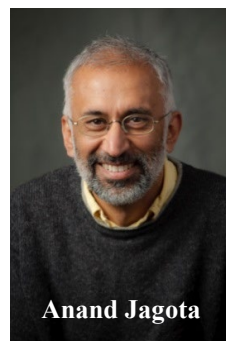
Manoj Chaudhury



James Gilchrist



James Hsu



Anand Jagota



Mayuresh Kothare



Steven McIntosh



William Luyben



Jeetain Mittal



Srinivas Rangarajan



Mark Snyder



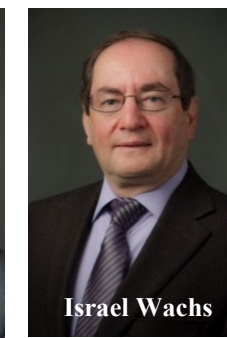
Kelly Schultz



Elsa Reichmanis



Kemal Tuzla



Israel Wachs

CHBE faculty are world-
renowned scholars
that mentor our graduate
students



National and International Awards won by CHBE faculty

Current and Past Awards to CHBE Faculty

Member, National Academy of Engineering (3)
 Donald Q. Kern Award, AIChE
 Professional Progress Award, AIChE
 R. H. Wilhelm Award, AIChE
 Allan P. Colburn Award, AIChE
 Thomas Baron Award, AIChE
 Heat Transfer Award, AIChE
 The Max Jakob Award, ASME/AIChE
 Industrial Gas Technology Award, AIChE
 Catalysis & Reaction Engineering Practice Award, AIChE
 CAST W. David Smith Jr. Graduate Publication Award (2), AIChE
 CAST Ted Peterson Graduate Publication Award, AIChE
 CAST Computing and Systems Technology Award, AIChE
 CAST Computing Practice Award, AIChE (2)
 CAST Outstanding Young Researcher Award, AIChE
 Separations Division Graduate Student Award, AIChE
 NAMF Early career excellence award in mixing, AIChE
 AIChE Distillation Division – special session
 Roy W. Tess Award in Coatings, ACS
 Victor K. LaMer Award, ACS
 Ind. Eng. Chem. Research Festschrift, ACS
 Industrial Innovation Award-SER, ACS
 The George A. Olah Award in Hydrocarbon or Petroleum Chemistry, ACS
 Langmuir Lecture Award, ACS

Doctoral New Investigator Award, ACS-PRF (3)
 Collaboration Success Award, Council of Chemical Research
 Melville Medal, ASME
 Orr Award, ASME
 Instrumentation Technology Award, ISA
 Donald P. Eckman Education Award, ISA
 Alan Glanville Award, Institute of Materials, Minerals and Mining
 Award for Excellence in Adhesion Science, Adhesion Society (2)
 Clean Air Excellence Award, EPA
 Young Protein Scientist Award, Protein Society Annual Meeting
 Alfred P. Sloan Research Fellowship in Chemistry
 Fellow, AIChE (3)
 Fellow, IEEE
 Fellow, National Academy of Inventors
 Fellow, ACS (2)
 Fellow, International Adsorption Society
 Fellow, ACS Division of Polymeric Materials Science and Engineering
 Patrick Fellow, Adhesion Society
 Fellow, Royal Society of Chemistry
 TechConnect Innovation Award, TechConnect World (3)
 Distinguished Young Rheologist Award, TA Instruments
 La Jolla Interfaces in Science (Burroughs Wellcome Fund) Award
 Exxon Research Incentive Award
 DuPont bicentennial 'Scientist of the Month'

Herbert D. Doan Award for Excellence in Research, Dow
 Dow Corning Chair, Lehigh
 CAREER Awards (6), NSF
 Presidential Young Investigators (2), NSF
 BRIGE Award, NSF
 Early Career Research Award, DOE
 Alan Berman Research Publication Award, NRL
 National Research Service Award, NIH (2)
 Pathways to Independence Award, NIH
 Process Control Hall of Fame
 Foreign Member, Polish Academy of Arts and Sciences
 Lee Hsun Lecture Award, Chinese Academy of Sciences
 Lee Hsun Research Award in Materials Science, Chinese Academy of Sciences
 Max Planck Research Prize
 Invited Professor, University of Pierre et Marie Curie, 2012
 Guest Professor, ECUST, Shanghai
 The Humboldt Research Award (3)
 EU Marie Curie Intra-European Fellowship, University of Twente
 ESPCI Paris Tech-Michelin Visiting Professorship (2)
 ESPCI Paris Tech-Total Chair
 The International Vandis Award, Vanadium Chemistry Organization
 Ramon y Cajal Award, Spanish Ministry of Science
 DuPont Chair, IISc Bangalore



**In 2020, Dr. Reichmanis
was elected**

- *Fellow of the National Academy of Inventors,*
- *Fellow of AIChE*
- *Director of AIChE Board*



New Faculty Member

(Fall 2020)

Dr. Elsa Reichmanis - *Carl Anderson Endowed Chair*

Formerly at Bell Labs, GeorgiaTech

Areas of Expertise

- alternative energy focused on photovoltaics
- organic semiconductor materials
- conjugated polymer synthesis
- flexible electronics and batteries

Awards and Recognitions

- Member, US National Academy of Engineers
- 2018 AIChE Margaret H. Rousseau Pioneer Award for Lifetime Achievement by a Woman Chemical Engineer
- Fellow - Bell Labs, AAAS, MRS, ACS
- Distinguished Woman in Chemistry and Chemical Engineering Award,
International Union for Pure and Applied Chemistry

COVID-19 research conducted by Lehigh Alumni

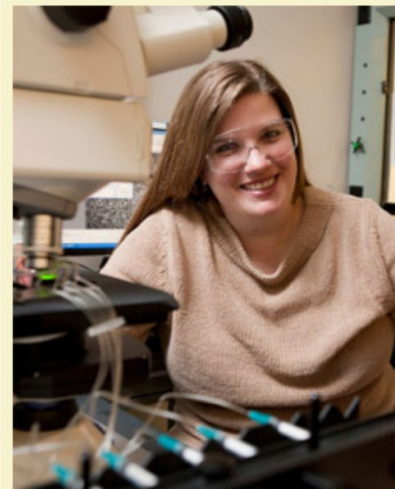
Academic and bioscience diagnostics leader

Researchers seek universal treatments to impede coronavirus

By David Nutt | April 7, 2020

New research from a team of Cornell collaborators points to a possible target for antiviral treatment for COVID-19.

Their review paper, "[Coronavirus Membrane Fusion Mechanism Offers a Potential Target for Antiviral Development](#)," published April 6 in Antiviral Research. The multidisciplinary group was led by [Susan Daniel](#), associate professor of chemical and biomolecular engineering, and [Gary Whittaker](#), professor of virology at the College of Veterinary Medicine.



Dr. Susan Daniel '99, '01G, '05 Ph.D has been promoted to Associate Professor at Cornell.



Chemical engineering alum
Stephen S. Tang '85G '88
PhD, president and CEO,
OraSure Technologies

OraSure Technologies, led by CHBE alumnus Dr. Stephen Tang, to seek emergency FDA approval of an in-home self-test for **Corona Virus** using rapid, oral fluid self-tests to battle **COVID-19**

Featured in TIME Magazine top 100 products of 2020



**CHBE graduate alums are
creative leaders in their
professions**

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Lehigh University and Lehigh ChBE: *Campuses and proximity*



Asa Packer Campus



Mountaintop Campus



Goodman Campus



**Proximity to major cities,
airports**

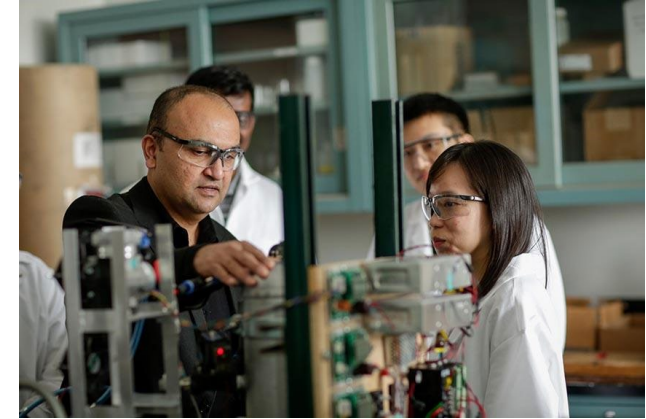
Located in Pennsylvania's beautiful Lehigh Valley, Lehigh is one of the most distinguished private research universities in the U.S. LU ChBE is housed in Iacocca Hall on Lehigh's Mountaintop Campus with simple and rapid connection to other campuses by bus system

Virtual campus tour: <http://www1.lehigh.edu/admissions/undergrad/visit/virtualtour>

Lehigh ChBE: *History of balancing personalized education and research impact*

Vibrant faculty-student culture at a scale amenable to *personalized mentorship*...

- 16 Tenured/Tenure-Track Faculty
 - 11 Full Professors
 - 4 Associate Professors
 - 1 Assistant Professor
- 2 Jointly appointed faculty (Environmental Engineering, Materials Science)
- 1 Professors of Practice



115+ year history of *excellence and impact in research & educational leadership*

- Numerous prestigious national faculty CAREER awards, National Academy of Engineering memberships, National Academy of Inventors membership, Institute awards
- Frequent regional, national, and international student research and travel awards
- Department ranked 22nd overall in the most recent (2010) decennial National Research Council's report on graduate programs (*Source: phds.org*)



Lehigh ChBE Research: *Broad, interdisciplinary, state-of-the-art, impactful*

Energy and the Environment: *Studying fundamental phenomena guiding energy conversion between conventional and renewable energy forms within the bounds of the First Law of Thermodynamics*

Baltrusaitis, Caram, Gilchrist, McIntosh, Rangarajan, Reichmanis, Snyder, Wachs

Biomolecular Sciences: *Solving grand societal challenges in health, energy, and sustainability*

Brown, Buceta, Hsu, Jagota, Kothare, Mittal, Schultz

Materials and Interfaces: *Rational engineering of existing materials and design of new materials to meet grand challenges in energy, the environment, water, food, and health (biomimetic surfaces, functional porous powders/thin films, nanocrystals, catalysts, ceramics, hydrogels, polymers)*

Chaudhury, Gilchrist, Jagota, McIntosh, Reichmanis, Schultz, Snyder, Wachs

Systems and Computation: *Developing and applying advanced computing methods to understand, design, and control emerging technologies for energy, health, and the environment*

Baltrusaitis, Buceta, Jagota, Kothare, Luyben, Mittal, Rangarajan

Research Funding



National Institutes of Health
Turning Discovery Into Health



pennsylvania
DEPARTMENT OF COMMUNITY
& ECONOMIC DEVELOPMENT

LU Seed Grant Programs

Various Industries

Lehigh ChBE Research: *Broad, interdisciplinary, state-of-the-art, impactful*

Energy and the Environment: *Studying fundamental phenomena guiding energy conversion between conventional and renewable energy forms within the bounds of the First Law of Thermodynamics*

Biomolecular Sciences: *Solving grand societal challenges in health, energy, and sustainability*

Materials and Nanotechnology

Colloidal and Interfacial Science

*Fundamental
Enabling
Technologies*

Molecular Modeling and Simulations

Data Science, Systems, and Controls

Research Funding



LU Seed Grant Programs

Various Industries

Research Infrastructure: *Enabling research impact*

Culture of collaboration in ChBE and across Lehigh

3 Interdisciplinary Research Institutes

- Institute for Functional Materials and Devices (IFMD)**

Focused on synthesis, fabrication, processing, and characterization of materials, devices and related systems. Existing research interests include photonics and electronics, metals, ceramics, biomaterials, polymers, and composites, and incorporate devices ranging in size from the nanometer and micrometer scales and beyond.

- Institute for Data, Intelligent Systems, and Computation (DISC)**

Devoted to the study of problems that involve massive amounts of data and/or large-scale computations, and developing the science that enables the extraction of useful and actionable information across disciplines and research fields.

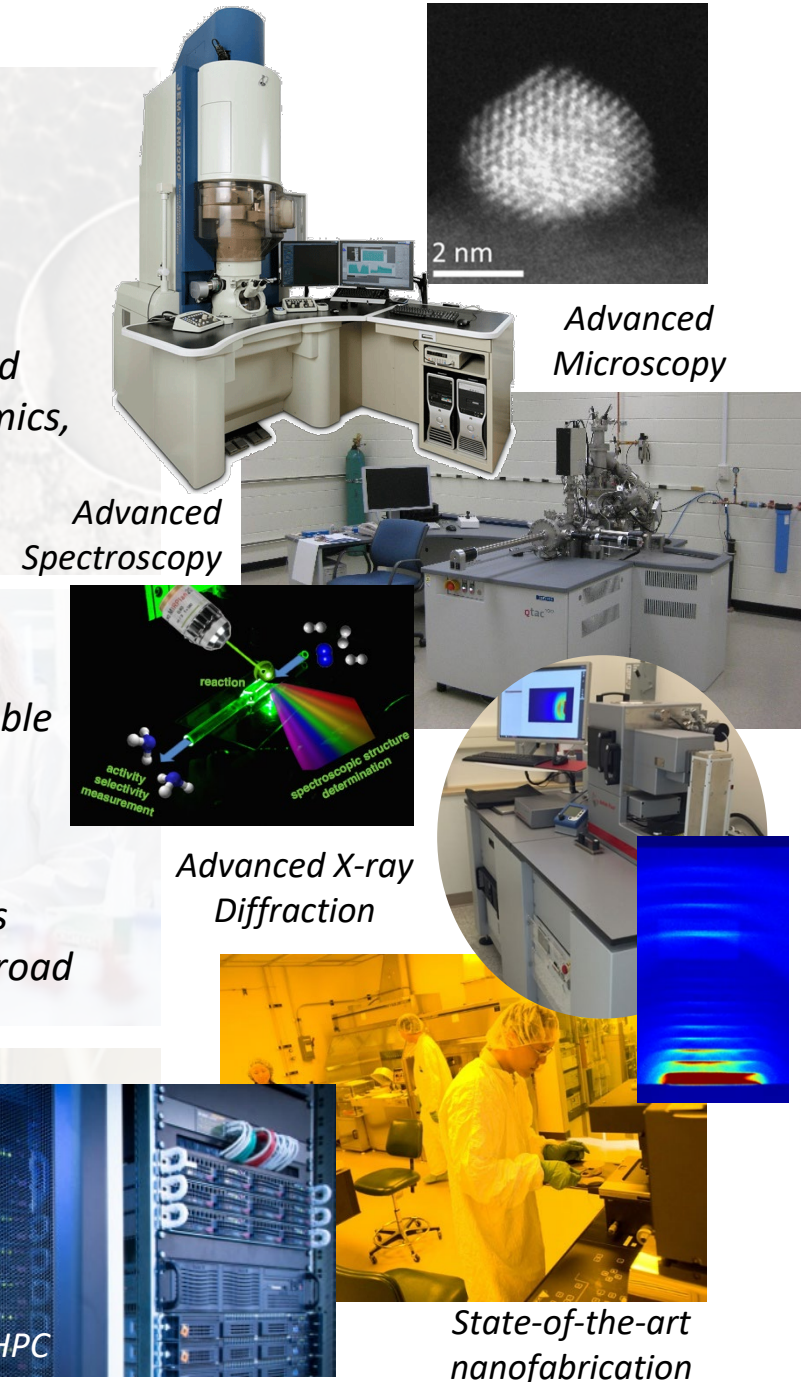
- Institute for Cyber Physical Infrastructure and Energy (CPIE)**

Research underpinning all aspects of modern society. The demands and impacts of society's reliance upon energy, communications, structural, and transportation systems requires a broad approach that's focused not only on engineering systems, but on improving people's lives.

Center for Advanced Materials and Nanotechnology

Center for Photonics and Nanoelectronics

Lehigh Baker Institute for Entrepreneurship, Creativity, Innovation



Lehigh ChBE Graduate Studies: *On-campus graduate programs*

Ph.D. in Chemical Engineering

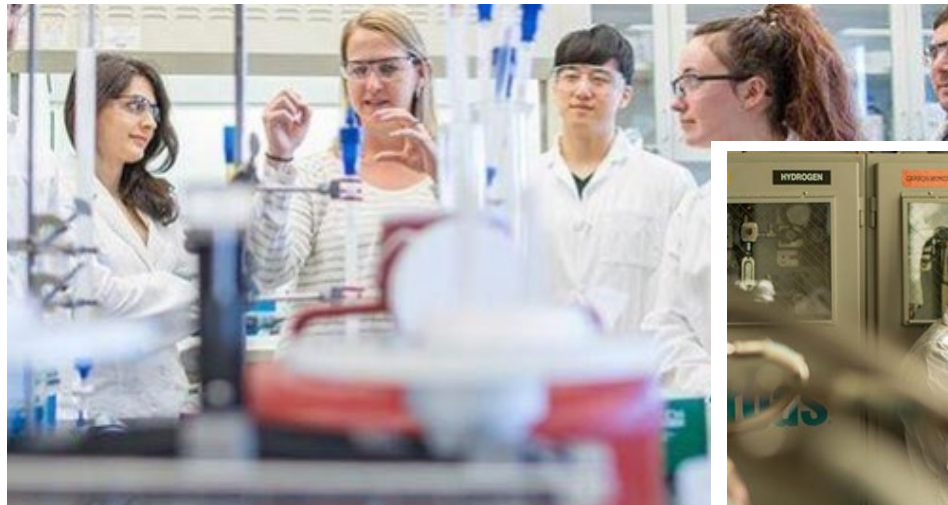
Master of Science (M.S.) in Chemical Engineering*

Master of Engineering (M.E.) in Chemical Engineering*

M.E. in *Biological* Chemical Engineering*

M.E. in Chemical *Energy* Engineering*

** Also offered through Distance Education*



Lehigh ChBE Graduate Studies: *On-campus graduate programs – Ph.D.*

Ph.D. in Chemical Engineering

Lehigh PhD Program At-A-Glance

a **supportive and vibrant** environment championing **personalized mentorship** for the highest-quality, advanced education and research, enabling graduates to **creatively** and **independently** tackle challenging problems of **fundamental** to **practical** significance

\$29k+
annual
guaranteed
minimum stipend

\$0
tuition costs


health benefits

4
average # of PhD
students per group

87%
phd completion
rate

4.7
average duration of
PhD

45%
female students

\$39k
total ChBE annual
merit awards to PhD
students

industry & academia
strong job placement
track record

Lehigh ChBE Graduate Studies: *On-campus graduate programs – Master's*

Ph.D. in Chemical Engineering

Master of Science (M.S.) in Chemical Engineering (30 credits)

Integration of rigorous *advanced coursework* with *cutting-edge research* resulting in graduates with a technical breadth and depth that offers *versatility in tackling fundamental to applied problems* in the chemical engineering and related industries as well as the pursuit of further advanced degrees.

Master of Engineering (M.E.) in Chemical Engineering (30 credits)

Rigorous *advanced engineering coursework* in core chemical engineering principles and *flexibility* for tailoring advanced elective coursework for a *customized degree to best match career goals*.

M.E. in Biological Chemical Engineering (30 credits)

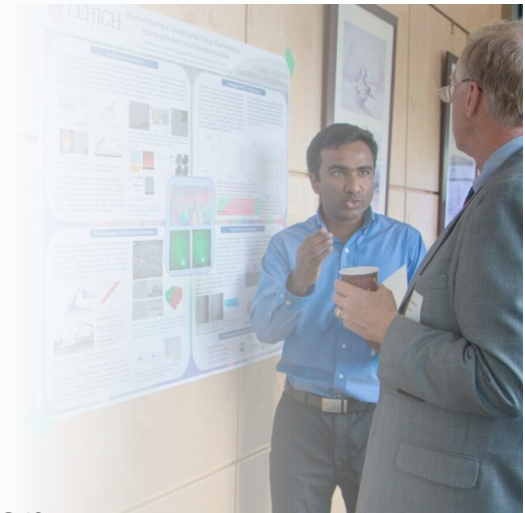
Integrated mixture of *core chemical engineering and biotechnology graduate coursework* with *flexibility* to choose among *biology, chemistry, and chemical engineering electives* customized for careers in biomolecular and biopharmaceutical engineering.

M.E. in Chemical Energy Engineering (30 credits)

Advanced coursework for *professionally-oriented graduates* that offers in-depth technical understanding and a global perspective of *chemical energy engineering practice*.

Graduate Studies: *Student-focused, supportive culture for research and professional growth*

- **Departmental seminar series:** Seminars by leading academics and industrial experts on current topics in science, engineering, and technology
- **1st-year research skills seminar series:** Establishing tools for research success and professional development
- **Annual Graduate Research Symposium:** Research showcase by senior Ph.D. students (talks) and all students (posters)
- **Chemical Engineering Graduate Association (ChEGA):** Academic and social organization
- **Student recognition**
 - **Wenzel Award:** Recognition of excellence in the Ph.D. Qualifying exam with discretionary research/travel money
 - **El-Aasser Award:** Recognition of research and classroom accomplishments with financial support for conference travel
 - **John Chen Fellowship:** Recognition of research productivity, publication history, performance in coursework, potential for future professional success with AIChE Professional Membership and financial support for conference travel
- **Teaching and Academia Preparedness:** *Rossin Doctoral Fellows Program, LU Teacher Development Series*



Lehigh ChBE strong placement track record: *Opening doors to a diversity of opportunities*

Industry...

GE	DuPont	Bemis	Honeywell UOP	Wanhua Chem Grp
Air Products	Bayer	Saint-Gobain	Corning	Novavak
ExxonMobil	Intel	Rive	AkzoNobel	LG Haisys
Dow Chemical	Xerox	Advanced Cooling	Cummins	Saudi ARAMCO
Praxair	BASF	Technologies	AMCS	Benjamin Moore
Linde	Arkema	Blue Origin	Regeneron	Evonik

Academia...

- ***Domestic faculty positions:*** Cornell, Akron, Clarkson, UMass-Lowell, UT-Dallas, U. Rhode Island
- ***International faculty positions:*** Canada, Kuwait, Taiwan, Netherlands, Turkey, India, Saudi Arabia, Korea
- ***Research scientists:*** Princeton
- ***Post-docs:*** MIT, Princeton, Harvard, Cambridge, Cornell, UT-Austin, Rice

National Laboratories...

- NIST, DOE

PhD Internships*...

- Air Liquide, P&G, Air Products,...

** project- and advisor-dependent*

Applying for Graduate Studies: *Jan. 15th Application Deadline*

GRE scores are *no longer required* and, if submitted, will not be used in evaluating applications

Complete applications require...

Resume

Personal statement

Complete transcript(s)

Testing (international students – TOEFL or IELTS)

Letters of Recommendation

- 3 letters for Ph.D. applications
- 2 letters for M.S./M.E. applications

Application fee (\$75) – *waiver codes available for today's attendees*

ChBE Ph.D. Applicant Profiles

3.5

Average B.S. GPA

3.78

Average M.S. GPA

52%

Applicants with Domestic B.S.
or M.S.

ChBE Master's Applicant Profiles

>3.0

Typical B.S. GPA

ChE and non-conventional
science/engineering (Chemistry,
Physics, Polymer Science, Material
Science, etc.)

Lehigh ChBE Graduate Studies:

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Prof. Mayuresh Kothare, *Professor and Department Chair*
- **Overview of Ph.D. and on-campus Master's Programs**
Prof. Mark Snyder
Associate Professor and outgoing Director of Graduate Studies
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Lehigh ChBE Graduate Studies: *Distance graduate programs*

Master of Engineering (M.E.) in Chemical Engineering

M.E. in *Biological* Chemical Engineering

M.E. in Chemical *Energy* Engineering

Certificate in Chemical and Biomolecular Engineering



**SUSTAINABLE
DEVELOPMENT**



Lehigh ChBE Graduate Studies: *Distance programs*

Master of Engineering (M.E.) in Chemical Engineering (30 credit)

Advanced coursework for *professionally-oriented graduates* with core chemical engineering rigor and *flexibility* for tailoring advanced elective coursework for a *customized degree to best match career goals*.

M.E. in Biological Chemical Engineering (30 credit)

Advanced coursework for *professionally-oriented graduates* with *flexibility* to choose among *biology, chemistry, and chemical engineering electives* customized for careers in biomolecular and biopharmaceutical engineering.

M.E. in Chemical Energy Engineering (30 credit)

Advanced coursework for *professionally-oriented graduates* that offers in-depth technical understanding and a global perspective of *chemical energy engineering practice*.

Certificate in Chemical Engineering (12 credit)

Advanced coursework for *professionally-oriented graduates* that provides students with competence in selected areas of chemical and biomolecular engineering applied science. This certificate is designed for working professionals in related technology fields who are seeking professional advancement.

Applying for Distance Studies: *rolling application, Fall and Spring admission*

GRE scores are no longer required and, if submitted, will not be used in evaluating applications

Complete applications require...

Complete transcript(s)

Resume

Personal statement

Testing (international students – TOEFL or IELTS)

Letters of Recommendation

- 2 letters for M.E. applications

ChBE distance M.E. Applicant Profiles

Typical B.S. GPA >3.0
Established industry professional
or
Recent ChBE B.S. graduate who
started industrial career

Non-ChBE distance Certificate Applicant Profiles

Typical B.S. GPA >3.0
Established industry professional
And
B.S. degrees in chemistry, biology,
biochemistry, and others

Lehigh ChBE Graduate Studies: *Distance programs – separating from others*

Master of Engineering (M.E.) in Chemical, Biological Chemical or Energy Engineering (30 credit)

- Four core chemical engineering courses
- Large pool of graduate interdisciplinary electives courses within the department
 - From *Advanced Controls* to *Regulatory Affairs* – depth and breath of ChBE
- Minimum of 18 credit hours in the field of Chemical Engineering – remaining relevant courses can be taken in other departments (Industrial, Materials, Civil & Environmental etc)
- Remote research with departmental faculty on a topic of interest (CHE480 and CHE481, 6 credits total)
- Study at your own pace: 6 years to complete a degree, typically 1 course/semester

Certificate in Chemical Engineering (12 credit)

- Bridge courses, such as CHE 201 or CHE 383 may be required based on the student's background. These will count towards the course credit requirements.
- Must take one course from the CHE Core Course list, 2 CHE courses from either the core course or elective lists, and 1 course from any of the remaining electives.
- Upon successful completion, can transfer credits to a full M.E. program

Many questions, single point of contact

- [HTTPS://DISTANCE.LEHIGH.EDU/PROGRAMS/ONLINE-MASTERS-DEGREE-PROGRAMS](https://distance.lehigh.edu/programs/online-masters-degree-programs)
- **Academic Advisor**
Professor Jonas Baltrusaitis
E-mail: inchbede@lehigh.edu
- **Academic Advisor**
Professor Hugo Caram
E-mail: inchbede@lehigh.edu
- **Academic Coordinator**
Eleni Moustardas
E-mail: inchbede@lehigh.edu

LU ChBE...offering students a ***supportive and vibrant environment*** championing ***distinguishably personalized mentorship*** for the ***highest-quality, advanced education and research***, enabling graduates to creatively and independently tackle challenging problems of ***fundamental to practical significance***

“...working in a group with few members gave me adequate time to discuss the research problems and learn directly from my adviser. The five years spent at Lehigh were the crucial formative years in my academic career...I grew both as a person and an academic in this environment...”

Aditi Chakraborty, LU Ph.D. '17
Postdoctoral Fellow, Harvard John A. Paulson School of Engineering and Applied Sciences

“The PhD program at Lehigh built upon my experience and took it to the next level. I gained the necessary tools to do world class research and most importantly, I was able to use my curiosity to explore interesting and challenging problems. Lehigh is also a great place to collaborate, learn and thrive in a nurturing academic environment.”

Gorgi Pavlov, LU Ph.D. '19
Scientist, Formulation Development Group, Regeneron

“I thoroughly enjoyed and appreciated my journey at Lehigh University. Faculty members and staff were always helpful and supportive. At Lehigh, I had many resources to conduct high quality research, and most importantly, my advisor was extremely patient and supportive of my learning and growth.”

Maryam Daviran, LU Ph.D. '20
Scientist, Merck & Co.

“Lehigh’s supportive faculty and close-knit department helped me develop the skills and independence I needed for graduate study. I’m grateful for the incredible academic opportunities I’ve had because of our ChBE program.”

Sam Layding, LU MS '20
Pursuing Ph.D. at the University of Pennsylvania

Panel Discussion

Information and future questions?

LU ChBE website
engineering.lehigh.edu/chbe

On-campus graduate studies
inchegs@lehigh.edu
Distance graduate studies
inchbede@lehigh.edu

LU ChBE Ph.D. Program: *Coursework and research milestones*



Year 1

- *Coursework and departmental seminars*
- *Advisor selection (fall)*
- Research

Year 2

- *Ph.D. Qualifying Exam (Aug./Sept.)*
- Complete remaining coursework
- Research

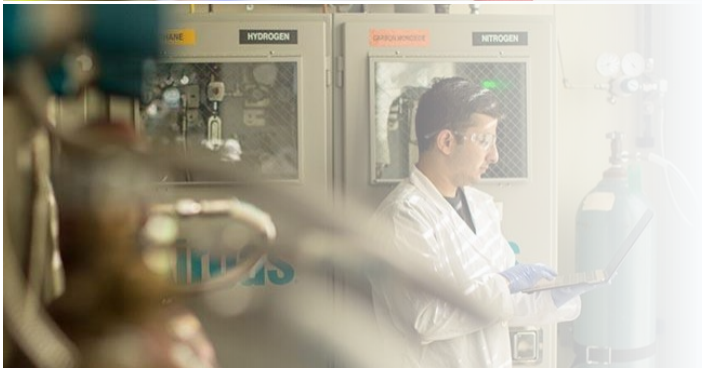
Year 3

- Research and seminars
- Form Ph.D. Committee
- Ph.D. **Proposal Defense** and Application for Admission to Candidacy
- Complete remaining coursework

Years 4 & 5

- Research and seminars
- Thesis writing
- **Ph.D. Defense**

Including 2 semesters of TA duties



Year 1



Full Fall & Spring Semesters

Advanced core ChBE coursework

Establishing advanced foundational knowledge in chemical engineering

M.S. & M.E.

November, December, & January

Exploring breadth of M.S. research opportunities

Detailed exploration of research opportunities culminating in identification of faculty lab for hosting M.S. research

M.S. Specific

Beginning of Spring Semester

Embarking on M.S. research

Joining a research group and taking first steps toward establishing a research identity while building a fundamental foundational background that motivates, frames, and enables early research advances

M.S. Specific



M.S. Specific

Summer

Productive and focused M.S. research

Seizing course-free opportunity to accelerate research progress

M.S. & M.E.

Full Spring Semester

Tailoring degree to meet career objectives

Customizing degree with choice of elective graduate coursework relevant to research (M.S.) and career goals

Establishing skills critical for success along the technical career ladder

Departmental seminar series for first-year graduate students aimed at building technical skills important for reaching career goals

Year 2



Full Fall Semester

Pursuing next career steps

Establishing career goals and pursuing opportunities to help meet them after completion of your degree

M.S. & M.E.

Full Spring Semester

Growing customized technical background through advanced elective coursework

Culminating coursework to establish a custom-tailored advanced degree enabling pursuit and achievement of career goals in the chemical engineering and related industries

M.S. & M.E.

All Years & All Semesters

Program-long activities

Developing broad science & engineering context, cultivating curiosity, establishing critical connections

Departmental seminar series from leading academics and industrial experts on topics spanning science, engineering & technology



On-Campus Master's Degree Timeline