Report of 20 November 2014 Meeting
Royal Society
Southern Highlands Branch

Speaker: **Professor Catherine Suter**
Head, Epigenetics Laboratory
Victor Chang Cardiac Research Institute

Topic: **Epigenetics and the Consequences of Epigenetic Changes**

An audience of 71 greeted Professor Catherine Suter to hear her deliver the last lecture of the year for the Royal Society Southern Highlands Branch. Having received her PhD in 2001 from the University of NSW for her work on breast cancer metastasis, she moved into the field of epigenetics during her post graduate studies. There she reported the first cases of germline epimutation in humans. Her lecture to the Southern Highlands Branch largely concerned her team's work on epigenetic changes over many generations of the viable yellow agouti mouse, AVY.

Epigenetics literally means *above* genetics, that is, it refers to the beacons that are on top of the DNA. In 2000 the human genome was finally mapped, but at that stage, scientists did not know of the hidden array of switches on the DNA that can be turned on or off, not only by what our bodies experience but also by the behaviour of our predecessors. Molecular modifications sitting on top of the DNA cause individual genes to be switched on or off without changing the genetic code. Our predecessors are now known to affect us not only by the passing on of their genes, but also by the passing on of epigenetic changes to their DNA.

Dr Suter demonstrated this by showing surprising pictures of five AVY mice which were essentially identical quintuplets. One mouse was very large, fat and golden-furred, her sisters appearing as small, brown, normal-looking mice. In the brown mice, the AVY gene had functioned normally. In the large yellow mouse however, some factor had caused the AVY gene to be switched on all the time, transforming the coat to yellow, and blocking the normal signals that tell the mouse it has eaten enough, thus pushing it toward diabetes. There had been no change at all in the DNA sequencing.

Other experiments by Suter's team have shown that feeding a pregnant agouti mouse with supplements such as folate and vitamin 12 not only made her offspring more likely to be brown, slim and healthy, but also had the same effect on her grandchildren. Even though the grandchildren mice were not fed the supplement, they were affected because they came from eggs that were growing inside the embryo while it was being affected by what the mother was eating. When the team continued feeding the modified diet to several generations of mice, the effects were magnified. This raises possible answers as to why some human populations have a greater risk of developing certain diseases.

Another interesting outcome of these experiments to date is the realization that the same gene that caused the large mouse to turn a beautiful yellow colour also caused it to overeat, thus causing obesity and type 2 diabetes. Of even more interest is that the mother's diet can determine whether the gene is switched on or off. The affected mouse will then pass on this epigenetic tag to the next generation. In essence, the diet of the grandmother can actually affect her grandchildren.

The question now to be investigated is to what extent epigenetic changes can be inherited in humans, and what effect this discovery would have on modern medicine as we know it. Professor Suter has in fact already found an epigenetic change involved in cancer which has been passed on the next generation, an incredible breakthrough in medical research.

Anne Wood