IMCB Invited Speaker

Speaker : **Prof. E. Peter Greenberg**

Professor, Department of Microbiology, University of Washington

Co-Director UW NIDDK Cystic Fibrosis Translational Research Core Center, USA

Date : 18 September 2012 (Tuesday)

Time : 10:00AM - 11:00AM

Venue : Level 3, IMCB Seminar Room 3-46, Proteos, Biopolis

Host : Prof. Lianhui Zhang

Seminar :

Quorum sensing in *Pseudomonas aeruginosa* - A metabolic mechanism for community restraining free-loaders in a cooperating group

In *Pseudomonas aeruginosa* LasR activates dozens of genes in response to the LasI-produced quorum-sensing signal 3OC12-HSL. The most overrepresented LasR-controlled functions code synthesis of exoproducts. Exoproducts are common goods that are made by individuals and shared amongst the group. Members of quorum-sensing groups are thus thought of as cooperators. Experiments have shown that groups of quorum-sensing cooperators are susceptible to invasion by social cheaters. LasR mutants emerge in and co-exist with LasR-wild-type cells. The LasR mutants benefit from cooperator-derived common goods without incurring a production cost. We wondered why a small percentage of LasR-controlled genes code for ability to grow on transported solutes where benefit is restricted to the cell in which the enzymes are produced (private goods). We hypothesized that one consequence of maintaining a few such activities under LasR control would be to restrain the emergence of social cheaters-to sanction cheaters in the group. We investigated the LasR-dependent nuh gene product, a cellular enzyme required for growth on adenosine. Consistent with previous reports, growth of P. aeruginosa on caseinate as sole carbon and energy source required LasR-controlled exoprotease production, and LasR mutant social cheaters emerged during prolonged growth on caseinate and reached about 25-40% of the population. Social cheaters did not emerge when we included adenosine as an additional carbon and energy source. As a control we substituted glucose (glucose metabolism is not dependent on quorum sensing) for adenosine and emergence of social cheaters was not restrained. When a stable population of cooperators and cheaters growing on caseinate alone was transferred to caseinate plus adenosine we observed a strong selection against the cheaters. Our evidence indicates that maintaining control of relatively few cytoplasmic catabolic enzymes by quorum sensing serves as a policing mechanism against social cheating in natural environments where it is likely that multiple carbon and energy sources are available to P. aeruginosa simultaneously. This provides a plausible explanation for why a small percentage of functions controlled by quorum sensing are private goods.

About the Speaker :

Dr. Greenberg received his Bachelor's degree from Western Washington University, a Master's from the University of Iowa, PhD from the University of Massachusetts. After a postdoctoral at Harvard he joined the faculty at Cornell University in 1977, eventually moved back to the University of Iowa in 1988 and finally returned to the Pacific Northwest as a member of the UW Medicine Microbiology faculty in 2005. Dr. Greenberg has spent his scientific career uncovering the secrete world of microbial social behavior. Due in large part to his efforts we now understand that bacteria possess chemical signals for communication and we understand mechanisms of bacterial communication. Bacterial communication controls virulence in a variety of pathogenic bacteria and has thus become a target for development of new therapeutic strategies. Bacteria have also become models for studies of selection for and evolution of cooperative behavior.

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