

# A Writer's Journey to an Unexpected Career in Science

Dennis Gessmann

September 7<sup>th</sup>, 2023

## Disclaimer:

The opinions expressed in this presentation and on the following slides are solely those of the presenter, Dennis Gessmann, and not necessarily those of Pfizer. Pfizer does not guarantee the accuracy or reliability of the information provided herein.

“We are free to choose our paths...”



“We are free to choose our paths...but we can't choose the consequences that come with them.”

Sean Covey, *The 7 Habits of Highly Effective Teens*



“We are free to choose our paths...but we can't choose the consequences that come with them.”

Sean Covey, *The 7 Habits of Highly Effective Teens*



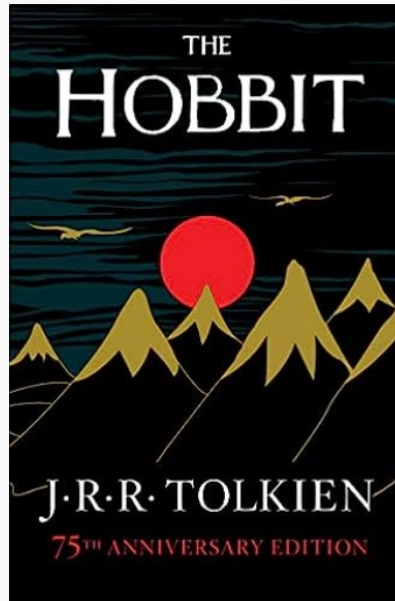
# Education and Career

*I always wanted  
to be a writer of fiction*

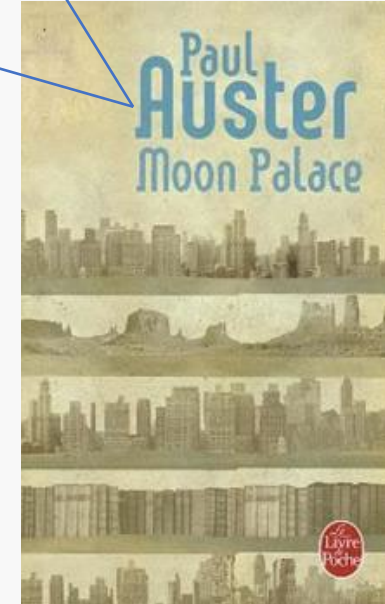
“We are free to choose our paths, but we can’t choose the consequences that come with them.”

Sean Covey, *The 7 Habits of Highly Effective Teens*

- 1983: Born in the suburbs of Stuttgart, Germany
- 2003: Graduated high school in Germany, focus in Physics, English and Ethics
- 2009: Masters in comparative literature with a minor in philosophy
- 2010: Writer of fiction



“All we have to decide is what to do with the time that is given us.” TLOTR



NYT: Mr. Auster employs the form of the picaresque adventure to create a sad-funny tale of coming of age.

Myself: Pulp Western vs Urban Philosophy

# Education and Career

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THE END



Plan B

or marine biologist  
THE END Part 2





# Education and Career

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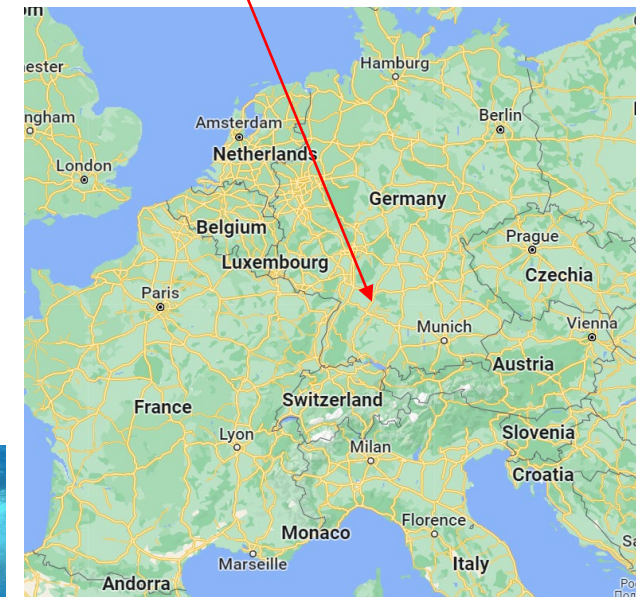


Plan B



or marine biologist  
THE END Part 2

You are here





# Desired Journey

*I always wanted  
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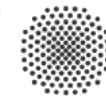
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Explain biology through physics & mathematics and apply engineering to create biotechnologies



University of Stuttgart

Bachelor

**Technical Biology**

German

The technical biology Bachelor's study program presents an interdisciplinary profile combining biology and technology that is unique in Germany. The studies concentrate on current, globally relevant challenges in research and industry. Modern biosciences, physics and chemistry (especially biochemistry and technical biochemistry) work closely with engineering-, materials-, and systems sciences and bioprocess engineering.

Numerous research-related laboratory exercises as well as sojourns in industry and abroad ensure a high degree of practical relevance. The study program is in great demand and well reputed in research and business.

# Education and Career

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Explain biology through physics & mathematics and apply engineering to create biotechnologies



University of Stuttgart

Bachelor

**Technical Biology**

German

or marine biologist  
THE END Part 2

# Education and Career

*The boulder 'making me' chase a career in science.*

“We are free to choose our paths, but we can't choose the consequences that come with them.”

Sean Covey, *The 7 Habits of Highly Effective Teens*

- 1983: Born in the suburbs of Stuttgart, Germany
- 2003: Graduated high school in Germany, focus in Physics, English and Ethics
- 2009: Diplom Biologist (t.o.) from the University of Stuttgart  
*Focus on Bioenergetics, Microbiology and Technical Biochemistry*  
Diplom Thesis: *Structural biology of eukaryotic  $\beta$ -barrel membrane proteins*
- 2012: Dr. rer. Nat. from the University of Stuttgart  
*Bioengineering of eukaryotic  $\beta$ -barrel membrane proteins*
- 2012
- 2014: Postdoctoral Research Fellow at Johns Hopkins University in Baltimore, MD, USA  
*Biophysics of prokaryotic  $\beta$ -barrel membrane protein folding*
- 2014
- 2014: Research Associate at Department of Bioengineering at University of Illinois Chicago, USA  
*Computational biology of prokaryotic  $\beta$ -barrel membrane protein folding*
- 2014
- 2015 Therapeutic Proteins International, LLC, Chicago IL  
*95% Biophysics 5% Mass spectrometry of biotherapeutics*
- 2015
- Present Pfizer Inc.  
*Mass spectrometry of biotherapeutics*  
2015-2022 in Lake Forest IL, 2022 – present in Andover, MA

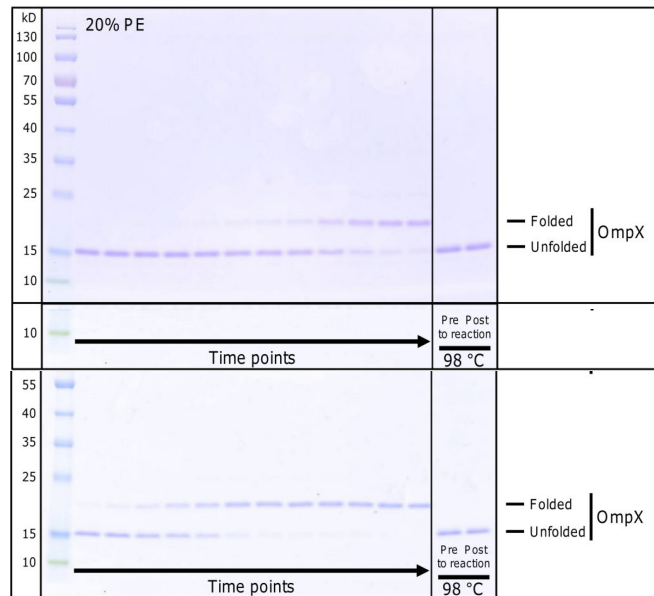


Postdoc

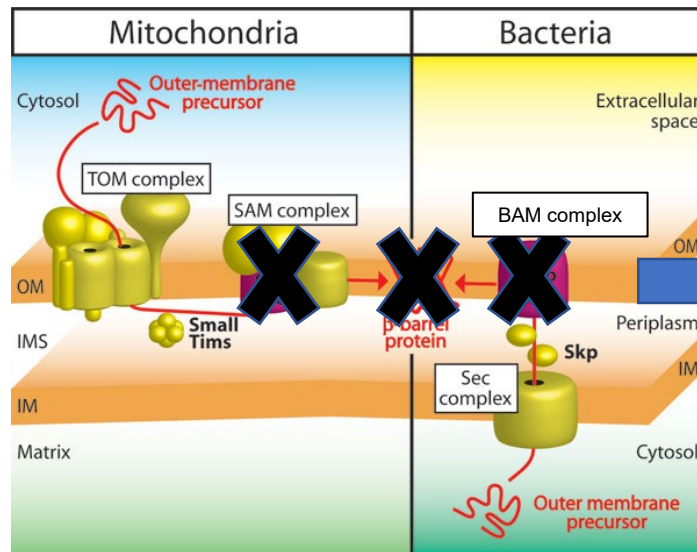
2012-2014 at JHU

Biophysics of prokaryotic  $\beta$ -barrel membrane protein folding

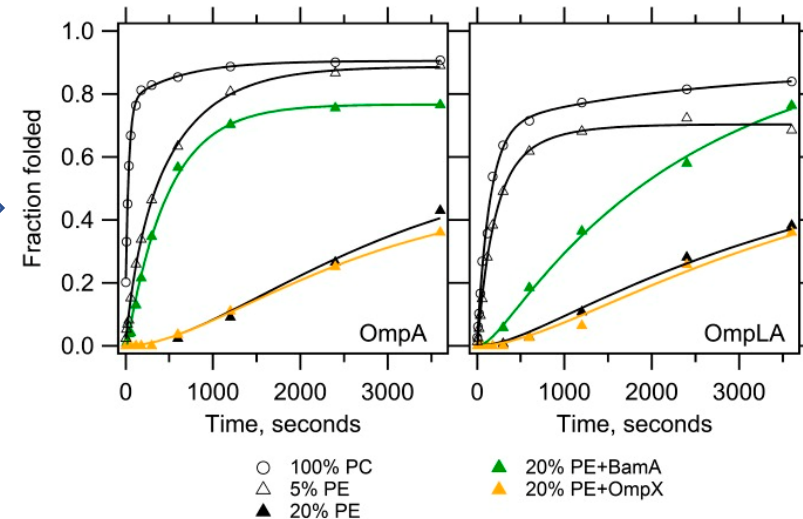
Be bold.



### Scientific Question or Biological 'Paradox'



The higher the amount of native lipid headgroups, the slower the folding *in vitro* (2012, Johns Hopkins)

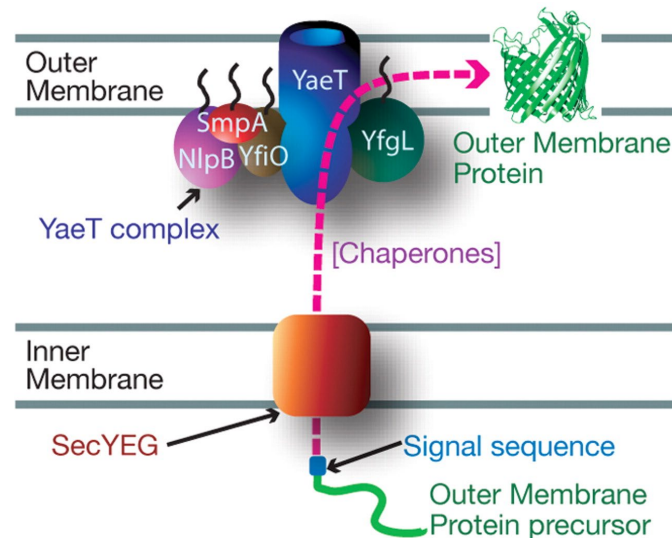


## Structure and Function of an Essential Component of the Outer Membrane Protein Assembly Machine

Seokhee Kim,<sup>1</sup> Juliana C. Malinverni,<sup>2</sup> Piotr Sliz,<sup>3,4</sup> Thomas J. Silhavy,<sup>2</sup> Stephen C. Harrison,<sup>3,4</sup> Daniel Kahne<sup>1,3\*</sup>

<sup>1</sup>Department of Chemistry and Chemical Biology, Harvard University, Cambridge, MA 02138, USA. <sup>2</sup>Department of Molecular Biology, Princeton University, Princeton, NJ 08544, USA. <sup>3</sup>Department of Biological Chemistry and Molecular Pharmacology, Harvard Medical School, Boston, MA 02115, USA. <sup>4</sup>Howard Hughes Medical Institute and Children's Hospital Laboratory of Molecular Medicine, Boston, MA 02115, USA.

Published 2007 in Science



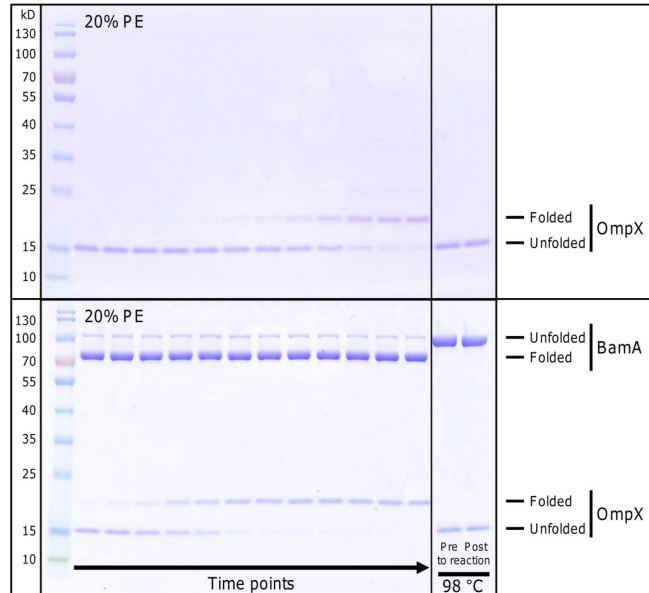
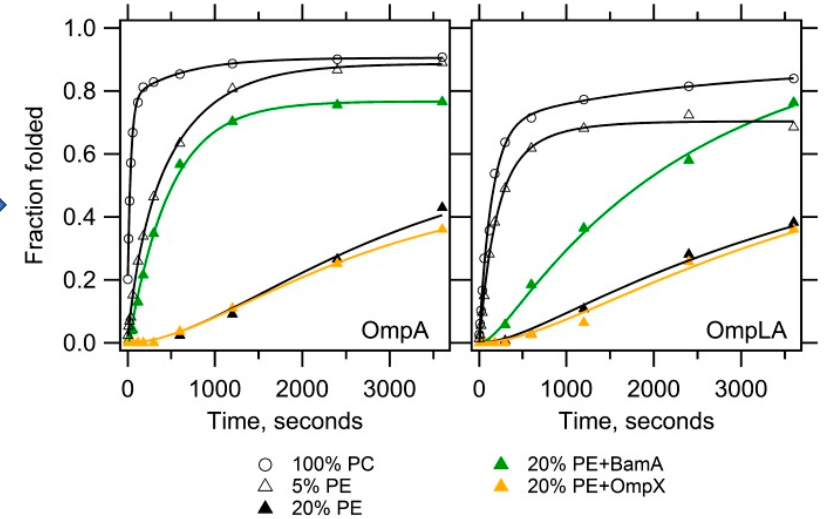
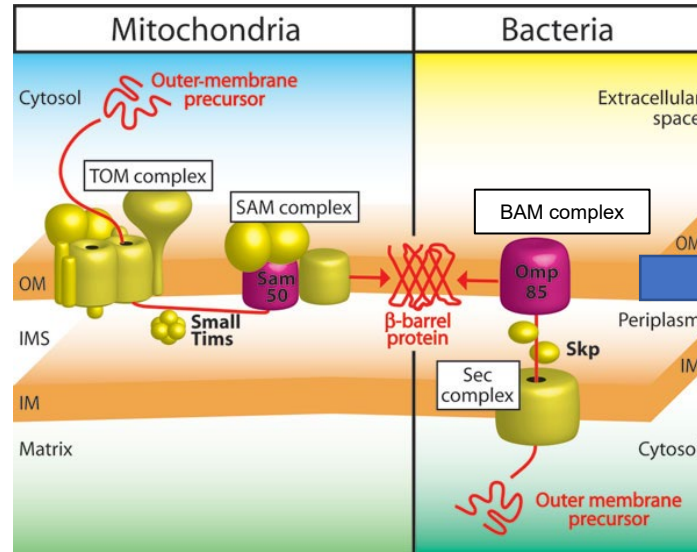
Postdoc

2012-2014 at JHU

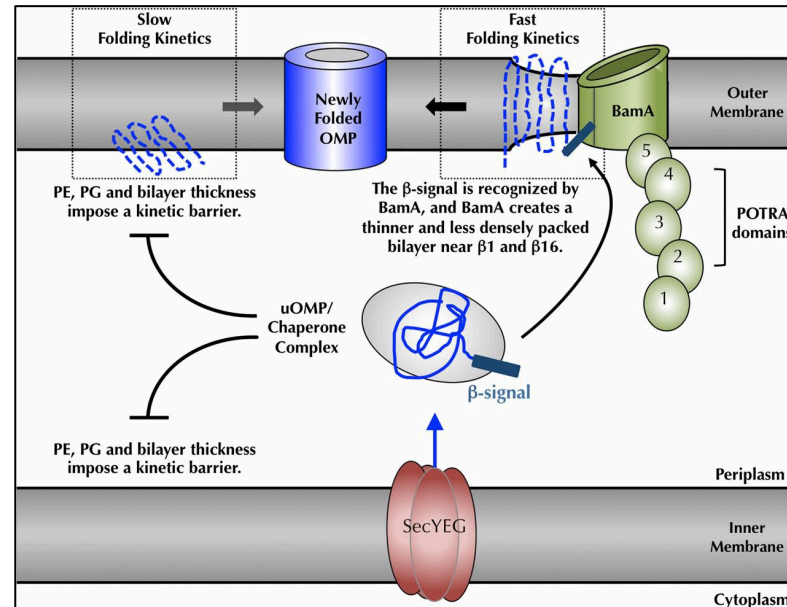
*Biophysics of prokaryotic  $\beta$ -barrel membrane protein folding*

Be bold.

Scientific Question or Biological 'Paradox'



Published 2014



Outer membrane  $\beta$ -barrel protein folding is physically controlled by periplasmic lipid head groups and BamA



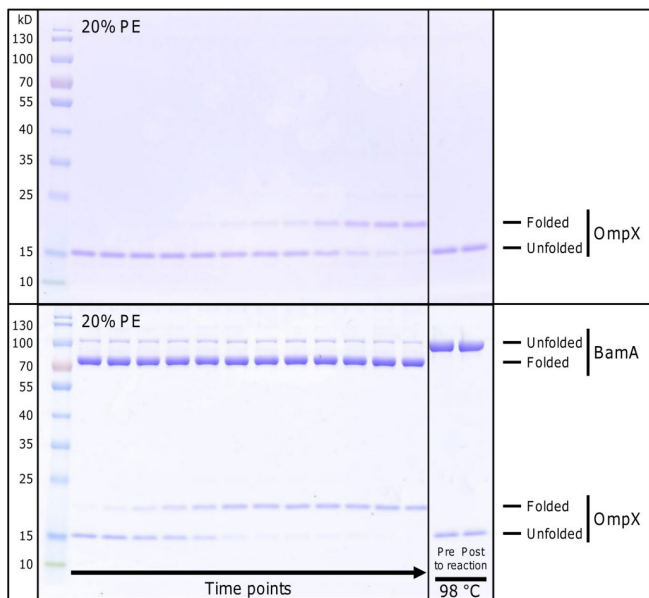
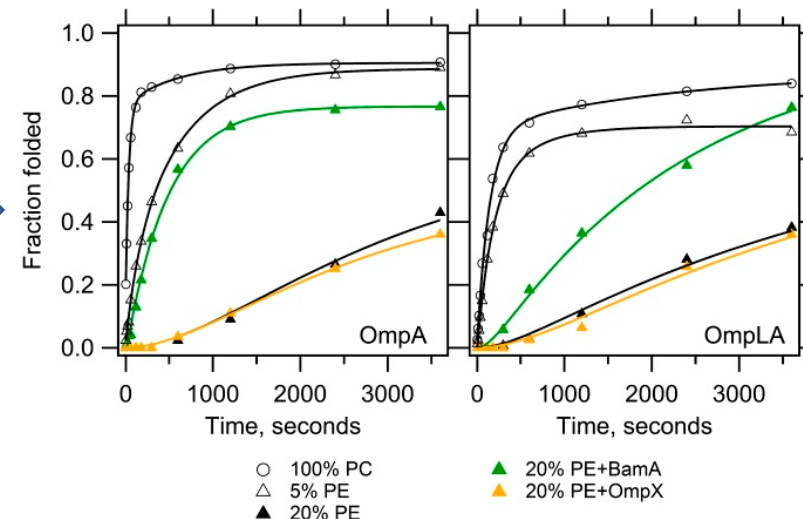
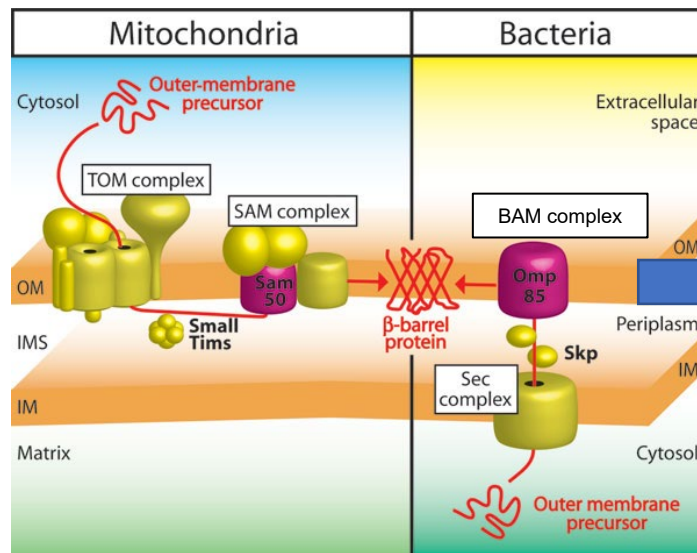
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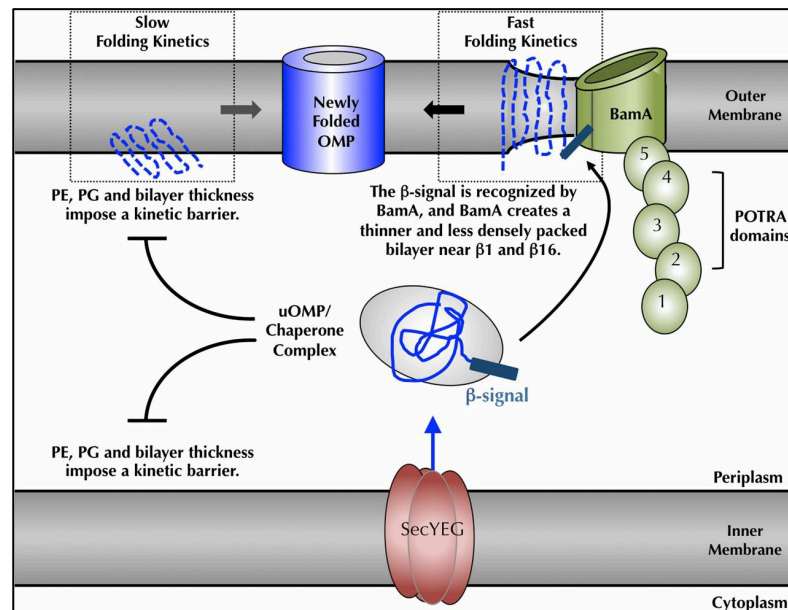
Biophysics of prokaryotic  $\beta$ -barrel membrane protein folding

Be bold.

Scientific Question or Biological 'Paradox'



Published 2014



New pathway(s) to common ground so that one may begin to merge *in vivo* and *in vitro* observations on the biogenesis of beta barrel OMPs

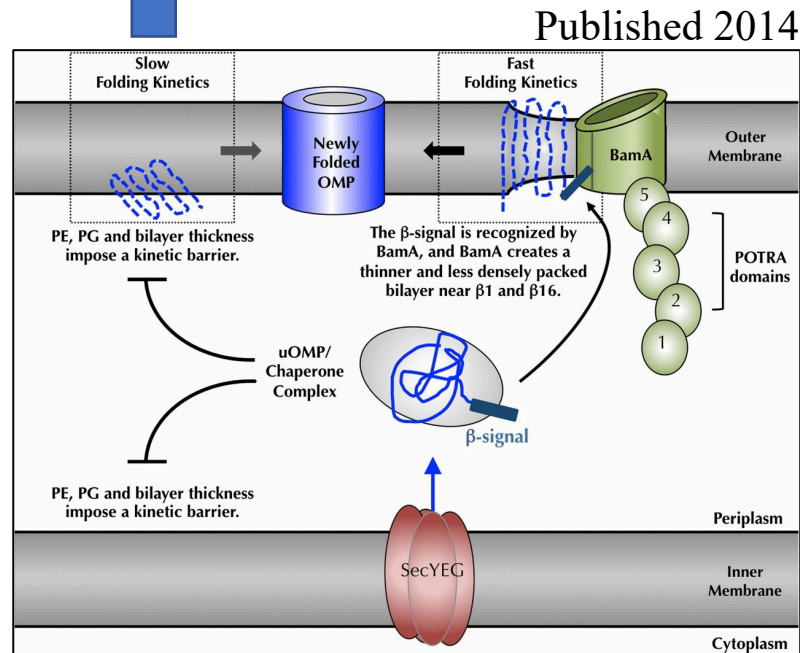
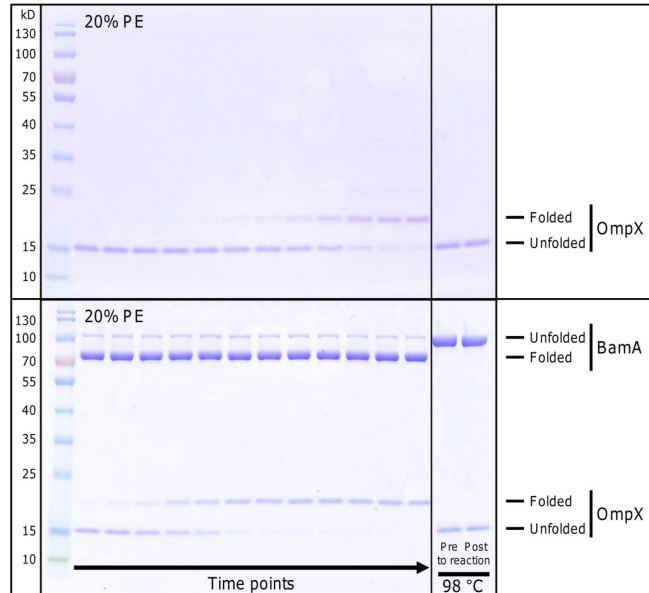
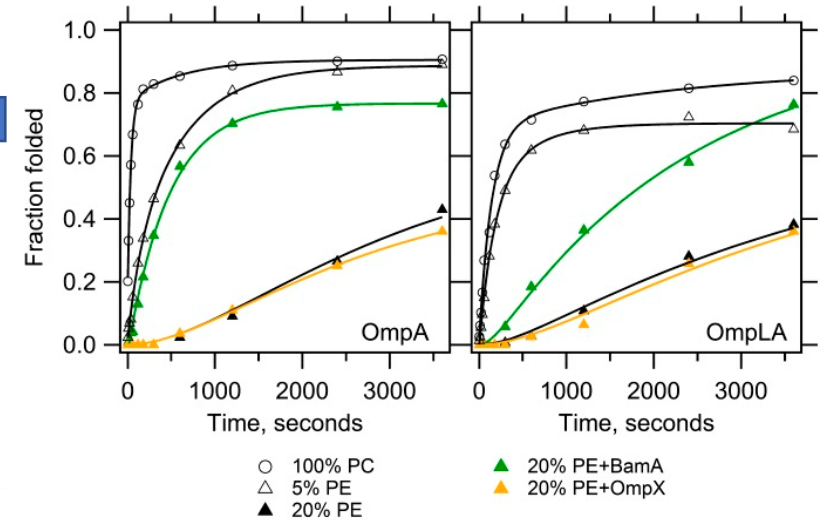
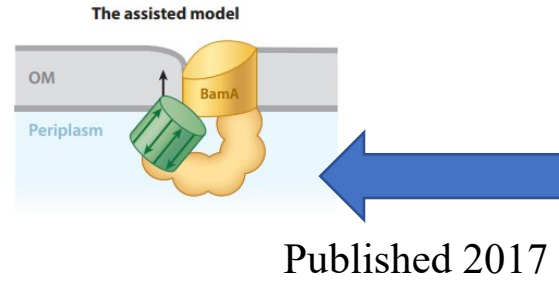
Postdoc

2012-2014 at JHU

Biophysics of prokaryotic  $\beta$ -barrel membrane protein folding

Be bold, be humble.

### Biogenesis of Outer Membrane Proteins



New pathway(s) to common ground so that one may begin to merge *in vivo* and *in vitro* observations on the biogenesis of beta barrel OMPs

“It often happens that things are other than what they seem, and you can get yourself into trouble by jumping to conclusions” Paul Auster, Moon Palace

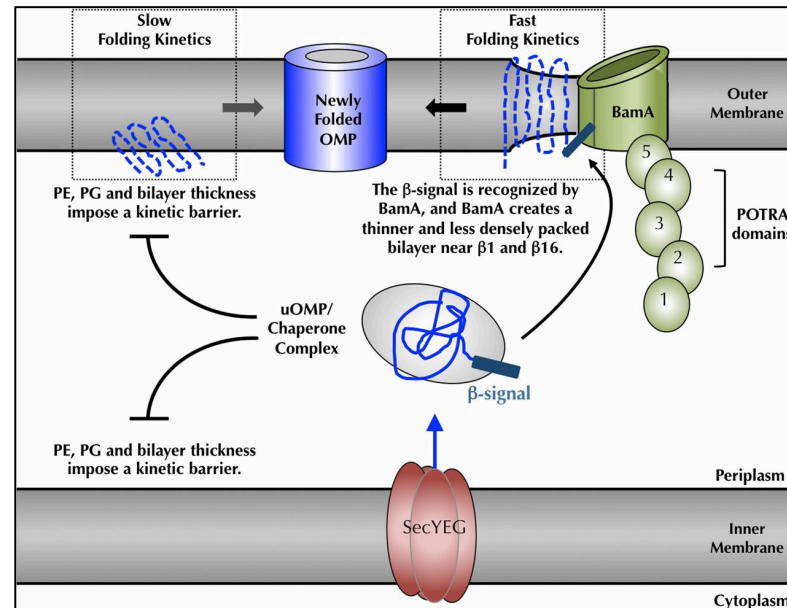
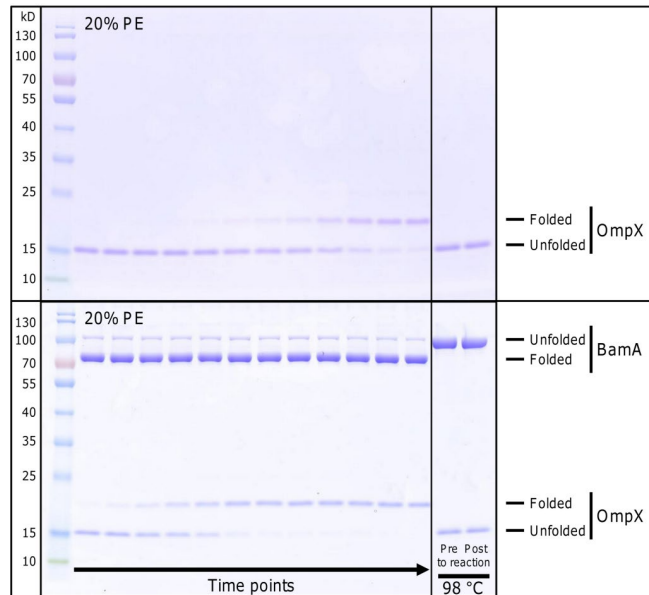
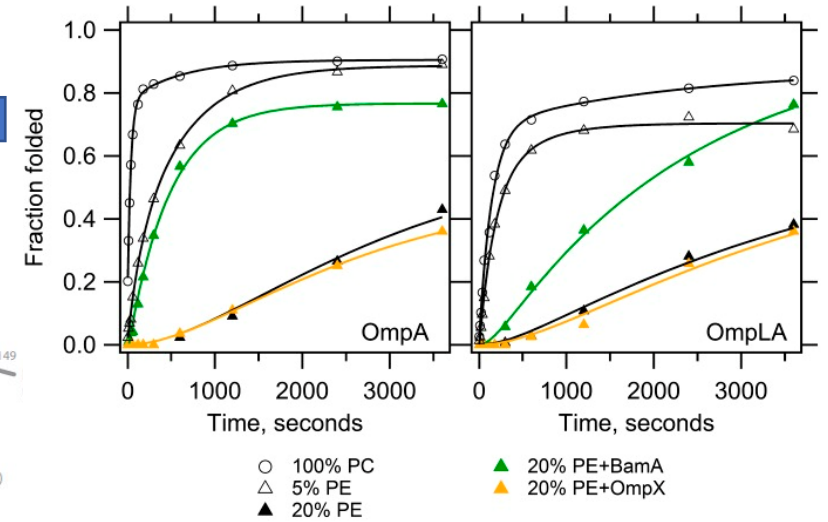
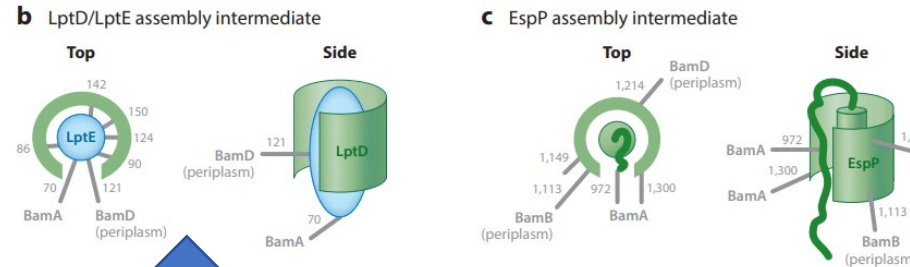
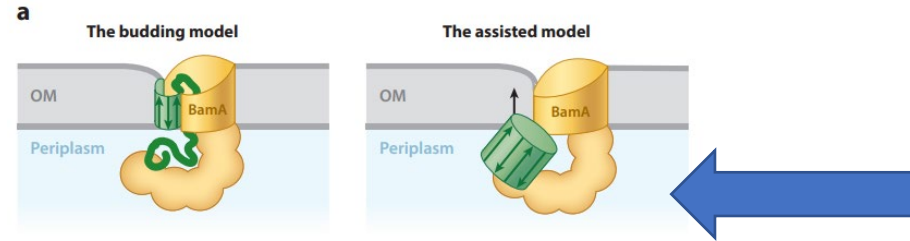
Postdoc

2012-2014 at JHU

*Biophysics of prokaryotic  $\beta$ -barrel membrane protein folding*

Use the tools at your disposal that allow you to answer the question you are asking.

Biogenesis of Outer Membrane Proteins



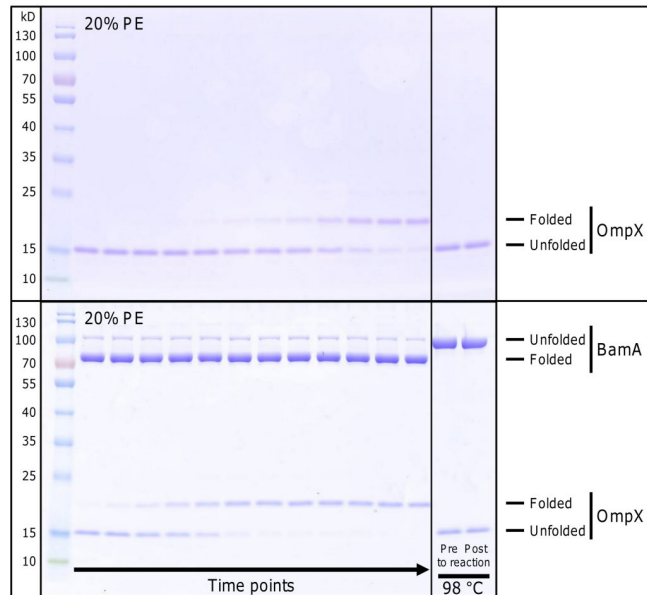
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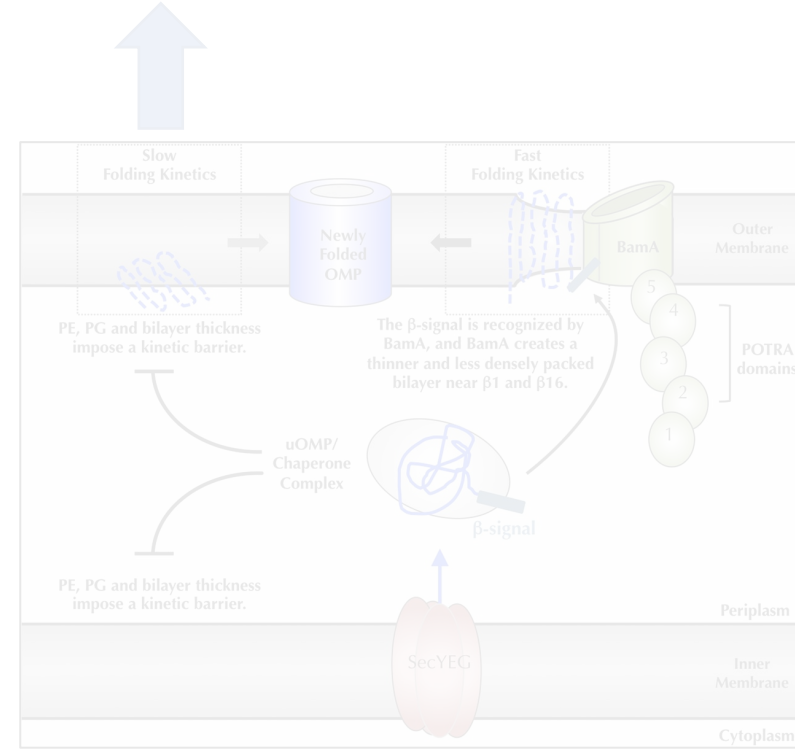
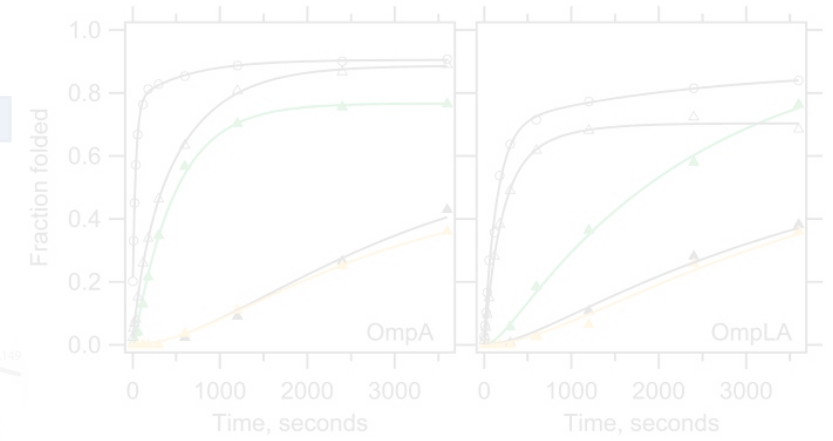
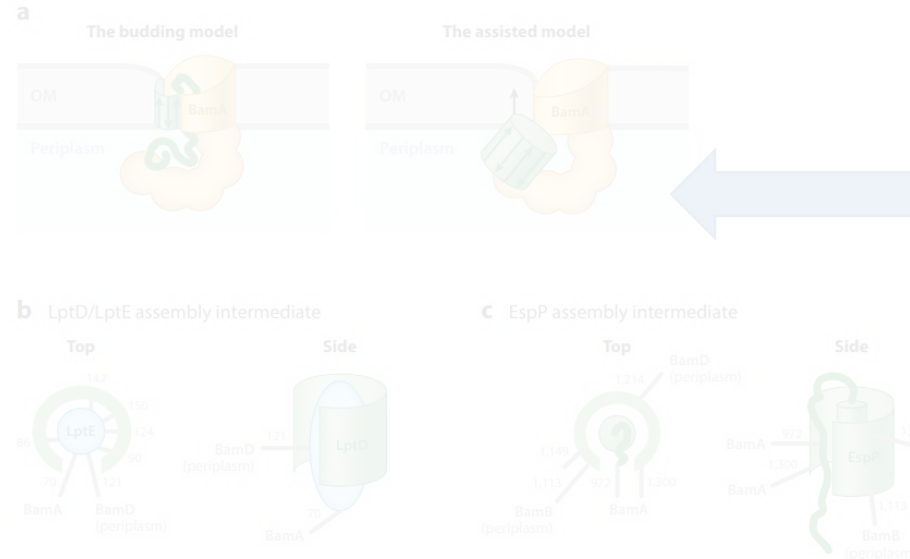
*Biophysics of prokaryotic  $\beta$ -barrel membrane protein folding*

Use the tools at your disposal that allow you to answer the question you are asking.

You might not get a bigger boat...



## Biogenesis of Outer Membrane Proteins





What if we do need a bigger boat?



Doctorate  
2009-2012  
University of Stuttgart

*Bioengineering of eukaryotic  
β-barrel membrane proteins*

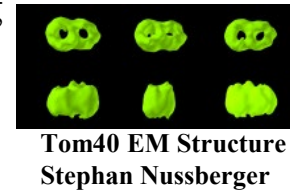
What if we do need a bigger  
boat?

Built the toolbox that you  
require through  
collaboration.

Collaboration is key to thrive in any environment

Goal: Bioengineer a β-barrel membrane protein to a  
functional nanopore capable of DNA sequencing

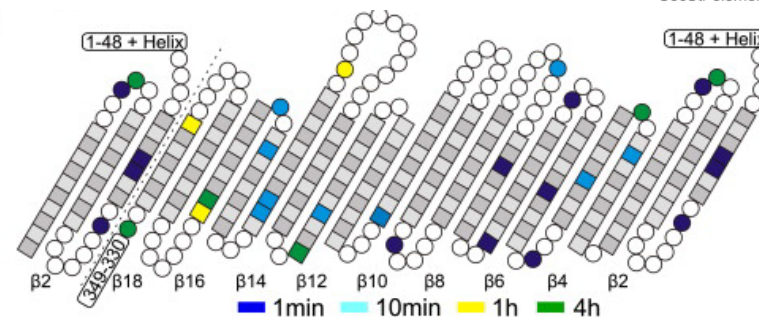
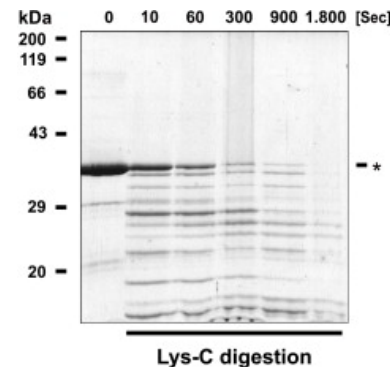
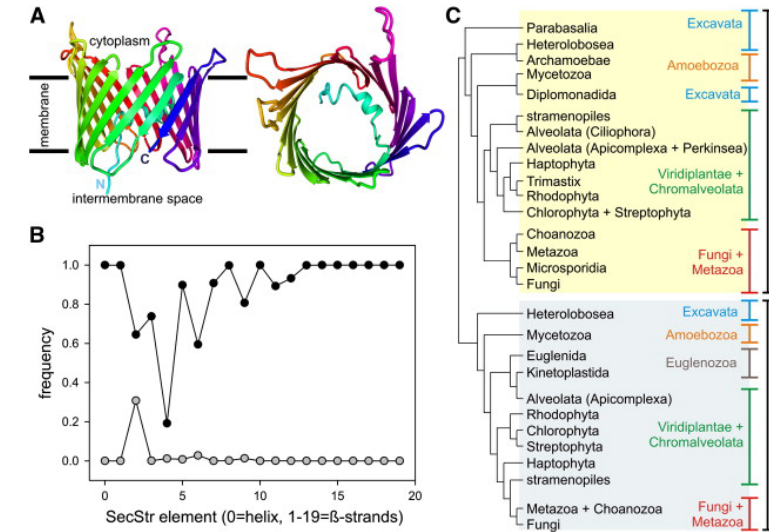
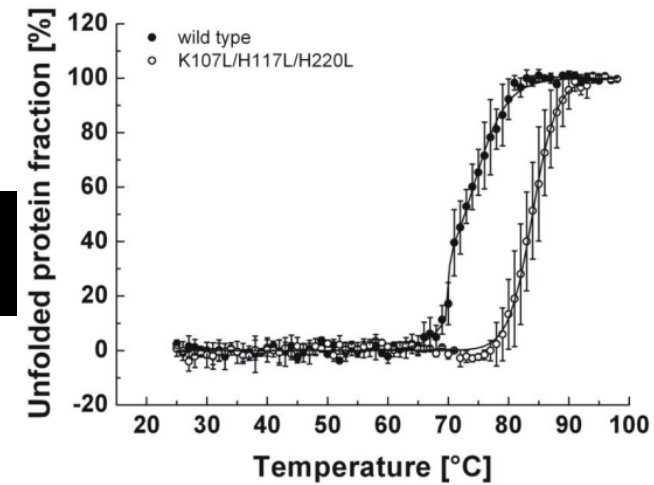
→ there was no high-resolution atomic structure



- Collaboration with the University of Illinois Chicago  
→ computational model to determine thermal instable  
(barrel) elements

- Collaboration with the University of Frankfurt  
→ ‘mine’ all known sequences to build a structural  
homology model

- Collaboration with Life Science Center Core Facility  
→ Mass Spectrometry to confirm homology model



■ 1min ■ 10min ■ 1h ■ 4h



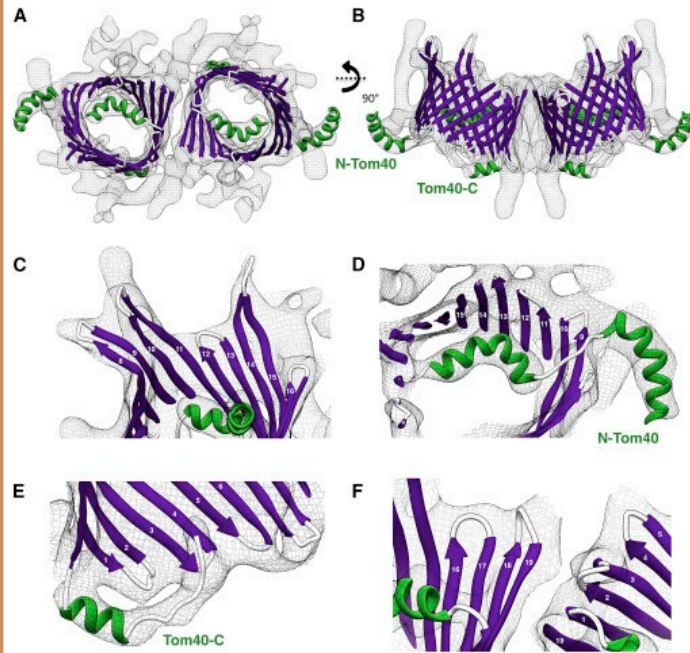
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*Bioengineering of eukaryotic  
β-barrel membrane proteins*

What if we do need a bigger  
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Built the toolbox that you  
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collaboration.

Collaboration is everything



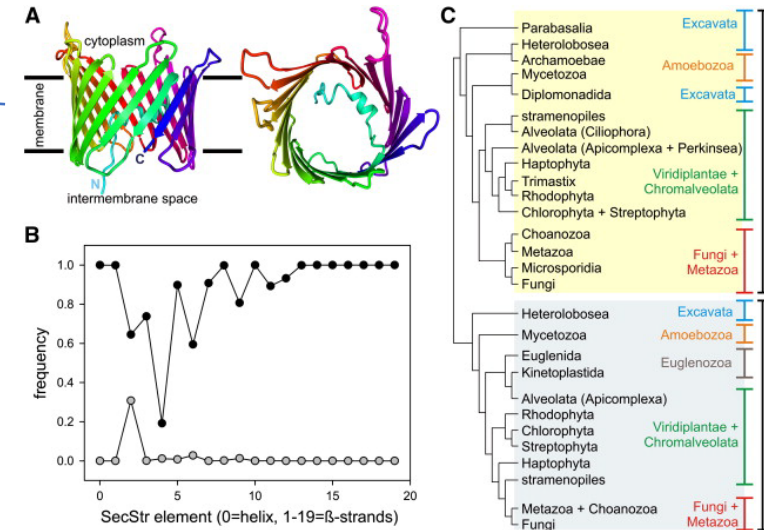
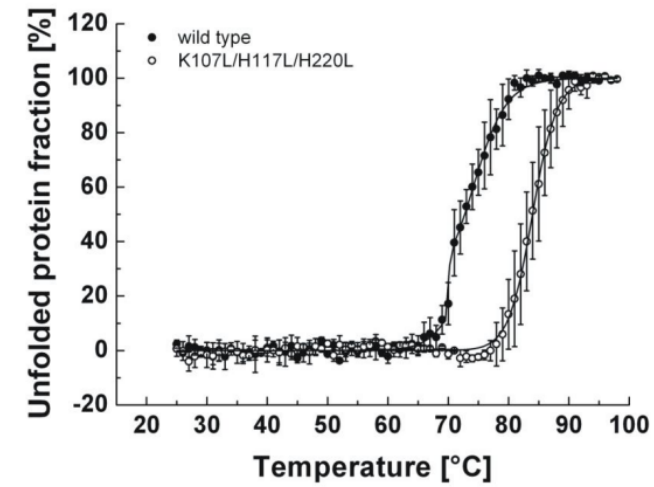
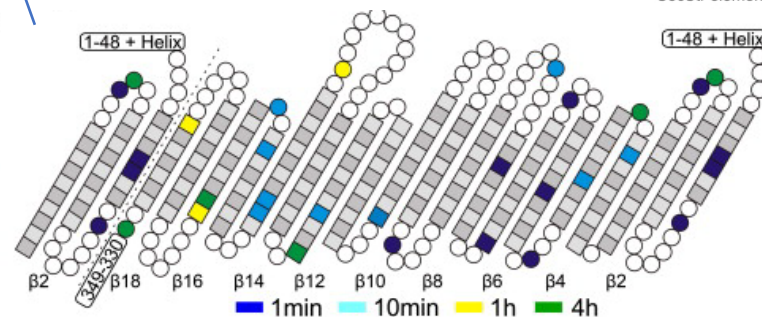
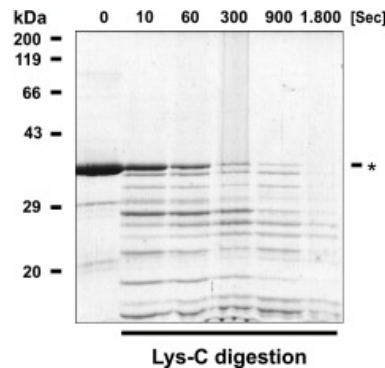
Biophysics  
& Thermodynamics

Computational  
Biology

Homology model  
fit into 6.8 Å map  
with an expected  
accuracy of ~1 Å

Cryo-EM Structure published in  
2017 in Cell

Mass Spectrometry



Published 2011

Doctorate  
2009-2012  
University of Stuttgart

*Bioengineering of eukaryotic  
β-barrel membrane proteins*

What if we do need a bigger  
boat?

Built the toolbox that you  
require through  
collaboration.

Collaboration: thrive to be constructive

Credit where credit's due

written

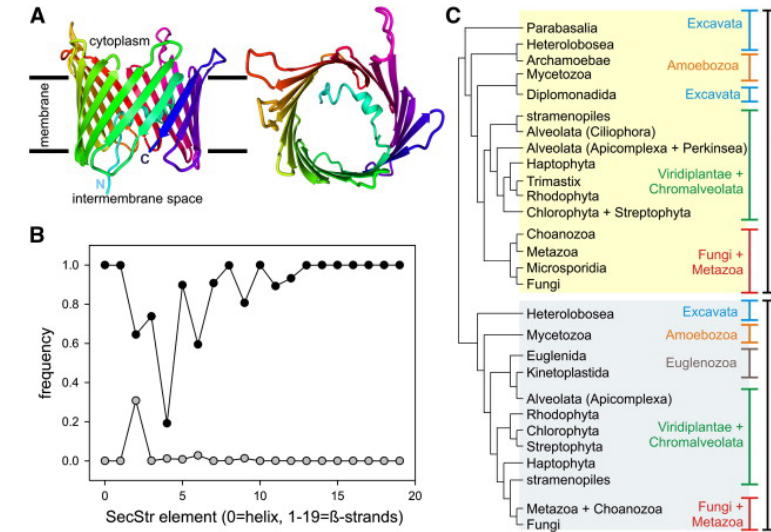
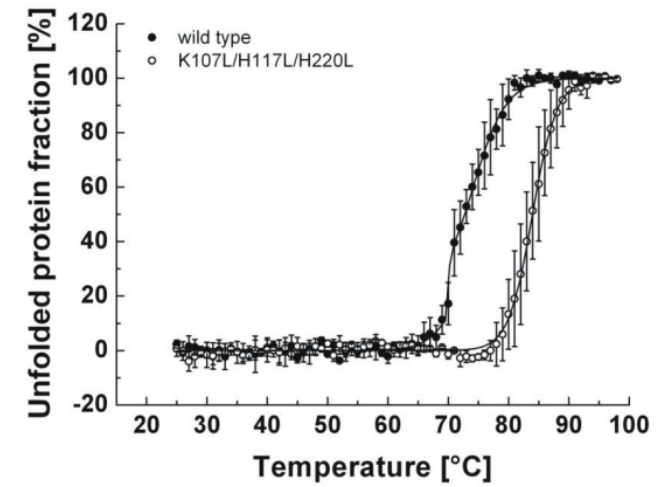
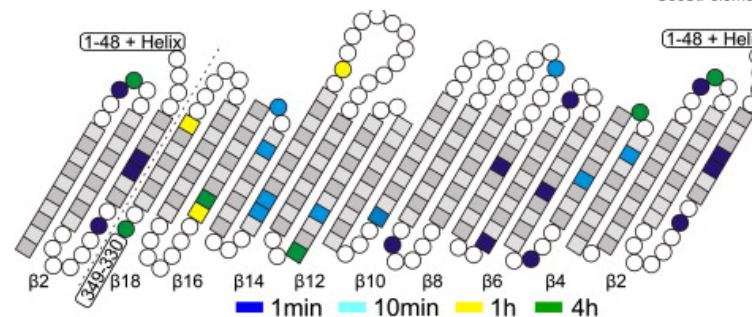
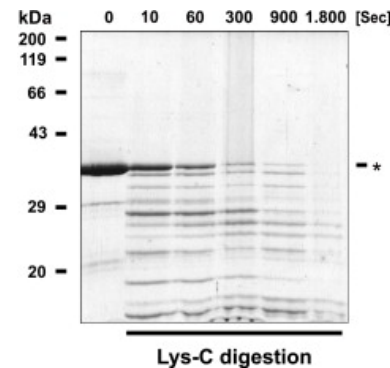
papers  
reports

...

verbally

in meetings  
in conversations

...



What if we do need a bigger boat?





What if we do need a bigger boat?

Constructive collaboration is everything and will allow you to thrive in any environment.



“Change is constant.”

Heraclitus

1<sup>st</sup> Postdoc at JHU  
2012-2014

*Biophysics of prokaryotic  $\beta$ -barrel  
membrane protein folding*

“Change is constant.”

Heraclitus

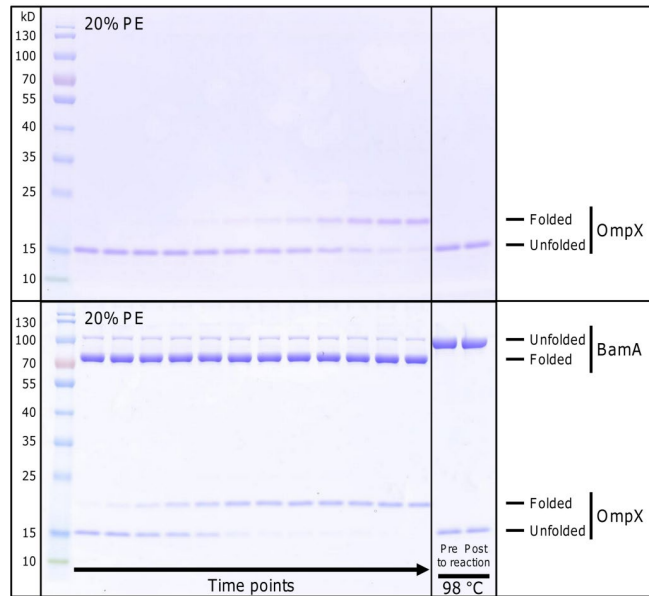


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*Biophysics of prokaryotic  $\beta$ -barrel  
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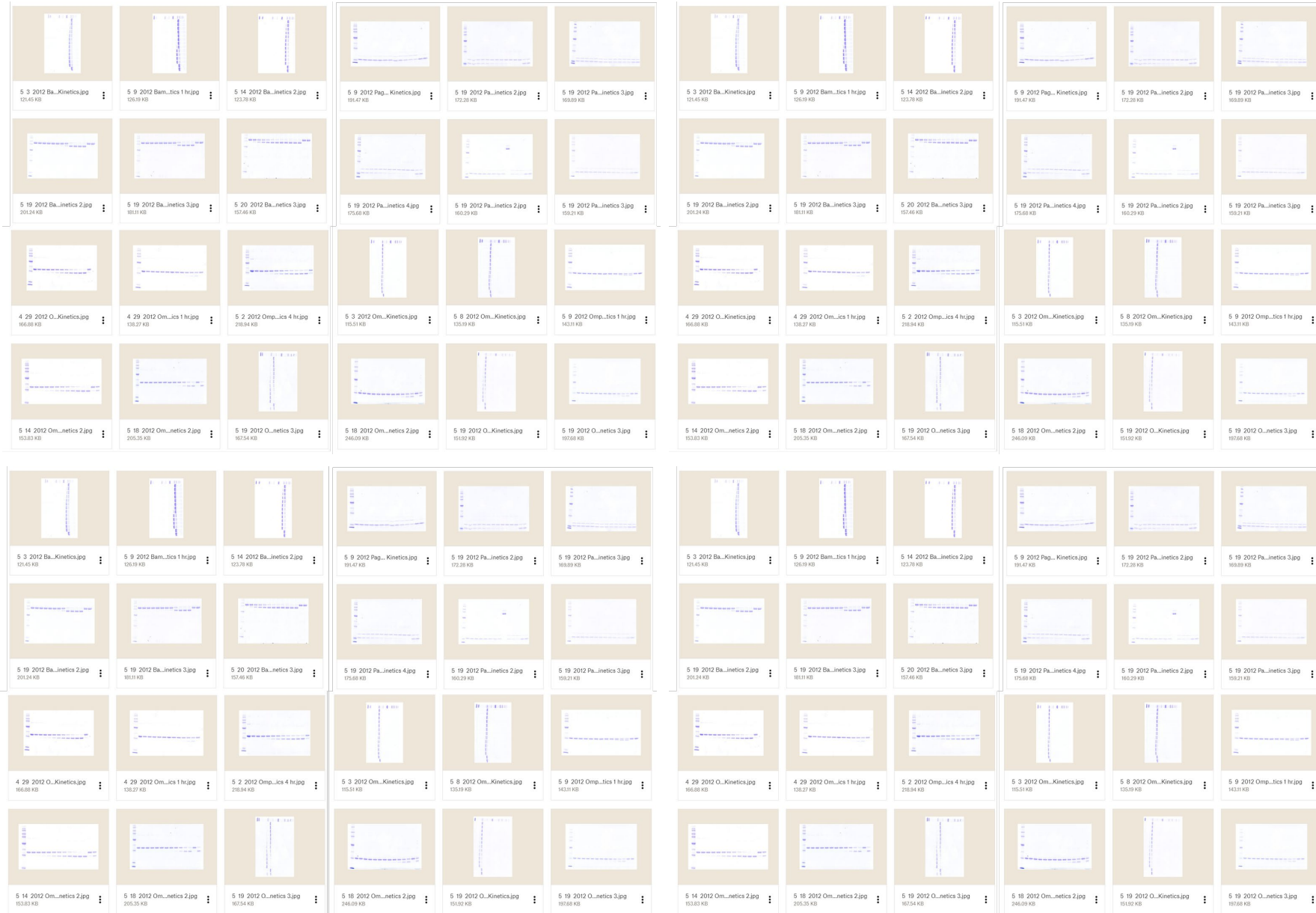
Heraclitus



Diversify your skill set

recognize when it is time to move on!

1096 gels...



# 2<sup>nd</sup> Postdoc at UIC 2014-2014

*Computational biology of  
prokaryotic  $\beta$ -barrel  
membrane protein folding*

“Change is constant.”

Heraclitus

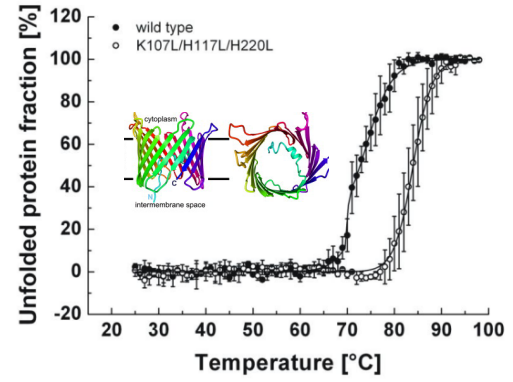
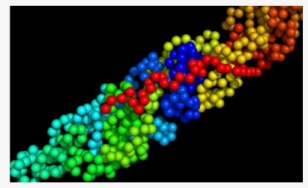
## Recognize what is realistic, when not to be bold, and trust your ‘gut’

UNIVERSITY OF ILLINOIS CHICAGO  
**Center for Bioinformatics and Quantitative Biology**  
Colleges of Engineering and Medicine



### Computational Design of Bionanopores and Decellularized Biomaterial. $\infty$

We also have unique and significant strengths in designing novel devices for data measurement. Bionanopores has the promise to sequence and quantify virtually all biologically relevant macromolecules. Its successful development will enable detection of modified state of proteins, as well as the presence of bacterial/virus.



Make the most of it!



Article  
pubs.acs.org/JACS

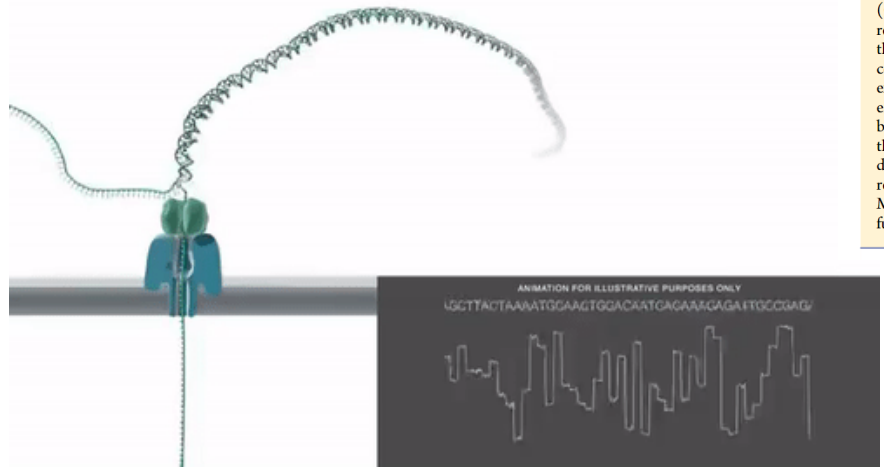
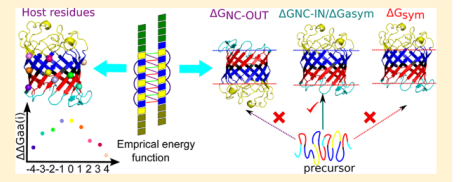
### Outer Membrane Protein Folding and Topology from a Computational Transfer Free Energy Scale

Meishan Lin, Dennis Gessmann, Hammad Naveed, and Jie Liang\*

Department of Bioengineering, University of Illinois at Chicago, Chicago, Illinois 60607, United States

[Supporting Information](#)

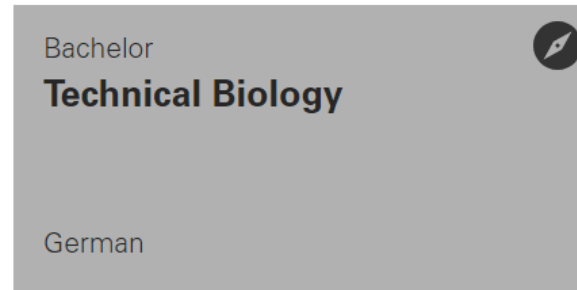
**ABSTRACT:** Knowledge of the transfer free energy of amino acids from aqueous solution to a lipid bilayer is essential for understanding membrane protein folding and for predicting membrane protein structure. Here we report a computational approach that can calculate the folding free energy of the transmembrane region of outer membrane  $\beta$ -barrel proteins (OMPs) by combining an empirical energy function with a reduced discrete state space model. We quantitatively analyzed the transfer free energies of 20 amino acid residues at the center of the lipid bilayer of OmpLA. Our results are in excellent agreement with the experimentally derived hydrophobicity scales. We further exhaustively calculated the transfer free energies of 20 amino acids at all positions in the TM region of OmpLA. We found that the asymmetry of the Gram-negative bacterial outer membrane as well as the TM residues of an OMP determine its functional fold in vivo. Our results suggest that the folding process of an OMP is driven by the lipid-facing residues in its hydrophobic core, and its NC-IN topology is determined by the differential stabilities of OMPs in the asymmetrical outer membrane. The folding free energy is further reduced by lipid A and assisted by general depth-dependent cooperativities that exist between polar and ionizable residues. Moreover, context-dependency of transfer free energies at specific positions in OmpLA predict regions important for protein function as well as structural anomalies. Our computational approach is fast, efficient and applicable to any OMP.



the journey so far...  
2009-2012

“Change is constant.”

Heraclitus



Explain biology through physics & mathematics  
and apply engineering to create biotechnologies

# Pharma Startup 2014-2015

*95% Biophysics  
5% Mass spectrometry  
of biotherapeutics*

“In the end we retain from our studies only that which we practically apply.”

Johann Wolfgang von Goethe

## How I diversified my skill set in the biopharmaceutical industry



Therapeutic Proteins International, LLC

*95% Biophysics 5% Mass Spectrometry of Biotherapeutics*

Pharma startup was a 1-year ‘boot camp’ of 40-70 something hours of weekly work

1. (c)GMP and GDP training
2. Physical lab notebooks was key for me to develop GDP skills
3. Draft, write, publish and execute analytical methods in (c)GMP environment
4. FDA audit experience
5. Part time in QA (Quality Assurance)

→ This year set the foundation for me to be able to join the biopharmaceutical industry

Pfizer  
2015-2022

*Mass spectrometry of  
biotherapeutics*

“In the end we retain from our studies only that which we practically apply.”

Johann Wolfgang von Goethe

## How I diversified my skill set in the biopharmaceutical industry

A time to be mentored...

*95% Biophysics 5% Mass Spectrometry of Biotherapeutics*

How would you feel about making this 50:50?

→ jump at an offer like this

→ do not be afraid to learn something new

I became a mass spectrometrist and realized I had a passion for something I would have never expected.

Listen to the advice you do not want to hear:

1. The feedback that ‘bugs you’
2. The comments you were ‘dreading’
3. The experiment you do not want to do/repeat

Digest them

Write them down

Then work on it and make it a platform to stand on

Pfizer  
2015-2022

*Mass spectrometry of  
biotherapeutics*

“In the end we retain from our studies only that which we practically apply.”

Johann Wolfgang von Goethe

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*Mass spectrometry of  
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“When the trust account is high, communication is easy, instant, and effective.”

Stephen R. Covey, *The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change*

Crucial lessons learned...some thoughts on trust

I personally never appreciated the following:

“...trust is built over time and lost quickly...”

Do trust your peers and your peers will trust you.

*or, in other words*

Respect your peers and your peers will respect you.

Trust creates room for independence and creativity.

(c)GMP is the ‘opposite of trust’: check, review & verify.  
→ yet again, trust is needed.

Pfizer  
2022-present  
*Mass spectrometry of  
biotherapeutics*

“Change is constant.”

Heraclitus

Be bold in hindsight

pharma's almanac  
NICE INSIGHT'S CONTENT COMMUNITY

## Evolution is Essential in the Dynamic Pharmaceutical Industry

March 19, 2020 PAP-Q1-20-CL-033

“The pharmaceutical industry is defined by constant  
change and evolution.”

Adapt and evolve with change

or

Make yourself a change

Decision to leave IL after seven years and transfer internally to MA

→ re-orient and align my personal scientific passions with my professional  
scientific passions

What may we take away  
from this?

Be bold, be humble.

Use the tools at your disposal that allow you to answer the question you are asking.

*or*

Built the toolbox that you require through collaboration.

Constructive collaboration is everything and will allow you to thrive in any environment.

Specialize and diversify through hands on experience. They are not mutually exclusive!

Listen to the advice you do not want to hear.

Do trust your peers and your peers will trust you.

Change is constant: adapt and evolve with it, or, make a change yourself.

What may we take away  
from this?

“All we have to decide is  
what to do with the time that  
is given us.”

J.R.R. Tolkien, *The Hobbit*



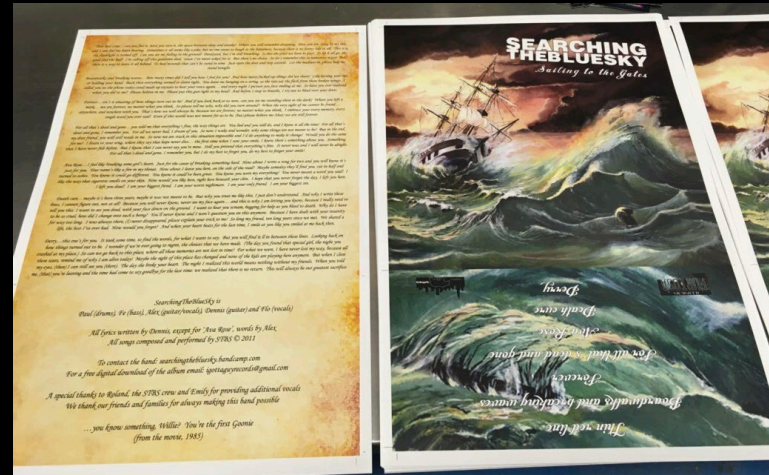


P.S.

### Two Hunters

Written by Dennis Geismann

A bird was screeching. It was sitting at the top of the tree. Its screams reached high into the sky, out of the jungle, traveled over the trees and were finally answered by the sound of the crashing waves out in the bay. Behind the bay lay the reef. The reef itself was a sunken jungle. If someone were to walk through it, breathing like a fish, one could see a perfect reflection of the jungle that was sitting on the island itself. It was filled with beautiful plants and fascinating creatures of all the colors of the spectrum. Spikes of dead beings grew on underwater trees, which created shadows on the bottom of the sea, often mistaken for the predators hunting in this jungle. The smaller beings sought refuge in one of the many underwater caves. The smaller things hunted even smaller things and the small things were eaten by bigger things. Around them, the world was growing in a never ending circle, forced on them, by nothing more than the laws of the universe itself. Every tiny aspect of this world embraced all facets of its world in a perfect symbiosis. It seemed indestructible. Lasius woke up and looked around. At first, he was wondering where he was. Then he remembered





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