# Call for application for Ph.D sandwich program in the field of biotechnology at the University of Rwanda

## I. Background

The University of Rwanda in collaboration with European Universities is pleased to announce the availability of 5 PhD positions in the areas of biotechnology. Interested and qualified candidates are invited to apply. The development of biotechnology can offer vast opportunities to a country, helping it to grow economically, providing jobs, and supporting sustainable development, public health, agriculture, and environmental protection. The University of Rwanda, in collaboration with Belgium universities, has received a fund from the European Union through the Enabel-Kwigira Project to support PhD studies in the area of biotechnology. Through consultative meetings with different stakeholders of biotechnology in Rwanda, research topics in the areas of biotechnology have been proposed. Those proposed areas cover different thematic of Biotechnology, Medical Biotechnology, Animal Biotechnology, Plant/Agriculture Biotechnology, Industrial Biotechnology, Pharmaceutics, and Vaccine clinical trials.

Interested candidates can choose one of the topics in the list and apply for a PhD grant. Shortlisted applicants will have to prepare a full research proposal (*see attached template*) and a short (10-minute) presentation on the subject before defending their application in front of a jury for the final selection. The aim is to select 5 PhD candidates with excellent projects. Successful candidates will be hired on a "sandwich" PhD program at the University of Rwanda.

## II. Description of the scholarship

This call is for PhD candidates and will be primarily funded by European Union through the Enabel-Kwigira Project. The aim of this scholarship's program is to develop faculty capacity in the area of biotechnology to sustain different programs in the area of biotechnology at the University of Rwanda and produce evidence-based research outputs that address a specific challenge.

The scholarship program is expected to start in the academic year 2024-2025 and priority will be offered to candidates from UR, though potential candidates from relevant government & public institutions will be given a chance to compete on these scholarships. The doctoral study will be performed partly in Rwanda and partly in a selected international host university. All selected candidates will be registered under the PhD in Biomedical Sciences-CMHS. The candidates will be working on one of the following thematic areas:

**Thematic area 1: Targeting the Lipid Metabolic Pathways for the Treatment of Malaria (General Theme: Lipidomics)**

In the context of targeting the lipid metabolic pathways for the effective treatment of malaria in resource limited settings, this PhD project will investigate pathways in Malaria development and pathogenesis. The present study will also characterize the importance of using genetic approaches to develop anti-malarial therapies targeting lipid metabolic pathways.

The control and eradication of human malaria is considered the most serious global health concern of the 21st century. Malaria caused by intraerythrocytic protozoan parasites of the genus *Plasmodium* is by far the most lethal and among the most prevalent infectious diseases. Besides the four species of *Plasmodium* (*P. falciparum, P. malariae, P.ovale, and P.vivax*) that are known to be infectious to humans, more recent cases of infection due to *P. knowlesi* have also been reported. The rapid emergence of drug-resistant *Plasmodium* strains in sub-Saharan Africa has been implicated to severely reduce the potency of medicines commonly used to treat and block the transmission of malaria and this threatens the effectiveness of combination therapy in the field. Furthermore, the spread of *P.vivax* in East Africa and the rise in the prevalence of co-infections pose additional challenges to malaria elimination programs.

For applications in precision medicine, the combination of genomic and lipidomic profiling can lead to personalized treatment plans based on an individual's genetic makeup and metabolic profile. There is a need to demonstrate how the integration of lipidomics with genomics, proteomics, and metabolomics can enable a holistic understanding of malaria pathogenesis and the development of novel diagnostics and therapeutics. Some findings suggest that changes in the lipid profile of resistant parasites compared to sensitive ones can provide insights into how lipid metabolism contributes to drug resistance. These insights can potentially lead to the development of combination therapies that target both genetic and lipidomic processes of the parasite. Recent studies highlighted novel metabolic pathways for the synthesis of *P. falciparum* phospholipids and fatty acids. These findings pinpoint new potential drug targets that target important parasite functions that currently are not the topic of anti-malarial development strategies and have the potential to act against multi-drug-resistant *Plasmodium* strains and are therefore urgently needed.

This research project will provide the student with exposure and experience to apply new technologies and approaches for the development of novel drugs such as essays, computer-aided drug design, known and potential drug targets, and natural sources for novel anti-malarial compounds. The student is also expected to learn about the performance of current drugs and therapies, the influence of formulation and targeted delivery, and strategies to overcome drug resistance without forgetting vaccination as an alternative to drug therapy in the resource-limited setting, Rwanda in particular. The application of this interdisciplinary research extends to other diseases highlighting the importance of metabolism in the development of new therapeutic strategies against infections as well as non-communicable diseases.

**Thematic area 2:** **Optimizing the Efficient Pathogen-Agonistic Aircraft-Based Wastewater Metagenomic Surveillances Network for early Warning of Future Pandemics in Rwanda for proactive Outbreak Preparedness and Response (General theme: Vaccine Clinical Trials).**

International airports can have a key role in screening, detection, and mitigating cross-border transmission of potentially infectious diseases. With aircraft passengers representing a subpopulation of a country or region, aircraft-based wastewater surveillance could be a promising approach to effectively identifying emerging viruses and other pathogens tracing their evolution, and mapping global spread with international flights.

This surveillance program requires routinely collecting aircraft wastewater samples for microbiological analysis and sequencing and linking the resulting data with associated international air traffic information. With the creation of a strong international alliance between the airline industry and health authorities, this surveillance network will potentially complement public health systems with a true early warning ability to inform decision-making for new variants and future global health risks. The objective of this PhD study is to have this project setup as part of an international collaboration of Water Based Epidemiology (WBE) scientists between several countries with wastewater samples collected from aircraft landing at different Airports.

In Rwanda, wastewater samples will be collected from aircraft landing at Kigali International Airport (KGL), and other international airports. The project will look to develop WBE laboratory technologies suitable and optimized for the detection of microbial signatures of potential public health importance directly from aircraft wastewater tanks. This includes both shotgun metagenomics for the exploration of all genetic material, plus pathogen-specific tools focused on anti-microbial resistance (AMR) genes and diseases of public health importance (such as enteric fever). This will involve the latest technologies with advanced methodologies. In combination with fully anonymized flight metadata, longitudinal sampling of aircraft wastewater at sites will use standardized tools to look at both within-country and between-country variations and create a descriptive model of air travel corridors from different parts of the globe. From the perspective of each project partner, these data can help inform the utility of this approach in looking to establish an evidence-based risk assessment for the future importation of diseases. These include WBE profiling from distinct regions of the world with separate endemic disease challenges, and common threats such as bacterial AMR.

The Outcome of this study is that a system can exploit new next-generation sequencing (NGS) technologies to identify known and novel viruses and pathogens and evaluate their diversity and circulation in relevant communities in areas with emerging infectious diseases of public health concern. The formation of this global network also aligns with the new WHO 10-year strategy (2022–32) to scale up and strengthen genomic surveillance of pathogens worldwide.

### Thematic area 3: Personalized Medicine. Genomic Profiling for Precision Medicine in Non-Communicable Diseases: A Focus on Cancer. (General theme: Immunogenomics in Personalized Cancer Treatment)

This PhD project will investigate the role of genomics in the context of non-communicable diseases, with a primary focus on cancer.

The candidate will use next-generation sequencing tools to profile the genomic landscape of cancer patients in Rwanda. This research aims to identify genetic variations associated with different cancer types, treatment responses, and prognosis. The outcome will contribute to the development of personalized treatment approaches, allowing for more effective cancer therapies tailored to individual patients. The expected outcome is the advancement of precision medicine in Rwanda's healthcare system.

By tailoring vaccines to the genomic profiles of patients, this research aims to enhance the efficacy of immunotherapy and precision medicine in combating non-communicable diseases. The expected outcome is the development of cutting-edge personalized vaccination strategies, aligning with Rwanda's goals for biotech-driven healthcare solutions.

**Thematic area 4:** Bacterial genomics: Investigating Molecular epidemiology, antimicrobial resistance patterns, and genomic characterization of multi-drug resistance bacterial pathogens (General theme: Antimicrobial Resistance)

Antimicrobial resistance (AMR) is a serious public health threat in both developed and developing countries. Healthcare-associated infections (HAIs) caused by multi-drug resistant (MDR) bacterial pathogens are a growing concern worldwide, posing significant challenges to patient safety and public health. In healthcare settings, the emergence and spread of these resistant bacteria can lead to increased morbidity, mortality, and healthcare costs. Effective strategies to combat the threat of MDR infections require a comprehensive understanding of the molecular epidemiology, antimicrobial resistance patterns, and genomic characteristics of the causative bacterial pathogens.

As part of efforts to address growing global resistance to antimicrobial medicines, WHO published a list of antibiotic-resistant "priority pathogens» that pose the greatest threat to human health. The list was drawn up in a bid to guide and promote research and development (R&D) of novel antibiotics for treatment. Among multi-drug resistant bacterial pathogens, ESKAPE (*Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumanii, Pseudomonas aeruginosa and Enterobacter* species) pathogens, which effectively 'escape' the effects of antibacterial drugs, has been grouped in critical and high groups of the WHO bacterial priority pathogen list. Phenotypic characterization of bacterial pathogens using conventional methods like culture and AST has been the classic method to detect AMR.

However, such methods have been associated with pitfalls like being lengthy (2-4 days), unable to confirm species or the presence of resistance genes and mobile elements, and lacking platforms for comparing results. Recently, molecular methods including the Whole-Genome Sequencing (WGS) have emerged as a fast and accurate method for AMR detection. It helps to monitor trends and mechanisms underlying specific resistances necessary to understand AMR transmission dynamics and genomic pathogen surveillance and AMR. The main objective of this research is to enhance the understanding of the epidemiology, resistance patterns, and genomic characteristics of MDR bacterial pathogens in the Rwandan healthcare systems. The findings will assist in understanding the transmission modes which will aid in strengthening infection control and prevention in healthcare facilities and in the community and AMR surveillance systems.

The candidate will conduct a whole genome sequencing analysis to understand the distribution of AMR, modes of transmission, and virulence factors of the selected pathogen of public health concern. The candidate will apply microbiological and molecular typing methods including WGS and Bioinformatics analysis tools in the state-of-the-art laboratories to identify resistance genes, virulence genes, and mutations associated with resistance.

**Thematic area 5**: Forensic Biotechnology for Investigation Using Genomic Information (Human Genome, Omics, Wildlife (General theme: Forensics Biotechnology DNA Analysis)

It is essential to build a specific skill set in Forensic Biotechnology that includes both biological and technology expertise. A very interdisciplinary branch of biology called biotechnology has completely changed civilization. Now more than ever, the criminal justice delivery system needs Forensic experts with the skills to appraise biological evidence, apply cutting-edge technology, and conduct forensic analysis. It also deals with the study and investigation of genomic information for the identification of specific signatures using DNA fingerprinting. The key specialties for forensic biotechnology include:

1. Forensic Human Genome Analysis: Develop expertise in decoding and interpreting the human genome to identify unique genetic markers critical for forensic investigations

2. Forensic Omics Technologies: Utilize comprehensive omics approaches, including genomics, proteomics, and metabolomics, to analyze complex biological data for forensic applications.

3. Wildlife Forensics: Apply advanced biotechnological methods to investigate wildlife crimes, ensuring the protection of biodiversity and the enforcement of wildlife laws.

This program provides students with exposure to state-of-the-art forensic biotechnological domains, including DNA forensics, forensic omics, and wildlife forensics. In addition, the PhD in forensic biotechnology program exposes students to modern biotechnological domains such as DNA forensics, forensic proteomics, wildlife forensics, and others thus, creating a skilled task force for forensic investigations. By integrating genomic information and biotechnological innovations, the PhD in Forensic Biotechnology prepares a highly skilled task force capable of advancing forensic investigations and contributing significantly to the criminal justice system.

The current PhD program in Forensic Biotechnology is designed therefore to cultivate experts with a profound understanding of both biological and technological aspects of forensic science.

This interdisciplinary field leverages biotechnology to revolutionize the criminal justice system, addressing the need for skilled forensic experts capable of analyzing biological evidence and applying cutting-edge technologies.

Key Requirements for the PhD Program in Forensics Biotechnology:

1. Academic Background: A Master's degree in Forensic Biotechnology, Forensic Science, or a related field is required.

2. Experience in Forensic Biotechnology: Demonstrated experience in forensic biotechnology, including practical laboratory work and familiarity with forensic analysis techniques.

3. Research and Publications: Evidence of research capability through previous publications in peer-reviewed journals, particularly in forensic biotechnology innovations.

4. Technical Proficiency: Proficiency in modern biotechnological tools and techniques, such as DNA using Autosomal STR, sequencing, PCR, capillary Electrophoresis, analysis and bioinformatics.

5. Interdisciplinary Skills: Ability to integrate knowledge from various scientific disciplines to address complex forensic problems.

6. Communication Skills: Strong written and oral communication skills, are necessary for presenting research findings and collaborating with multidisciplinary teams.

7. Ethical Understanding: A solid understanding of ethical issues related to forensic science and the handling of biological evidence.

By meeting these requirements, candidates will be well-prepared to contribute to the advancement of forensic biotechnology and support the criminal justice system through cutting-edge research and innovative forensic applications.

### III.   Hosting institutions and funding

The selected candidates will perform their PhD studies at the University of Rwanda and in selected international host universities in collaboration with UR following the sandwich program model. The European Union through Enabel-Kwigira Project will provide full funding support for the PhD.

### IV.   Application requirements

The applicant must be :

1. A Rwandan
2. UR permanent Staff will be given priority
3. Holding a relevant MSc degree related to the above topics
4. Prepared to work full-time on the PhD project in collaboration with the appointed supervisors
5. Ready to continue to work with UR after the completion of PhD studies
6. Not in possession of another fellowship for a PhD
7. English proficient

### V.   Application file

1. Application letter addressed to the Director of the University of Rwanda, Center for Post-Graduate Studies (UR-CPGS) indicating for which thematic area the application is being made
2. A personal motivation statement for the scholarship programme. The statement should demonstrate commitment, motivation, and reasons for interest in the topic (Max. 2 pages)
3. Updated Curriculum Vitae (Max 3 pages)

4. Notarized Masters and Bachelor's degrees and transcripts
5. Recommendation letter from at least two academic referees. One of the recommendation letters should be issued by a previous supervisor, preferably the master's degree supervisor
6. Copies of valid identification card or passport
7. A statement of not having another PhD active scholarship
8. Recommendation letter from the current employer stating past and current positions occupied by the candidate in the institution and ensuring the candidate gets study leave for the entire period if chosen for the scholarship (if any).
9. Copy of publication(s) (if any)
10. PhD research concept note (Max 15 pages) indicating the research gaps, the research problem, and the research objectives, a detailed methodological approach, and a description of the expected scientific results, significance, and the development impact of the research *(use the attached PhD research template)*.

## VI. Selection process

Shortlisted candidates will be invited to the interview on dates that will be communicated through emails.

## VII. How to apply and key dates

A copy of the complete application file should be submitted by email (*as a zipped file*) to the UR-CPGS officer at ur-cpgscholarship@ur.ac.rw, Tel: + 250792988304 with a copy to Assoc. Prof. Dieudonne Mutangana d.mutangana@ur.ac.rw , Tel:+ 250788358282 to Prof. Antoine Nsabimana a.nsabimana@ur.ac.rw, and Prof. Léon Mutesa l.mutesa@ur.ac.rw

The applications should be submitted no later than **23rd August 2024**.

Done at Kigali 23./07/2024

**Assoc. Prof. KAYIHURA Muganga Didas**
**Ag. Vice Chancellor**

## CALL FOR APPLICATIONS TO STUDY MASTER OF SCIENCE IN BIOTECHNOLOGY
### ACADEMIC YEAR 2024/2025
### SEPTEMBER INTAKE

The University of Rwanda in collaboration with European Universities is pleased to announce the availability of 25 Masters positions in biotechnology in the areas of health, environment, animal models, agriculture, and veterinary medicine. Interested and qualified candidates are invited to apply for these programs.

I.     **Programme, entry requirements, duration and mode of attendance**

| Entry Requirements | Duration | Mode of attendance |
|---|---|---|
| To apply for this program the applicant must have:<br>1. At least a bachelor's degree in medicine or bachelor's degree in Life Sciences including Biomedical Lab Sciences and pharmacy (area of health), bachelor's degree in biotechnology or bachelor's degree in biology (area of sciences), or related sciences<br>2. Bachelor's degree in veterinary medicine, Animal Science or bachelor's degree in agriculture or Agro-business (area of animal models and agriculture and veterinary medicine) or related sciences<br>3. Ability to speak, write, and understand English language<br>4. Aptitude to comply with the postgraduate regulations of the University of Rwanda<br>5. Be Rwandan by nationality<br>6. A minimum of at least two years of relevant work experience in public institutions in the respective area, having worked at the University of Rwanda or affiliated institutions is an added value.<br>7. Having at least one peer-reviewed publication in above mentioned field is an added value. | 2 years | Theoretical and practical classes are conducted daily at UR CST Nyarugenge Campus. |

## II.     Key dates for this call

1. Closing of the online application process: August 15$^{th}$, 2024 (at 5:00 pm)
2. Written exam, interviews, and starting date: To be communicated

## III.    Required documents for application

Interested candidates should submit the following documents:

1. A cover letter addressed to the director of the UR CPGS and a description of the motivation to join the program.
2. Updated Curriculum Vitae.
3. Copy of National ID or Passport.
4. Undergraduate degree or equivalence from the High Education Council (HEC) for degrees acquired outside of Rwanda.
5. Copies of undergraduate academic certificates (Notarized copies will be required before admission)
6. Copies of undergraduate academic transcripts (Original/notarized transcripts will be required before admission).
7. Professional license for those in applicable fields.
8. Two recommendation letters, one from academic senior staff and one from employer (if applicable) or relevant supervisor.
9. Working certificate if any.

## IV.    Selection criteria

The selection will be done through the assessment of submitted documents. Only applicants who meet the entry requirements indicated above and who have submitted all the required documents will be shortlisted, then successful candidates will be invited to an oral interview. Twenty-five students with the highest marks will be selected and admitted to the program.

## V.     Funding

This Masters in Biotechnology will be implemented by the University of Rwanda in close collaboration with European Universities and Enabel Kwigira program with financial support from the European Union and the admitted student will be given a scholarship to cover the tuition fees and the stipend.

## VI. Application process

1. Go to UR Website (www.ur.ac.rw )
2. Go to Admission, Applicant Portal, and click on (New Application)
3. Fill out the **Biographical Form** and click (**Save**) at the end, you will get "**Your Student ID Reference Number**". *Please keep this ID Number as it will be your ID identification for all transactions at UR*
4. Create a PIN of 5 numeric digits, do not start with a 0 (this PIN will serve as your password to access your student account), leave the page, and open the link below.
5. Candidates are requested to submit all required documents by using the

   Link: https// **pgfile.ur.ac.rw/pgfile/findme.php**

**NB:**

- All documents must be in PDF

- If all required documents are not submitted, you cannot go to the next step.

- A candidate should submit only one application

**For more information, contact:** Ms. Christine Mukangoga; e-mail: c.mukangoga@ur.ac.rw; Tel: +250788642427, Mr. Marcus Bushaku; e-mail: m.bushaku@ur.ac.rw; Tel:+250783703222; Mr. Alexis Rugamba; e-mail: a.rugamba2@ur.ac.rw; Prof. Antoine Nsabimana; e-mail: a.nsabimana@ur.ac.rw; Prof. Leon Mutesa; e-mail: l.mutesa@ur.ac.rw;

Done at Kigali on 23./07./2024

**Assoc. Prof KAYIHURA Muganga Didas**
**Ag. Vice Chancellor**