School of Engineering
PhD Information Session

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Contents

- The Basics:
  - What is a PhD?
  - Why do a PhD?
  - Why not to do a PhD.
- PhD Funding
- Meet an Engineering PhD Student.
- PhD Research Areas

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A PhD: The Basics

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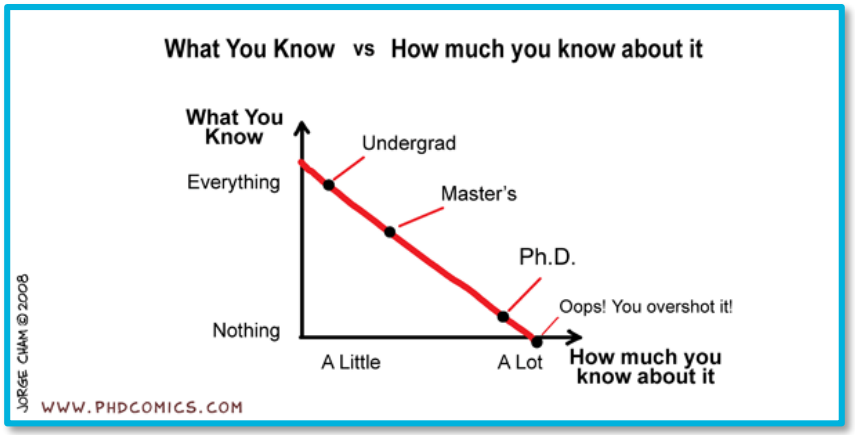
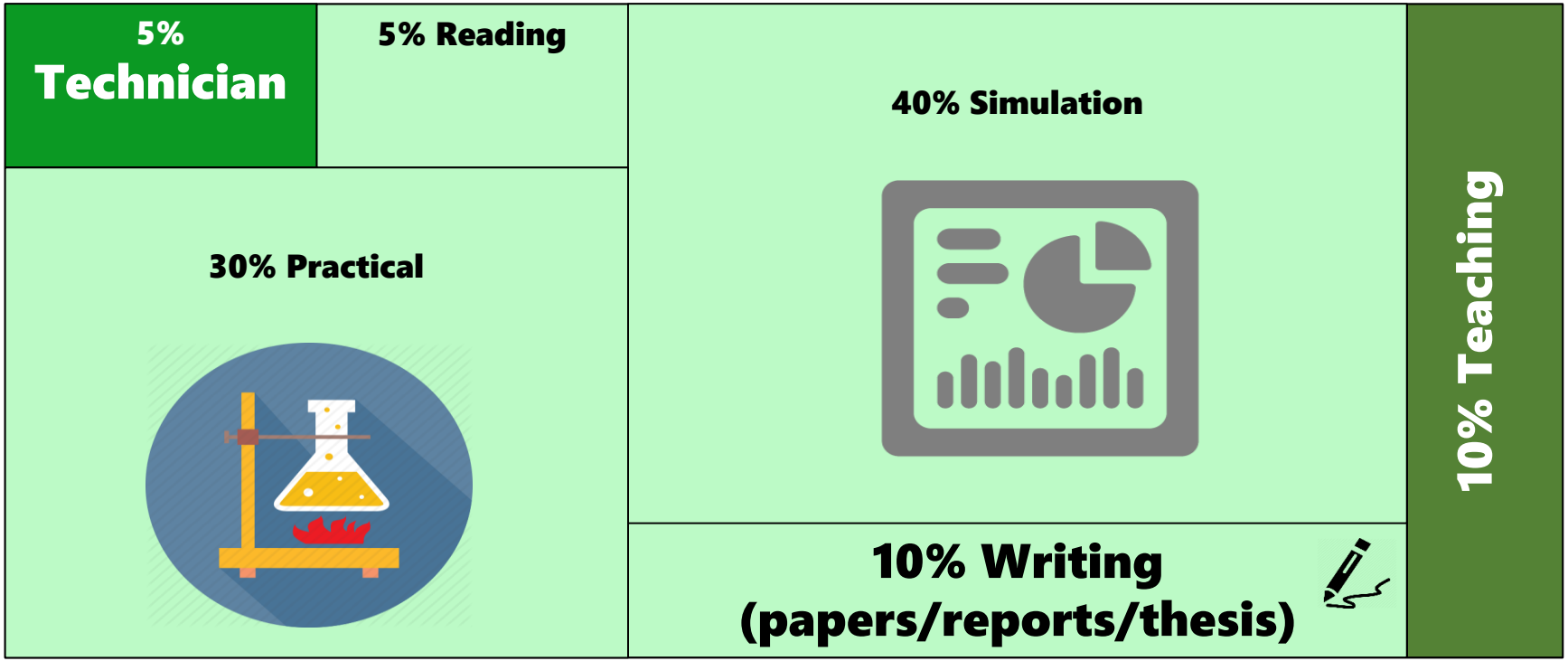
What is a PhD?

- 3 to 4 years of post-graduate study following either a Bachelors or Masters level course.
- A requirement to produce a thesis offering **a significant new contribution to knowledge** in their subject.
- A PhD = A doctorate = Dr X [*e.g. Strangelove, No or Dolittle*]
- A PhD can be from any subject, but all are *Doctors of Philosophy.*
- Day-to-day work is research, but tasks can include teaching.



What does a PhD in Engineering entail?

- It varies… Each PhD is entirely individual. One example:



Why do a PhD?

- **#1 Because you are really interested in a subject.**
- **#2 Because you are really interested in a subject.**

(i.e., active research; freedom which comes with it; search for information)

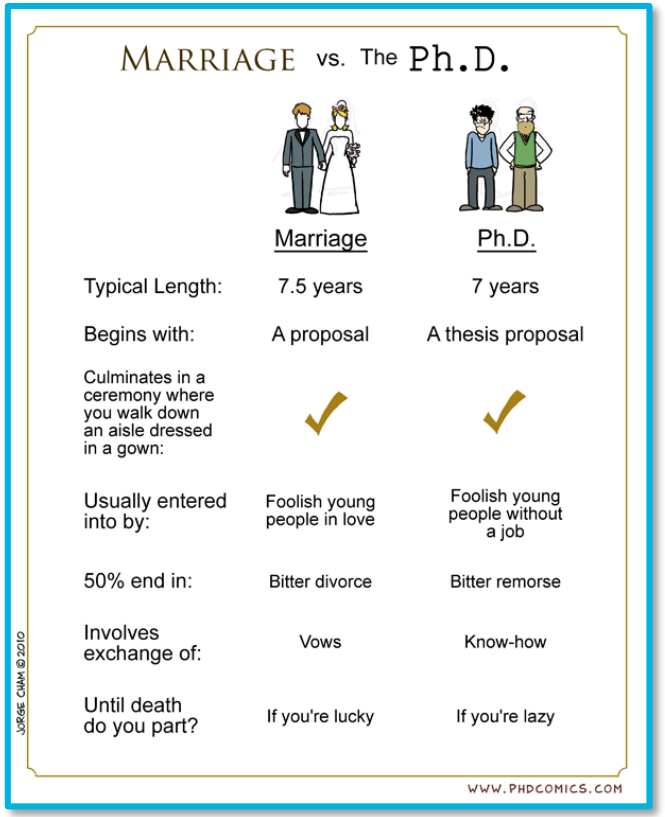
Secondary (tertiary?) considerations…

- Because you enjoy research (think 3rd year projects?)
- Because you want to make a contribution.
- To access research-based jobs of interest in Academia OR Industry.
- Because of the transferable skills you will develop

https://www.jobs.ac.uk/careers-advice/studentships/2221/why-should-you-do-a-phd

~~Why do a PhD?~~ Reasons NOT to do a PhD!

- To get rich!! Think about type of job not salary.
- Because I want to extend my stay at University / my partner is here for another year.
- Because my supervisor tells me how wonderful the subject is.
- Because it sounds easier than getting a job.
- **Because I don't know what else to do.**
- 3-4 years is a big commitment. Don't take the decision lightly.



How to apply for a PhD?

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The Applications Process

- To be accepted for a PhD you must have:
  - At least **a 2.1 undergraduate degree** in a relevant subject
  - Bachelors Award minimum,
  - MSc/MEng recommended but not essential
  - **English** to IELTS level 6.5 (UK nationals, and those who have studied here are exempt).
  - Often you need to provide a **Research Proposal**

- Apply for your PhD here: https://warwick.ac.uk/fac/sci/eng/postgraduate

- **You need to have discussed this with a member of staff first!**

How to finance a PhD?

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The PhD Funding Process

- Once accepted to a course you will be able to start your PhD subject to you paying (2024/25 rates):
  - Home Students - £4,742 per year
  - International Students - £29,200 per year (including EU)

- Many students self-finance their way through a PhD.

- However, many avenues for funding exist, covering fees and a stipend (typically £16,400/year tax free)

School of Engineering Home (UK) PhD Scholarship Scheme

- For students who qualify for the **home fee rates.**
- Full funding for fees and stipend, for 3.5 years.
- Must apply with a Engineering academic.
- Requires a **CV** and a **3 page Research Proposal**, and an **application form.**
- Applicants must first make PhD application, then apply.
- Start date – October 2024
- http://warwick.ac.uk/soepss
- Deadline 1st April 2024 .

Chancellor's International Scholarship

- For students who qualify for **international fee rates** (including EU students from 21/22).
- Full funding for fees and stipend, for 3.5 years.
- Must apply with an academic.
- Requires a **Research Proposal**, and an **application form.**
- Applicants must first make PhD application, then apply
- Start date – October 2024
- Deadline **14th December 2023**.
- https://warwick.ac.uk/services/dc/schols_fund/scholarships_and_funding/chancellors_int

42 available for whole University – extremely competitive.

Chinese Scholarship Scheme

- For **Chinese nationals** only.
- 30 studentships for the University.
- **Engineering a priority**: 10 nominations in 2023, 5 successful.
- Applicants are obliged to return to China after graduation.
- Applications to Warwick first, to CSC second.
- **No other CSC applicants will be funded outside this competition.**

https://warwick.ac.uk/services/dc/schols_fund/scholarships_and_funding/warwick_china

Start date – October 2024

- Deadline **16th January 2024**.

30 expected for whole University – very good chance of success.

All Students

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Individual Scholarships attached to Research Projects

- Academics hold a number of research awards, many with PhD Studentships.
- Full funding for fees and/or stipend, for 3 to 3.5 years, depending on the scholarship.
- A list of all funded projects we know about are here: https://warwick.ac.uk/fac/sci/eng/postgraduate/funding
- A database of all projects is here: https://warwick.ac.uk/fac/sci/eng/postgraduate/phdm/project/
- Talk to the academic(s) in the field you are interested in, find a project and then apply to a scholarship.

All Students

Other Sources of Funding

- Warwick Postgraduate Sanctuary Scholarships

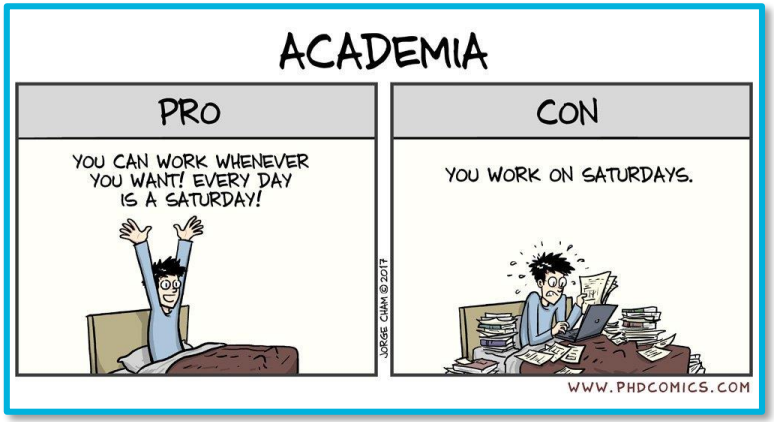
https://warwick.ac.uk/services/dc/schols_fund/scholarships_and_funding/sanctuary

- National Government Scholarships

- Other Universities / Departments
- https://www.findaphd.com/
- https://www.jobs.ac.uk/

What Next?

- Student – Academic Match making! Find an academic in an area you are interested in.
- Speak to / email me if you want a pointer to a particular subject area (n.khovanova@warwick.ac.uk)
- Choose a Scholarship competition (or two)
- Work on an application – compile an impressive CV and Research Proposal (if necessary)
- Ask for help! (email above)
- Submit your PhD application well in time (you can add documents later)



What does an Engineering PhD Student look like?

Ollie Jackson, PhD student in Fluid Mechanics

Liam Weaver, PhD student in Biomedical Modelling

Kyrylo Melnyk, PhD student in Power Electronics

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Day-to-Day Activities

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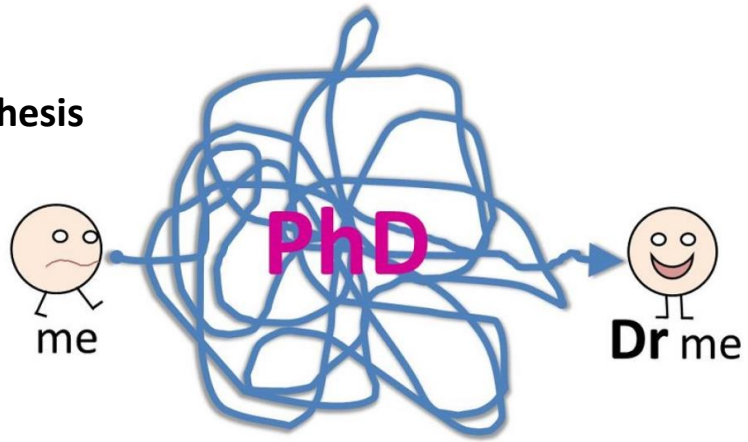
What does a Ph.D. student do????

- **Full-time Research (Part-time)**
  - **Learning, reading, writing, teaching, thinking and questioning**
  - **Theoretical, computational, experimental**

- **You work with your supervisor not FOR you supervisor**

- **NO lectures, NO assignments:**
  - **PAPERS PAPERS PAPERS and eventually a thesis**

- **It takes time for your ideas to evolve.**
  However, don't let it take too long..
  You only have 3/4 years!



How does your week look?

Work Patterns

- There is no such thing as an **“average PhD week”** and how you arrange your week will depend on a number of factors:

  -Subject area (very different work patterns will emerge if you have to be in a lab for example).

  -Your learning style.

  -Your personal preferences

Number of Hours

- If you ask current PhD students, you will get a range of **estimates from 35 to 75 hours.**
- A PhD is indeed hard work and there will be different demands on your time, especially if you undertake teaching or other university-related activities.

- As with all things, there is a balance to be struck. **A physical presence does not necessarily mean productivity.**

What do I need to do?

- Find a subject
- Find and *meet* a supervisor
- Choose a project (advertised/self-proposed)
- Find funding (scholarship/project/self)
- Apply (funding & doctoral college)

Extra-Curricular

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What else do we do?

Postgraduate (PG) Courses

- Courses in everything and anything. Including **languages** and **teaching qualifications**

Work Opportunities at University

- Graduate Teaching Assistant (GTA)
- Research Assistant (RA)

PG Researcher Events and Facilities

- Wolfson Research Exchange (Lib.), Research Refresh, PG Tips, PG Pub Quiz, PG Open Jam and Acoustic Night, Wellbeing Hour etc.

Conferences, Journals, and Travel

- Opportunity to **present your research globally**

Collaboration with other Ph.D. students and other Universities

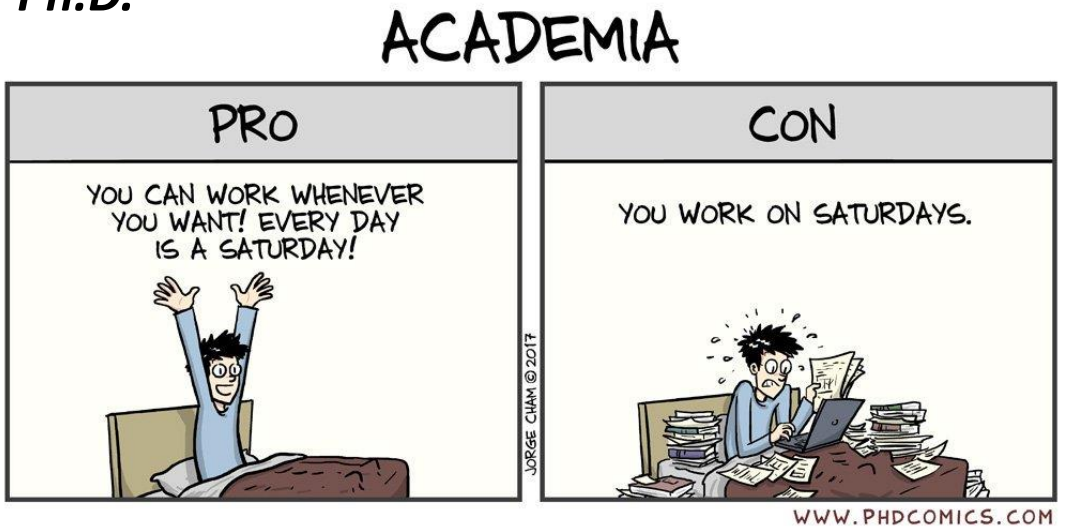
- Not only departmentally but again globally

Sports Clubs and Societies

- The same as undergraduate. **A large PG cohort at Warwick**

Most Importantly Work-Life Balance

- There **is little limit to working hours** (max is 24 per day)
- **Be ambitious** but give yourself the chance to escape from research
- ***Have a social life besides your Ph.D.***
- **Learn to manage your time & focus on what really matters**



How did you decide?

- Previous experiences in doing research
- Enjoy learning and improving personal development
- ***Really*** enjoy your subject area and your project
- What do you think you would like to do after?
- Make sure you get on with your supervisor

Don't think of it as the next step that you 'should' be doing

Research Excellence in the School of Engineering

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Welcome to the School of Engineering

Systems and Information Engineering

Systems and Information brings together expertise in: nonlinear and stochastic systems; modelling of human activity; neural engineering; telemedicine; imaging; and synthetic biology. Much of the research undertaken is around health and security and the nature of the work means that many labs are cross-group.

- Biomedical and Biological Systems
- Information Engineering
- Systems Modelling and Control

Electrical and Electronic Engineering

Power, sustainability and improved communications are at the heart of our Electrical and Electronic stream. Key areas of research include: artificial olfaction (or 'electronic nose'); electrical energy conversion; grid-scale energy storage; nanoscale communications; and quantum devices.

- Connected Systems
- Electrical Power
- Sensors and Devices

Mechanical and Process Engineering

The largest and most diverse stream, Mechanical and Process Engineering includes: fluid mechanics; fire and explosion hazards; chemical engineering; precision and surfaces; 3D printing; and thermal energy technology.

- Fluid Dynamics and Multiscale Modelling
- Measurement and Machines
- Reaction and Materials Engineering
- Sustainable Thermal Energy Technologies

Civil and Environmental Engineering

Our Civil and Environmental researchers work on a broad range of issues underpinning civil engineering. Combining modelling with practical experimentation, they tackle issues such as: sustainable housing; dynamic loading of structures; earthquake destabilisation of land; and pollution of waterways.

- Ground Engineering
- Structural Engineering
- Water Engineering

https://warwick.ac.uk/fac/sci/eng/research/

HetSys Centre for Doctoral Training

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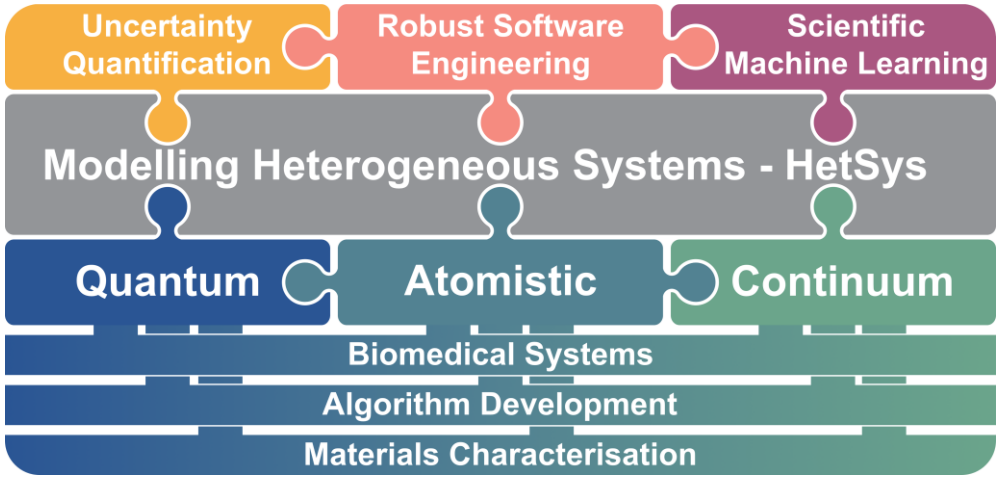
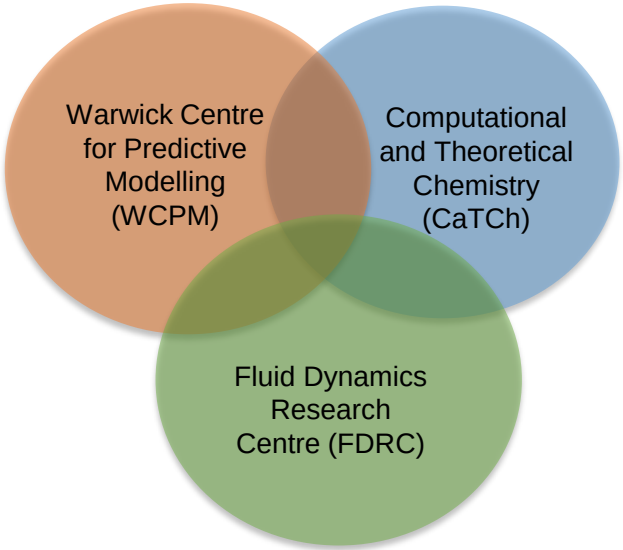
- HetSys CDT promotes **mathematical skills** and **flexible thinking** for **complex physical problems,** e.g. electronic devices, pharmaceutical drug design, superalloys, microfluidics, etc
- Funding available for **4-year project-based PhD programme,** with integrated training in years 1-2 and links to industrial partners
- For more info, contact **Prof James Kermode**
- First 3 projects for Oct 2024 are on our website!
- First round application deadline **25 Jan 2024** (important for international students)



Web: warwick.ac.uk/HetSys | Email: hetsys@warwick.ac.uk | Twitter: @HetSysCDT

HetSys Community

Interdisciplinary community spanning
7 departments and 3 research centres at Warwick



Management Team
James Kermode (Eng)
Julie Staunton (Phys)
Nicholas Hine (Phys)
Sarah Jarratt (Admin)

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+ rest of core team of PhD supervisors

Chemistry
Livia Bartok-Partay
Scott Habershon
Bora Karasulu
Becky Notman
Reinhard Maurer
Gabriele Sosso
Phill Stansfeld

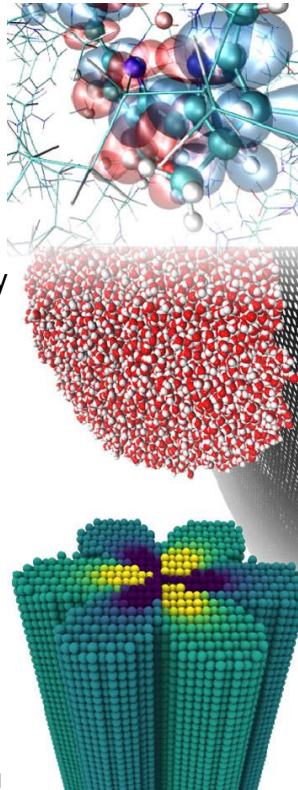
Physics
Tony Arber
Animesh Datta
David Quigley
Tom Goffrey
Ravi Desai

plus:
Life Sciences
WMG

Engineering
Peter Brommer
Duncan Lockerby
Phytos Neophytou
Hatef Sadeghi
Albert Bartok-Partay

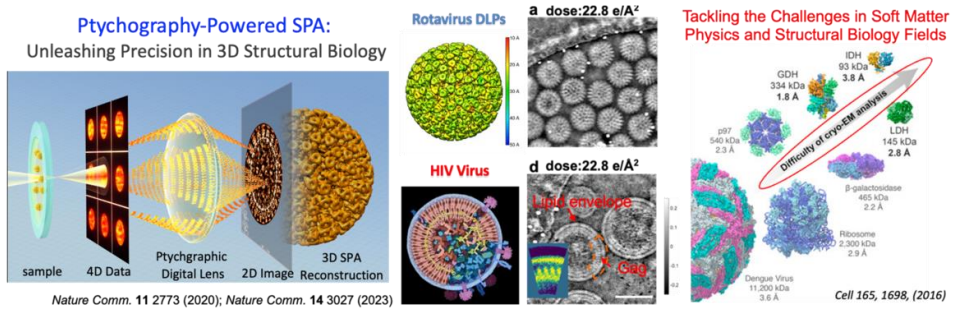
RSE (SCRTP)
Chris Brady
Heather Ratcliffe
Heather Turner

Maths & Stats
Radu Cimpeanu
Thomas Hudson
Susana Gomes
Tim Sullivan
James Sprittles
Jeremie Houssineau

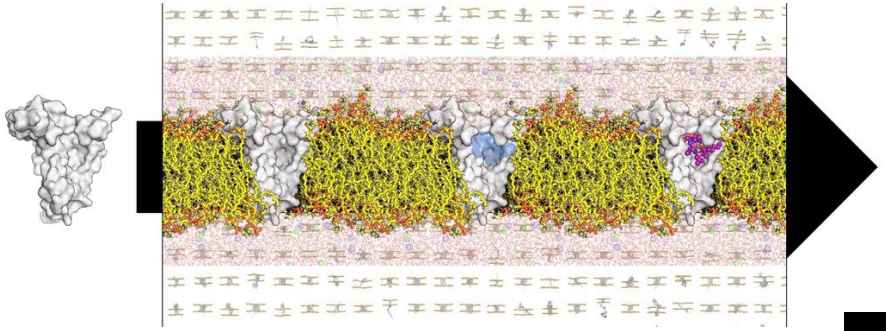


2024 HetSys PhD Projects

GPU-Enhanced Ptychography Integration in Cryo-EM Biological 3D Imaging Framework
Dr Peng Wang (Physics) with Single Particle LLC

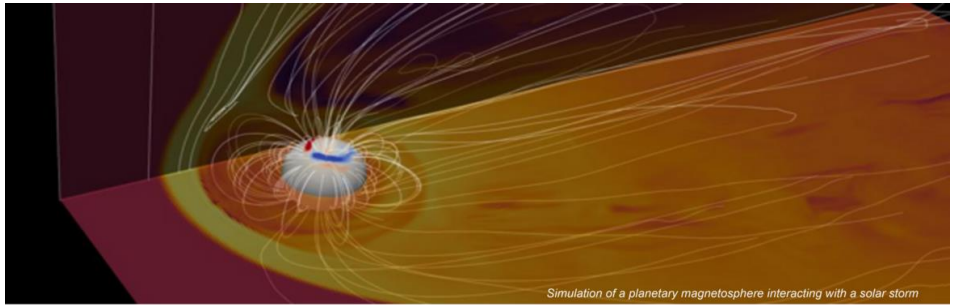


Nature Comm. **11** 2773 (2020); *Nature Comm.* **14** 3027 (2023)
Cell **165**, 1698, (2016)



DRUG-THE-BUG: Determining druggable binding sites in bacterial membrane proteins
Phillip Stansfeld (SLS/Chem) and
Livia Bartok-Partay (Chem)
with Cresset Biomolecular Discovery

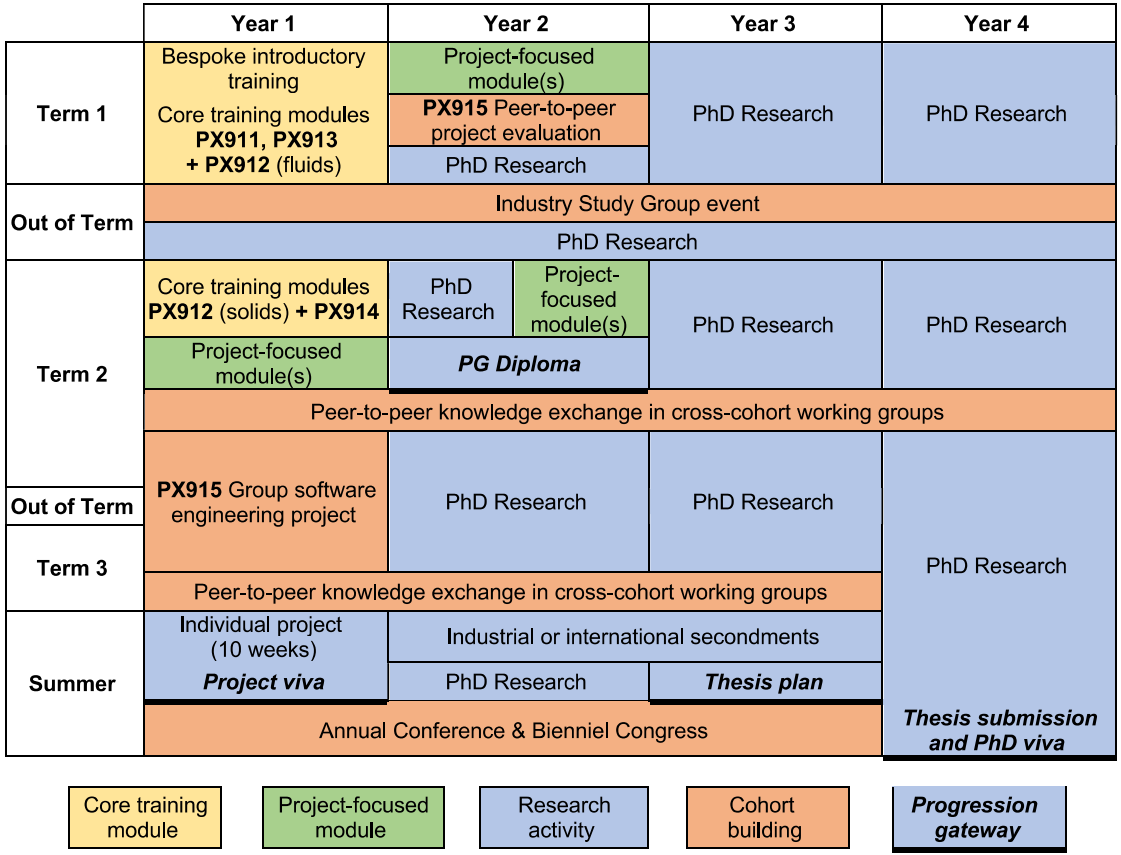
Modelling extreme magnetosphere-atmosphere interactions
Ravindra Desai, Dimitri Veras, Prof. Natasha Jackson-Booth (QinetiQ)



Web: warwick.ac.uk/HetSys | Email: hetsys@warwick.ac.uk | Twitter: @HetSysCDT

HetSys Training Programme

- Training runs throughout the four year PhD programme but most is concentrated in the **first 18 months.**
- Students associated with projects from the start, enabling **bespoke programme** for each student.
- **Common core** ensures broad knowledge of multiscale modelling methods, plus software engineering and UQ techniques.
- Training leads to a **Postgraduate Diploma**
- Years 2-4 predominantly research plus cohort activities.



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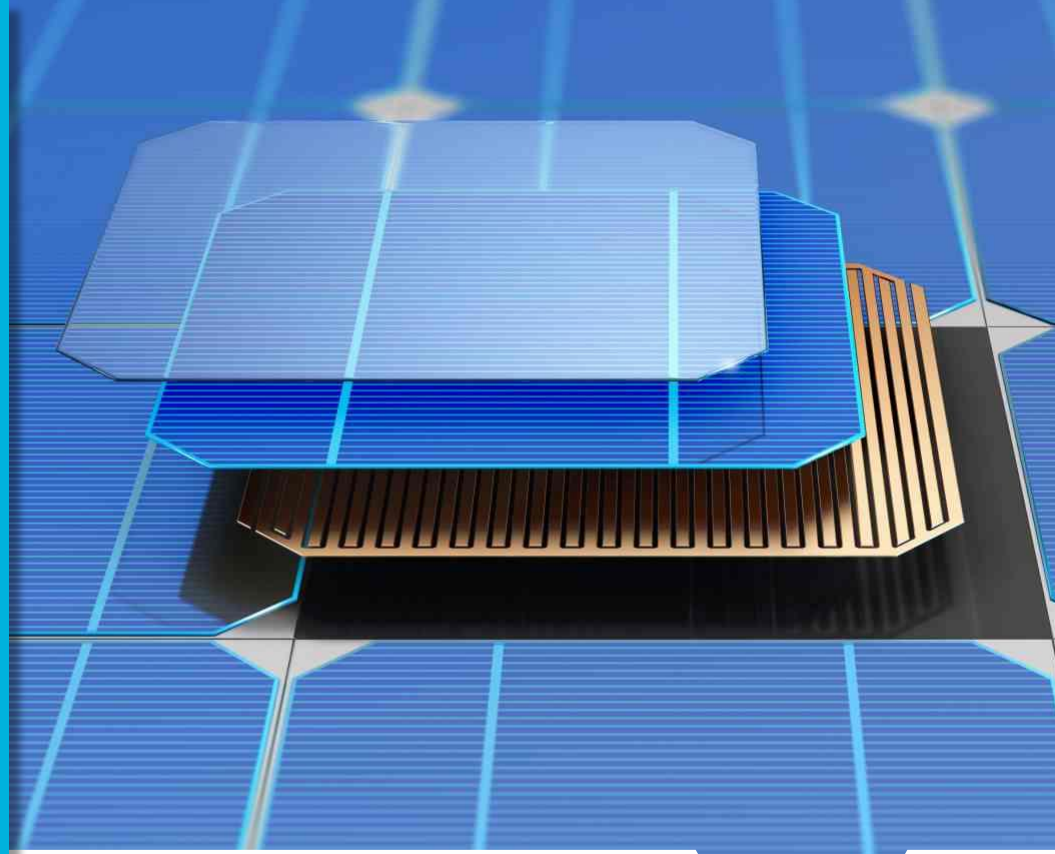
Electronic Materials and Interfaces Group

School of Engineering

Dr Nicholas E. Grant
nicholas.e.grant@warwick.ac.uk

Prof. John D. Murphy
john.d.murphy@warwick.ac.uk



warwick.ac.uk/fac/sci/eng/people/nicholas_grant/

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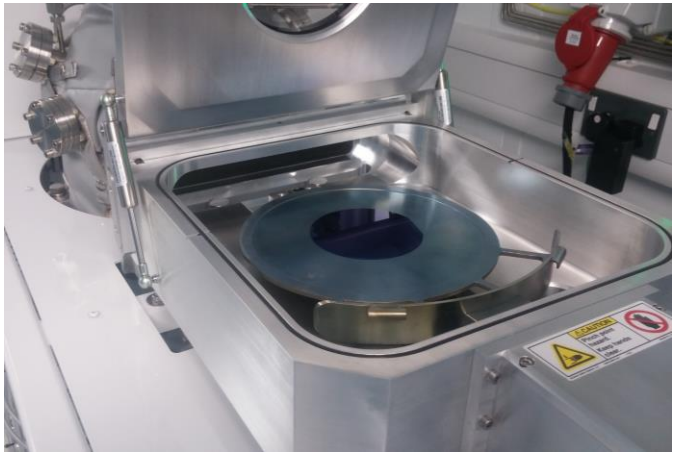
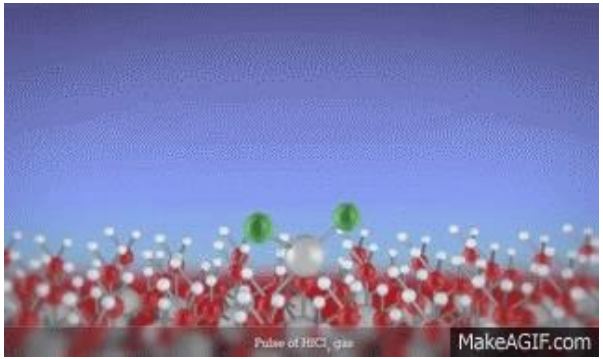
Electronic Materials and Interfaces Group

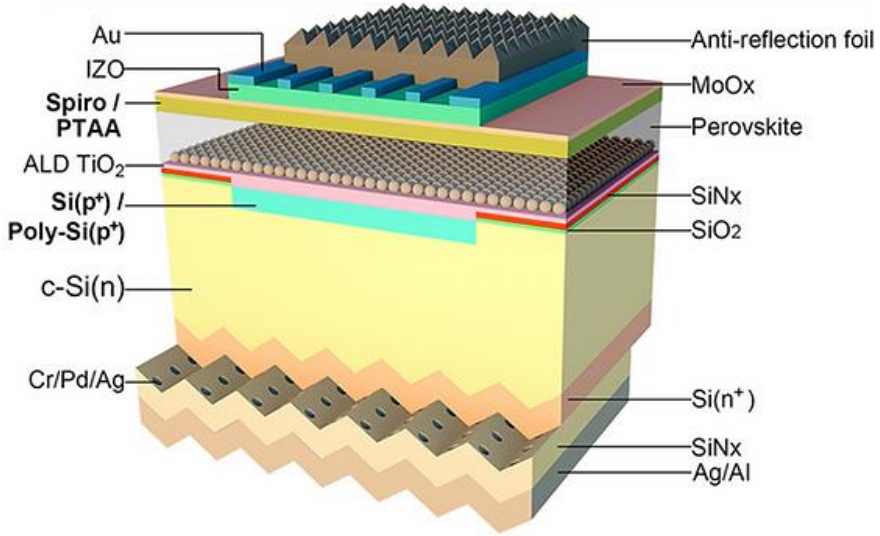
- Experimental research into the properties in electronic materials and their interfaces.

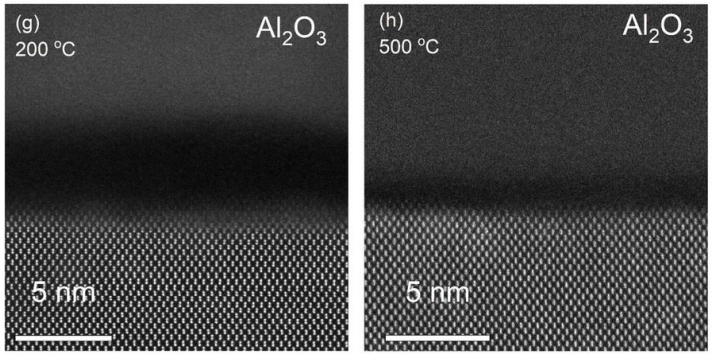
- Central to our research is the use of atomic layer deposition (ALD) to develop functional coatings

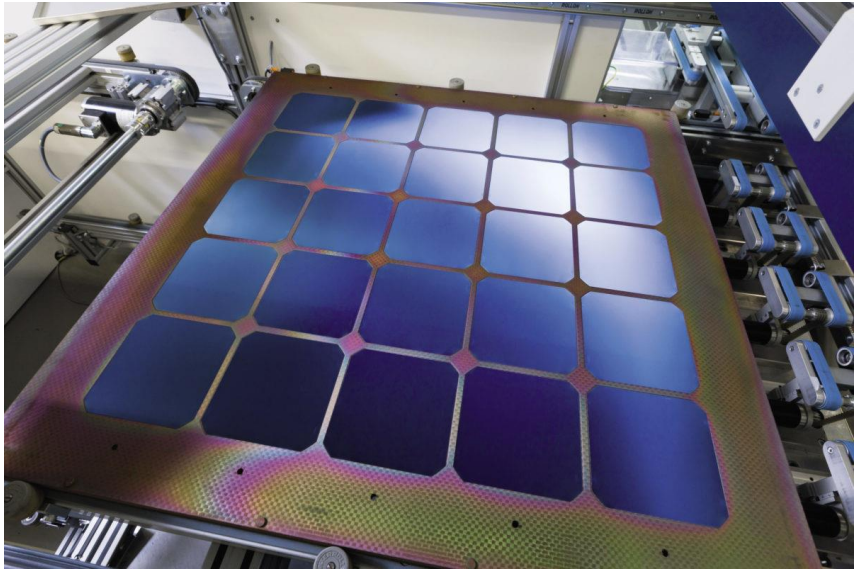




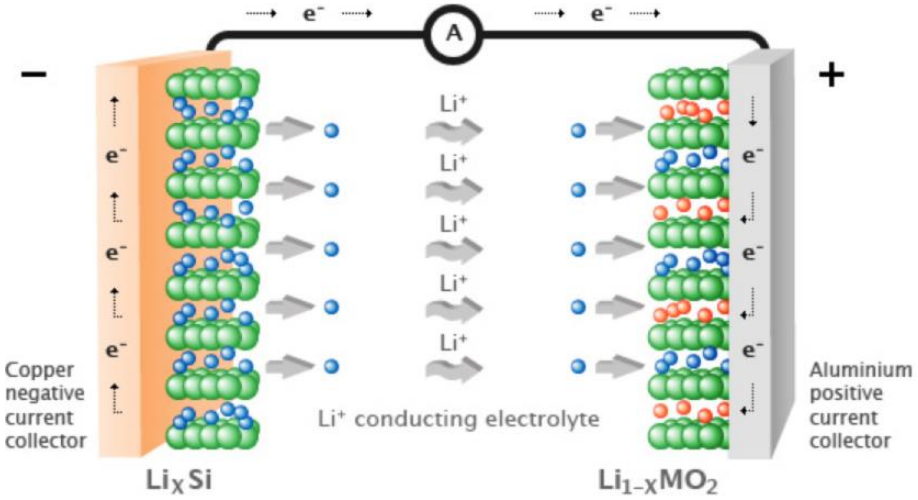
ALD for silicon based solar cells

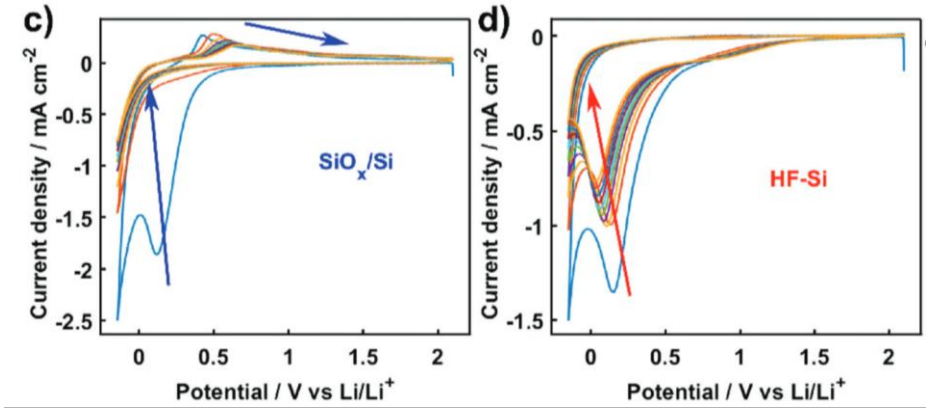




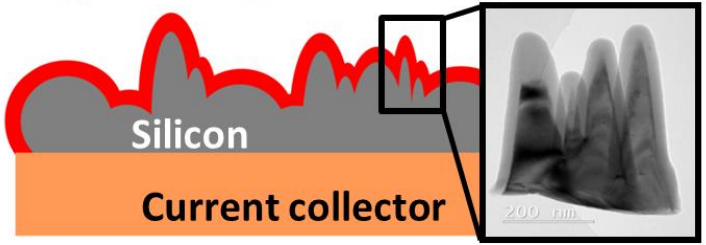


ALD for battery electrodes





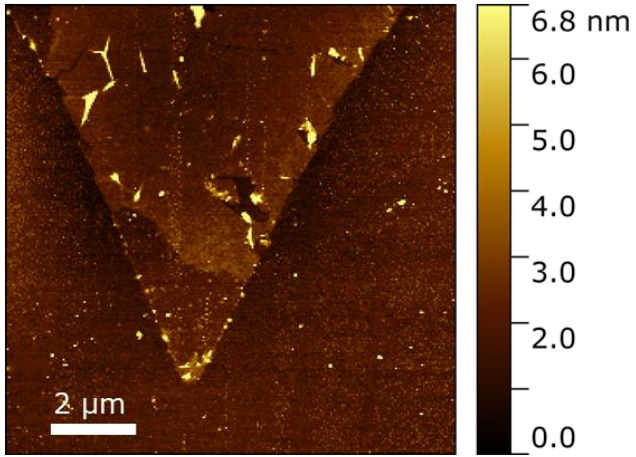
Deposit thin passivation layer by ALD

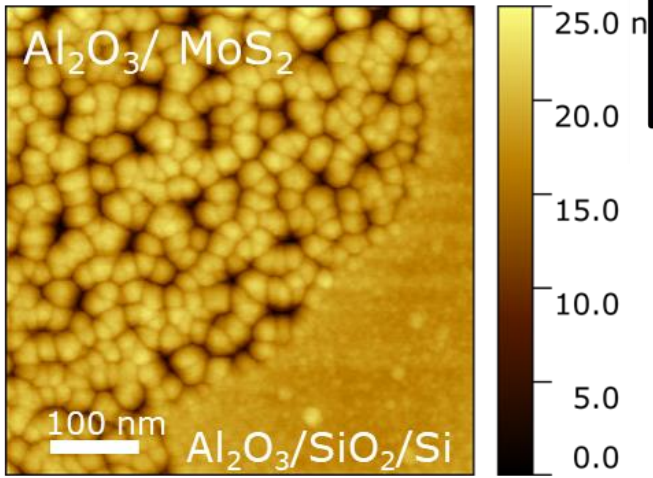


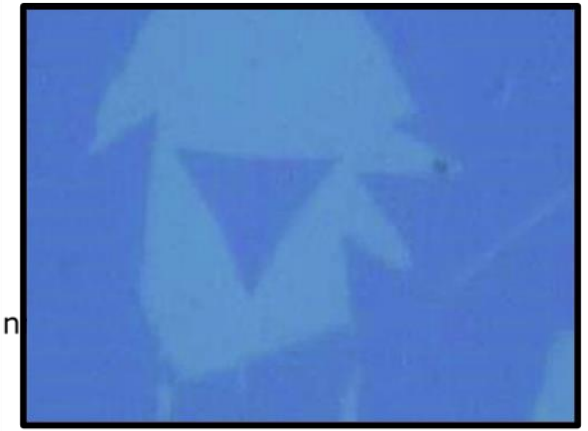
Stabilise Si battery anode

Improve longevity and performance

ALD for 2D materials







Collaborators (with active projects and recent papers/ grants)

Australian National University

maxeon

UNSW SYDNEY

WARWICK

Fraunhofer ISE

Trinasolar

LONGi

TOPSiL

UNIVERSITY OF EXETER

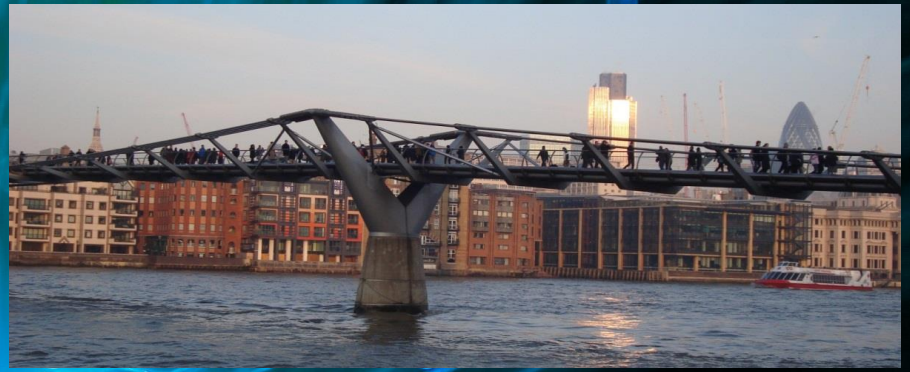
MANCHESTER 1824
The University of Manchester

UNIVERSITY OF OXFORD

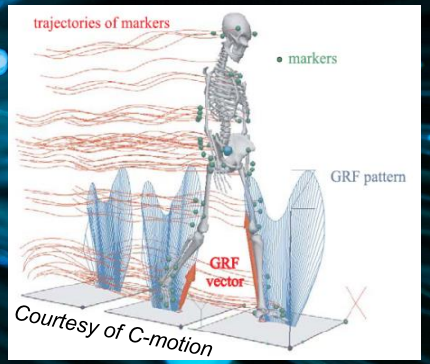
UNIVERSITY OF Southampton

Research Area

Dynamics of structures (traditional)



Dynamics of humans (more recent)



Prof. Stana Zivanovic
S.Zivanovic@warwick.ac.uk

https://warwick.ac.uk/fac/sci/eng/people/stana_zivanovic/

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Research challenge

Keywords:

Urbanisation

Climate emergency

Resilient structures (and people!)

Embodied carbon

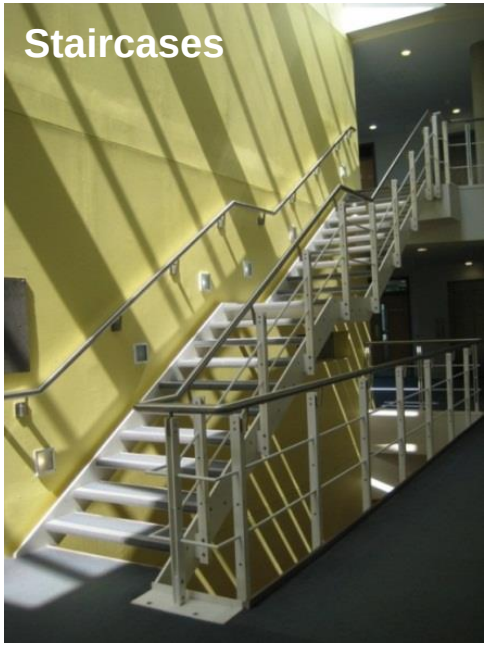
Slender structures

Lightweight construction materials

Vibration challenges for humans

Human-centred design

Contemporary structures



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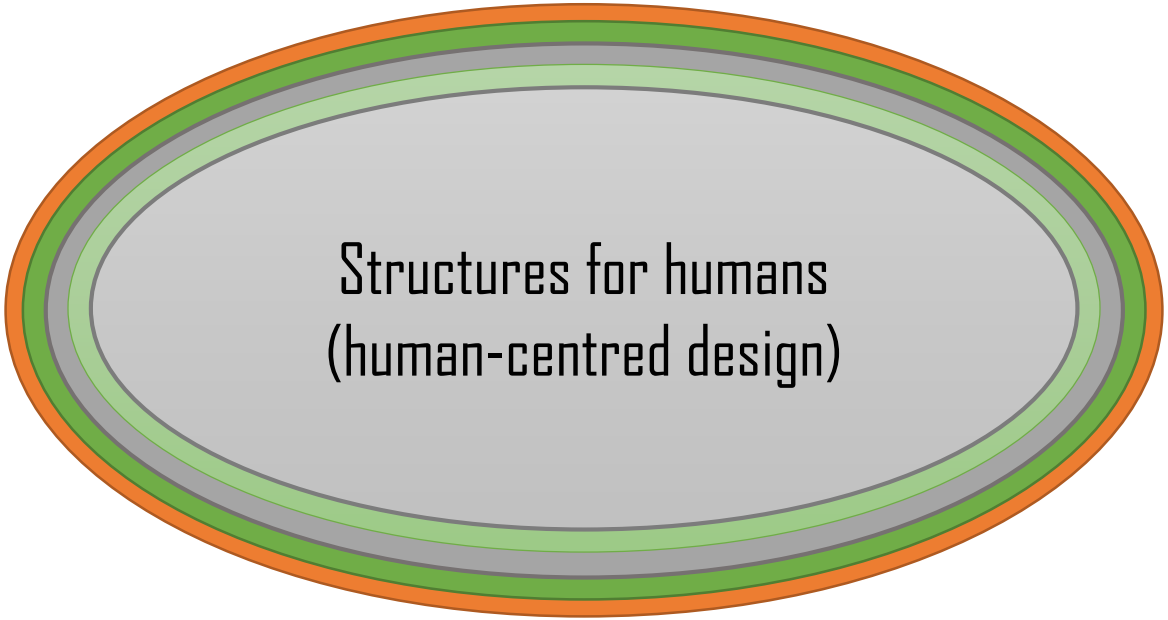
Research challenge

"Infrastructure is responsible for more than half of the UK's total carbon emissions." (Institution of Civil Engineers)



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Human-centred design

Research challenge: examples

Millennium Bridge: excessive sway

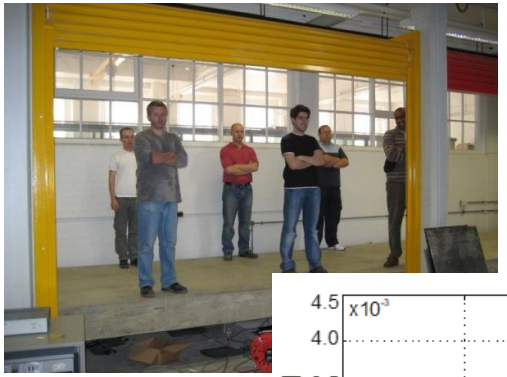
Original cost: £18M, rectification: £5M

Design of grandstands: saving carbon

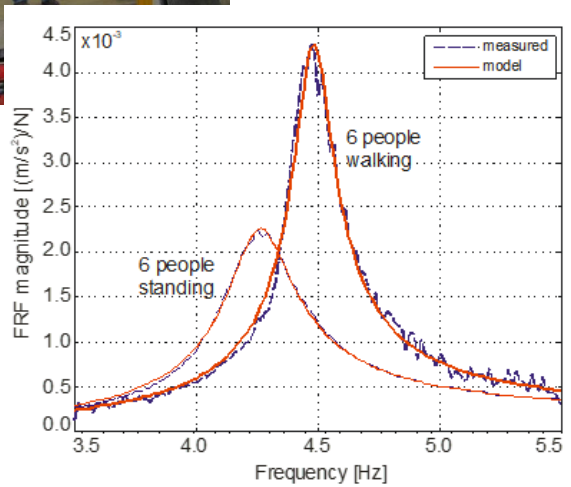
Saves 100s of tonnes in embodied carbon

How to model lightweight structures occupied by humans?

<=In situ

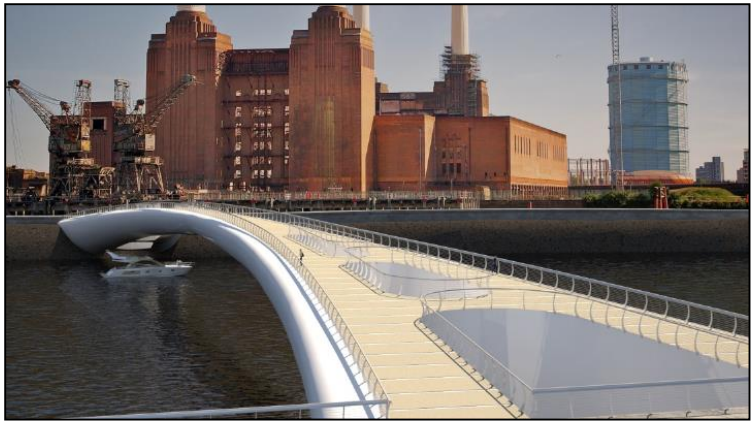


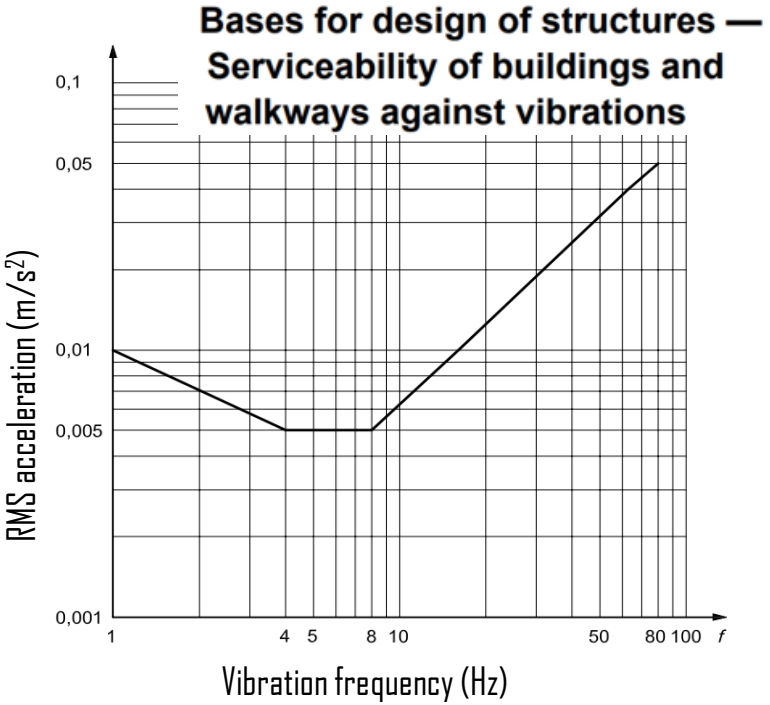
In labs =>



How to reconcile carbon savings and vibration performance?

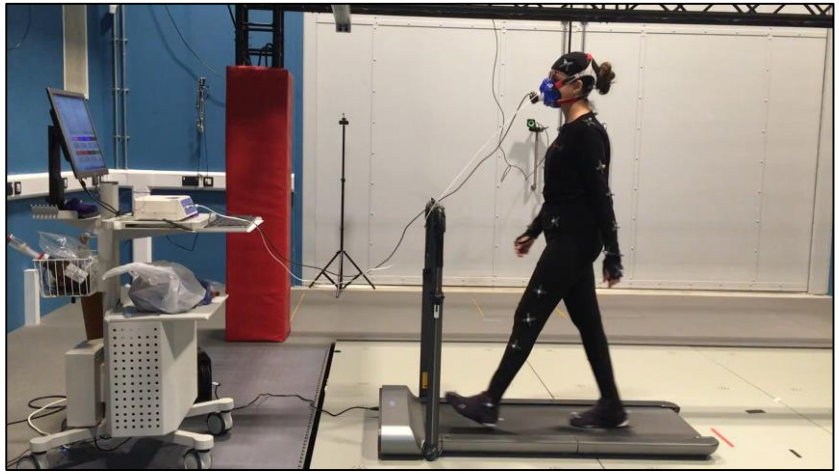
D. Kendall: a proposal for design of 260m footbridge over the River Thames, London





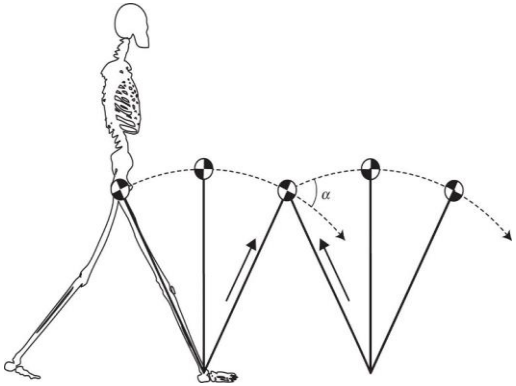
How to model human's dynamics?

Experimental observations in lab

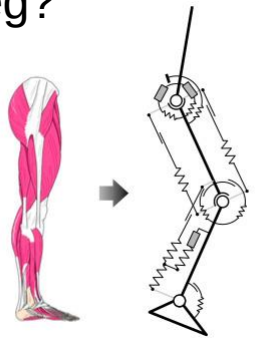


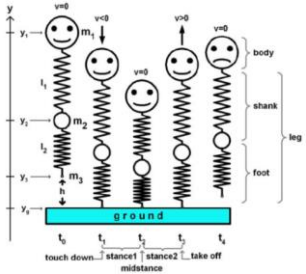
Modelling

Kinematics of rigid segments?



Damping & stiffness of leg?





How to model human's dynamics?

WARWICK

Model verification on test structure (under construction at Warwick campus)

Research Highlight

Professor Xueyu Geng, PhD, CEng, FICE, FGS, FHEA,

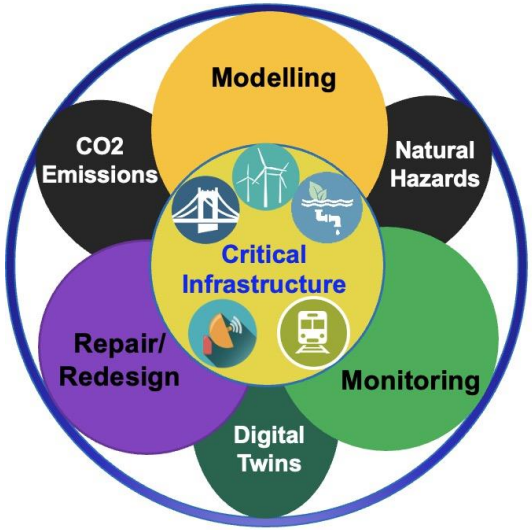
Deputy Chair of the British Standards Institution, B/526 Geotechnical Engineering

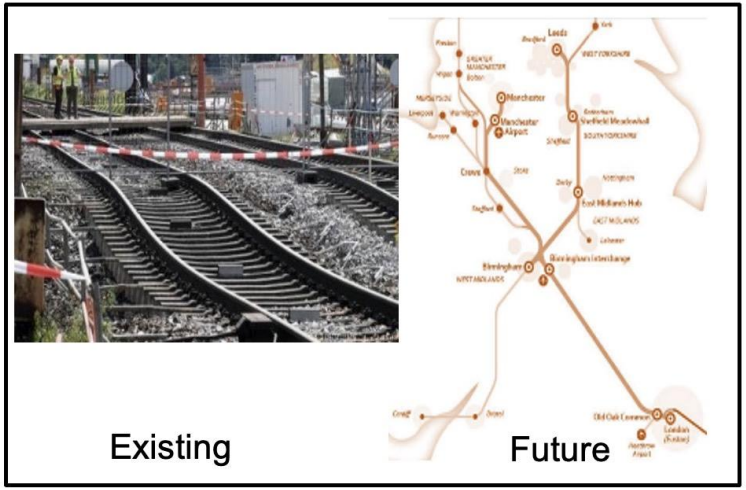
School of Engineering, University of Warwick

Email: xueyu.geng@warwick.ac.uk

Principles

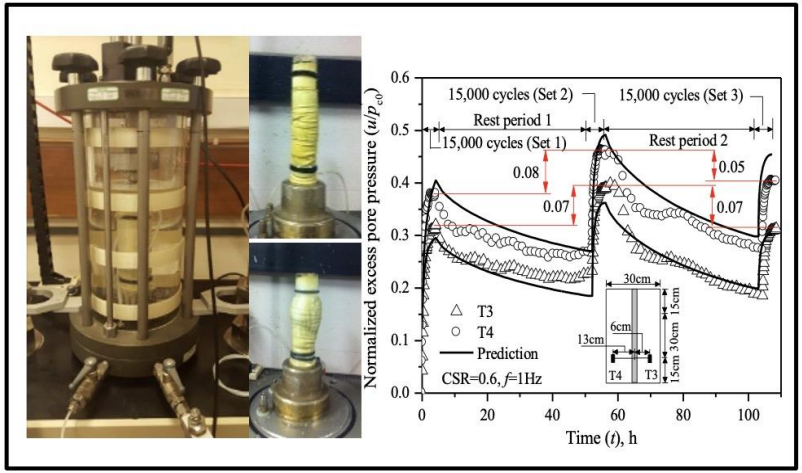
- ✓ Maintain aging infrastructure
- ✓ New design for future

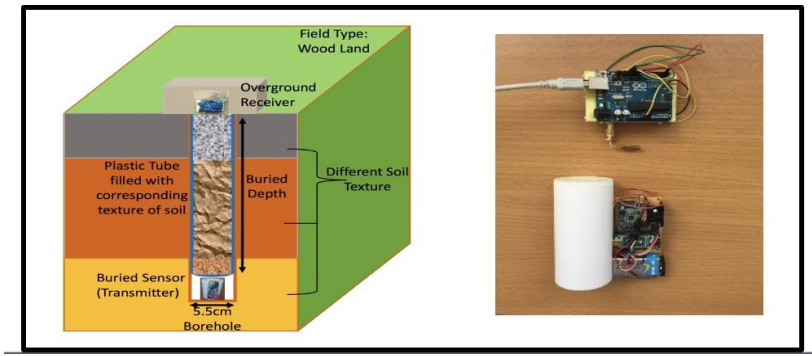




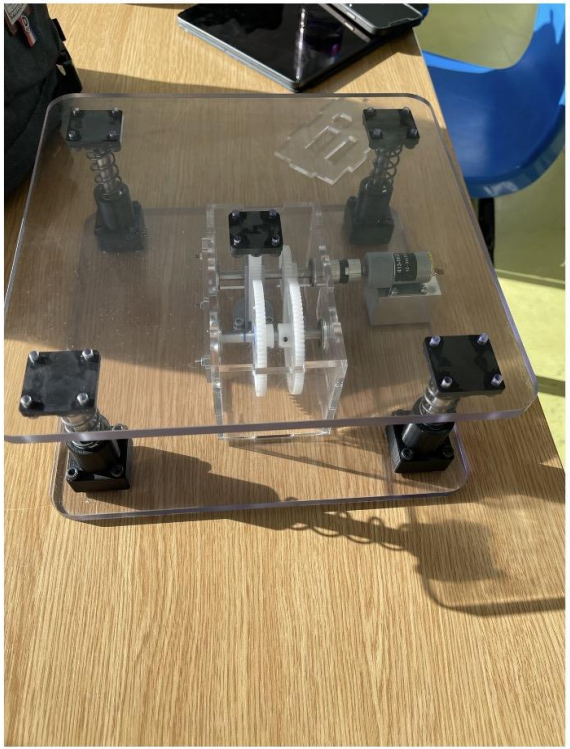
- Soil Dynamics
- Ground Improvement
- Data Assist Infrastructure Design & Intelligent Operations

Soil Dynamics

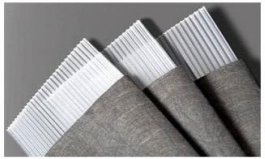




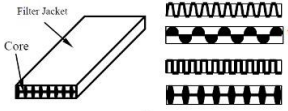
Noise and vibration related to transport infrastructures, e.g. railways highway



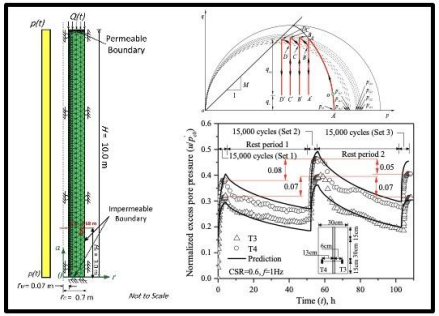
Ground Improvement

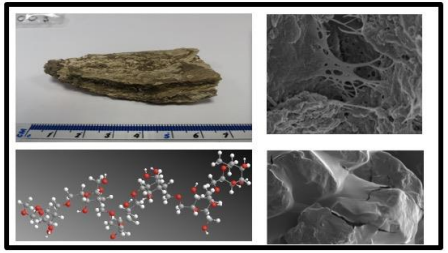


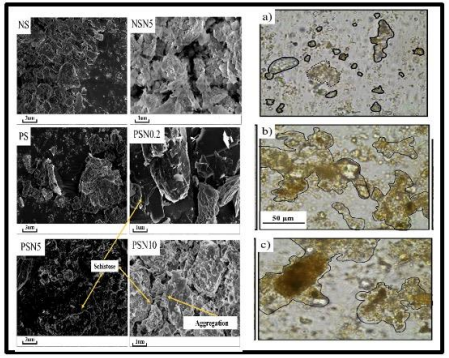
(a)

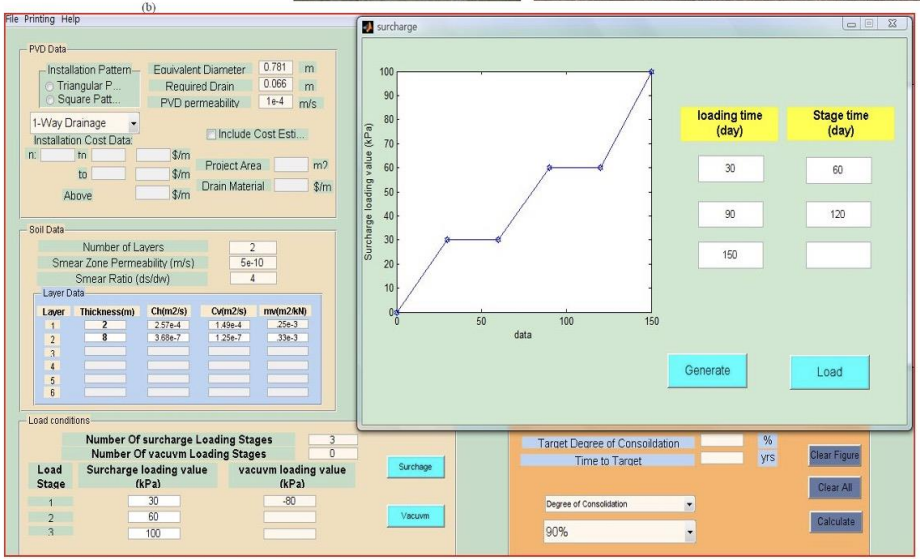


(b)



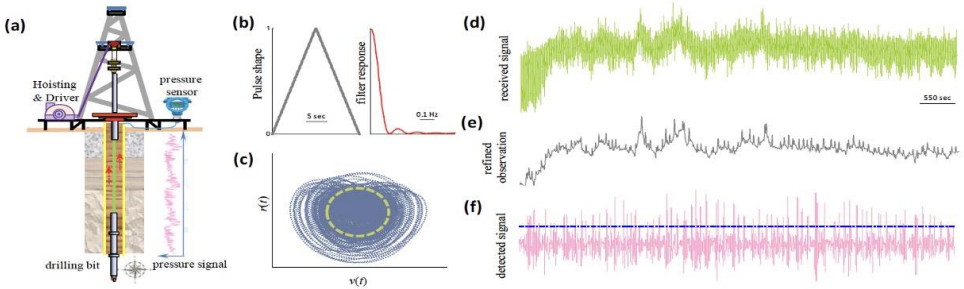


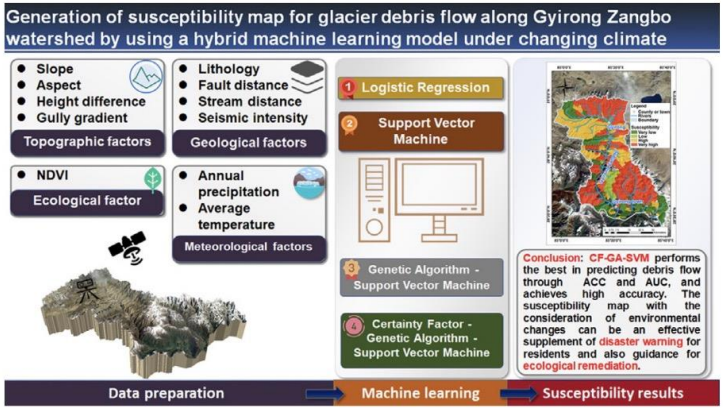


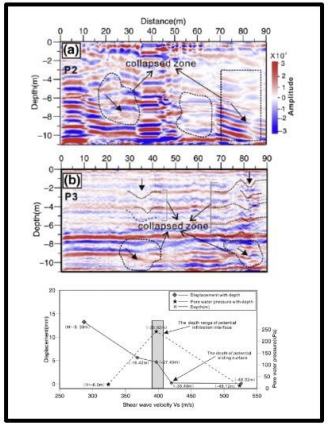


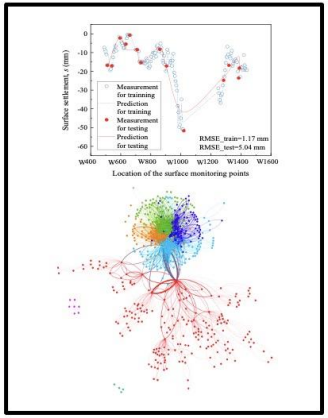
Data Assist Infrastructure Design & Intelligent Operations

Data Driven Forecasting & Causality to Inform Intervention










Thank you ☺

SiC Power Semiconductor Devices

Elec/Elec Engineering, Semiconductor Materials, Device Physics

Dr Marina Antoniou
Marina.antoniou@warwick.ac.uk

warwick.ac.uk/fac/sci/eng/people/marina_antoniou/

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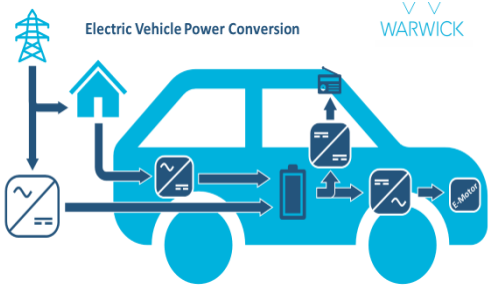
Background

Requirements to curb the global carbon emissions include:

- Electrification
- Improved electrical efficiency
- More green electricity in the energy mix

The objectives can only be achieved with the utilization of energy efficient power semiconductor devices - building blocks of any power electronics technology.



Power Electronics – Enabling 21st Century Technologies

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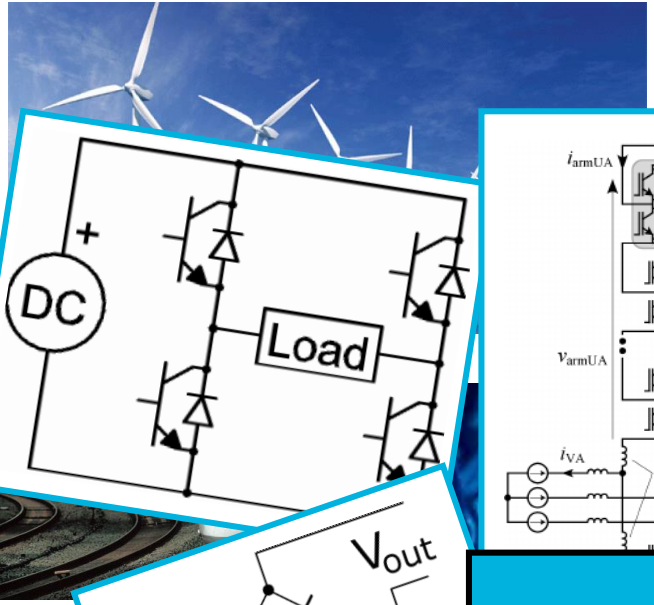
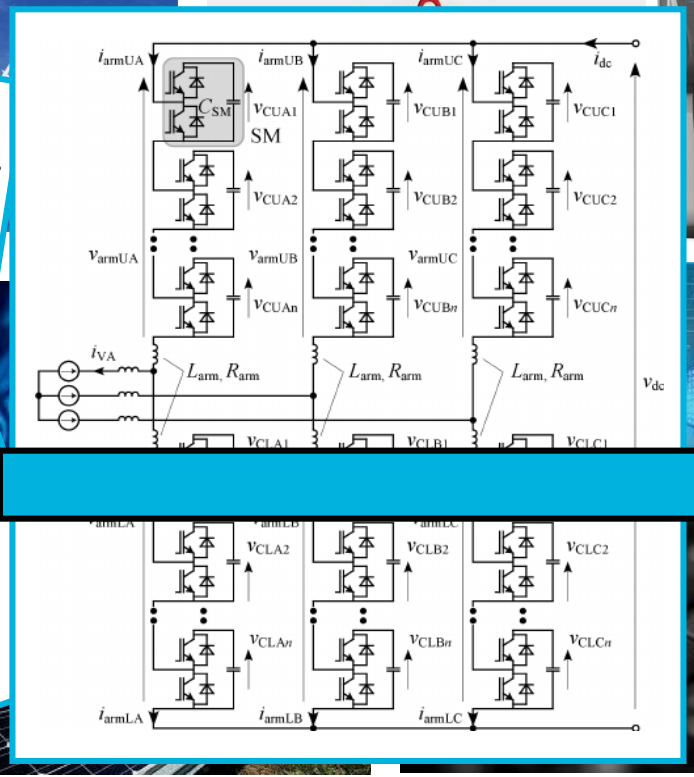
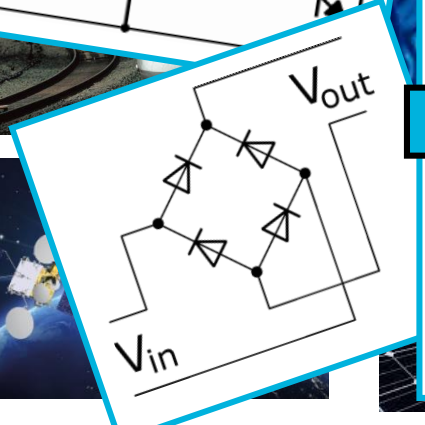
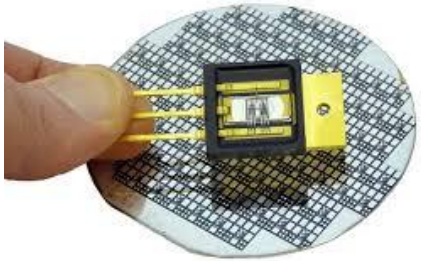
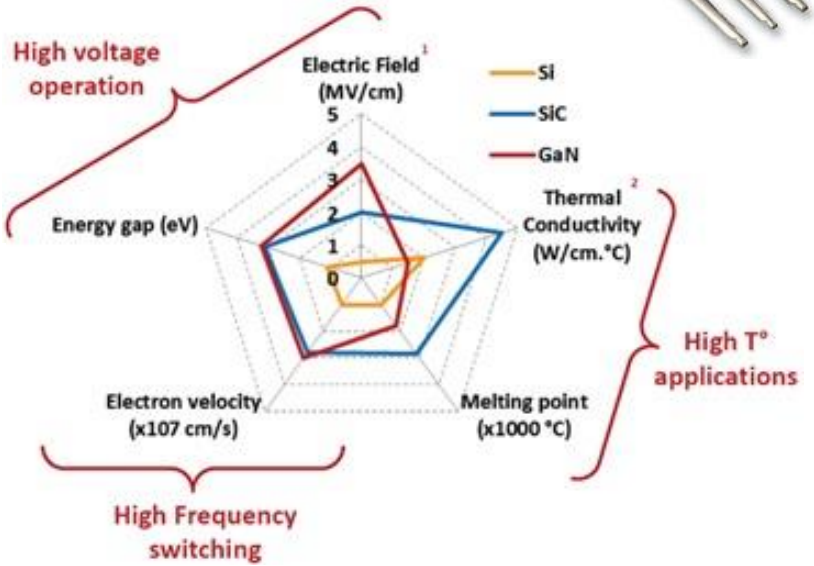






Silicon Carbide Electronics – Faster, Hotter, Smaller Power





PhD Projects in Silicon Carbide at Warwick

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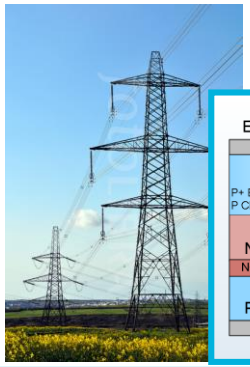
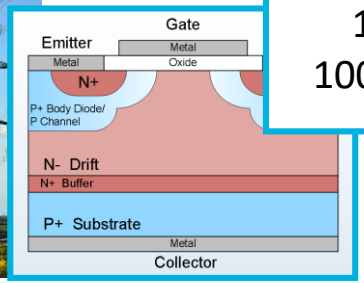




Scaling it up…

10, 15, 25kV…
100, 500, 1000 A…

Sending it to Space

High Rad, High Rel

SiC @ Warwick

And more and more and more…

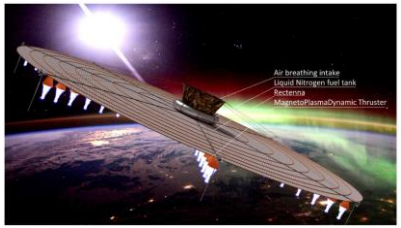
- Novel Device Simulation
- Materials Growth + Science
- Reliable Device Packaging
- Reliability, testing.
- Power Systems

What next?

Ga_2O_3
Diamond
Al_2O_3

Keeping it on the Road

Efficiency, High Rel



SIEMENS Gamesa
RENEWABLE ENERGY

Hitachi Energy

ThalesAlenia Space
a Thales / Leonardo company

Applied Biomedical Signal Processing Intelligent eHealth Lab

Dr Davide Piaggio
Davide.Piaggio@warwick.ac.uk

warwick.ac.uk/fac/sci/eng/people/davide_piaggio

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Applied Biomedical Signal Processing Intelligent eHealth Lab

ABSPIE LAB

Research interests:

- Medical device design and regulations
- Frugal&Sustainable engineering
- Digital health
- Image and signal processing
- Artificial intelligence
- Health economics
- Infection prevention and control
- Pandemic Preparedness

Ongoing projects samples:

- Medical device design and regulatory aspects for low-resource settings
- Smartphone-based eye tracking for neurodegenerative diseases
- A game app for the early screening of learning disorders in kids
- A simulation model to estimate the lifetime health and economic outcomes of using Continuous Glucose Monitoring from paediatric age
- Artificial intelligence for non-invasive glycaemic monitoring via ECG from wearable sensors
- ....

Systems Pharmacology & Biomechanics

Systems modelling & control
Model validation
Drug development (3Rs)
Motion capture & analysis

Dr Neil Evans
Neil.Evans@warwick.ac.uk

Systems Pharmacology & Biomechanics

Ditto!
AstraZeneca (including Pharmacometrics)
PROLIMB lead

Prof Mike Chappell
M.J.Chappell@warwick.ac.uk

warwick.ac.uk/fac/sci/eng/people/neil_evans

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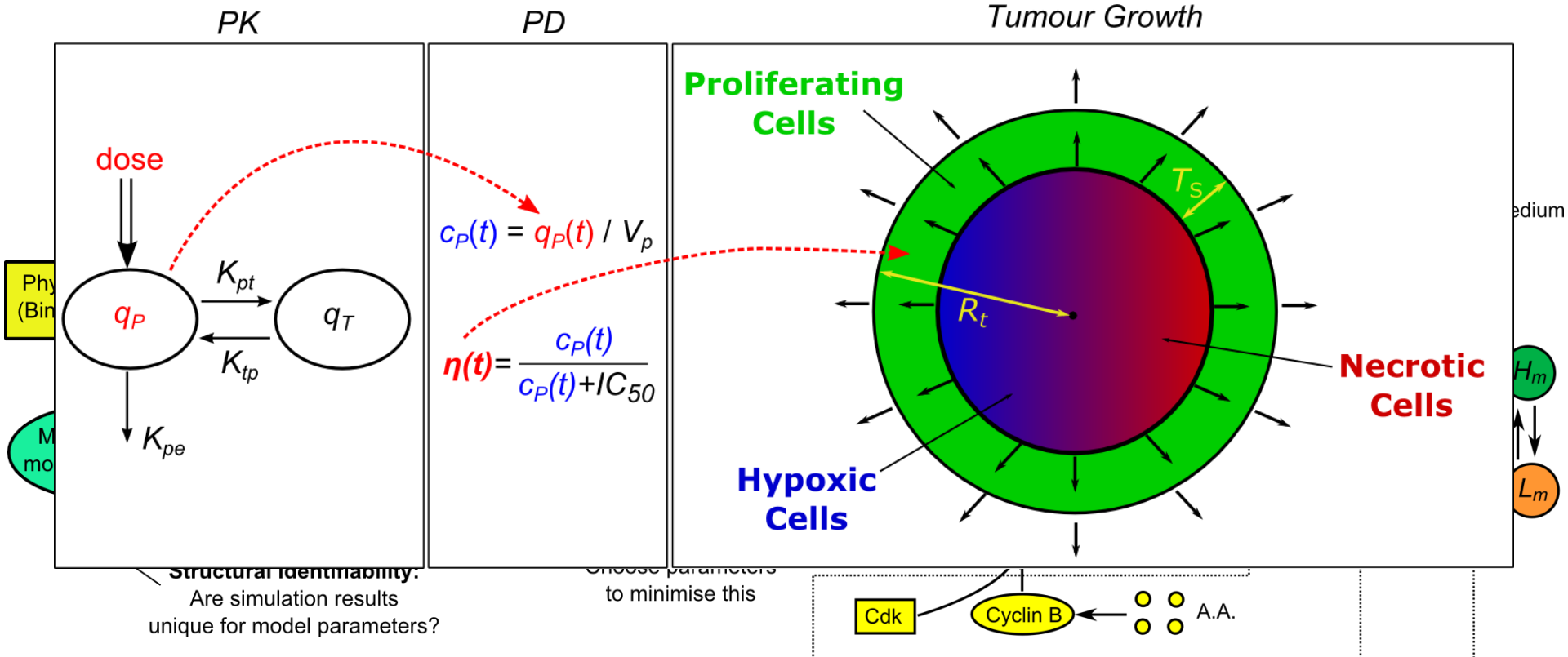
❖ Biomedical systems modelling

– Systems Pharmacology: applying mathematical modelling to assist in research & development of new & existing pharmaceuticals (3Rs)



➢ Characterise binding affinity in incompatible renal transplants

- Greater risk of rejection -> tailor immunosuppression
- Antibodies bind for rejection -> need estimate of binding affinity

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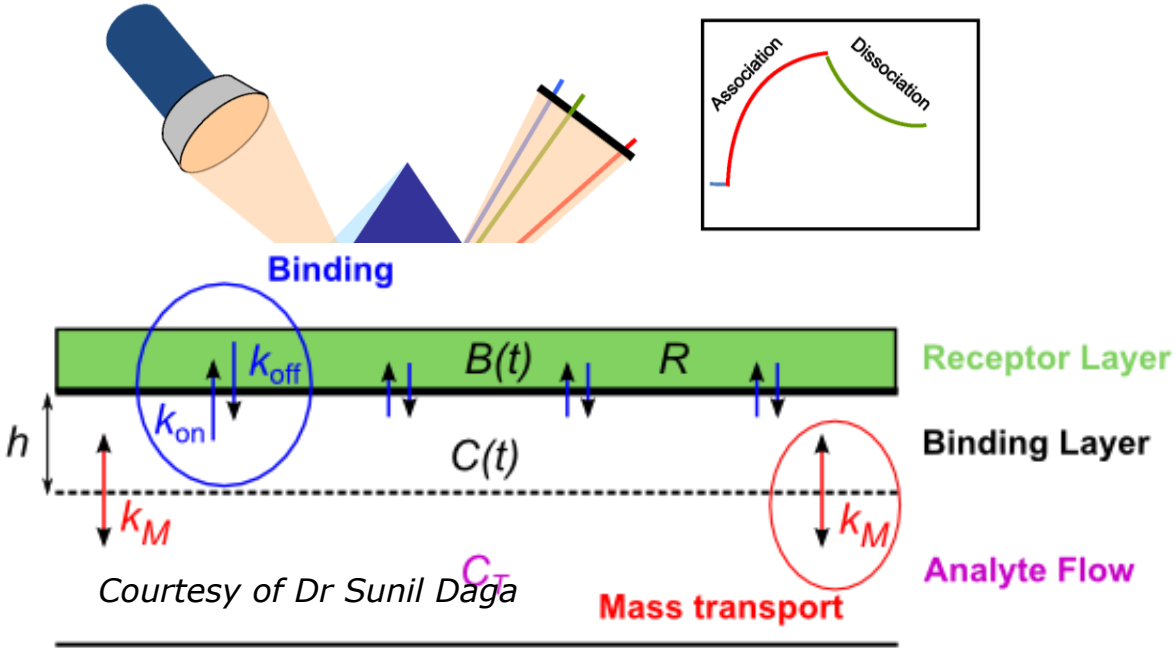
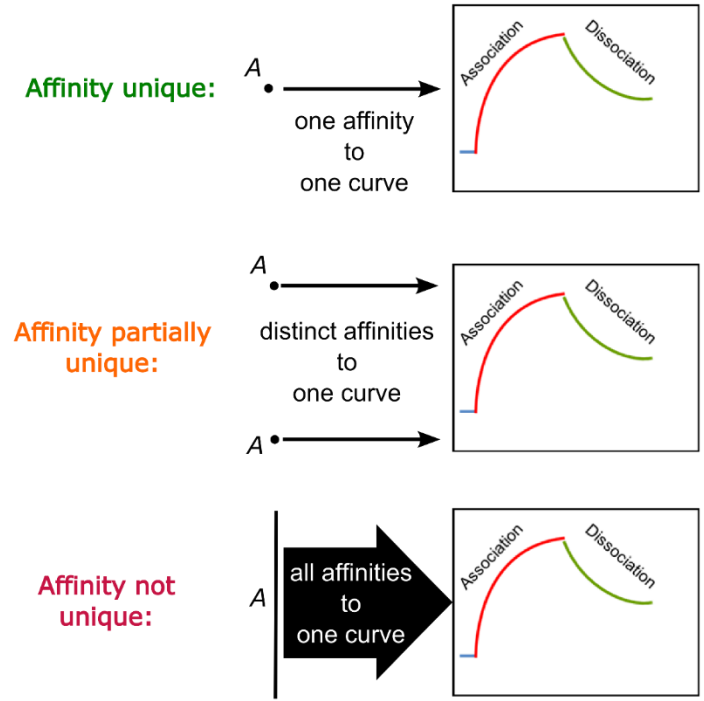


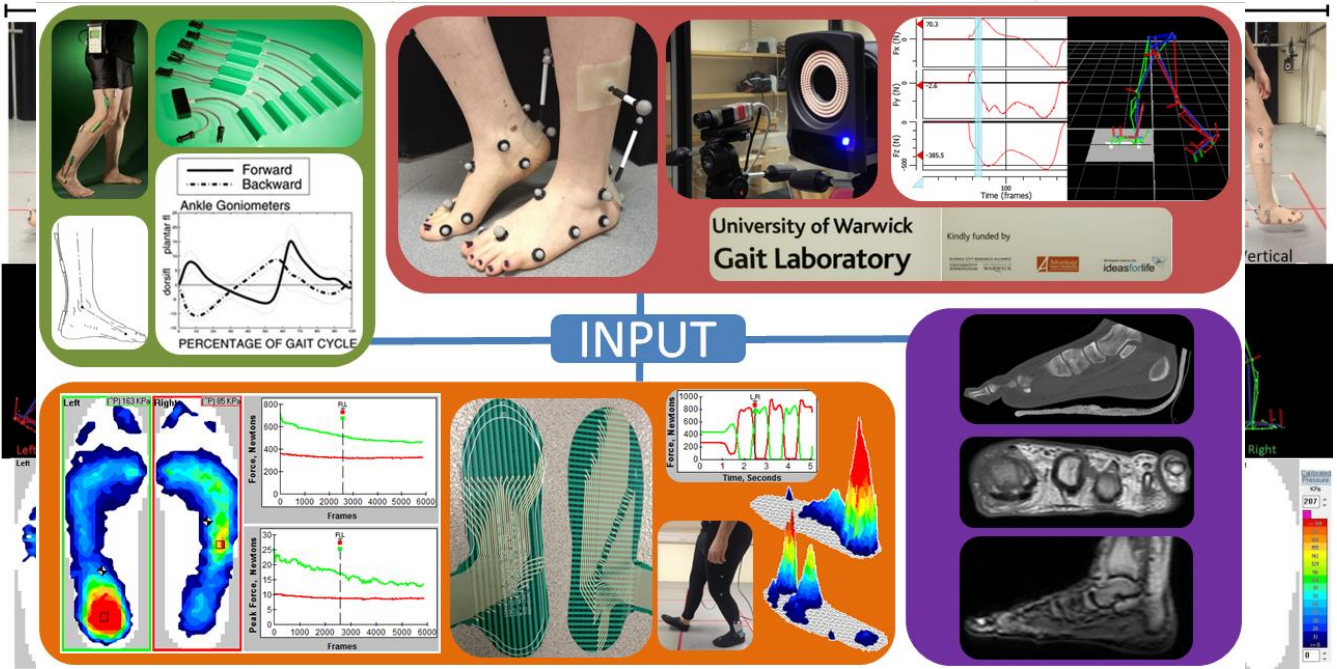
Courtesy of Dr Sunil Daga



BRS/RA 2011

❖ Biomechanics

- Mobility and balance in disease & aging
- Optimal design of orthoses & prostheses, rehabilitation
- Work with hospitals, industry, scientists
- Control systems



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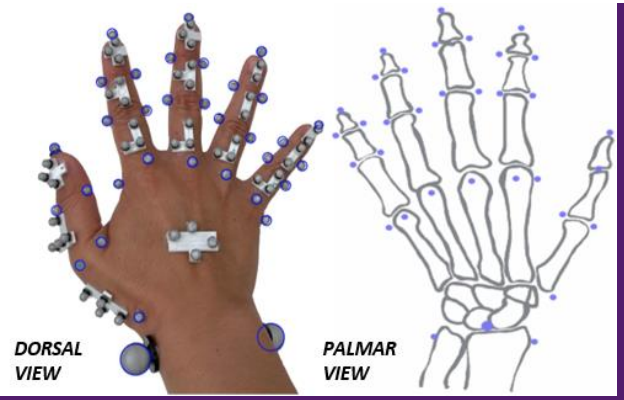
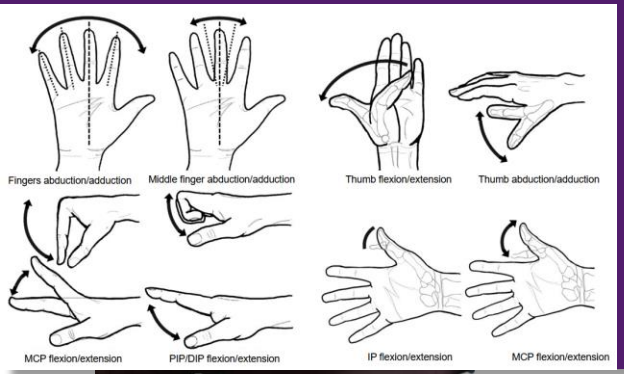
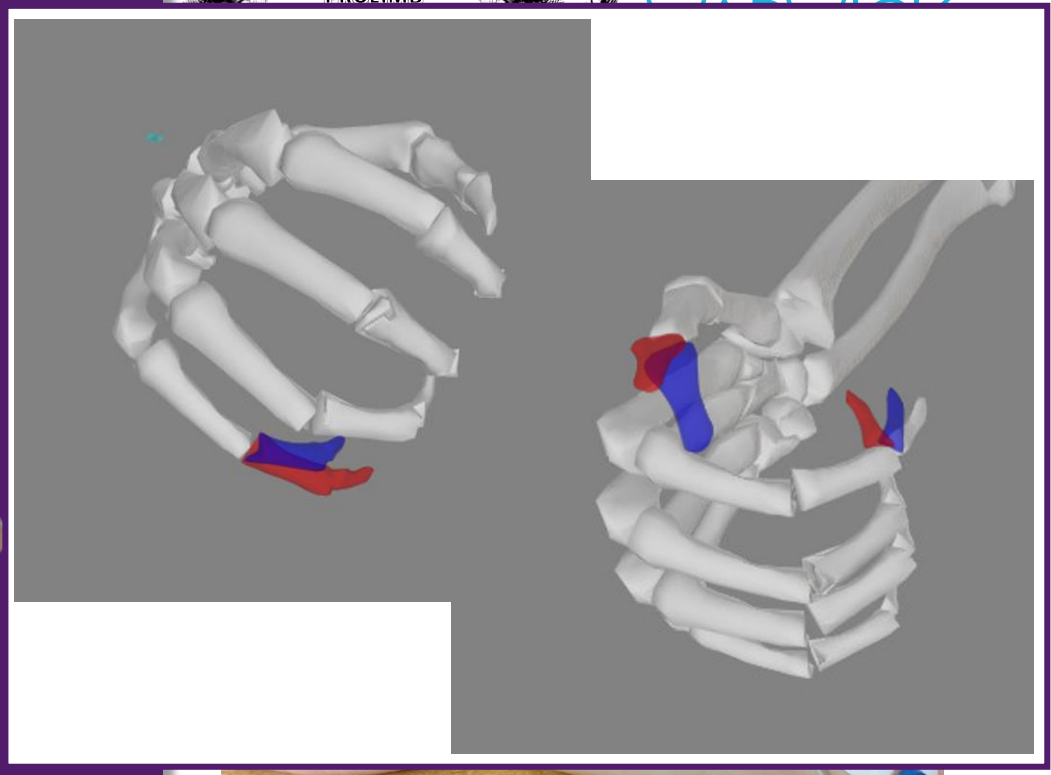
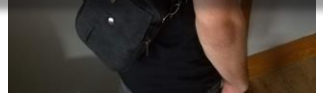
Courtesy of Dr Jaitman (2016)

➢ Modelling of Hand to Support Design of Prostheses









Systems and control for engineering biology

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What does engineering biology mean?

Synthetic/engineering biology seeks to modify or control the dynamics of living cells for useful purposes.

Potential applications

Sustainable chemical production

Image production of chemicals or materials from plastic waste.

"Living therapeutics"

Imagine engineering microorganisms to seek out diseased cells and destroy them.

New applications all the time!

(Bio)electronics: Using electronics to control cell behaviour.

Role of the Engineer

We use our modelling skills to understand cellular processes and identify the new connections needed to enact new "programmes".

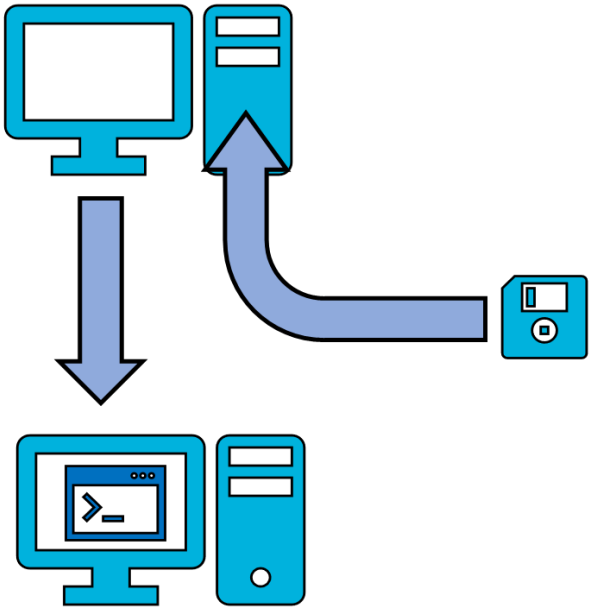
Imagine if…

We could programme cells like a computer.

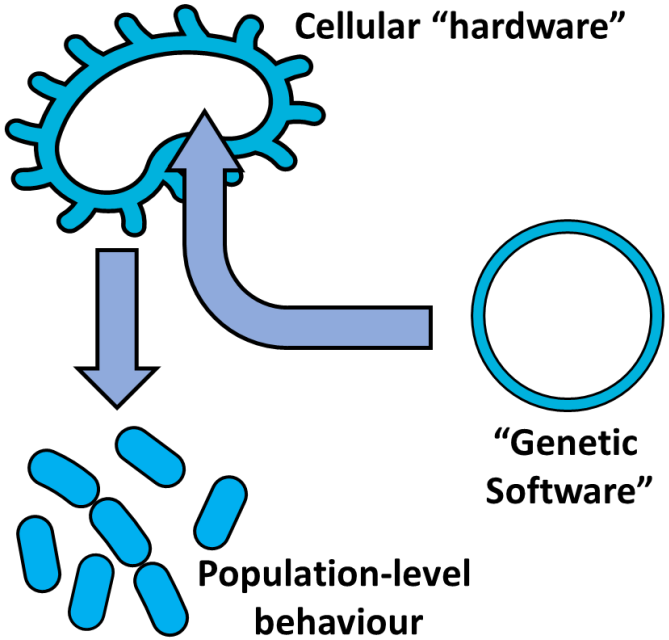
What could we do with microscopic self-renewing computers?

Our research tackles fundamental roadblocks

Computers execute software faithfully.



We hope the same is true in syn. biol.



Our research tackles fundamental roadblocks

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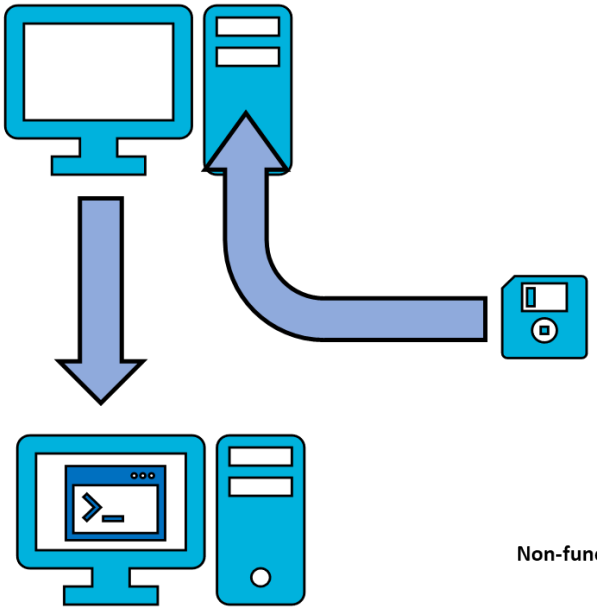
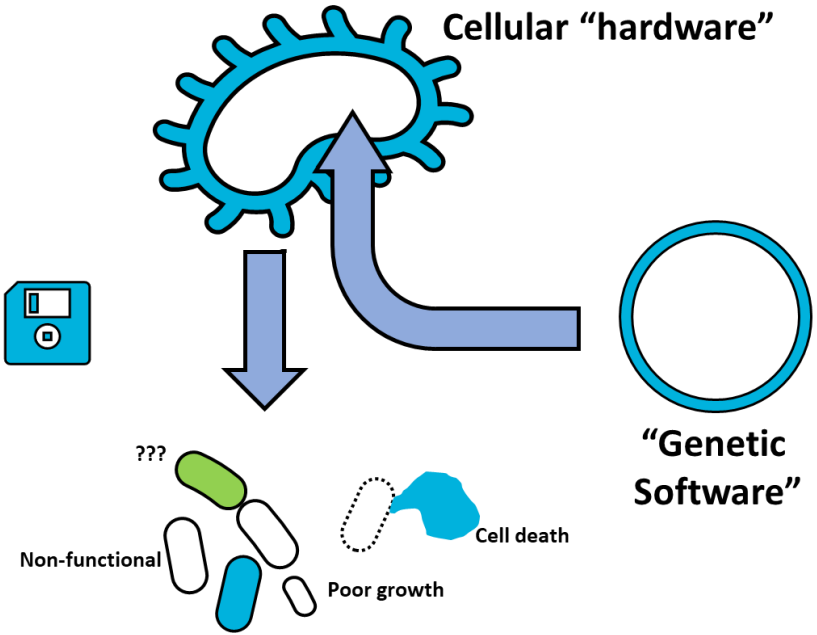


But often synthetic programs fail!



Cellular hardware/Genetic software interactions cause engineered programmes to fail!

We develop predictive dynamic models of cellular processes to understand how to engineer them in a more robust- and host-friendly way.

On going projects in the group

1 New model discovery

Foundational projects with international collaborators.

Can we automate model building?

What is the minimum data we need?
How do we design optimal experiments?

2 Pathway control

Applications in chemical manufacture with academic and industrial partner support.

How do we optimise *both* growth *and* production?

How do we control pathways with toxic intermediates?

Model predictive control for fermentation

3 Control for protein manufacture

Applications in drug discovery (drug target manufacture) with industrial partner support.

How do we integrate cellular stress signals to optimise protein production?

How do we produce unstable but high value proteins?

4 Balancing competing cellular population

Applications in chemical manufacture with academic partner support.

When are two cells better than one?

How do we maintain population composition over long time periods?

What we offer PhD students

Research skills

Systems modelling and control theory

Model calibration and/or (multi-)optimisation

Scientific computing

Statistical design of experiments

Even hands on biological experimental skills
(from standard bio to multi-litre fermentations)

Transferable skills

Multidisciplinary team working

Entrepreneurship training through industrial partnerships

International networking

Current group composition

2 PhD students
(1st year from Chem. Eng and 2nd year from Maths)
1 Co-supervised PhD
(2nd year from Biol.)

2 Post Docs starting in 2024