UNIVERSITY OF CYPRUS
DEPARTMENT OF BIOLOGICAL SCIENCES

The Department of Biological Sciences cordially invites you to the thesis defense of the PhD candidate

Theodoulakis Christofi
(Dr. Yiorgos Apidianakis Research Laboratory)

entitled

"PSEUDOMONAS AERUGINOSA INTERACTIONS WITH ITS HOST AND WITH COMMENSAL ESCHERICHIA COLI"

Abstract

Bacterial communities reside in parts of the human body namely the skin, the respiratory system, the genitalia and the gastrointestinal tract that come in direct contact with the environment or the consumed food. The human microbiome of the gut is the largest and most complex of all and plays a pivotal role in homeostasis and disease. One of its main functions is to protect mammals from pathogens. Accordingly, we demonstrate its efficacy and mode of action against the human opportunistic bacterium *Pseudomonas aeruginosa*.

The *Pseudomonas* genus includes some of the most versatile bacteria species found in nature. They can colonise a wide range of environmental niches due to their broad metabolic processes and virulence factors that enable them to cause multiple human opportunistic infections.

P. aeruginosa may prime and evade the host defense. We demonstrate that *Drosophila melanogaster*, which readily succumbs to infection with *P. aeruginosa*, can be primed immunologically by attenuated or heat killed *P. aeruginosa* against a lethal secondary infection. This phenomenon was attributed to humoral and cellular immune responses that last for at least 10 days following exposure to a persistent low-in-virulence infection, but it ends within a week if the host is primed with dead bacteria.

In addition, we have investigated the virulence of 30 fully sequenced *Pseudomonas* strains in two *Drosophila* infection models. We group the 30 strains as high and low in virulence using a *Drosophila* wound and an oral infection model and validate 6 of them in a mouse lung infection model. We are now performing genomic and transcriptomic analysis to identify the core mechanisms related to difference in *P. aeruginosa* virulence among strains in an effort to provide novel anti-infective targets.

In our study we focus on the interaction of this microbe with the host and *Escherichia coli*, a common commensal of the mammalian intestine. We studied bacterial interaction in culture and in fly and mouse animal models to show that *P. aeruginosa* and *E. coli* antagonize each other directly using their quorum sensing and metabolism respectively. This antagonism is evident in bacterial media cultures and in the gut of *Drosophila*. Moreover, we developed a model of *Pseudomonas* infection in mice that mimics the condition of hospitalized and immunocompromised patients, the most susceptible group to bacterial infections. Antibiotic use eradicates the normal gut microbiota including *E. coli* and favors *P. aeruginosa* infection and disease. Elimination of commensal *E. coli* is detrimental to host especially during immunodeficiency.

Dietary habits are also very important in the maintenance of a healthy microbiome. In our study we investigated the role of three extreme and a conventional diet in mice and the way they affect *E. coli* - *P. aeruginosa* interaction. We found that moderate sugar fermentation to lactic and acetic acid through conventional diet as well as a fat-based diet assist *E. coli* in preventing *P. aeruginosa* colonization in the mouse gut. And vice versa *P. aeruginosa* pyocyanin, a toxin with bactericidal properties can inhibit the growth of *E. coli* in the absence of sugars.

Collectively, our study identified novel host-pathogen and bacterial interactions that reveal the complexity behind bacterial infections and the role of diet and microbiota in health and disease.

Tuesday, May 29, 2018 at 10:00
Building ΘΕΕ02, Room B128 (Panepistimioupoli Campus)

The presentation is open to the public.