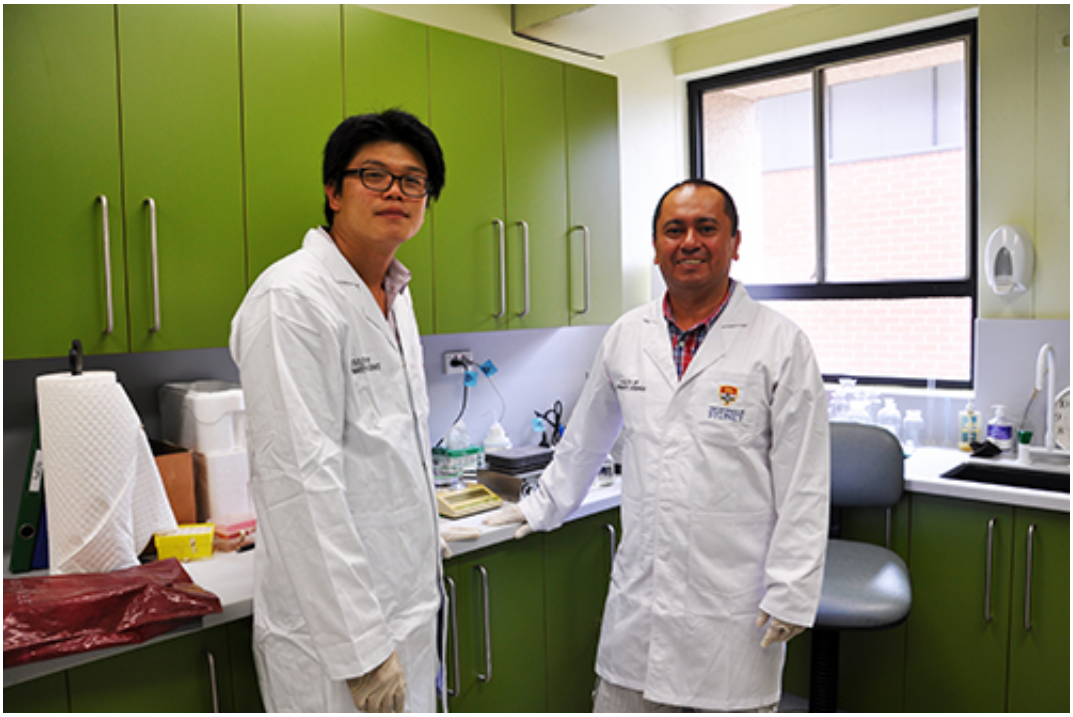
Tough life key to croc immunity

February 10 2014, by Verity Leatherdale



PhD student Weerachai Jaratlerdsiri and Dr Jaime Gongora have researched the immune system of crocodiles.

(Phys.org) —The immune systems of crocodiles and alligators have remained relatively unchanged for centuries despite their worldwide distribution, as revealed for the first time by University of Sydney researchers. This new knowledge could assist in the conservation and breeding strategy of Australian freshwater and saltwater crocodiles.

Dr Jaime Gongora, research project leader from the University of

Sydney's Faculty of Veterinary Science said "Alligators and crocodiles occupy an evolutionary mid-point between mammals and birds so they provide a unique link. Our research helps address fundamental questions about how evolution drives and maintains genetic diversity of the immune genes.

"The study looked at the diversity and evolutionary mechanisms of two primary gene classes of the major histocompatibility complex (MHC), key components of the immune system. The study investigated 20 species of crocodilians including the two Australian crocodile species; freshwater and saltwater crocodiles.

"This research helps to close a gap in our knowledge of immune gene evolution particularly since the crocodilian families (crocodiles and alligators) diverged from a common ancestor 90 million years ago."

The MHC is a group of genes that help the immune system identify microbes and parasites. They play an important role in disease resistance, as diverse genes allow animals to resist a wider range of diseases. The research published this week in the journals *PLOS ONE* and Immunogenetics shows that some of the genes involved in the fight against viruses, bacteria and parasites have remained the same across all crocodilian species while other immune genes seem to have diversified in crocodiles.

"The diverse environments occupied by many crocodilians, whether saltwater crocs in the Northern Territory or alligators in Florida, appear to have exposed crocodilians immune genes to a wide range of germs," Dr Gongora said.

Researchers found multiple instances of crocodilians losing and/or duplicating genes showing that their immune system is still responsive to evolutionary changes.

"We now have a genetic resource to understand the immune system in crocodilians, thanks to this research. It will enable genetic investigations of how these animals respond to local conditions including susceptibility to disease," said lead author of the article Weerachai Jaratlerdsiri, who recently completed his PhD at the University of Sydney.

"In an agricultural context, crocodiles are produced for their skins as part of a very successful sustainable-use conservation strategy. Part of this strategy is to place an economic value on the wild population, in this case the crocodile eggs, which are collected and artificially incubated before rearing the offspring in captivity. However, since these animals are not domesticated, no selection against bugs has occurred. Thus, understanding the genetic regulation of disease susceptibility will provide crocodile producers with selection tools and lessen the reliance on vaccinations and antibiotics" said Dr Sally Isberg, honorary associate at the University of Sydney and Managing Director of the Centre for Crocodile Research which consults to the Australian crocodile industry.

"The innovative and fundamental knowledge generated from this research serves as the base for further research into the immunological fitness of wild and farmed populations especially to explain how they maintain the health of their immune system to deal with parasites and microbes."

"We suggest that throughout crocodilian evolution, immune gene diversity responded to disease-causing organisms in the environment. This might provide further insights into disease resistance by explaining how immune genes evolve in other vertebrates, in particular reptiles" Mr Jaratlerdsiri said.

More information: Jaratlerdsiri W, Isberg SR, Higgins DP, Miles LG, Gongora J (2014) "Selection and Trans-Species Polymorphism of Major Histocompatibility Complex Class II Genes in the Order Crocodylia."

PLoS ONE 9(2): e87534. DOI: 10.1371/journal.pone.0087534

Weerachai Jaratlerdsiri, Sally R. Isberg, Damien P. Higgins, Simon Y. W. Ho, Jan Salomonsen, Karsten Skjodt, Lee G. Miles, Jaime Gongora "Evolution of MHC class I in the Order Crocodylia." *Immunogenetics* January 2014, Volume 66, Issue 1, pp 53-65 DOI: 10.1007/s00251-013-0746-1.