



WARWICK

THE UNIVERSITY OF WARWICK

Recruitment Brief - Postdoctoral Research Fellow

Prepared by Good Talent 8/5/17
"Building your capacity to change the world"

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1. A Message from the Project Leader

Imagine a world where you could design in a few days an antimicrobial against any novel pathogenic bacterium from only the knowledge of its genome sequence. This would revolutionise medicine as we know today.

To move towards this aim, we are redesigning evolution to create a new class of synthetic antimicrobials using the same mechanism as bacteriophages (phages) to specifically recognise bacterial hosts. We combine optimisation algorithms from engineering with novel gene circuits from synthetic biology to create selection systems allowing the design of modular phages.



The postdoctoral associate will re-design and combine existing phage systems to implement selection strategies. Your role will be essential to designing a careful and systematic testing of the selection system. This requires taking full advantage of the current phage-host understanding to engineer alternative genetic dependencies.

Thank you very much for your time considering this role.

Best Regards,

Professor Alfonso Jaramillo

2. The University of Warwick

The University of Warwick consistently ranks in the top ten of all major rankings of British universities and it is the only multi-faculty institution aside from the Universities of Oxford and Cambridge to have never been ranked outside of the top ten. It was ranked as the third best 'young' university in the world, and the best in Europe. It is the best university under 50 years of age in Europe, and the third best under 50 years of age in the world.

The School of Life Sciences is home to a wide range of exciting interdisciplinary bioscience. It is an international centre of excellence with more than 80% of our research rated as 'world leading or internationally excellent' in the REF 2014 assessment and 94% overall student satisfaction in the National Student Survey (NSS).

Our focus is in excellent teaching and research with impact.

In 2015 we were the BBSRC 5th highest funded institute and we have 27 PhD studentships per year from 2015-2019 through our BBSRC doctoral training partnership award.

Research awards in 2014/15 totalled £23million. These include:

- BBSRC/EPSRC funding to establish the Warwick Interdisciplinary Synthetic Biology Centre (WISB)
- Funding from the Bill and Melinda Gates Foundation to research neglected tropical diseases (the largest ever award for modelling of infectious disease)
- over £5million to support research into antimicrobial resistance
- in excess of £4million for plant and crop science

Our research falls into four themes: Biomedical Science, Biotechnology, Environmental Bioscience, and Plant and Crop Science. This research impacts across a broad range of areas, particularly in crop improvement and protection, biosensing and early medical diagnoses, ageing, animal health, earth biosystems, pollution and environmental genomics.

Our facilities support multidisciplinary research programmes across Warwick and with other universities, research institutes and industry both nationally and internationally.

3. Context

“The more we look at drug resistance, the more concerned we are. It basically shows us that the end of the road isn't very far away for antibiotics.” - Tom Frieden

According to the World Health Organisation antibiotic resistance is one of the biggest threats to global health, food security, and development today. The prevalent use of modern antibiotics over the last century has led to a bacterial arms race with increasingly potent infections proving more difficult to treat as each year passes. As the efficacy of our current armoury of antibiotics wanes, hospital stays lengthen, medical costs rise and without urgent action we will soon enter a post-antibiotic world where common infections will kill once again. While there are some new antibiotics in development, none of them are expected to be effective against the most dangerous forms of antibiotic-resistant bacteria of the future.

Is there a possible response that could safeguard humanity? Professor Alfonso Jaramillo thinks so and his lab at the University of Warwick is working hard to provide such a solution. It is a multidisciplinary lab that develops novel automated methodologies for design optimisation using computers, viruses or living cells to create a viable alternative to Phage Therapy. The ambition is the eventual development of synthetic phages, powerful antimicrobials which if their work proves successful will herald a new age in the fight against bacterium. Progress of the lab since 2013 has been steady with the foundations already laid of new technologies (computational and experimental) for the engineering of biomolecules. The key current focus is on the creation of automated algorithms that enable directed evolution in support of the difficult design phase of Synthetic Biology, by developing a general methodology for the de novo engineering of synthetic RNA parts and circuits it is hoped they will work robustly as targeted in a given cellular context.

The goal of the lab is to achieve proof of concept within the next 3 years. By working at the interface of molecular biology, combinatorial optimization, microfluidics, directed evolution and 3D printing it is hoped that reaching this goal will accelerate more synthetic biology research globally thus enhancing our ability to combat diseases of the future.

This is where you come in, as a Postdoctoral Researcher we need your expertise to help build the lab's research capability. You will form part of a high profile international team with labs in Warwick and ISSB in France. Your contribution to the lab's body of knowledge in support of the goal of reaching proof of concept will have a direct impact on one of the most urgent health threats facing humanity.

4. The Jaramillo Lab

The Vision

The therapeutics of tomorrow will be individualised, specific, and self-regulated. This could be achieved by synthetic organisms, once we know how to engineer them. The simplest and safest is the bacteriophage. I believe that by engineering a synthetic phage to be used in phage therapy against antibiotic-resistant bacteria, my lab will provide a proof-of-concept that will trigger more synthetic biology efforts to fight human diseases. For this, we work at the interface of molecular biology, combinatorial optimisation, microfluidics, directed evolution and 3D printing.

The History

The bacteriophage was discovered one century ago and soon after its discovery its antimicrobial properties were exploited. The strategy consisted in isolating phages from the natural environment of the host, test them for infectivity of the target strain, analyse them and then repeat the whole procedure to find more phages. For one hundred years the strategy has been followed and the analysis techniques have been improved, but basically the same artisanal procedure has been used. This is too demanding compared with chemical antimicrobials that are broad-host range and which only need to be analysed in a single context to be approved. This has not only hampered the development of phage therapy, but the required specialised manual labour difficult scaling phage therapy to arbitrary bacteria. We propose to completely reverse the strategy and remove the requirement of isolating the phage from the environment. Moreover, our procedure could be automated, which will allow its scaling up to create antimicrobials specific a target bacterium from the knowledge of its genome only.

The Team

Project Leader - Alfonso Jaramillo

Alfonso Jaramillo holds a PhD in Particle Physics (1999) and a Habilitation in Biology (2007). After postdoctoral appointments with Prof. Wodak (ULB Brussels, 1999-2002) and Prof. Karplus (ULP France and Harvard USA, 2002-2003), Nobel laureate in Chemistry 2013, he started in 2003 as Assistant Professor at the Ecole Polytechnique (France), becoming tenured in 2005. There, he further developed computational synthetic biology. In 2009, he moved to Genopole (France) as CNRS-senior researcher to started his experimental synthetic biology lab, utilizing directed evolution, microscopy,

microfluidics and 3D printing. In 2013, he opened a second lab at the University of Warwick (UK), where he holds the Chair of Synthetic Biology. His lab focuses in the development of technologies for synthetic biology based on evolution, including regulatory circuits and retargeted bacteriophages.

The University of Warwick - <http://synth-bio.org/>

A current team of 10 researchers based in the UK.

Research

We focus on the engineering of phages by developing a new type of directed evolution. The phages will be tested in vitro and eventually in vivo.

5. Mission

Mission for Postdoc Research Fellow UoW Jaramillo Lab

Contribute to the research efforts of the lab by way of experimentation and publication leading to a successful proof of concept for synthetic phage design within a 3 year timeframe.

Outcomes:

1. Creative Problem Solving
 - Development and execution of new experiments.
 - Solving problems that don't yet exist.
2. Research Output
 - Writing high quality publications in support of the research activity.
3. Project Management
 - Playing a key role in organising a cooperative, distributed project, enabling effective interaction.
 - Executing work both independently and as part of a wider research team.

6. Candidate Profile - Research Fellow

We are looking for a self motivated and highly talented Postdoctoral researcher. Designing and engineering phages is very different from isolating and studying them, as such we need a creative outlook and daringness to explore the new - so mavericks apply here.

In terms of previous experience, we ideally would like to find a PhD with working knowledge of bacteriophages and phage engineering. However, as a multidisciplinary project we would also welcome applications from PhDs with an emphasis in Synthetic Biology, Biophysics, Biomolecular Science and Engineering, Biochemistry, Bacteriology and or related research experience. A strong track record with first class publications is a must.

Beyond that if you ask us what kind of behaviours and capabilities someone will need to be a success this is what we are looking for:

Core Profile:

- **Research Excellence.** Sufficient breadth or depth of specialist knowledge in the discipline and of research methods and techniques to work within established research programmes.
- **Self Starter.** A hungry, resourceful self-motivated individual with the responsibility and drive to “create” their own success.
- **Intellectual Maturity.** First class analytic capabilities are a hygiene factor. More importantly we are looking for the ability to synthesise, think systemically, join the dots and see the bigger picture.
- **Communication.** An excellent communicator, with a natural flair for people.
- **Flexible/Adaptable.** Comfortable with change and ambiguity, the ability to navigate often “uncharted” waters.

7. The Rewards

What do we offer you in return for your hard work and dedication? Well if the thought of saving the world is not motivation enough then The University of Warwick consistently ranks in the top ten of all major rankings of British universities and is the best university under 50 years of age in Europe, and the third best under 50 years of age in the world. We really can offer a first class environment in which to conduct your work and all the career enhancing benefits that entails.

The project provides an excellent training opportunity at the interface between synthetic systems and biology which is key to modern biotechnology research. It is intended that the successful applicant will, through their work in the post, gain considerable new technical and analytical experience in a key area. They will also gain transferable skills in science communication, research planning and administration.

However, our unique offer is bound to our mission, this truly is a fantastic chance to join a world class research project, grow your own skills, develop your career and save humanity at the same time. So if you are looking for the chance to really make your mark and impact humanity's future for the better this could be the opportunity you have been looking for.

8. Further Information

Interested candidates should send a CV (including a full publication list) and a motivation letter (detailing how your former experience, skills and goals would fit in the position) to Prof Alfonso Jaramillo (<http://jaramillolab.org>).