Project Reference: CTE\_EMERC\_Meredith\_001\_25\_26

### About the Project

This is an exciting PhD opportunity within the College of Technology and Environment (CTE) at London South Bank University (LSBU). The successful candidate will receive a tuition fee waiver beginning in September 2025 for 4 years, including the write-up year.

### **Project Title**

Advancing Biochar Microbiome Engineering with Computer Vision

### **Project Overview**

Biochar, a sustainable material derived from waste biomass, can engineer environmental microbiomes using its high surface area and carbon content to adsorb microorganisms and act as a growth substrate. These interactions can reduce pollution by removing harmful microorganisms from the environment, or by or adding beneficial ones.

Biochar can filter pathogens from wastewater and selectively adsorb them from soil and waterways. It can also seed and promote growth of microorganisms that degrade pollutants or outcompete pathogens. However, the mechanisms underlying biochar-microorganism interactions are poorly understood.

This project will image these interactions (in both 2D and 3D), elucidate their mechanisms using advanced image analysis techniques, and enhance them by optimising biochar production conditions. Findings will enable manufacturers to design biochars with pore structures tailored for microbial adsorption applications like wastewater treatment and soil microbiome engineering, providing sustainable and affordable methods to reduce pollution, enhance crop productivity, and sequester carbon.

The successful applicant will be supported by a supervisory team spanning three Schools (Engineering & Design, Computer Science & Digital Technologies, and Applied & Health Sciences), two Colleges (CTE and the College of Health and Life Sciences), and four University Research Centres (see below). Their research will combine Engineering Biology and Al—critical technologies in the UK Science & Technology Framework—producing highly interdisciplinary research of national importance to address the timely, global issues of pollution, antimicrobial resistance (AMR), and climate change.

## Who Are We Looking For?

- Open to any UK or international candidates. Starting in September 2025.
- The candidate must meet the minimum entry requirements for our PhD programme specified <u>here</u>.
- Previous research experience in biomass conversion (esp. biochar), image analysis (esp. computer vision), porous materials characterisation, and/or environmental microbiology is essential. Experience in multiple areas is highly desirable.
- A keen interest in agriculture, wastewater treatment, and/or pollution is highly desirable.

#### Selection Criteria:

 Academic Qualifications - Applicants for a Research Degree programme at LSBU are usually expected to have a good honours degree (2:1 and above or international equivalent) and a relevant postgraduate qualification, preferably a merit at Master's level. For this project, at least one of your degrees should be in engineering, computer science, materials science, life science, or another relevant discipline.

- Research and Analytical Skills Ability to conduct comprehensive literature reviews, experience in qualitative and quantitative data collection and analysis, strong research design and methodology skills, ability to independently collaborate with stakeholders, and excellent academic writing and communication skills.
- Professional Skills Project management and organisational skills, ability to work independently and as part of a team, problem-solving and critical thinking skills, and adaptability and willingness to learn new skills.
- Computational Research Experience Experience conducting computational research—ideally including image analysis and HPC systems—is essential. The candidate should be proficient in at least one relevant software package (e.g. MATLAB, Python, ImageJ).
- Experimental Research Experience Experience conducting experimental research—ideally including material characterisation, biochar production, and/or wet-lab microbiology—is essential. This should be experience beyond compulsory practicals.
- Communication Skills The candidate should be highly motivated, able to collaborate and communicate the work's outcomes to commercial, industrial, and scientific audiences, and have good visual, oral, and written communication skills.
- Language Proficiency Overseas applicants will be required to prove competency in English, showing an IELTS score of at least 7.0 at postgraduate level.
- Understanding of Equality and Diversity Able to demonstrate an understanding of equality and diversity and their practical applications.
- Visa and Legal Requirements Non-EU/EEA nationals may need to apply to the Foreign and Commonwealth Office (FCO) for clearance from the Academic Technology Approval Scheme (ATAS).

# **Training & Development Opportunities**

Doctoral students at London South Bank University (<u>LSBU</u>), through the London Doctoral College (<u>LDC</u>), benefit from a rich and structured training environment designed to support academic excellence and professional development. All PhD candidates are offered a comprehensive programme of workshops and seminars covering essential research skills, including research design, data analysis, academic writing, ethics, and project management. These sessions aim to support students through every stage of their doctoral journey—from literature review and methodology to thesis completion and viva preparation. Postgraduate researchers can access advanced, discipline-specific training aligned with their research focus. LSBU's doctoral training environment is designed to build deep expertise in a chosen research area and the broader skills necessary for successful careers in research, industry, and beyond.

## About the College

The College of Technology and Environment (CTE) at London South Bank University (LSBU) is a newly formed academic college, launched in January following the university's recent reorganisation. Led by Executive Dean Professor Chris Harty, CTE brings together four schools: Architecture & Planning, Construction, Property & Surveying, Engineering & Design, and Computer Science & Digital Technologies. The college fosters a collaborative and interdisciplinary environment, addressing the complex challenges of the built and digital environments. CTE strongly emphasises research, with doctoral students playing a key role in shaping and contributing to the college's research agenda. CTE prepares students to become future leaders through innovation, industry partnerships, and a commitment to sustainability. With a focus on real-world impact and academic excellence, the college is set to drive forward LSBU's vision of delivering applied knowledge that transforms lives and communities locally and globally. The university has five centres, and any academic staff and students in the college can join. These research centres are described below.

## About the Bioscience and Bioengineering (BB) Research Centre

The <u>Bioscience and Bioengineering Research Centre</u> advances understanding of health and disease through biological research and innovative technologies. Our interdisciplinary team focuses on improving diagnostics, treatments, and patient management across healthcare settings. Areas of

expertise include cancer biology, bioinformatics, pharmacokinetics/pharmacodynamics, microwave and ultrasound sensing, and image analysis. We also explore human biomechanics and the mechanical properties of muscle and tendon in both healthy and diseased states. By integrating science and engineering, we strive to translate cutting-edge research into real-world healthcare improvements that benefit patients and practitioners alike.

# About the Building Future Communities (BFC) Research Centre

The <u>Building Future Communities Research Centre</u> supports inclusive, participatory research on realworld transformation and social justice. We work collaboratively with diverse stakeholders—charities, community groups, local authorities, and more—to co-create research with impact. Using an intersectional approach, our work spans funded research, enterprise, consultancy, and researcher development. BFC is a creative and unifying umbrella for projects prioritising community voice and engagement. Our goal is to drive positive change through research that reflects and responds to the needs and experiences of communities, with a clear commitment to inclusion, equity, and collaborative practice.

# About the Digital x Data (DD) Research Centre

<u>Digital x Data Research Centre</u> is a university-wide interdisciplinary research centre exploring the impact and potential of digitalisation and datafication. We focus on cutting-edge AI and data science developments, addressing opportunities and challenges through a responsible, explainable, and sustainable lens. Rooted in LSBU's commitment to social justice, our research fosters equity by integrating science, technology, the arts, and the humanities. We drive innovation through applied research and strong partnerships with industry, academia, and the public sector and ensure that our work delivers real-world, transformative outcomes. Our approach is collaborative and future-facing, aiming to inform policy, practice, and public understanding.

## About the Energy, Materials and Environment (EME) Research Centre

The <u>Energy</u>, <u>Materials and Environment Research Centre</u> leads interdisciplinary research on sustainable energy systems and material innovation. We address climate change by developing whole energy systems, spanning generation, storage, distribution, and consumption. Our research draws from materials engineering, policy, and societal impact to understand and influence the complex relationships between energy, economy, and society. With expertise in multiscale systems and cross-sector collaboration, we aim to shape policy and technology that supports the transition to a low-carbon future. Our work informs sustainable development strategies that balance environmental, economic, and social needs across local and global contexts.

## About the Health and Wellbeing (HW) Research Centre

The <u>Health and Wellbeing Research Centre</u> promotes understanding how to protect and enhance health and wellbeing across all life stages. We focus on underserved populations and the services and professionals supporting them. Our research, grounded in social justice and inclusion, aims to reduce inequalities and improve outcomes through knowledge mobilisation and real-world application. Collaborating with academics across disciplines and health and social care partners, we explore lived experiences, service delivery, and workforce development. Our work informs policies and practices that support more effective, inclusive, and responsive health and social care systems. For Enquiry

## **Project Research Centre Alignment**

Nominally aligned with EME, this project spans four university research centres. It uses renewable waste-based materials to improve environmental, ecological, and climate outcomes of agriculture and the built environment (EME). This is achieved by engineering soil and water microbiomes (BB) to reduce pathogen pollution and the spread of environmental AMR, which can affect clinical outcomes through the One Health principle (HW). The project involves analysis of large image datasets using

computer vision techniques (DD) to determine how biochar morphologies influence microbial interactions.

# **Contact Person**

Before applying, please contact the main supervisor, <u>Dr Meredith Barr</u>, a lecturer in Chemical & Energy Engineering at the School of Engineering & Design, College of Technology and Environment.

E-mail: meredith.barr@lsbu.ac.uk

In your email, include:

- Details of your current level of study and academic background.
- A summary of any relevant experience.
- A brief paragraph about your motivation for pursuing this PhD project.

Please include the reference number (CTE\_EMERC\_Meredith\_001\_25\_26) in the subject line.

#### Fee Waiver

The fee waiver is available for 4 years (48 months), including the writing-up year, examination period, and submission of the corrected thesis. No stipend is provided—you must be able to support your own living expenses.

### How to apply

Applications should be submitted via the programme page using the link below:

https://www.lsbu.ac.uk/study/course-finder/chemical-process-and-energy-engineering-phd

You should upload a personal statement, qualifications, CV, and other relevant documentation to the application portal. Remember to state the correct reference number and the appropriate supervisor.