



**Ciência sem Fronteiras (Science Without Borders)  
PhD Project Template:**

**\*\*Please use one form per project\*\***

Please complete & submit to [huw.lewis@ul.ie](mailto:huw.lewis@ul.ie) as soon as possible,  
but preferably before 23<sup>rd</sup> November

<b>PI name &amp; contact details:</b>	Dr. Achim Schmalenberger University of Limerick Life Sciences Schrodinger Building Limerick Ireland <a href="mailto:Achim.schmalenberger@ul.ie">Achim.schmalenberger@ul.ie</a>
<b>Department</b>  <i>Has project been agreed with head (or nominee) of proposed registration school?</i>	Life Sciences  tbc
<b>Research Centre / group affiliation:</b>	
<b>Research group / centre website:</b>	<a href="https://sites.google.com/site/environmicro/">https://sites.google.com/site/environmicro/</a>
<b>PI website / link to CV:</b>	<a href="http://www2.ul.ie/web/WWW/Faculties/Science%26Engineering/Departments/Life%20Sciences/People/Achim%20Schmalenberger">http://www2.ul.ie/web/WWW/Faculties/Science %26 Engineering/Departments/Life Sciences/People/Achim%20Schmalenberger</a>
<b>Brief summary of PI research / research group / centre activity (2 or 3 lines max):</b> 1) Microbial driven mobilization of soil nutrients from organic matter e.g. soil sulfur and phosphorus mobilization, nitrogen fixation and carbon sequestration. 2) Microbial mobilization of nutrients from primary minerals in rocks. 3) Microbial community analysis using DNA fingerprinting techniques.	
<b>Title &amp; brief description of PhD project (suitable for publication on web):</b> <b>Bacterial weathering of rocks and minerals in the mycorrhizosphere</b>  Tree roots in temperate climates are often sheathed by symbiotic ectomycorrhizal fungi which are supported with up to a third of the carbon fixed by the plant hosts using solar energy. In return, the fungal mycelium extends into the soil to absorb nutrients for the plants, partially through secretion of oxalic acid that can accelerate the dissolution of specific minerals from rocks [1]. In a recent research project the proposing PI reported high dissolution rates of rocks and minerals by the symbiotic ectomycorrhizal fungus <i>Paxillus involutus</i> in monoxenic microcosms with pine seedlings as plant host driven through fungal secretion of oxalate. While this finding highlights the importance of microbial weathering, very little is known about the role of bacteria in the mycorrhizosphere in natural systems and whether these bacteria would enhance weathering through organic acid exudation or reduce	



the mycorrhizal wreathing effect through utilization of oxalate as a carbon source.

This project will investigate role of bacteria in rock mineral weathering and the role of bacteria in the mycorrhizosphere of weathering ectomycorrhizal fungi. In the first part of the project, rocks and minerals will be deposited in soils with ectomycorrhizal activity in nylon mesh bags that include or exclude mycorrhizal hyphae. Cultivation dependent and independent molecular analysis of microbial communities on weathered rocks and minerals and ectomycorrhizal hyphae will be investigated. In the second part of the project, microcosm systems with pine seedlings as plant host and *P. involutus* as ectomycorrhizal symbiont will be set up that will be selectively inoculated with isolated bacteria from the first part of the project in order to compare dissolution rates of systems with and without the addition of bacteria. The second part of the project will be carried out in collaboration with a partner at the University of Sheffield, UK.

[1] Schmalenberger A, Duran AL, Leake JR, et al. (2010) *Geochim. Cosmochim. Ac.* **74**: A923.

**Unique selling points of PhD project in UL:**

The proposer in Limerick has a profound track record in microbial community analysis and has over the last 4 years acquired in depth skills to carry out mycorrhiza research. The integration of the UK partner will provide this research project a unique cutting edge.

**Name & contact details for project queries, if different from PI named above:**

**Please indicate the graduates of which disciplines that should apply:**

Environmental Sciences, Life Sciences, Microbiology, Molecular Ecology

**Please indicate whether students can apply for:**

**Sandwich programme only**

**Full PhD programme only**

**Either of the above**

**X**

**Ciência sem Fronteiras / Science Without Borders Priority Area:**

Please indicate the specific programme priority area under which the proposed PhD project fits- choose only one (tick box):

Engineering and other technological areas	
Pure and Natural Sciences (e.g. mathematics, physics, chemistry)	X
Health and Biomedical Sciences	
Information and Communication Technologies (ICTs)	
Aerospace	
Pharmaceuticals	
Oil, Gas and Coal	
Renewable Energy	
Minerals	
Biotechnology	
Nanotechnology and New Materials	



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