Institut Microbiologie, Bioénergies et Biotechnologie
Aix*Marseille Université

Identification and characterization of Cysteine-rich proteins from giant viruses

Keywords: iron-sulfur clusters, giant virus, structural biology, EPR spectroscopy, cysteine-rich proteins

Summary

The discovery of Mimivirus in 2003 was revolutionary for the field of virology. Giant viruses revived old debates about the concept of virus, their position in the tree of life, their biology, and the role they played in the emergence of life on Earth(1). Seven distinct families of giant viruses have since been discovered by a handful of research teams, including the IGS. The giant double-stranded DNA viruses have viral particles easily visible under a regular light microscope. In addition, these families all bring unexpected characteristics that have extended the interest of the scientific community from virology all the way to evolutionary biology: (i) their genome sizes, encoding for 500-2500 proteins, rival with most bacterial ones; (ii) they do not rely entirely on the host for transcription or translation of their genomes, contrary to "classical" viruses; (iii) ~2/3 of their genomes encode for ORFan proteins without cellular or viral homolog. Genomic and transcriptomic studies of Acanthamoeba cells infected by giant viruses allowed identification of a large number of cysteine-rich proteins whose function is unknown(2). These proteins may present unique iron-sulfur coordination patterns, participate in novel metabolic pathways, and may help us elucidate the origins of all viruses. Characterizing new metabolic pathways in these viruses may therefore provide new clues about chemical and biological processes at the origin of life. For this project, interdisciplinary approaches including bioinformatics, cell biology, biochemistry, spectroscopy and biophysics will be used to elucidate the role of these proteins in the physiology of giant viruses. The elucidation of new cellular and metabolic pathways in giant viruses will be of outstanding interest for the fields of virology, evolutionary biology, and biology in general. The discovery of proteins with novel function and chemistry may provide a new source for biotechnology tools, similar to what bacterial restriction enzymes provided for the development of molecular biology as we know it today, or the CrispR/cas system for genetic studies.

1. Claverie, J.-M., and Abergel, C. (2018) Mimiviridae: An Expanding Family of Highly Diverse Large dsDNA Viruses Infecting a Wide Phylogenetic Range of Aquatic Eukaryotes. Viruses. 10, 506

2. Legendre, M., et al. (2010) mRNA deep sequencing reveals 75 new genes and a complex transcriptional landscape in Mimivirus. Genome Res. 20, 664–674

The co-supervisors

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Location

IGS, campus de Luminy, Marseille, France
BIP, 31 chemin Joseph Aiguier Marseille, France

Doctoral school

Sciences de la vie et de la santé (ED 62) ou Chimie (ED 250), Aix-Marseille université

Expected profile of the candidate

The candidate should have an education background in Biochemistry, Structural Biology and/or Chemistry for Biological Sciences, with strong knowledge on protein expression/purification, molecular and structural biology. The PhD student will carry experimental characterization of targeted cysteine-rich proteins

including protein cloning, expression, purification, biochemical, structural and biophysical experiments, under the joined supervision of S1 and S2.

Context of the proposal: The present PhD proposal falls within a PhD call for applications launched by Institute of Microbiology, Bioenergies and Biotechnology (IM2B) of Aix-Marseille University. Please see below for further information.

How to apply?

The application file includes:

- A CV in English, specifying the level of English
- A copy of the diplomas obtained and the transcripts of Master 1 and Master 2 grades.
- A cover letter in English
- 2 letters of recommendation sent directly by their authors to the co-directors

All documents must be sent to the co-directors of the PhD project. The deadline for sending applications is **April 30, 2020***. Nevertheless, we strongly encourage you to let us know as soon as possible of your intention to apply, by contacting the project leaders.

***The deadline is subject to change as the current health situation evolves. We invite you to keep yourself informed of any change in dates by contacting the project leaders or by writing to the following address: im2b-direction@univ-amu.fr**

PhD Call for applications - Institute of Microbiology, Bioenergies and Biotechnology of Aix-Marseille Université Deadline for applications: 30 April 2020*

The Institute of Microbiology, Bioenergies and Biotechnology (IM2B) is financing **4 PhD positions** starting in October 2020.

The PhD projects described below are eligible for funding under this call for applications. These 8 interdisciplinary projects rely on inter-laboratory collaborations and are related to the scientific theme of the Institute: exploring the diversity and functioning of the microbial world, at the molecular, cellular and ecosystem levels or through its close association with other organisms (plants, microbiota, etc.) with a view to developing innovative biotechnological solutions in the fields of renewable carbon for Green Chemistry and Energy, Environment and Health.

Future PhD students will benefit from the personalised support offered by the Plinius PhD Cursus. They will thus be able to train in a wide range of cutting-edge technologies, and also prepare their professional project in a multidisciplinary and international environment.

At the end of a two-steps selection procedure, conducted in first by the co-directors of the thesis project and then by a selection board during an audition to be held in June, the selected applicants will be granted with a 3-year fellowship (salary of €1421 net / month).

About the Institute of Microbiology, Bioenergies and Biotechnology

Created in 2019 by Aix-Marseille Université, this Institute brings together more than 400 permanent staff, 250 Masters students, 150 PhD students and 160 post-docs, to strengthen interdisciplinary Research and Teaching in the field of Microbiology and its applications in Bioenergies, Environment and Health. Relying on a network of 10 internationally renowned research laboratories and a network of leading facilities, the IM2B brings together recognized expertise in viruses, bacteria, archaea, fungi, protists and photosynthetic organisms. It covers a large range of approaches, including bioinformatics, mathematical modelling, structural and cellular biology, molecular genetics, biophysics, biochemistry, biodiversity, chemistry. **The research effort of IM2B is focused on the integration of all the scales of study, from the atom to the ecosystem, and its biotechnological applications on the different systems studied.** The targeted applications are in particular in the field of **energy** such as CO_2 storage, production of biofuel, biogas or bioethanol, new bio-inspired materials, biosensing or biosourced molecules, but also in the field of the **environment** (biodepollution...) or **health** (infectious diseases).