HR EXCELLENCE IN RESEARCH

ORGANISATION/COMPANY	Institutions across Europe in the BactiVax ITN European Training Network
RESEARCH FIELD	Biological sciences; Medical sciences
RESEARCHER PROFILE	Early/First Stage Researcher (R1)
APPLICATION DEADLINE	**31st December 2019, 17:00 GMT**
START DATE	On or before 1st April 2020
LOCATION	Multiple locations, see partner institutions below
TYPE OF CONTRACT	Temporary
JOB STATUS	Full-time
HOURS PER WEEK	36 – 40
EU RESEARCH FRAMEWORK PROGRAMME	H2020 / Marie Skłodowska-Curie Actions
MARIE CURIE GRANT AGREEMENT NUMBER	860325

Applications are invited for 15 three-year PhD studentships to be funded by the Marie-Skłodowska-Curie Innovative Training Network "**BactiVax**" within the Horizon 2020 Programme of the European Commission.

BactiVax (**anti-Bacterial Innovative Vaccines**) is an innovative European Training Network that will provide high-level training in vaccinology to 15 high-achieving, creative Early Stage Researchers (ESRs), and equip them with a wide range of transferrable skills for thriving careers in vaccine research within academia and industry. BactiVax will focus on developing novel vaccines to tackle the huge challenge of antimicrobial-resistant human pathogens that cause chronic, life-threatening respiratory and/or systemic infections. This network comprises 14 Principal Investigators with expertise in vaccinology, proteomics, medicine, microbiology, biochemistry, immunology, structural biology, medicinal, peptide and glycochemistry from 8 European countries and two companies which will collectively train ESRs in entrepreneurship, commercial vaccine development and bioprocessing.

Participant organisations and principal investigators

- University College Dublin (UCD, Dublin, Ireland) - Assoc. Prof. Siobhán McClean (2 positions)
- National Research Council, Institute of Biostructures and Bioimaging (CNR-IBB, Naples, Italy) - Dr. Rita Berisio

- Queens University Belfast (QUB, Belfast, UK) – Prof. Miguel Valvano
- CIC bioGUNE | Center for Cooperative Research in Biosciences (Bilbao, Spain) – Prof. Juan Anguita
- CIC bioGUNE | Center for Cooperative Research in Biosciences (Bilbao, Spain) – Prof. Jesús Jiménez-Barbero
- St. George's University of London (SGUL, London, UK) – Dr. Rajko Reljic
- Ludwig Maximilian University of Munich (LMU, Munich, Germany) – Prof. Johannes Huebner
- University of Milano Bicocca (UNIMIB, Milan, Italy) – Prof. Francesco Peri
- Imperial College London (London, UK) - Prof. Rosemary Boyton and Prof. Danny Altmann (one position)
- École Polytechnique Fédérale de Lausanne (EPFL, Lausanne, Switzerland) – Prof. Christian Heinis
- Eötvös Loránd University (Budapest, Hungary) – Dr. Kata Horváti
- LIONEX GmBH (Braunschweig, Germany) – Prof. Mahavir Singh
- ImmunXperts (Gosselies, Belgium) – Dr. Séverine Giltaire

Eligibility criteria for candidates

We are looking for talented and highly motivated early career researchers with an Honours BSc and/or MSc degree and experience in biology, infection & immunity, biochemistry, microbiology, pharmacology, organic synthesis, glycochemistry, drug delivery or related subjects.

Successful applicants will be offered a 36-month employee contract at one of the partner institutions where they will be registered as PhD students. ESRs will receive a salary set out by the Marie Skłodowska-Curie Actions (MSCA) regulations. The salary includes living and mobility allowances and, if appropriate, a family allowance.

Please note that all criteria below are mandatory:

- Admission to the programme is open to applicants who hold a bachelor's and/or master's degree. A minimum of 240 ECTS and four years of legal duration in total is mandatory (please see each project for institutional requirements) or a comparable university degree (Second Cycle qualification), as required by the partner universities for admission to doctoral studies. The above-mentioned degrees must be obtained before the deadline indicated in this call for applicants.
- Requirements set by the consortium include a minimum of BSc Honours 2.1 and/or MSc degree (or equivalent) graduates in the fields of chemistry, medicinal chemistry, pharmacology, biochemistry, biology, microbiology, biomedical and biopharmaceutical sciences, medicine.

- Applicants should be proficient in written and spoken English (minimum level of B2 or equivalent). Those who have passed an English proficiency test such as (but not limited to) IELTS Academic or TOEFL should enclose the relevant certificate with their application. English proficiency of short-listed applicants will be assessed during the selection interview. Please note that English-speaking countries might have specific language requirements.
- Applicants should, at the time of recruitment, be **in the first four years** (full time equivalent research experience) of their research careers and not have been awarded a doctorate.
- At the time of recruitment by the host organisation, they must not have resided or carried out their main activity (work, studies, etc.) in the country of their host organisation **for more than 12 months in the 3 years** immediately prior to the recruitment date. Compulsory national service, short stays such as holidays, and time spent as part of a procedure for obtaining refugee status under the Geneva Convention are not taken into account.

Application and selection process

Applications for the positions below will be through a central application process run by the programme recruitment team.

Please note that to be eligible for appointment, successful applicants must comply with career stage and mobility criteria.

- Each applicant must submit a **single application** to the programme, which should include: **(i)** CV, **(ii)** detailed academic transcripts in the form of certified copies of all undergraduate and postgraduate level certificates, **(iii)** a motivation letter, **(iv)** a rank of 3 projects as instructed below, and **(v)** name, title, contact details (address, telephone number, email address) and the capacity in which you know them for three referees.
- Each candidate should **rank 3 projects** that they would like to be considered for, in descending order, together with a short justification for their preference. Candidates should, therefore, be willing to undertake any of the projects they indicated preference for, if they are successful in the application process.
- Applications should be submitted as a single .pdf document by email to office@bactivax.eu**.**
- Each applicant will be notified in writing of the outcome of their application. Incomplete applications will not be considered.
- Successful candidates will be invited for an interview at the recruitment meeting. Each interview will be attended by a panel including principal investigators from the BactiVax consortium. Interviews may also be carried using Skype or other online platforms.

BactiVax values gender balance and is committed to creating a diverse environment. All qualified applicants will receive equal opportunities and consideration for employment.

Projects

ESR1 – Exploiting an innovative proteomic approach for novel *Pseudomonas aeruginosa* vaccine antigen identification

Organisation/Institute: University College Dublin (Dublin, Ireland), www.ucd.ie

Supervisor: Assoc. Prof. Siobhán McClean

Informal enquiries: Siobhan.mcclean@ucd.ie

Project description: *P. aeruginosa* is a major cause of opportunistic infections in hospitalised patients and in people with chronic pulmonary disorders (e.g. cystic fibrosis; CF), and chronic obstructive pulmonary disease (COPD). It is highly antibiotic resistant and there is a clinical need for a vaccine to protect patients from chronic *P. aeruginosa* infection. This project involves using proteomic approaches to identify new vaccine antigens against *P. aeruginosa* and evaluating their host response. This ESR will (i) exploit our proteomic technology platform to identify a series of vaccine antigens by specifically identifying bacterial proteins involved in host cell binding; (ii) confirm expression during human infection by immunoproteomics; (iv) test efficacy as prophylactic vaccines in an acute infection model (WP2); (v) characterise mucosal response via secondment to CIC bioGUNE (Bilbao, Spain); (vi) be trained in protein fusion of subunit antigens in LIONEX (Braunschweig, Germany).

Specific requirements for the project: Minimum of BSc Hons 2.1 (minimum 240 ECTS during 4 years of study) or equivalent in Biochemistry, Microbiology, Immunology or related disciplines.

ESR2 – Novel glycoprotein vaccines to fight *Burkholderia* infections globally

Organisation/Institute: Queens University Belfast (Belfast, UK), www.qub.ac.uk

Supervisor: Prof. Miguel Valvano

Informal enquiries: m.valvano@qub.ac.uk

Project description: *Burkholderia* species are Gram-negative opportunistic bacteria that cause various diseases in humans, notably infections in people with cystic fibrosis and endemic infections in East Asia and Northern Australia (melioidosis). Vaccines for these infections are not available. We have characterised a novel protein glycosylation pathway conserved in all *Burkholderia* species that will be investigated to develop a novel anti-*Burkholderia* vaccine. Also, the *Burkholderia* lipopolysaccharide (LPS) and the protein glycosylation system will be glycoengineered as a scaffold to express and display various surface glycans exposed to the bacterial surface, giving rise to the possibility to engineer various vaccine antigens. This ESR will (i) Develop and test a refined vaccine antigen containing glycan antigens as well as T-cell antigens generated by other ESRs for use in humans and veterinary animals; (ii) Map the nature of the immune response against the most effective vaccine form (e.g. T- *vs*. B-cell responses); (ii)

perform glycoengineering and glycan surface display at the bacterial surface. Antigens will be characterised via collaboration with CNR-IBB in Naples, Italy (crystallography, molecular modelling). The ESR will involve secondments at Imperial College (London, UK) for training in ELISPOT and in Pfizer for training in bioconjugation & antigen purification.

Specific requirements for the project: MSc or equivalent in Biochemistry, Microbiology, Molecular Biology or related disciplines.

ESR3 – Vaccine antigen identification against systemic infections

Organisation/Institute: Ludwig Maximilian University of Munich (Munich, Germany), www.en.uni-muenchen.de, www.ccrc-hauner.de/ccrc

Supervisor: Prof. Johannes Huebner

Informal enquiries: johannes.huebner@med.uni-muenchen.de

Project description: The ESKAPE bacteria encompasses six pathogens (*Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa*, and *Enterobacter spp*) that are of great concern in the clinical setting due to their virulence and multiple antibiotic resistances. These ESKAPE pathogens are able to escape the biocidal effects of many antimicrobial agents and are major causes of nosocomial infections worldwide.

Therefore, the development of non-antibiotic treatments such as vaccines is of great importance. In this context, we will focus on methods to identify and characterise vaccine targets in Gram-positive ESKAPE pathogens (i.e. enterococcus and staphylococcus) related to serious systemic infections. The ESR will (i) use different approaches to identify carbohydrate and protein antigens targeted by opsonic antibodies; (ii) purify and characterise the antigens; (iii) conjugate protein and carbohydrate antigens for immunisation of rabbits; (iv) assess protective efficacy of rabbit sera and conjugates in established mouse models; (v) assess efficacy of novel adjuvants in these models with UNIMIB (Milan, Italy) (vi) characterise the precise epitopes of binding opsonic antibodies with CIC bioGUNE (Bilbao, Spain). The ESR will receive training by secondments in: (i) a proteomic platform developed by University College Dublin (Dublin, Ireland) to identify proteins involved in host cell attachment and (ii) in late stage process development (bioconjugation, high end analysis and purification) in Pfizer (Ireland).

Specific requirements for the project: MSc or equivalent in Biochemistry, Microbiology, Immunology, Molecular Biology or related disciplines (minimum 240 ECTS during 4 years of study). Physicians pursuing an MD-PhD (minimum of 3 years and 180 ECTS) will also be eligible.

ESR4 – Structural and functional characterisation of novel vaccine antigens

Organisation/Institute: National Research Council, Institute of Biostructures and Bioimaging (Naples, Italy), www.ibb.cnr.it

Supervisor: Dr. Rita Berisio

Informal enquiries: rita.berisio@cnr.it

Project description: Structure-based antigen design approach is a valid strategy for next-generation vaccine development. To this aim, the structural definition of the overall atomic-resolution structure of an antigen of its epitope regions is the driving force in the production of engineered antigens with improved immunological properties and provides biophysical tool that facilitate vaccine design and production. This project involves the use of a plethora of structural biology and biochemical approaches to characterise vaccine antigens against bacterial pathogens, including previously identified and patented efficacious *Burkholderia* antigens (UCD) and new Gram-positive and Gram-negative antigens, identified at UCD, QUB and LMU. The ESR will (i) clone, express & purify the antigens; (ii) characterise antigens by x-ray crystallography and spectroscopy; (iii) study protein-protein interactions by Surface Plasmon Resonance & Isothermal Titration Calorimetry; (iv) rationalise biological results using experimental and in silico analysis and identify mechanisms of action of identified antigens, and (v) apply data to design synthetic peptide epitopes. The ESR will involve secondments at CIC bioGUNE (Bilbao, Spain), EFPL (Lausanne, Switzerland) and IMXP (Gosselies, Belgium) for training in STD-NMR and in the development of synthetic peptide vaccines and analysis of T cell responses.

Specific requirements for the project: MSc or equivalent in Biochemistry, Chemistry, Biotechnology, Molecular Biology or related disciplines.

ESR5 – NMR molecular recognition of antigens by key receptors

Organisation/Institute: CIC bioGUNE | Center for Cooperative Research in Biosciences (Bilbao, Spain), www.cicbiogune.es

Supervisor: Prof. Jesús Jiménez-Barbero

Informal enquiries: jjbarbero@cicbiogune.es

Project description: The ESR will be trained in the study of molecular recognition events, with particular emphasis on the application of state-of-the-art NMR and molecular modelling techniques for the structural characterization of the complexes of different antigens with antibodies. The ESR will (i) investigate conformations of the antigens, their analogues and their molecular mimics with emphasis on structural and functional information by NMR spectroscopic techniques; (ii) The experimental data will be combined with those obtained molecular modelling (docking and molecular dynamics) and other biophysical techniques (ITC).

Specific requirements for the project:

The candidate should have a BSc in Biochemistry or Organic Chemistry and a MSc degree on Medicinal Chemistry or Biochemistry. Fluent English is required. Knowledge of Spanish language

will also be valued. Due to the interdisciplinary nature of the project, demonstrated knowledge on the application of NMR and computational chemistry in molecular recognition would be advantageous. Experience in protein expression, synthetic chemistry and drug design will also be valued.

ESR6 – Development of Toll-Like Receptor-directed adjuvants and incorporation in innovative vaccine formulations

Organisation/Institute: University of Milano Bicocca (Milan, Italy), www.unimib.it/

Supervisor: Prof. Francesco Peri

Informal enquiries: francesco.peri@unimib.it

Project description: Adjuvants are important components of vaccine formulation that optimise the protective immune response. Our group recently patented and published new small molecules that activate Toll-like Receptor 4 (TLR4), thus acting as immunostimulating agents and can be used as vaccine adjuvants. In this project the ESR will: 1) project and synthesize new TLR4 agonists; 2) analyse the TLR4 activity on cells of natural compounds extracted from natural sources; 3) formulate the adjuvant in the vaccine (in collaboration with Pfizer). Natural compounds will be also chemically modified to improve their pharmacodynamics and pharmacokinetic properties.

The ESR will be trained in medicinal chemistry and specifically in computational chemistry, synthetic methods, NMR spectroscopy, mass analysis and HPLC purification. The ESR will work in a young, multidisciplinary environment, encompassing the fields of organic and medicinal chemistry, computational chemistry, immunology and cell biology. The ESR will develop expertise in writing scientific papers, grants, in presenting oral communications at international meetings and will be trained to industrial skills and soft skills. The ESR is expected to do secondments at CIC bioGUNE (Bilbao, Spain) for training in NMR; at Cyclolab (Budapest, Hungary) for training in pharmacological formulations, and at Pfizer (Ireland) for training in vaccine development.

Specific requirements for the project: MSc or equivalent in Organic or Bioorganic Chemistry, Medicinal Chemistry or related disciplines.

ESR7 – Elucidation of the host response to facilitate more effective vaccines

Organisation/Institute: CIC bioGUNE | Center for Cooperative Research in Biosciences (Bilbao, Spain), www.cicbiogune.es

Supervisor: Prof. Juan Anguita

Informal enquiries: janguita@cicbiogune.es

Project description: Persistent pathogens have co-evolved with theirs hosts and developed strategies to modulate the immune responses of the host in order to avoid their clearance. These strategies include the 'training' of innate immune cells. The modulation of innate immune responses is particularly important in tissues in which the penetration of antibodies is poor, or the induction of antibodies responses (i.e. mucosal sites) is insufficient or inappropriate. The design of

vaccine formulations that not only induce T and B cell responses but are also able to enhance innate immune responses (particularly phagocytosis) offers novel strategies to control infections, especially those that yield predominant antibody responses that are not particularly efficient. The ESR will evaluate the comparative generation of immune responses against pathogens and symbionts as well as vaccine formulations against several microorganisms, including the mucosal pathogens enterohemorrhagic *E. coli* (EHEC) and *Mycobacterium tuberculosis*. The ESR will also train in vaccine efficacy and aerosol infection at SGUL (London, UK), proteomics and antigen identification at UCD (Dublin, Ireland) and in silico correlations of immune responses at ImmunXperts (Gosselies, Belgium).

Specific requirements for the project: MSc or equivalent in Biochemistry, Microbiology, Molecular Biology or related disciplines.

ESR8 – Production and characterisation of fusion protein antigens with a focus on increased solubility for large membrane proteins

Organisation/Institute: LIONEX GmBH (Braunschweig, Germany), www.lionex.de

Supervisor: Prof. Mahavir Singh

Informal enquiries: info@lionex.de

Project description: This project will focus on production and characterisation of fusion proteins with a high emphasis on increased solubility particularly for large membrane proteins and other biomarkers identified as vaccine candidates. The ESR will (i) be trained in the optimization of expression of high-quality proteins under ISO13458 certified conditions; (ii) clone vaccine candidates; (iii), fuse, express, purify in preparation for efficacy testing in different models; (iv) scale-up potential vaccine candidate expression using LIO GMP-compliant facilities and evaluate expression in several bacterial, yeast, baculovirus and eukaryotic systems; (v) characterise vaccine targets by the Octet platform analysis for studying receptor-ligand interactions. The ESR role will involve secondments at CNR-IBB (Naples, Italy) for training in structural biology approaches and at SGUL (London, UK) for training in vaccination planning and vaccination.

Specific requirements for the project: MSc or equivalent in Microbiology, Biology, Biochemistry, Molecular Biology or related disciplines.

ESR9 – Optimisation of host response and T-cell targeting

Organisation/Institute: Imperial College London (London, UK), www.imperial.ac.uk

Supervisors: Prof. Rosemary Boyton and Prof. Danny Altmann

Informal enquiries: r.boyton@imperial.ac.uk

Project description: This ESR project is based in the busy molecular immunology lab of Prof. Rosemary Boyton and Prof. Daniel Altmann. The lab has a long track-record of training students in human immunology studies and laboratory models to investigate a range of infectious and autoimmune disease processes. The proposed studies will build on ongoing work in the lab to

characterise the immunology of *Pseudomonas aeruginosa* (PA) infection – a cause of chronic lung infection of susceptible individuals such as those with bronchiectasis and cystic fibrosis. PA has genomic and transcriptomic adaptations that allow it to survive in the host lung, but the impact of these on immune system recognition have been only partially characterised. The first part of the project will investigate PA adaptations on innate immune activation and antigen-presenting cell gene expression and function. During the next phase of the project, the ESR will study the impact of these changes on T cell antigen recognition, activation and polarisation. In the last stage of the project, this knowledge will be used to characterise protective and pathogenic immune mechanisms in lung infection models, including analysis in our ongoing vaccine programme. The selected candidate will be trained in cellular and molecular immunology and microbiology. In addition, the candidate will be utilising state-of-the-art technologies including flow cytometry, transcriptomics, proteomics, and models of infectious and allergic inflammation using transgenics. Imperial College London is among the top 10 universities in the World and has an established PhD programme. The university provides support with high-quality training and career development activities which includes development of skills essential for career progression such as presentation and writing skills. The student will be based at the Hammersmith Hospital Campus of Imperial College London, which provides an exciting training environment. Informal enquires can be sent to Professor Rosemary Boyton.

Specific requirements for the project: Applicants must have a first or upper second-class BSc degree from a UK University, or the overseas equivalent, in immunology, biochemistry or microbiology and a strong interest in immunity to infection. A relevant Master's degree and experience in laboratory techniques and immunology would be advantageous. Applicants are required to meet Imperial College's English language requirements that can be found here: http://www.imperial.ac.uk/study/pg/apply/requirements/english

ESR10 – Post-exposure vaccination against multi-drug resistant tuberculosis

Organisation/Institute: St. George's University of London (London, UK), www.sgul.ac.uk

Supervisor: Dr. Rajko Reljic

Informal enquiries: rreljic@sgul.ac.uk

Project description: Tuberculosis is the single biggest killer among infectious diseases with 1.5 million deaths globally in 2018. Better measures are required at all levels to bring this dreadful disease under control, including better treatments, diagnostics and vaccines. The ominous rise in incidence of multidrug-resistant TB (MDR-TB) calls for further urgency in dealing with this global health threat. Post-exposure vaccination is an attractive approach to reducing disease incidence and transmission, particularly in the context of MDR-TB where the treatment options are limited. In this project, we will explore the potential of monoclonal antibodies (passive vaccination) and polymeric fusion protein antigens (active vaccination) to suppress an ongoing infection with MDR-

TB. The ESR will therefore be involved in an exciting, cutting edge project with significant translational potential towards application in humans.

We have at our disposal newly built state-of-the-art CL3 containment facilities for working with *Mycobacterium tuberculosis*, including the highly advanced Biaera aerosol infection system for experimental TB. Our institute is one of the main UK centres for studying bacterial resistance for academic and clinical purposes. The ESR will also have access to a number of core facilities such as whole genome sequencing, transcriptomics, imaging, microscopy, tissue culture, flow cytometry, recombinant protein production technologies and microbiological services. The ESR will be seconded to LIONEX (Braunschweig, Germany) to learn the process of recombinant protein and antibody production and purification.

Specific requirements for the project: The ESR should have a Master's degree in a biomedical discipline that involves some immunology or microbiology. The ESR should be familiar with basic laboratory techniques such as tissue culture, ELISA, Western and SDS-PAGE electrophoresis and protein chemistry. Experience with working with mycobacterial infection or experimental animals will be a distinct advantage.

ESR11 – Bicyclic peptide vaccine antigens

Organisation/Institute: École Polytechnique Fédérale de Lausanne (Lausanne, Switzerland), www.epfl.ch

Supervisor: Prof. Christian Heinis

Informal enquiries: christian.heinis@epfl.ch

Project description: Bicyclic peptides can be exploited as drugs that bind to and modulate disease targets, or as mimics of antigens for vaccine development. Our laboratory is specialized on the in vitro evolution of bicyclic peptides by phage display (Heinis, C., et al., Nature Chemistry, 2009). We have developed bicyclic peptides to a range of protein targets and are interested in translating them into therapeutics (Deyle, K., et al., Accounts in Chemical Research, 2017). C. Heinis is a co-founder of Bicycle Therapeutics (www.bicycletherapeutics.com). The ESR will (i) learn, apply and further develop our bicyclic peptide phage display technology; (ii) identify binders by NGS; (iii), chemically synthesize bicyclic peptides by solid-phase peptide synthesis; (iv) characterise their binding properties and test their efficiency as prophylactic antigen; (v) develop and screen a library of bicyclic peptides; (vi), synthesise and characterise isolated bicyclic peptides, for testing of the best peptides as vaccines/ligands.

Specific requirements for the project: MSc in Chemistry, Chemical Biology, Molecular Biology, Biochemistry, or related disciplines.

ESR12 – Optimisation of adjuvants for therapeutic vaccinations against respiratory infections

Organisation/Institute: University College Dublin (Dublin, Ireland), www.ucd.ie

Supervisor: Assoc. Prof. Siobhán McClean

Informal enquiries: Siobhan.mcclean@ucd.ie

Project description: Effective vaccines require appropriate adjuvants to optimise the protective immune response. This project will focus on investigating novel adjuvants that elicit effective mucosal immune responses. The ESR will be investigate host responses to chronic *Pseudomonas aeruginosa* infection, apply proteomic approaches to identify host receptors for novel vaccine antigens and assess a series of novel BactiVax adjuvants and antigens to optimise a vaccine therapy for clearance of chronic infection. The ESR will also develop methods to identify correlates of protection associated with clearance of chronic infection, on secondment in ImmunXperts (Gosselies, Belgium).

Specific requirements for the project: Minimum of BSc Hons 2.1 (minimum 240 ECTS during 4 years of study) or equivalent in Pharmacology; Biochemistry, Microbiology, Immunology or related disciplines.

ESR13 – Nanocapsulated peptide-based immunotherapeutics

Organisation/Institute: Eötvös Loránd University (Budapest, Hungary), www.elte.hu

Supervisor: Dr. Kata Horváti

Informal enquiries: khorvati@gmail.com

Project description: The most important issue in vaccine development is to balance safety with efficacy. The use of synthetic peptide-based vaccines which can trigger the desired immune response and can reflect on the antigenic variability is a safe approach, but the low immunogenicity needs to be addressed. In this project we will investigate a new approach that combines vaccination, host-directed therapy and advanced vaccine/drug-delivery with the aim of improving treatment outcomes of antimicrobial resistant infection with a focus on *Mycobacterium tuberculosis.* The ESR will work on the synthesis and characterisation of multicomponent peptide-based vaccine conjugates. To increase immunogenicity and overall bioavailability, conjugates will be formulated (polymeric nanoparticles, cyclodextrins, etc.) and the new candidates will be tested *in vitro* and *in vivo* in a murine model of tuberculosis. Planned secondments involve the training in preparation of cyclodextrin formulations (Cyclolab, Budapest, Hungary- 2 months) and training in BSL3 infectious agents, respiratory infection model and testing of vaccine efficacy (St George's, University of London, 6 months).

Specific requirements for the project: MSc degree in chemistry, biochemistry, pharmacology or related fields with an interest in peptide chemistry and the willingness to learn BSL2 and BSL3 biological assays.

ESR14 – Development of a therapeutic vaccine against *P. aeruginosa*

Organisation/Institute: Ludwig Maximilian University of Munich (Munich, Germany), www.en.uni-muenchen.de, https://www.ccrc-hauner.de/ccrc

Supervisor: Prof. Johannes Huebner

Informal enquiries: johannes.huebner@med.uni-muenchen.de

Project description: *Pseudomonas aeruginosa* is an important opportunistic pathogen causing a wide range of acute and chronic infections in immunocompromised patients. These pathogens pose increasing problems in the hospital setting due to the emergence of drug-resistant strains. This project will try to isolate and characterize novel monoclonal antibodies against P. aeruginosa. The ESR will (i) isolate B-cells that produce opsonic and protective antibodies against bacterial pathogens; (ii) isolate and characterise novel monoclonal antibodies in vitro for affinity and opsonic activity; (iii) scale-up promising monoclonal antibodies for efficacy testing in chronically infected mice in collaboration with UCD; (iv) identify target antigens through secondments with partners CIC bioGUNE (Bilbao, Spain) and CNR-IBB (Naples, Italy).

Specific requirements for the project: MSc or equivalent in Biochemistry, Microbiology, Immunology, Molecular Biology or related disciplines (minimum 240 ECTS during 4 years of study). Physicians pursuing an MD-PhD (minimum of 3 years and 180 ECTS) will also be eligible.

ESR15 – Development of *in vitro* immune monitoring for candidate vaccines and identification of correlates of protection

Organisation/Institute: ImmunXperts (Gosselies, Belgium), www.immunxperts.com

Supervisor: Dr. Séverine Giltaire

Informal enquiries: severine.giltaire@immunxperts.com

Project description: The BactiVax project was created to tackle the societal challenge caused by the emergence of antimicrobial resistance (AMR) human pathogens and bring significant impact on dealing especially with pathogens causing chronic, life-threatening respiratory and/or systemic infections. The project BactiVax will target selected ESKAPE pathogens (a group of multidrug resistant bacteria that are the leading cause of hospital infections globally, which “escape” biocidal action of antibiotics (3), e.g. *Pseudomonas aeruginosa*, staphylococci, enterococci). The ESR will be trained at IMXP in immunoanalytical platforms such as cytokine analysis (ELISA, HTRF and Luminex), T and B cell ELISPOT and multicolour flow cytometry for the evaluation of different phenotypic populations in combination with the secretion of cytokines. The ESR will optimise a suite of in vitro assays to evaluate candidate antigens/adjuvant combinations (identified in WP1) using human peripheral blood cells from healthy donors (male and female) and to identify correlates of protection in patient samples. ESR15, on secondment at St Georges Hospital, University of London (SGUL), will perform in vivo studies to evaluate Th17 response giving maximal protection against mucosal pathogens and will be trained in identification of host receptors using a proteomic approach at University College Dublin (UCD).

Specific requirements for the project: MSc or equivalent (minimum 300 ECTS) in Biology, Immunology, Cellular Biology, Molecular Biology or related disciplines.