# WPI and UMMS Joint PhD Program

## Core Faculty

Students in the program experience mentorship by faculty from two leading institutions; one a major research university and the other a premier technological university.

### Kristen L. Billiar, PhD

***Professor and Head, Biomedical Engineering Department***
***WPI***

**Research Focus**

The Billiar lab works to understand how mechanical forces affect the cell's living in the bodies soft tissues. We engineer in vitro model systems to study mechanobiology of connective and muscular tissues, with a particular focus on heart valves. We work across scales from whole organ mechanics to molecular mechanisms of mechanotransduction.

### Daniel Bolon, PhD

***Professor, Department of Biochemistry and Molecular Pharmacology***
***UMMS***

**Research Focus**

Our lab developed technology to quantify the effects of mutations in high throughput. We have used this approach to determine protein fitness landscapes for genes in yeast, mammalian cells in culture, and viruses. Using protein fitness landscapes as a guide, we are striving to understand the biochemical and biophysical underpinning of genetic health and disease. This is proving to be a wonderful challenge that requires interdisciplinary approaches drawing on strengths in computer science, physics, biochemistry, genetics, and evolution.

### Jean King, PhD

***Dean of Arts and Sciences and Professor, Department of Biology and Biotechnology***
***WPI***
***Professor of Psychiatry, Director of the Center for Comparative NeuroImaging, Department of Psychiatry***
***UMMS***

**Research Focus**

The King lab is focused on the translation of neuroscience to clinical psychiatry through the use of functional magnetic resonance imaging techniques in both animal models and humans. The overall objective of the King lab is to enhance our understanding of the mechanisms that mediate the development of these disorders and their adverse effects on the regulation of emotion and cognition. As director the Center for Comparative NeuroImaging at UMass, we collaborate on interdisciplinary integrative studies of addiction, ADHD, depression, anxiety, autism, air pollution, Parkinson's Disease, traumatic brain injury, and the role of complementary interventions, such as mindfulness, in improving health. A recent development in the lab is an increased emphasis on data science techniques for both enhancing imaging data analysis as well as comprehensively integrating these data with other biological variables and symptoms.

### Dmitry Korkin, PhD

***Director, Bioinformatics and Computational Biology Program and Associate Professor, Department of Computer Science***
***WPI***

**Research Focus**

Research in Korkin Lab around three main themes: (1) bioinformatics and computational systems biology of complex genetic and infectious disease; (2) evolutionary genomics; and (3) data mining and machine learning in the biological applications. The majority of current research projects in the lab

leverage interactomics, structural genomics, NGS, and clinical genomics data obtained from public and private sources. Korkin Lab has a long track record of collaborations with data scientists, clinicians, microbiologists, geneticists, and biostatisticians on the educational and research projects.

### Anita Mattson, PhD

***Associate Professor of Chemistry,***
***Department of Chemistry and Biochemistry***
***WPI***

**Research Focus**

In the Mattson Group, we blend our love of catalyst design and complex molecule synthesis with drug discovery. Investigators on our team work on the interface of organic synthesis and medicinal chemistry for the purposes of advancing new therapeutic agents that have been inspired by naturally occurring molecules. Our current interests are focused on better understanding the potential of tetrahydroxanthones as therapies for cisplatin resistant cancers.

### Athma A. Pai, PhD

***Assistant Professor, RNA Therapeutics Institute***
***UMMS***

**Research Focus**

Our lab lies at the intersection of RNA biology, computational genomics, and systems biology. The central goal of our lab is to understand the dynamic nature of gene regulation in eukaryotic systems, by dissecting the kinetics of mRNA biogenesis. To do so, we develop and apply both experimental and computational methods to study the genome-wide speed and efficiency of decisions made during key steps of mRNA maturation – transcription elongation, mRNA splicing, and cleavage and polyadenylation. The nature of our work necessitates an interdisciplinary and quantitative mindset, since we routinely use high-dimensional mathematical and statistical approaches to analyze state-of-the-art genetic, molecular, and cellular genomics datasets.

### Reeta Rao, PhD

***Associate Professor, Biology and Biotechnology***
***WPI***

**Research Focus**

Understanding and managing fungal diseases using a variety of biochemical, molecular-genetic, genomic tools and model hosts to explore fungal virulence and host defense strategies.

Identifying novel therapeutics against emerging and drug resistant fungal pathogens.

Study multi kingdom microbial interactions and probiotics to understand inflammatory bowel disease, Crohns and Ulcerative Colitis .

### Susan C. Roberts, PhD

***Professor and Head, Chemical Engineering***
***WPI***

**Research Focus**

My research interests are in cellular and metabolic engineering and cell culture biotechnology, with a primary focus on plant-based systems for synthesis of natural products. We work with a number of plant model and non-model systems, including Taxus suspension culture for production of the anti-cancer agent paclitaxel (Taxol®). Efforts are directed towards understanding plant specialized metabolism and its regulation through development and application of tools such as flow cytometry, genetic engineering, aggregation profiling and metabolic modeling.

**Sean P. Ryder, PhD**
***Biochemistry and Molecular Pharmacology,***
***Graduate School of Biomedical Sciences***
***UMMS***

**Research Focus**
My lab works at the interface between quantitative biochemical measurements and developmental biology. We are interested in understanding the circuitry of maternal RNA regulation during embryogenesis, focusing on the model organism Caenorhabditis elegans. We seek to define the pre-programmed instructions—passed on from mother to child through the cytoplasm—that enable cell fate specification prior to transcription activation in the new zygote.

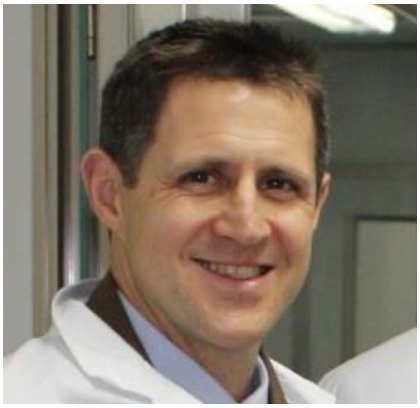
**Suzanne Scarlata, PhD**
**Professor, Department of Chemistry and Biochemistry**
**WPI**

**Research Focus**
Our lab seeks to understand how extracellular signals are communicated into the cell and cause growth, division, migration and communication with other cells. We are specifically interested in how hormones and neurotransmitters regulate both direct responses through changes in calcium and other molecules, but also impact indirect processes, like protein translation and the formation of intracellular aggregates. Our long term goal is to understand and predict how different stimuli affect the way cells deal with stress and aging.

**Karen Troy, PhD**
***Associate Professor, Biomedical Engineering***
***WPI***

**Research Focus**
My research focuses on non-invasive measurements of musculoskeletal structure and function. We use a combination of medical imaging, computational modeling, and clinical biomechanics techniques to assess skeletal strength, measure fracture risk, and to design interventions to maximize bone health. We also investigate relationships between mechanical loading environment and changes to joint structure in health and disease.

## Kristen L. Billiar, PhD



*Professor and Head*
*Biomedical Engineering Department, WPI*

**https://www.wpi.edu/people/faculty/kbilliar**
**https://labs.wpi.edu/billiarlab/**

**Research Focus**

The Billiar lab works to understand how mechanical forces affect the cell's living in the bodies soft tissues. We engineer in vitro model systems to study mechanobiology of connective and muscular tissues, with a particular focus on heart valves. We work across scales from whole organ mechanics to molecular mechanisms of mechanotransduction.

**Personal Statement**

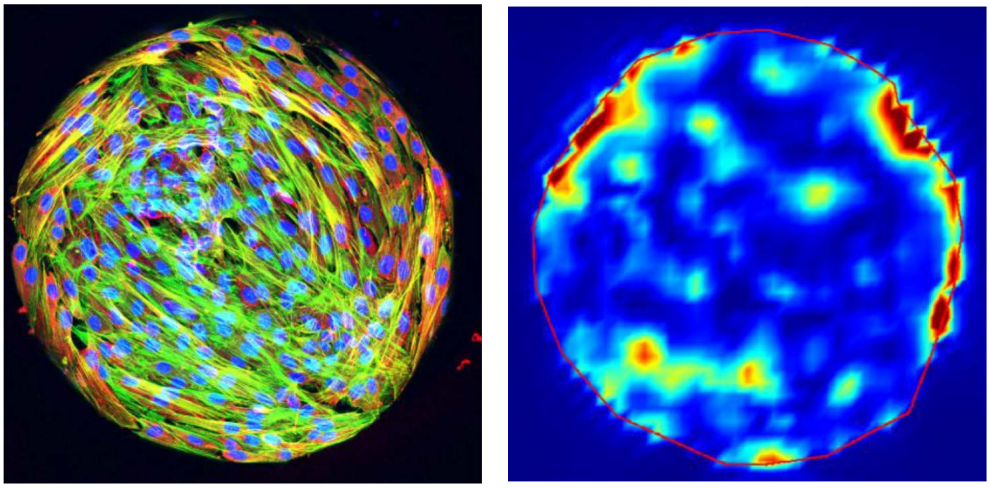
I am excited to be a part of the WPI-UMMS joint program as it offers my students the opportunity to be trained both in world-class engineering at WPI and cell signaling at UMass. Mechanobiology is truly at the interface of bioengineering and molecular biology, and students with such a strong training in both areas will be leaders in this new field.

**Graduate Students**

Our lab needs students who are genuinely passionate about combining engineering in vitro and in silico modeling with basic cell biology to determine the mechanisms by which our cells respond to their environment in health and disease.

**Publications**

- TRIP6 inhibits Hippo signaling in response to tension at adherens junctions. Dutta S, Mana-Capelli S, Paramasivam M, Dasgupta I, Cirka H, Billiar K, McCollum D. EMBO reports. 2018; 19(2):337-350. (note that we have a collaborative NSF grant with Dr. McCollum, Professor of Biochemistry and Molecular Pharmacology at UMMS).
- Reproducible in vitro model for dystrophic calcification of cardiac valvular interstitial cells: insights into the mechanisms of calcific aortic valvular disease. Cirka HA, Uribe J, Liang V, Schoen FJ, Billiar KL. Lab on a chip. 2017; 17(5):814-829.
- Active Traction Force Response to Long-Term Cyclic Stretch Is Dependent on Cell Pre-stress. Cirka H, Monterosso M, Diamantides N, Favreau J, Wen Q, Billiar K. Biophysical Journal. 2016; 110(8):1845-1857.



Micro-contact printed multi-cellular aggregate model for studying cell-cell mechanical interactions (left); traction stresses generated by the aggregated cells in the soft substrate on which they are cultured (right).

## Daniel Bolon, PhD

*Department of Biochemistry and Molecular Pharmacology*
*University of Massachusetts Medical School*

**https://profiles.umassmed.edu/display/133553**
**https://www.umassmed.edu/bolon-lab/**

**Research Focus**

Our lab developed technology to quantify the effects of mutations in high throughput. We have used this approach to determine protein fitness landscapes for genes in yeast, mammalian cells in culture, and viruses. Using protein fitness landscapes as a guide, we are striving to understand the biochemical and biophysical underpinning of genetic health and disease. This is proving to be a wonderful challenge that requires interdisciplinary approaches drawing on strengths in computer science, physics, biochemistry, genetics, and evolution.

**Personal Statement**

I am enthusiastic to be a part of this program because of the creative and exciting projects that I believe it will enable at the interface between fields.

**Graduate Students**

My lab welcomes students with interest in a broad array of disciplines including computational approaches such as machine learning to analyze large datasets, bio-informatic approaches to compare experimental fitness landscapes to genetic diversity in nature.

**Publications**

**Pervasive contingency and entrenchment in a billion years of Hsp90 evolution.**
Starr TN, Flynn JM, Mishra P, Bolon DNA, Thornton JW.
Proc Natl Acad Sci U S A. 2018 Apr 24;115(17):4453-4458.

**Evolutionary mechanisms studied through protein fitness landscapes.**
Canale AS, Cote-Hammarlof PA, Flynn JM, Bolon DN.
Curr Opin Struct Biol. 2018 Feb;48:141-148.

**CRISPR-Cas9-mediated saturated mutagenesis screen predicts clinical drug resistance with improved accuracy.**
Ma L, Boucher JI, Paulsen J, Matuszewski S, Eide CA, Ou J, Eickelberg G, Press RD, Zhu LJ, Druker BJ, Branford S, Wolfe SA, Jensen JD, Schiffer CA, Green MR, Bolon DN.
Proc Natl Acad Sci U S A. 2017 Oct 31;114(44):11751-11756.

**Systematic Mutant Analyses Elucidate General and Client-Specific Aspects of Hsp90 Function.**
Mishra P, Flynn JM, Starr TN, Bolon DNA.
Cell Rep. 2016 Apr 19;15(3):588-598.

**Latent effects of Hsp90 mutants revealed at reduced expression levels.**
Jiang L, Mishra P, Hietpas RT, Zeldovich KB, Bolon DN.
PLoS Genet. 2013 Jun;9(6):e1003600.

**Experimental illumination of a fitness landscape.**
Hietpas RT, Jensen JD, Bolon DN.
Proc Natl Acad Sci U S A. 2011 May 10;108(19):7896-901.

## Jean King, PhD

*Dean of Arts and Sciences, WPI*
*Professor of Psychiatry, Director of the Center for Comparative NeuroImaging, UMass*
*Department of Biology and Biotechnology, WPI*
*Department of Psychiatry UMass Medical School*

**https://www.wpi.edu/people/faculty/jaking**
**https://www.umassmed.edu/psychiatry/ccni/people/faculty/jean-king/**
**https://www.researchgate.net/profile/Jean_King**

**Research Focus**

The King lab is focused on the translation of neuroscience to clinical psychiatry through the use of functional magnetic resonance imaging techniques in both animal models and humans. The overall objective of the King lab is to enhance our understanding of the mechanisms that mediate the development of these disorders and their adverse effects on the regulation of emotion and cognition. As director the Center for Comparative NeuroImaging at UMass, we collaborate on interdisciplinary integrative studies of addiction, ADHD, depression, anxiety, autism, air pollution, Parkinson's Disease, traumatic brain injury, and the role of complementary interventions, such as mindfulness, in improving health. A recent development in the lab is an increased emphasis on data science techniques for both enhancing imaging data analysis as well as comprehensively integrating these data with other biological variables and symptoms.

**Personal Statement**

There is tremendous potential for advancing neuroscience and psychiatric research through increased collaboration between neuroscientists, engineers, clinicians, and data scientists at WPI and UMass. We look forward to initiating and supporting these types of projects through the Joint Progam and the opportunities it will provide for highly talented and motivated students from both WPI and UMass.

**Graduate Students**

We are looking for creative, organized, and motivated students broadly interested in collaborative translational neuroscience projects ranging from animal studies to clinical trials.

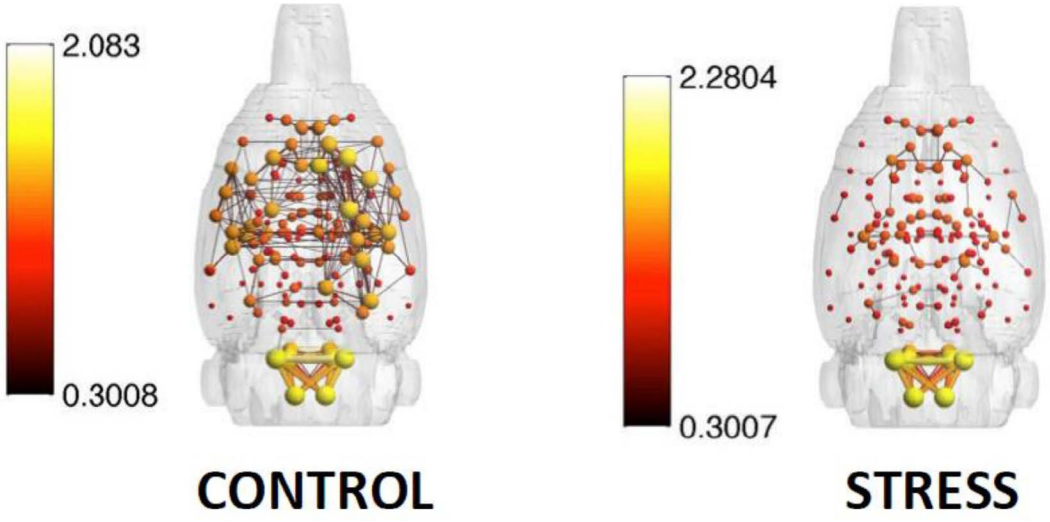
**Publications**

**https://www.researchgate.net/publication/318725627_Menthol_enhances_nicotine-induced_locomotor_sensitization_and_in_vivo_functional_connectivity_in_adolescence**

**https://www.researchgate.net/publication/322219845_Early_life_social_stress_and_resting_state_functional_connectivity_in_postpartum_rat_anterior_cingulate_circuits**

**https://www.researchgate.net/publication/291808205_Effects_of_Recent_Concussion_on_Brain_Bioenergetics_A_Phosphorus-31_Magnetic_Resonance_Spectroscopy_Study**

**https://www.researchgate.net/publication/311246373_Keeping_Weight_Off_Study_protocol_of_an_RCT_to_investigate_brain_changes_associated_with_mindfulness-based_stress_reduction**




This figure illustrates substantially decreased functional neural connectivity (assessed with fMRI) in female rats exposed to early life social stress (Stress) in a transgenerational rodent model of postpartum depression and anxiety. These stress exposed females display deficient maternal care towards their offspring.

## Dmitry Korkin, PhD

*Director, Bioinformatics and Computational Biology Program*
*Associate Professor*
*Department of Computer Science*
*Worcester Polytechnic Institute*

**https://www.wpi.edu/people/faculty/dkorkin**
**http://korkinlab/org**

**Research Focus**

Research in Korkin Lab around three main themes: (1) bioinformatics and computational systems biology of complex genetic and infectious disease; (2) evolutionary genomics; and (3) data mining and machine learning in the biological applications. The majority of current research projects in the lab leverage interactomics, structural genomics, NGS, and clinical genomics data obtained from public and private sources. Korkin Lab has a long track record of collaborations with data scientists, clinicians, microbiologists, geneticists, and biostatisticians on the educational and research projects.

**Personal Statement**

I am excited to be a part of the program because it reflects the interdisciplinary nature of my research. The program provides access to a unique cohort of students, allowing me to contribute to their training scientists and "translators" between the languages of different scientific disciplines.

**Graduate Students**

We are looking for students who are eager to learn both kinds of skills, computational and life science. Programming knowledge is often a great asset but is not required.

**Publications**

Cui H, Zhao N, Korkin D. Multilayer view of pathogenic SNVs in human interactome through in-silico edgetic profiling. J Mol Biol. 2018 Sep 14;430(18 Pt A):2974-2992

Johnson NT, Dhroso A, Hughes K, and Korkin D. Biological classification with RNA-seq data: Can alternatively spliced transcript expression enhance machine learning classifiers? RNA 24 (9), 1119-1132.

Zhao N, Han JG, Shyu CR, Korkin D. Determining effects of non-synonymous SNPs on protein-protein interactions using supervised and semi-supervised learning. PLoS Comput Biol. 2014 May;10(5):e1003592.

Reneker J, Lyons E, Conant GC, Pires JC, Freeling M, Shyu CR, Korkin D. Long identical multispecies elements in plant and animal genomes. Proc Natl Acad Sci U S A. 2012 May 8;109(19):E1183-91.

Liu S, Kandoth PK, Warren SD, Yeckel G, Heinz R, Alden J, Yang C, Jamai A, El-Mellouki T, Juvale PS, Hill J, Baum TJ, Cianzio S, Whitham SA, Korkin D, Mitchum MG, Meksem K. A soybean cyst nematode resistance gene points to a new mechanism of plant resistance to pathogens. Nature. 2012 Dec 13;492(7428):256-60.

## Anita E. Mattson, PhD

*Associate Professor of Chemistry*
*Department of Chemistry and Biochemistry, WPI*

**https://www.wpi.edu/people/faculty/aemattson**
**https://www.amattson.com/**

**Research Focus**

In the Mattson Group, we blend our love of catalyst design and complex molecule synthesis with drug discovery. Investigators on our team work on the interface of organic synthesis and medicinal chemistry for the purposes of advancing new therapeutic agents that have been inspired by naturally occurring molecules. Our current interests are focused on better understanding the potential of tetrahydroxanthones as therapies for cisplatin resistant cancers.

**Personal Statement**

I am thrilled to be part of the WPI/UMMS Joint program so I can better help my team focus on the health applications of natural product synthesis.

**Graduate Students**

Joint students from the WPI/UMMS program will have an amazing opportunity to link natural product synthesis to drug discovery by working at WPI and the University of Massachusetts Medical School.

**Publications**

Guan, Y.; Attard, J.; Visco, M.; Fisher, T. J.; Mattson, A. E.* "Enhanced Catalyst Systems from Copper(II) Trifalte and BINOL-Silanediols" Chem. Eur. J. 2018, 28, 7123-7127.

Hardman-Baldwin, A. M.; Visco, M. D.; Wieting, J. M.; Stern, C.; Kondo, S.; Mattson, A. E. "Silanediol Catalyzed Chromenone Functionalization" Org. Lett. 2016, 18, 3766-3769.

Wieting, J. M.; Fisher, T. J.; Schafer, A. G.; Visco, M. D.; Galluci, J. C.; Mattson, A. E.* "Preparation and Catalytic Activity of BINOL-Derived Silanediols" Eur. J. Org. Chem. 2015, 525-533.

## Athma A. Pai, PhD

*Assistant Professor*
*RNA Therapeutics Institute, University of Massachusetts Medical School*

**https://profiles.umassmed.edu/display/17578974**
**http://www.pai-lab.org**

**Research Focus**

Our lab lies at the intersection of RNA biology, computational genomics, and systems biology. The central goal of our lab is to understand the dynamic nature of gene regulation in eukaryotic systems, by dissecting the kinetics of mRNA biogenesis. To do so, we develop and apply both experimental and computational methods to study the genome-wide speed and efficiency of decisions made during key steps of mRNA maturation – transcription elongation, mRNA splicing, and cleavage and polyadenylation. The nature of our work necessitates an interdisciplinary and quantitative mindset, since we routinely use high-dimensional mathematical and statistical approaches to analyze state-of-the-art genetic, molecular, and cellular genomics datasets.

**Personal Statement**

I'm excited about the WPI-UMMS Joint Program since it will facilitate a greater deal of interaction between students and faculty at our two campuses. My hope is that this program will increase the synergy between research across both institutions and foster further collaborations across disciplines in the quantitative sciences.

**Graduate Students**

I would like to recruit students who are curious about fundamental biological frontiers, motivated to tackle difficult quantitative conundrums, and fearless in learning and applying novel tools to progress their research questions. Students in the WPI-UMMS Joint Program will be ideally positioned to bring their diverse backgrounds and skillsets to this style of interdisciplinary research.

**Publications**

Pai AA and Luca F. Environmental influences on RNA processing: biochemical, molecular, and genetic regulators of cellular response. WIREs RNA. e1503. (2018)

Pai AA, Paggi JM, Yan P, Adelman K, Burge BC, Numerous recursive sites contribute to accuracy of splicing of long introns in flies. PLOS Genetics. 14(8):e1007588. (2018)

Pai AA, Henriques T, McCue K, Burkholder A, Adelman K, Burge CB. The kinetics of pre-mRNA splicing in the Drosophila genome and the influence of gene architecture. eLife. 6:e32537. (2017)

Pai AA, Baharian G, Sabourin AP, Brinkworth JF, Nedelec Y, Foley JW Grenier JC, Siddle KJ, Dumaine A, Yotova, Y, Johnson ZP, Lanford RE, Burge CB, Barreiro LB. Widespread shortening of 3' untranslated regions and increased exon inclusion are evolutionarily conserved features of innate immune response to infection. PLOS Genetics. 12(9):e1006338. (2016)

## Reeta Rao, PhD

*Associate Professor*
*Biology & Biotechnology*
*WPI*

**https://www.wpi.edu/people/faculty/rpr**
Rao Lab: **http://labs.wpi.edu/raolab/**

**Research Focus**

Understanding and managing fungal diseases using a variety of biochemical, molecular-genetic, genomic tools and model hosts to explore fungal virulence and host defense strategies.

Identifying novel therapeutics against emerging and drug resistant fungal pathogens.

Study multi kingdom microbial interactions and probiotics to understand inflammatory bowel disease, Crohns and Ulcerative Colitis .

**Personal Statement**

This program allows me to recruit students who are interested in studying infectious diseases that is one of the largest killers of the last decade.

**Graduate Students**

Students who are interested in clinical research around fungal infectious diseases.

**Publications**

- YANG B, RAO R Emerging pathogens of the Candida species (2018).

Open access book entitled "Candida albicans," published by IntechOpen, London.

- Cuomo, C, Shea, T, YANG, B, RAO R, Forche, A (2017) Whole genome sequence of the heterozygous clinical isolate Candida krusei 81-B-5 (Jul10, pii:G3.10.1534/g3.117.043547).

- Ford CB, Funt, JM, Abbey, D, ISSI, L., Oliver, BG, Guiducci, C, Martinez, DA, DELOREY, T, Li, BY, White, TC, Cuomo, C, RAO, R. P, Berman, J, Thompson, D, Regev, A. (2015) The evolution of drug resistance in clinical isolates of Candida albicans. eLife;4:e00662.

- Fazly A, JAIN C, Dehner AC, ISSI L, Lilly E, Fidel PL, RAO R. P *, Kaufman PD*

(* Corresponding authors) (2013) Chemical screening identifies a small molecule inhibitor of C. albicans adhesion, morphogenesis and pathogenesis. PNAS 110(33): 13594-13599.

## Susan C. Roberts, PhD

*Professor and Head*
*Chemical Engineering, WPI*

**https://www.wpi.edu/people/faculty/scroberts**

**Research Focus**

My research interests are in cellular and metabolic engineering and cell culture biotechnology, with a primary focus on plant-based systems for synthesis of natural products. We work with a number of plant model and non-model systems, including Taxus suspension culture for production of the anti-cancer agent paclitaxel (Taxol®). Efforts are directed towards understanding plant specialized metabolism and its regulation through development and application of tools such as flow cytometry, genetic engineering, aggregation profiling and metabolic modeling.

**Personal Statement**

The joint WPI-UMMS Program has the potential for significant advancements by bringing together scientists and engineers to work on some of medicine's most challenging problems. For our research, the development and application of bioinformatics and experimental tools to study gene regulation and epigenetics will facilitate breakthroughs in the understanding of plant metabolism and the global supply of medicines.

**Graduate Students**

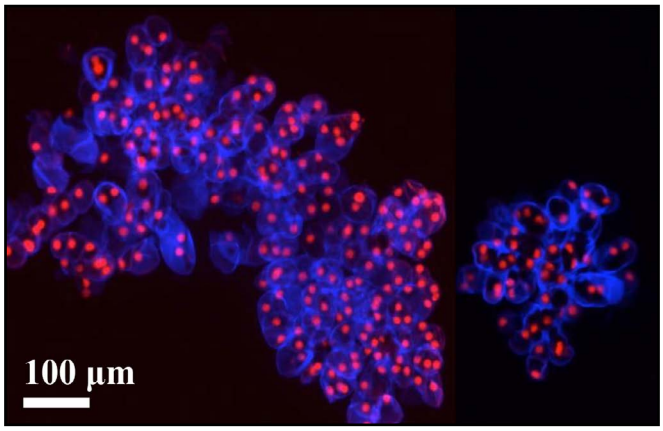
I would like to attract students interested in bioinformatics, gene regulation, genetic engineering, supply of anti-cancer drugs and metabolism.

**Publications**

1. Wilson, S.A., Keen, P., McKee, M., Raia, N.R., Van Eck, J., and Roberts S.C. (2018) "Development of agrobacterium-mediated transformation method for Taxus suspension culture," In Vitro Cellular and Developmental Biology – Plant, 54(1), 36-44.

2. Lenka, S.K., Nims, E., Vongaseuth, K., Boshar, R.A., Roberts, S.C., and Walker, E.L. (2015) "Jasmonate-responsive expression of paclitaxel biosynthesis genes in Taxus cuspidata cultured cells is negatively regulated by the bHLH transcription factors TcJAMYC1, TcJAMYC2, and TcJAMYC4," Frontiers in Plant Science, 6(article 115), 1-12.

3. Wilson, S.A., Cummings, E.M., and Roberts*, S.C. (2014) "Multi-scale engineering of plant cell cultures for promotion of specialized metabolism," Current Opinion in Biotechnology, 29C, 163-170.




Aggregated cultured Taxus suspension cells synthesizing Taxol. Red indicates nuclei. Blue indicates cellulose.

## Sean P. Ryder, PhD

*Biochemistry and Molecular Pharmacology*
*Graduate School of Biomedical Sciences, UMass Medical School*

**https://profiles.umassmed.edu/display/133547**
**https://www.umassmed.edu/Ryderlab**

**Research Focus**

My lab works at the interface between quantitative biochemical measurements and developmental biology. We are interested in understanding the circuitry of maternal RNA regulation during embryogenesis, focusing on the model organism Caenorhabditis elegans. We seek to define the pre-programmed instructions—passed on from mother to child through the cytoplasm—that enable cell fate specification prior to transcription activation in the new zygote.

**Personal Statement**

We are excited to develop and apply novel instrumentation and applications to improve the pace of research. I firmly believe that interdisciplinary science is strong science, and there is currently a need for the integration of engineering and instrumentation design principles into life science so that the pace of phenotypic studies can keep up with genotypic studies.

**Graduate Students**

I am looking for students who will bring innovative ideas to the lab to improve the flow of data collection, from robotics to software development to new technology implementation. Creativity and an open mind are the keys.

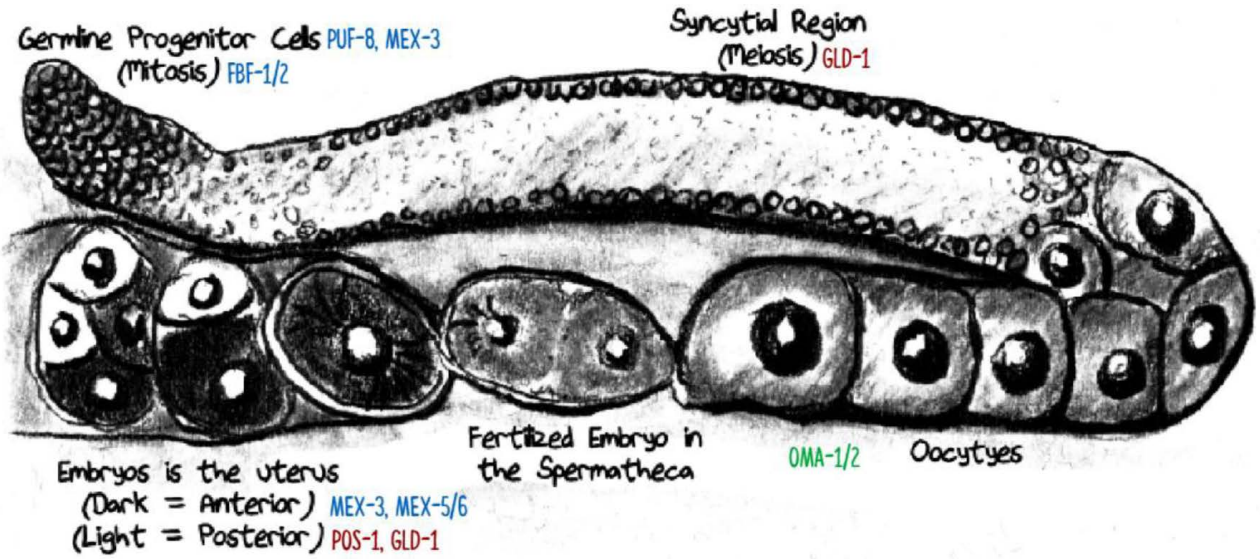
**Publications**


1. Kaymak, E., Farley, B.M., Hay, S.A., Li, C.H., Ho, S., Hartman, D.J. & Ryder, S.P. (2016) Efficient generation of transgenic reporter strains and analysis of expression patterns in Caenorhabditis elegans using Library mosSCI. Dev. Dyn. 245, 925-936

2. Clingman, C.C., Deveau, L.M., Hay, S.A., Genga, R.M., Shandilya, S.M., Massi, F, and Ryder, S.P. (2014) Allosteric inhibition of a stem cell RNA-binding protein by an intermediary metabolite. eLife. e02848. doi: 10.7554/eLife.02848.

3. Farley, B.M. and Ryder, S.P. (2012) POS-1 and GLD-1 repress glp-1 translation through a conserved binding site cluster. Mol. Biol. Cell, 23, 4473-4483.


RNA-binding proteins regulate maternal mRNAs in order to effect cell fate specification. The ability of the RNA-binding proteins to discriminate between sequences is limited, implying that context of the cis-regulatory elements is important for function in vivo. We seek to define that context so that we can efficiently map out regulatory networks.




| CCCH ZN FINGER | KH DOMAIN | PUMILIO |
|---|---|---|
| POS-1: UAUU$_{1-2}$[A/G][A/G/U]N$_{1-3}$G | MEX-3: [A/G/C][G/U]AGN$_{0-8}$U[U/A/C]UA | FBF-1: UGUA[U/A/C][U/A/C]AU[A/G] |
| MEX-5: U-RICH | GLD-1: (U>[A/G/C])ACU(C/A)AY | PUF-8: UGUA[U/A/C]A[U/A]A |
| OMA-1/2: [UA(A/U)]$^{N}$ | | |

## Suzanne Scarlata, PhD

*Professor*
*Department of Chemistry and Biochemistry*
*Worcester Polytechnic Institute*

**https://www.wpi.edu/people/faculty/sfscarlata**
**http://scarlatalab.wpi.edu/**

**Research Focus**

Our lab seeks to understand how extracellular signals are communicated into the cell and cause growth, division, migration and communication with other cells. We are specifically interested in how hormones and neurotransmitters regulate both direct responses through changes in calcium and other molecules, but also impact indirect processes, like protein translation and the formation of intracellular aggregates. Our long term goal is to understand and predict how different stimuli affect the way cells deal with stress and aging.

**Personal Statement**

We monitor cellular events in live cells or small organisms using state of the art fluorescence imaging and correlation methods and mathematically analyze processes such as synapse breakage and neurite retraction during stimulation. The UMassMed-WPI program will allow us to apply our methods to better understand the biological basis of disease.

**Graduate Students**

We are particularly interested in students that would like to observe cells processes and understand their underlying molecular basis.

**Publications**

Phospholipase Cβ1 regulates proliferation of neuronal cells
Osama Garwain, Kaitlyn Valla, and Suzanne Scarlata
FASAB J. 2018 Jan 12

Regulation of the activity of the promoter of RNA-induced silencing, C3PO
Shriya Sahu, Leo Williams, Alberto Perez, Finly Philip, Giuseppe Caso, Walter Zurawsky, Suzanne Scarlata
Protein Sci. 2017 July 16

Super-resolution Visualization of Caveola Deformation in Response to Osmotic Stress.
Yang L, Scarlata S.
J Biol Chem. 2017 Mar 3

## Karen L. Troy, PhD

*Associate Professor*
*Biomedical Engineering, Worcester Polytechnic Institute*

**https://www.wpi.edu/people/faculty/ktroy**
**http://Wp.wpi.edu/MBL**
**https://www.researchgate.net/profile/Karen_Troy**
**https://scholar.google.com/citations?user=p8XGHf0AAAAJ&hl=en&oi=sra**

**Research Focus**

My research focuses on non-invasive measurements of musculoskeletal structure and function. We use a combination of medical imaging, computational modeling, and clinical biomechanics techniques to assess skeletal strength, measure fracture risk, and to design interventions to maximize bone health. We also investigate relationships between mechanical loading environment and changes to joint structure in health and disease.

**Personal Statement**

I am excited to contribute to the WPI/UMMS joint program because I believe that cross-disciplinary collaboration is a critical part of research success. Students and faculty alike will benefit from the differing perspectives on a given problem. Since my research includes a clinical component, I am excited to strengthen collaborations with clinical and research faculty at UMMS through this program.

**Graduate Students**

Students in my research group typically have a background in biomechanics, which could include mechanical engineering, biomedical engineering, human movement science/kinesiology. Students also need strong quantitative skills, such as applied mathematics or computer science.

**Publications**

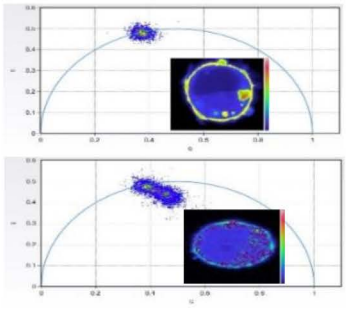
Johnson JE, Troy KL Simplified boundary conditions alter cortical/trabecular load sharing at the distal radius; a multiscale finite element analysis. Journal of Biomechanics, 2017 Nov 4. pii: S0021-9290(17)30576-6. doi: 10.1016/j.jbiomech.2017.10.036.

Bhatia V.A., Edwards W.B., Johnson, J.E., Troy K.L. Short-Term Bone Formation is Greatest within High Strain Regions of the Human Distal Radius: a Prospective Pilot Study. J. Biomech. Eng., 2015 Jan 1;137(1)

Edwards, W.B., Schnitzer, T.J.,Troy K.L. Reduction in proximal femoral strength in patients with acute spinal cord injury Journal of Bone and Mineral Research, 2014 Sep;29(9):2074-9

Description: Multi-scale, subject specific finite element model of a distal radius. The color map shows the strain distribution within the entire bone and within the bone microstructure. This model simulates a compressive load onto the palm of the hand, similar to a push-up.

The fluorescent protein in a cell alone (*top*) and interacting with a partner (*bottom*).



Synaptic breakage due to changes in membrane tension during calcium signaling.