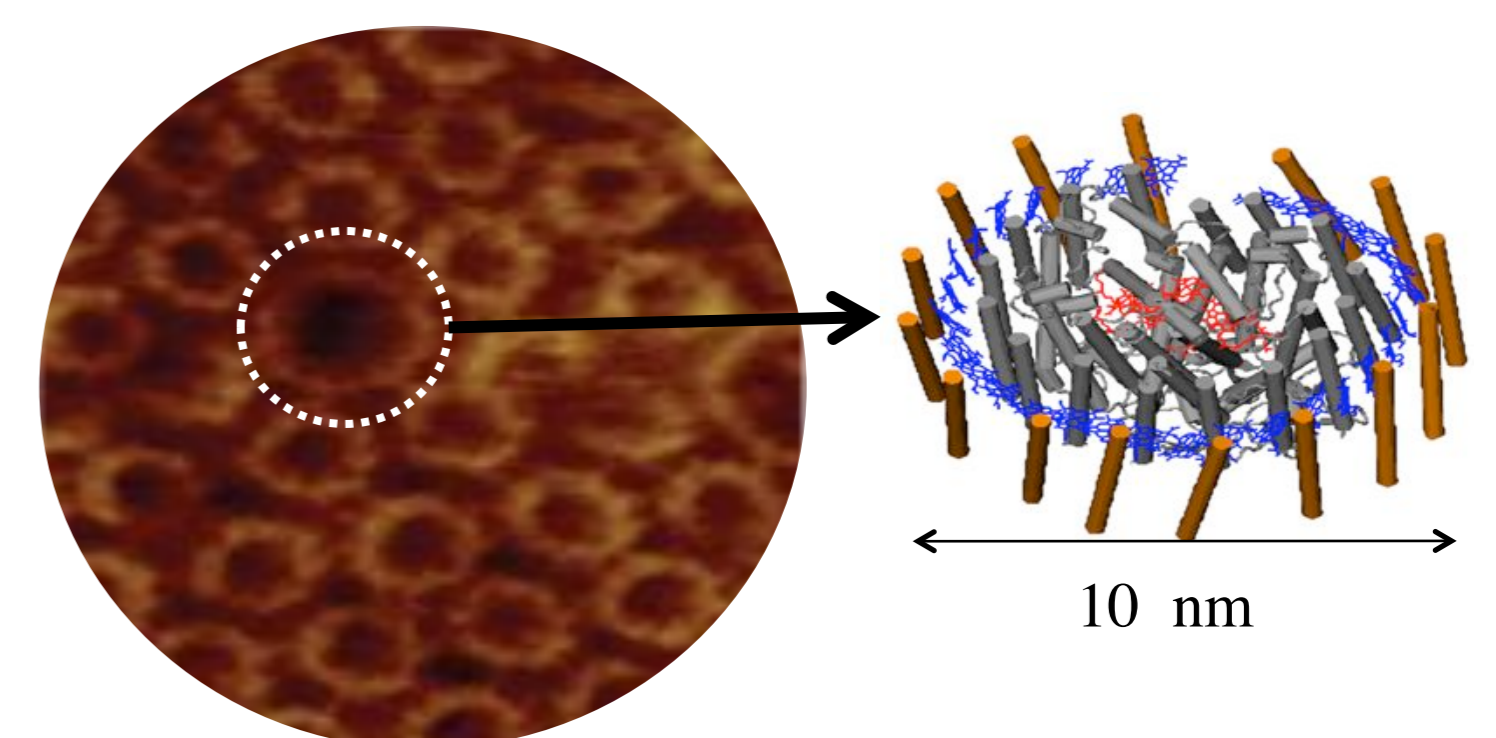


Modelling how nano-scale processes relate to macroscale function

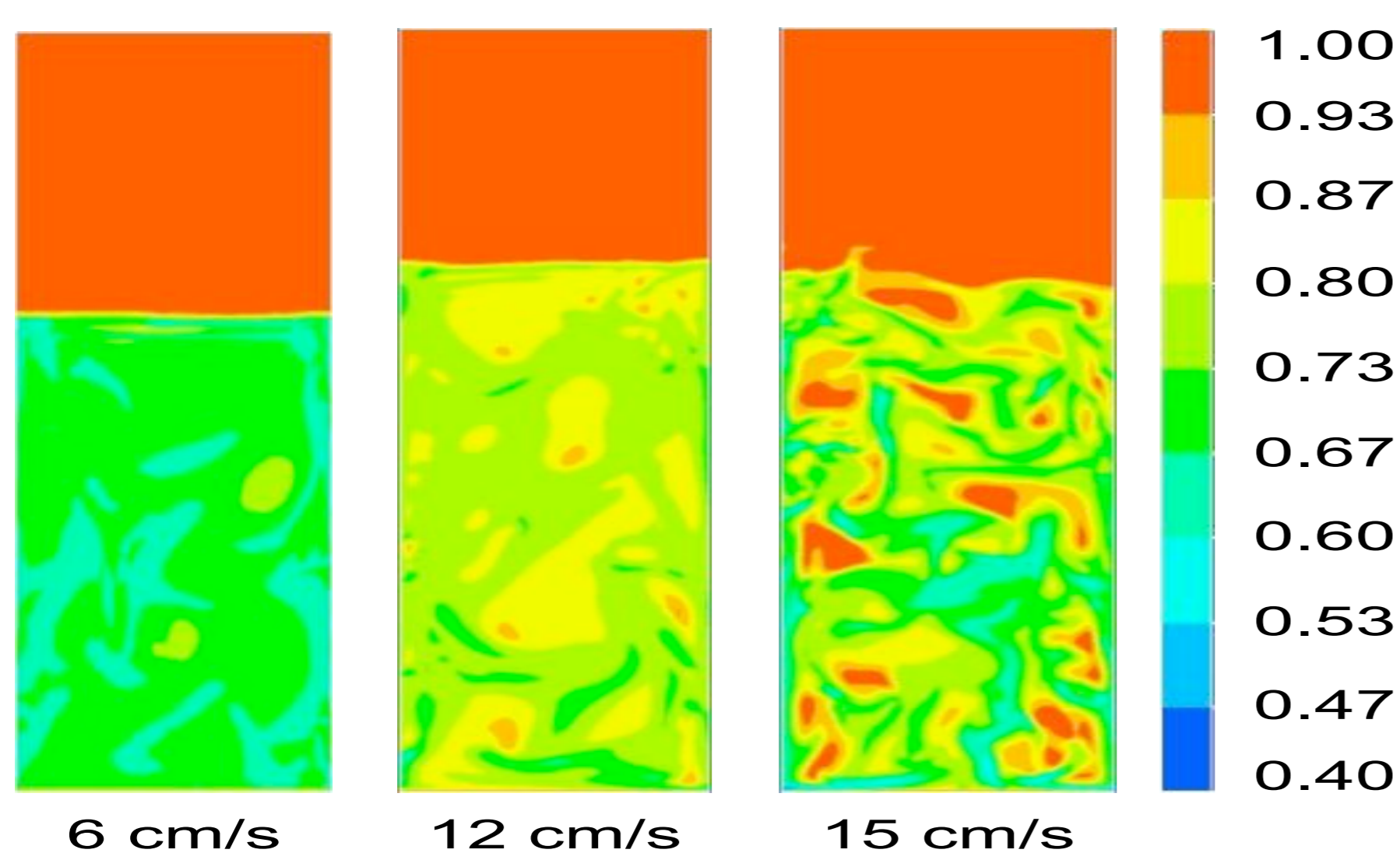
Alexandra Olaya-Castro (Physics and Astronomy), Luca Mazzei (Chemical Engineering) and Alexandra Porter (London Centre for Nanotechnology)

Quantum effects in photosynthetic energy transfer

Dr Olaya-Castro's group developed two theoretical studies investigating possible relations between quantum properties and efficient energy transfer in photosynthetic systems. The results indicate that quantum transport have a small but important influence on efficient energy transfer and therefore further studies are needed to establish how such effects can be enhanced and controlled. The work yielded two peer-reviewed publications and two joint grant proposals, one for the Human Frontiers Science Foundation and a collaborative project proposal in the frame of FP7 of the European Commission.



Caption 1: Photosynthetic membrane and core molecular complex found in purple bacteria. Theory predicts quantum effects could be important for energy transfer between light-absorbing molecules (blue) and the reaction centre where chemical energy conversion begins (red).



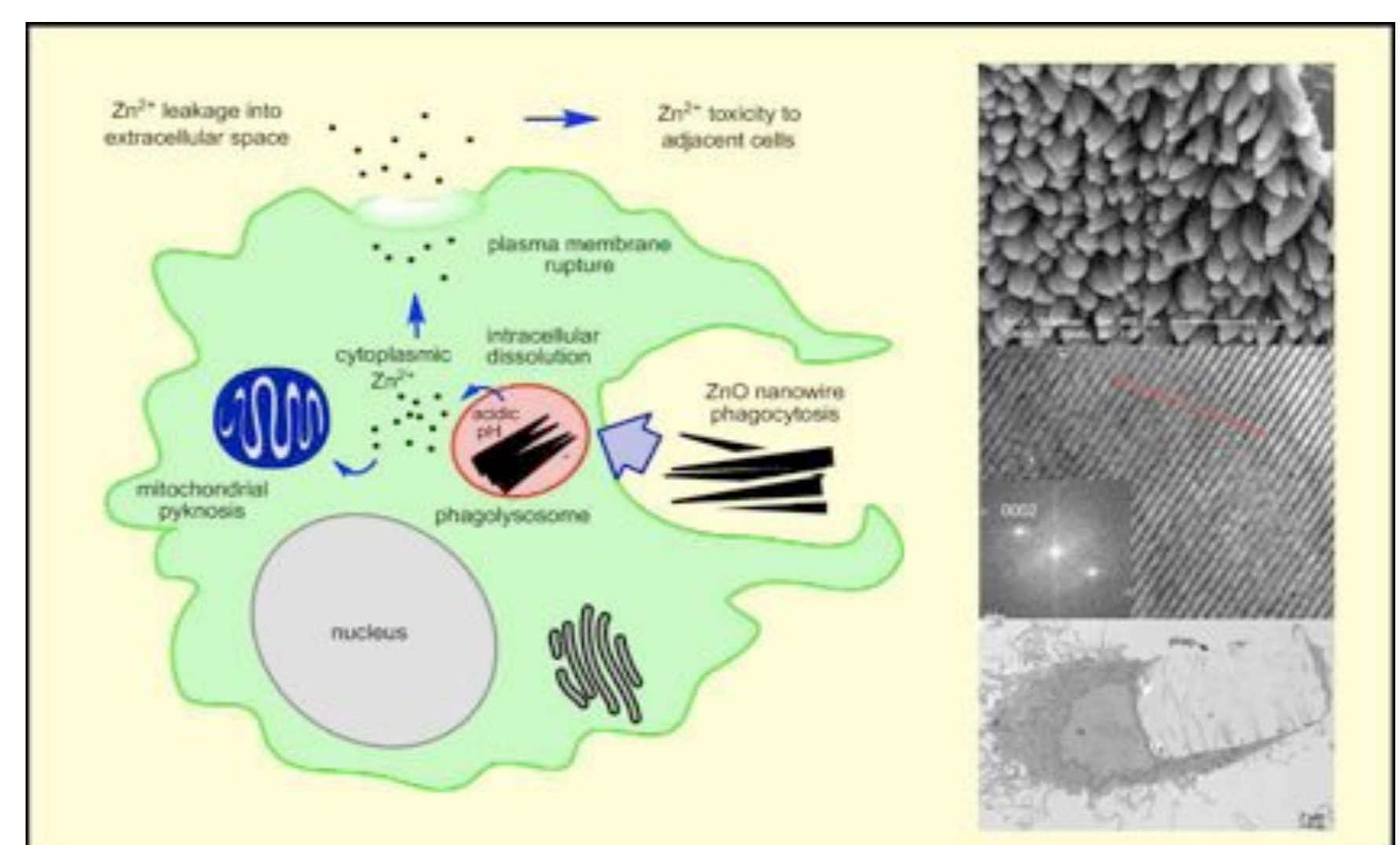
Caption 2: Void fraction profile in a fluidized bed at different fluidization velocities. Multiscale modelling allows to study the dynamics of fluidized beds from detailed information about particle interactions at the microscale level.

Multiscale modelling of fluidized suspensions

Dr Mazzei's group developed a theoretical and computational framework to describe the macroscopic behaviour of polydisperse fluidized suspensions using computational fluid dynamic starting from a particle description. The work has yielded one published article, one recently submitted, and a third paper presented at the conference Fluidization XIII -the most prestigious on fluidization. The work has also generated a draft for an EPSRC proposal which will be submitted in the next academic year.

Citototoxicity of nanowires revealed by multiscale imaging

Dr. A Porter's group applied a multi-scale imaging method to assess which physical and chemical properties of Zinc Oxide (ZnO) wires cause toxicity to lung cells. Using a combination of micrometer scale light microscopy and nanometer scale electron microscopy of live cells exposed to ZnO, it was shown that high aspect ratio of such nanowires were toxic to human lung cells. The preliminary results generated in this study were used to prepare three grant proposals, two of which were successfully funded –one by NERC-NIH and one by Kaust.



Caption 3: Cellular uptake of ZnO nanowires. Uptake results in dissolution of the wires inside the cells is monitored by electron microscopy at the nanoscale and subsequent cell death is monitored by confocal microscopy