Horizontal transfer of a disease resistance gene

With the support by the National Natural Science Foundation of China (Grant No. 31221091) and the National Basic Research Program of China (Grant No. 2010CB945300), Prof. Zhu Shunyi and his research team from the Institute of Zoology, Chinese Academy of Sciences, discovered nematode-derived drosomycin-type antifungal peptides (DTAFPs), which provides evidence for horizontal gene transfer (HGT) of a disease resistance gene between plants and ecdysozoans (*Nature Communications*, 2014, 5: 3154).

DTAFPs are key innate immunity components of *Drosophila* and plants to deal with potential fungal infections. This study identified 15 members of DTAFPs in the fruit nematode *Caenorhabditis remanei* (termed cremycin-1 to crymycin-15), which all share highly similar amino-acid sequences and identical precursor organization with fruit fly drosomycins. Among the 15 cremycin genes, 10 were transcriptionally active and six up-regulated after microbial challenge.

Synthetic cremycin-5 exhibited low haemolysis and high serum stability. Antimicrobial assays showed that it damaged the spores of filamentous fungi and inhibited their germination into hyphae. Cremycin-5 was also active on a series of clinical isolates of human pathogenic yeasts through a non-membrane disruption mode of action. The treated cells were not capable of dividing into two single daughter cells due to the cytokinesis inhibited.

The survey identified the restricted distribution of DTAFPs in a clade of moulting animals (Ecdysozoa), including Arthropoda (Insecta, Entognatha, Myriapoda and Arachnida), Nematoda (Rhabditida and Tylenchida) and Tardigrada. Considering that DTAFPs are widespread in plants but absent in fungi and protozoans, a complex evolutionary history of DTAFPs has been revealed, in which an ancient HGT from plants led to the origin of a disease resistance gene in ecdysozoans and subsequent vertical inheritance involving gene duplication, loss and functional diversification occurred. This work might be also valuable in guiding the discovery of new DTAFPs with therapeutic potential from other ecdysozoans living in fungi-rich niches.

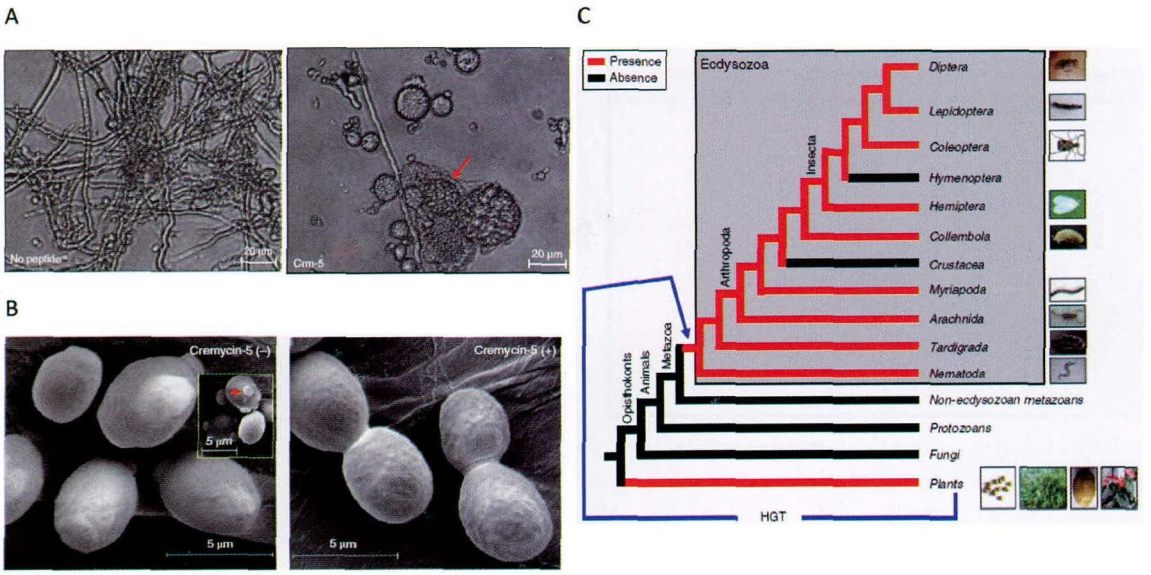

Figure A, Effects of cremycin-5 on *Neurospora crassa*. The damaged spores are indicated by red arrows. B, Scanning electron micrographs of *Candida albicans* cells in the presence and absence of cremycin-5. The red arrow indicates budding of a normal cell. C, Patch distribution and proposed HGT of DTAFPs.