



Marie Curie ANSWER ITN announces 15 PhD student positions in the framework of urban wastewater treatment and reuse

Applications are invited for 15 PhD student positions ("Early Stage Researchers" (ESRs)) to be funded by the Marie Skłodowska Curie Innovative Training Network **ANSWER - "Antibiotics and mobile resistance elements in wastewater reuse applications: risks and innovative solutions"** within the Horizon 2020 Programme of the European Commission. ANSWER is a consortium of high profile universities, research institutions and companies located in Austria, Cyprus, Germany, Israel, Italy, the Netherlands, Portugal, Slovakia and Spain.

Number of PhD positions available: 15

The main objective of ANSWER is to develop well-trained and creative ESRs through innovative PhD projects to unravel the highly complex factors driving antibiotics and antibiotic-resistant bacteria and resistance genes (A&ARB&ARG) propagation in the framework of urban wastewater reuse, in order to assess the relevant environmental and public health risks, able to face current and future challenges and to convert knowledge and ideas into products and services for economic and social benefit. ANSWER aims to substantially contribute to the relevant EU wastewater policies, by providing valuable contributions for guidelines and recommendations for sustainable wastewater reuse. This will be achieved by a combination of innovative hypothesis-based empirical studies encompassing small- to field-scale experiments, novel combination of bioassays for effect monitoring, which will collectively result in the determination of A&ARB&ARG with highest impact in effluent reuse. Novel protocols/systems for their identification will be developed, particularly for wastewater, for soil where irrigation is taking place, groundwater beneath such soils, in crops and in surface water that serve as storage before reuse. Soil amendment strategies will be explored in order to reduce their bioavailability during irrigation. The fate of A&ARB&ARG during activated sludge treatment will be investigated and modelled, while innovative wastewater treatment technologies will be evaluated for their potential to minimise in downstream environments. A scientific base for prioritization and policy development will be developed. This will improve the understanding of how various conditions and processes impact the diversity and spreading of A&ARB&ARG, supporting the implementation of measures to prevent the contamination of the environment and food chain.

For more information about the project objectives and activities please contact Dr. D. Fatta-Kassinou (dfatta@ucy.ac.cy). For further details regarding specific positions (i.e. deadline for applications submission, specific required expertise, etc.), please contact the responsible scientists indicated in the specific advertisement below. Applications should be submitted directly to the respective hosts.

Eligibility criteria

We are looking for talented, highly motivated and enthusiastic junior scientists, able to plan and prioritise their work in order to meet deadlines, with a preferential background in environmental sciences, chemical engineering, environmental engineering, analytical chemistry, molecular biology, microbial ecology, microbiology and bioinformatics. Previous experience in fields directly related to the specific positions is a plus. Excellent research skills and analytical abilities are required, fluency in English (both spoken and written), proactive communication skills and problem solving as part of a team, strong record keeping, great work ethic and initiatives are essential characteristics.



Applicants need to fully respect three eligibility criteria:

1. **Early stage researchers (ESRs):** are those who are, at the time of recruitment by the host organisation, in the first four years (full-time equivalent research experience) of their research careers and have not been awarded a doctoral degree. This is measured from the date when they obtained the degree which formally entitles them to embark on a doctorate, either in the country in which the degree was obtained or in the country in which the researcher is recruited or seconded, irrespective of whether or not a doctorate is or was ever envisaged.
2. **Conditions of international mobility of researchers:** Researchers are required to undertake transnational mobility (i.e. move from one country to another) when taking up the appointment. **At the time of selection by the host organisation, researchers must not have resided or carried out their main activity (e.g. work, studies, etc.) in the country of their host organisation for more than 12 months in the 3 years immediately prior to their recruitment.** Compulsory national service and/or short stays, such as holidays are not taken into account.
3. **English language:** Network fellows (ESRs) must demonstrate that their ability to understand and express themselves in both written and spoken English is sufficiently high for them to derive the full benefit from the network training.

Salary

ESRs participating in "ANSWER" ITN will receive a salary, determined by the Marie Curie Actions/Horizon 2020 guidelines.

For more information, please see:

http://ec.europa.eu/research/mariecurieactions/careers_en.htm

Applications

To apply, please provide:

1. a cover letter detailing your suitability for the position in question;
2. a detailed CV;
3. original or certified copies of all tertiary-level academic transcripts and grading schemes;
4. two recommendation letters from Academics;
5. evidence of proficiency in English language;
6. a recent photograph.

*All the above certifications should be applied/translated in English language.

All applications will be evaluated by a committee, consisting of representatives from the host institutions, with equality and based strictly on the candidates' skills, whereas issues as gender, ethnicity, disability, etc. will be irrelevant to the selection.

All applications should be submitted directly to the responsible scientists of the respective hosts as indicated in the specific advertisement.



The positions

The following 15 PhD positions are available:

No	Title	Host institution	Country
ESR1	Measurement of the impact of antibiotic resistance discharge in wastewater and in soil: ecological aspects	UCP	Portugal
ESR2	Development and application of novel methods for targeting mobile genetic elements in wastewater and downstream environments	ARO	Israel
ESR3	Effect of wastewater irrigation on the passage of ARB&ARG towards ground/surface waters	TUD	Germany
ESR4	Modelling the dissemination of ARB&ARG from irrigation to ground/surface water	TUD	Germany
ESR5	Dissemination and fate of wastewater-derived ARB&ARG in surface water as a storage means before reuse	KWR	The Netherlands
ESR6	Genetic analysis of endophytic bacteria in edible plants by high-throughput sequencing	CSIC	Spain
ESR7	Evaluation of possible risks of antibiotic resistance transmission to humans by treated wastewater-irrigated crops	UCP	Portugal
ESR8	Uptake of antibiotics and antibacterial contaminants in crops	CSIC	Spain
ESR9	Modelling horizontal resistance gene transfer by free DNA in activated sludge treatment plants and soil	TU-Wien	Austria
ESR10	Management options for conventional and advanced wastewater treatment technologies and plant operation conditions to improve the efficiency of antibiotic resistance removal	TU-Wien	Austria
ESR11	MBR followed by light-driven oxidation for the minimization of A&ARB&ARG from urban wastewater intended for reuse	UCY	Cyprus
ESR12	Development of a new photocatalytic reactor for wastewater disinfection and subsequent application in crops irrigation: effect on antibiotic resistance transfer and ARB&ARG accumulation in crops	UNISA	Italy
ESR13	Light-Emitting Diodes (LEDs)-driven photocatalytic membrane treatment of ARB&ARG and market/benchmark assessment	Adventech	Portugal
ESR14	Investigating the potential of transformation products (TPs) of antibiotics formed during advanced wastewater treatment to induce biological adverse effects and antibiotic resistance	UCY	Cyprus
ESR15	Advanced methods for identification and risk assessment of present and future antibiotics and their transformation products in wastewater	EI	Slovakia

Adventech: Adventech - Advanced Environmental Technologies LDA; ARO: The Ariculture Research Organization of Israel - The Volcani Centre; EI: Environmental Institute; KWR: KWR Water B.V.; UCP: Universidade Catolica Portuguesa; TUD: Technische Universitaet Dresden; CSIC: Agencia Estatal Consejo Superior de Investigaciones Cientificas; TU-Wien:Technische Universitaet Wien; UCY: University of Cyprus; UNISA: Universita Degli Studi Di Salerno.



Below a description is given for each of the 15 positions:

ESR1

Title: Measurement of the impact of antibiotic resistance (AR) discharge in wastewater and in soil: ecological aspects

Brief description:

- evaluate the fate of ARB&ARG discharged through wastewater in soils, using microcosm assays and multi-parametric ecology approaches;
- monitor AR phenotypes, genotypes and resistance/mobilization gene expression over time, in function of different controlled variables including: i) type/dose of A&ARB&ARG; ii) presence of antibiotic sub-inhibitory concentrations; iii) temperature; iv) soil C:N:P ratio and salinity; v) soil microbial community (diversity/richness/stability);
- test the influence of the most relevant variables determined based on microcosm assays in real wastewater irrigated fields.

Duration: 36 months

Location: Universidade Catolica Portuguesa (UCP), Portugal

Contact: Dr. C. Manaia; email: cmanaia@porto.ucp.pt

ESR2

Title: Development and application of novel methods for targeting mobile genetic elements in wastewater and downstream environments

Brief description:

- develop novel methods for characterization of plasmid - and integron - associated ARGs (PI-ARGs);
- determine the abundance and diversity of PI-ARGs in wastewater as a function of treatment technologies;
- assess the stability, host range and transfer frequency of effluent-derived PI-ARGs in downstream environments;
- develop models to predict PI-ARGs dynamics in downstream environments.

Duration: 36 months

Location: The Ariculture Research Organization of Israel - The Volcani Centre (ARO), Israel

Contact: Dr. E. Cytryn; email: eddie@legacy.agri.gov.il



ESR3

Title: Effect of wastewater irrigation on the passage of ARB&ARG towards ground/surface waters

Brief description: - assess and quantify ARB&ARG during subsoil passages from surface water/matter to groundwater;

- evaluate potential impacts of subsoil criteria (physico-chemical composition) influencing the resistomes, mobilomes, and composition of bacterial communities analysed via metagenomic approaches. Transcriptome analyses will describe key targets involved in the selection and micro-evolution during passages to water;
- bacteria will be identified being relevant for ecology and human health risk, including the persistence in anaerobic groundwater and their genetic backgrounds.

Duration: 36 months

Location: Technische Universitaet Dresden (TUD), Germany

Contact: Prof. Th. Berendonk; email: thomas.berendonk@tu-dresden.de

ESR4

Title: Modelling the dissemination of ARB&ARG from irrigation to ground/surface water

Brief description: - evaluate models on the chemical fate for the groundwater impact of irrigation and assess the suitability for mathematical modelling of ARB&ARG;

- establish small-scale experiments to verify (ecological, molecular and evolutionary) processes implemented in the mathematical model;
- include data from ESR3 and finalise modelling on the fate and proliferation, propagation of ARB&ARG and evaluate the abundance and accumulation of them in ground/surface water;
- formulate a hazard assessment for the potential long-term contamination of existing water resources.

Duration: 36 months

Location: Technische Universitaet Dresden (TUD), Germany

Contact: Prof. Th. Berendonk; email: thomas.berendonk@tu-dresden.de



ESR5

Title: Dissemination and fate of wastewater-derived ARB&ARG in surface water as a storage means before reuse

Brief description:

- initiation of q-PCR-based monitoring strategy for fast and robust detection of A&ARB&ARG in wastewater and surface water;
- monitor the dissemination and fate of ARB&ARG in surface water;
- determine the antibiotic resistance uptake potential of indigenous microbiological populations present in surface water by microcosm assays;
- assess the biological potency of the wastewater and how this relates to antibiotic resistance spread.

Duration: 36 months

Location: KWR Water B.V. (KWR), the Netherlands

Contact: Prof. G. Medema; email: Gertjan.medema@kwrwater.nl

ESR6

Title: Genetic analysis of endophytic bacteria in edible plants by high-throughput sequencing

Brief description:

- assess taxonomic changes of endophytic bacteria related to the quality of irrigation water (16S RNA sequencing) using *Daucus carota* as a model species;
- quantify the prevalence of secondary metabolism enzymes in the roots' microbiome related to degradation/metabolism of antibiotics (metagenome analysis);
- detect and quantify plasmids bearing antibiotic resistance genes plasmid assembly and characterization. This crop is selected because of its fully characterized DNA.

Duration: 36 months

Location: Agencia Estatal Consejo Superior de Investigaciones Cientificas (CSIC), Spain

Contact: Dr. B. Piña; email: benjami.pina@idaea.csic.es



ESR7

Title: Evaluation of possible risks of antibiotic resistance transmission to humans by treated wastewater-irrigated crops

Brief description:

- characterise the microbiota associated with various plants and inference of the likelihood of the transmission via wastewater-soil-plant;
- identify vulnerable crops and vegetables types;
- compare the resistance prevalence (culture-dependent and independent) in plants cultivated with freshwater and wastewater irrigation;
- assess resistance stability in human stomach model medium, infer about the potential of transfer to humans.

Duration: 36 months

Location: Universidade Catolica Portuguesa (UCP), Portugal

Contact: Dr. C. Manaia; email: cmanaia@porto.ucp.pt

ESR8

Title: Uptake of antibiotics and antibacterial contaminants in crops

Brief description:

- investigate the fate of antibiotics in water-soil-root system;
- evaluate the uptake and translocation of antibiotics and their metabolites prone to promote antibiotic resistance bacteria;
- identify key physico-chemical properties affecting uptake, translocation and metabolization of antibiotics in field-scale irrigation and greenhouse experiments;
- develop strategies to reduce the antibiotics' uptake by crops from soils.

Duration: 36 months

Location: Agencia Estatal Consejo Superior De Investigaciones Cientificas (CSIC), Spain

Contact: Dr. J. Bayona; email: josep.bayona@idaea.csic.es



ESR9

Title: Modelling horizontal resistance gene transfer by free DNA in activated sludge treatment plants and soil

Brief description:

- develop a mathematical model to describe horizontal ARB&ARG transfer by free DNA in activated sludge wastewater treatment plants and in soil as a function of relevant parameters as bacterial growth and decay;
- identify additional parameters significant for the model precision and perform sensitivity analysis;
- use results derived from the determination of selected ARB&ARG under different environmental conditions (ESRs1,2,4) for model calibration and validation;
- apply the model to ARB&ARG to compare transformation intensities and derive selection criteria for corresponding genes.

Duration: 36 months

Location: Technische Universitaet Wien (TU-Wien), Austria

Contact: Dr. N. Kreuzinger; email: norbkreu@iwag.tuwien.ac.at

ESR10

Title: Management options for conventional and advanced wastewater treatment technologies and plant operation conditions to improve the efficiency of antibiotic resistance removal

Brief description:

- assess the significance of typical fluctuations in the inflow of wastewater treatment plants (e.g. flow, organic and salt load, temperature, seasonal occurrence of A&ARG and operation conditions (e.g. redox conditions, sludge retention time, bacteria density) on antibiotic resistance mechanisms;
- evaluate advanced technologies for further removal of antibiotics (i.e. ozonation, activated carbon adsorption) for their effect on antibiotic resistance mechanisms;
- identify processes selecting for antibiotic-resistant bacteria that can be influenced by optimization of technology and operation.

Duration: 36 months

Location: Technische Universitaet Wien (TU-Wien), Austria

Contact: Dr. N. Kreuzinger; email: norbkreu@iwag.tuwien.ac.at



ESR11

Title: Membrane bioreactor (MBR) followed by light-driven oxidation for the minimization of A&ARB&ARG from urban wastewater intended for reuse

Brief description:

- determine the potential of MBR treatments, operated at pilot scale, to remove selected A&ARB&ARG;
- evaluate the efficiency of the process when combined to light-driven (i.e. solar, UV, LED) + H₂O₂ oxidation to remove A&ARB&ARG;
- assess the uptake potential of A&ARB&ARG from the treated effluents, by selected crops (i.e. tomatoes, lettuce, alfalfa: *Medicago sativa*) in irrigated experimental fields already available by UCY, (uptake potential will be evaluated in roots, leaves and stems);
- cost analysis of the optimum technology to be identified.

Duration: 36 months

Location: University of Cyprus (UCY), Cyprus

Contact: Dr. D. Fatta-Kassinos; email: dfatta@ucy.ac.cy

ESR12

Title: Development of a new photocatalytic reactor for wastewater disinfection and subsequent application in crops irrigation: effect on antibiotic resistance transfer and ARB&ARG accumulation in crops

Brief description:

- develop a method/protocol to evaluate the effect of heterogeneous photocatalysis (HPC) on antibiotic resistance transfer mechanism in aqueous matrices;
- evaluate the effect of HPC on the inactivation and antibiotic resistance transfer in aqueous matrices;
- develop a new photocatalytic reactor with fixed catalyst for secondary treated wastewater treatment/disinfection;
- apply the new photocatalytic reactor to real wastewater treatment to evaluate the effect on the abundance of target genes in crops irrigated with the treated wastewater vs. non-treated crops in small-scale greenhouse

Duration: 36 months

Location: Università Degli Studi Di Salerno (UNISA), Italy

Contact: Dr. L. Rizzo; email: l.rizzo@unisa.it



ESR13

Title: Light-Emitting Diodes (LEDs)-driven photocatalytic membrane treatment of ARB&ARG and market/benchmark assessment

Brief description:

- identification of the best catalyst and immobilization technique into ultrafiltration (UF) ceramic membranes for the LEDs-driven photocatalytic treatment of ARB&ARG contained in urban wastewater (experiments will be performed using simulated and real effluents, systematic evaluation of pH, temperature, initial concentration/flow rates of A&ARB&ARG stream and of the oxidant);
- optimization of the treatment efficiency for ARB&ARG removal (using bioassays, determining antibiotics and antibiotic resistance removal);
- up-scaled technology (biofouling and clogging of membranes when applied to real wastewater will be dealt - e.g. through periodic relaxation, backwashing, chemical cleaning and possible manipulation of hydrodynamic conditions – along with rigorous screening of the feed wastewater; the evaluation of the efficiency under unstable conditions e.g., inlet concentration in the raw wastewater will be studied as well as possible consecutive regeneration steps of the membrane);
- benchmarking of the results obtained against conventional treatment (focused on efficiency, price and placement of the new technology; the price of a commercial unit using the technology developed here will be estimated based in the field experience of Adventech and compared with the conventional solutions, such as non-catalytic UV oxidation, etc.);
- market placement analysis to evaluate the economic viability of the new solution and its market acceptability.

Duration: 36 months

Location: Adventech - Advanced Environmental Technologies LDA (Adventech), Portugal

Contact: Mr. S. C. Silva; email: sergio.silva@adventech.pt



ESR14

Title: Investigating the potential of transformation products (TPs) of antibiotics formed during advanced wastewater treatment to induce biological adverse effects and antibiotic resistance

Brief description:

- elucidate the structures of TPs of selected antibiotics formed during light-driven (solar, UV, LED) + H₂O₂ oxidation;
- evaluate their potential of being active after their release in the environment and to contribute to the development of resistance in soil bacteria;
- evaluate the potential of the antibiotics and their TPs to induce toxicity, cyto/muta/estro/genogenicity, thyroid and glucocorticoid disruption, etc. and understand the implications that this may have on ecological and human health;
- establish correlation factors between TPs, biological effects and resistance development;
- test/validate the aforementioned tools and methods for wastewater treated by various advanced oxidation technologies.

Duration: 36 months

Location: University of Cyprus (UCY), Cyprus

Contact: Dr. D. Fatta-Kassinos; email: dfatta@ucy.ac.cy

ESR15

Title: Advanced methods for identification and risk assessment of present and future antibiotics and their transformation products (TPs) in wastewater

Brief description:

- develop a robust workflow for determination of antibiotics and their TPs in wastewater using advanced chromatography-mass spectrometry techniques and latest available software for structure elucidation;
- develop an automated procedure for collection of experimental modelling-based data on physicochemical and (eco)toxicological properties of antibiotics and their TPs;
- develop an automated procedure for prioritisation of antibiotics and their TPs based on their hazards as identified in ESR14;
- contribute to a guidance for establishment of emission limits values (ELVs) for antibiotics and their TPs in wastewater for irrigation;
- assess the potential of the state-of-the-art passive sampling techniques in the monitoring of antibiotics and their TPs.

Duration: 36 months; **Location:** Environmental Institute (EI), Slovakia;

Contact: Dr. J. Slobodnik; email: slobodnik@ei.sk
