



- Dissecting the cause of devil facial tumour disease
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RESEARCH

A devil of a disease



AMMRF @ SARF

Tasmanian devil facial tumour disease (DFTD) is decimating devil populations across large areas of Tasmania. The disease was first sighted in 1996 and causes cancerous lesions around the mouth that develop into large tumours of the face and neck. It is always fatal and has depleted approximately 80% of the devils in Tasmania. Such rapid devastation calls for a strong and committed research program to understand the rapid spread of this baffling disease and so there is a great deal of work being done to tackle the problem.

The unusual thing about DFTD is that it is a contagious cancer. This occurs by the direct transmission of cancerous cells from animal to animal through biting. Because of the general lack of genetic variation within the population, there appears to be reduced immune recognition of the foreign cells when they invade the bitten animal, allowing them to survive. Some hope, however, is now on the horizon, stemming from the observation that a population of devils in western Tasmania appears to be disease free, which might imply resistance or simply that the disease has not yet reached this population. Another, possibly related, observation, that affected devils carry an inverted chromosome, could also shed light on the difference between the two populations and suggests a possible

mechanism of disease susceptibility. The rearrangement of a whole section of chromosome could be disrupting the function of nearby genes, possibly affecting immune responses.

Robyn Taylor, of the Tasmanian Government's Save the Tasmanian Devil Program (STDP), is very passionate about these cute, noisy creatures. She is determined to put her knowledge of molecular science to good use in the quest to prevent their extinction from the wild, where they are a vital part of the natural Tasmanian ecosystem.

Robyn is assisting Anne-Maree Pearse and Kate Swift, also from the STDP, with the investigation of the inverted chromosome. She visited the AMMRF at the University of Adelaide in March to micro-dissect devil chromosomes by laser capture microscopy. The work is part of a Linkage Project with Dr Jeremy Austin of the University of Adelaide and A/Prof. Katherine Belov (voted Australia's favourite scientist at the 2009 Eureka prizes) of the University of Sydney. The dissected sections of chromosome that Robyn has prepared allow a targeted approach to the construction of DNA probes to help understand the impact of the inversion on devil susceptibility to DFTD.

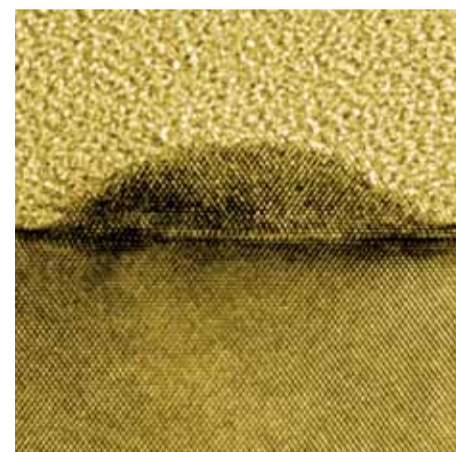
Down the line, this research could lead to a breeding program introducing normal chromosomes back into the current devil population with the aim of increasing population immunity to the tumour cells. ■

Creating a positive spin on electronics

AMMRF @ UQ

Currently, transistors are made of semiconductors that control the charge of electrons. Creating a semiconductor that takes advantage of the magnetic properties (spin polarisation) of electrons as well as their charge at room temperature would be a huge step forward in semiconductor electronics. Having it integrate with current semiconductor (CMOS) platforms would also be necessary for large-scale practical device applications. Information storage currently uses metal-based magnetic devices, whereas information processing uses semiconductor devices. The exchange of information between these two separate systems is energy and time consuming. With magnetic semiconductor-based spintronics, data manipulation and long-term storage can be achieved in one computer chip, rather than separately in a central processing unit and a hard drive as is practiced at present.

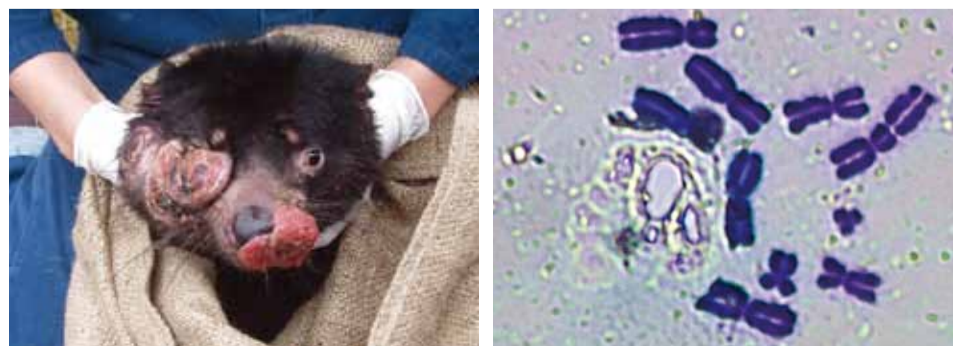
Prof. Jin Zou and Dr Yong Wang from the University of Queensland (UQ), Prof. Kang L. Wang and Dr Faxian Xiu from the University of California at Los Angeles and Dr Ajey Jacob from the Intel Corporation in Santa Clara have published their latest research in *Nature Materials*. They describe the successful fabrication of a new class of magnetic semiconductor quantum dots that take advantage of electrons' charge and spin to combine electronic and magnetic properties. In particular, they showed that the magnetic properties of the quantum dots could be controlled by changes in electric field at ambient temperatures, making it possible to build practical spin devices (or 'spintronics').



Quantum dot on a silicon substrate.

Characterising the dots' structure and understanding how the components are distributed was wholly dependent on the microscopy carried out in the AMMRF at UQ. The dots are composed of 95% germanium and 5% manganese. They are 30 nm in diameter and sit just 8 nm high on a silicon substrate. Prof. Zou says, "The key was getting just the right concentration of manganese mixed in with the germanium matrix of the quantum dot. Manganese has characteristics that, in combination with other semiconductor atoms in the right concentration, allows magnetic properties to be achieved."

The small size of the dots will enable electronic devices to be made smaller, thereby reducing variability and allowing the possibility of constructing nonvolatile logics for substantial power savings when systems are in standby mode. Eventual spintronic devices will have applications in nearly all fields, especially as spintronic-based computers would be smaller and faster and would consume less energy. ■



A devil with DFTD (left) and laser capture microscopy of devil chromosomes (right).