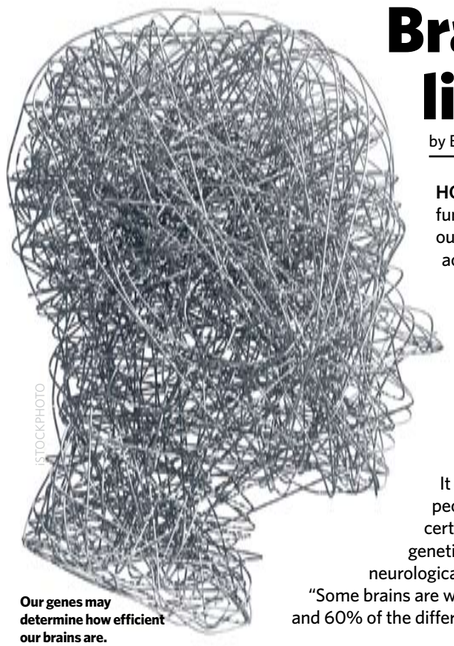

Our genes may determine how efficient our brains are.

Brain cost-efficiency linked to family genes

by Becky Crew

HOW WELL OUR brain functions is largely based on our family's genetic makeup, according to a study that provides the first evidence of genes affecting how 'cost-efficient' our brain network wiring is.

It could shed light on why some people are better at performing certain tasks than others, and the genetic basis of mental illnesses and neurological diseases.

"Some brains are wired better than others, and 60% of the differences can be explained by genetic factors," said lead author, neuroscientist Alex Fornito from the University of Melbourne. "The novelty is that we now have new methods to identify different aspects of brain network organisation. Previously it was very difficult to try and map these connections."

Cost efficiency involves a balance between two competing priorities. Communication efficiency increases with the number of connections added, but the more connections, the more costly it is in terms of energy to run them, the team report in *The Journal of Neuroscience*.

> "The brain tries to maximise its bang-for-buck by striking a balance between making connections and minimising the 'cost'."

"The brain tries to maximise its bang-for-buck by striking a balance between making more connections and minimising the 'cost' required to make these connections," said Fornito. "Our findings indicate this balance has a strong genetic basis."

Warding off blackleg fungus

by Bridget Murphy

THE DISCOVERY OF a unique genome organisation in the blackleg fungus, which infects and damages canola crops worldwide, will help farmers protect their harvest from the disease.

Blackleg fungus produces blackened legions at the base of the stem in canola plants. Changes in the virulence of blackleg populations can lead to disease epidemics for certain canola varieties, wiping out the oilseed crops.

Molecular biologist Barbara Howlett of the University of Melbourne led a research team that cracked the genetic code of the blackleg fungus, providing them with a map for identifying the genes that cause a disease.

The team then used the sequence to make molecular markers in fungal populations that will allow scientists to note when large changes in virulence occur, and identify varieties of canola that are less susceptible.

"The 12,500 genes that constitute the genetic blueprint for the fungus *Leptosphaeria maculans* have been identified and now can be mined to discover how this fungus causes the deadly disease," said Howlett.

> "Blackleg fungus and canola are in an evolutionary arms race."

The blackleg has a unique 'patchwork' genetic structure in which the disease-associated genes are not evenly spaced in the genome, the researchers report in *Nature Communications*.

"The location of disease genes means that they are easily gained, lost and changed in the blackleg fungus," said Howlett. "This fungus produces millions of spores that are genetically different." If just one of these spores contains a different disease gene that the canola plants don't recognise, it can cause large crop losses.

"Blackleg fungus and canola are in an evolutionary arms race. Growing a single highly-resistant canola variety provides crop immunity over the short term, but in the long run we are putting the canola at a disadvantage," she said.

Scientists are using the genome of the blackleg fungus to protect canola crops.

Musical baby talk could have evolved to strengthen the mother-baby bond.

The origins of music

by Myles Gough

COULD MUSIC HAVE originated in the playful babble spoken by a mother to her child? While the origins of music are lost in time, one researcher believes the key may be in the way our mothers speak to us as infants.

Richard Parncutt, a professor of systematic musicology, said music originally spawned from 'motherese' – the whimsical voices mothers adopt when speaking to young children. Although it may sound cute – even nonsensical – on the surface, motherese is actually a sophisticated form of communication, Parncutt told experts at a lecture at the University of Melbourne earlier this year.

The theory is, increased human brain sizes caused by evolutionary changes resulted in earlier births, more fragile infants and a critical need for stronger relationships between mothers and their newborn babies. According to Parncutt, who is based at the University of Graz in Austria, motherese arose as a way to strengthen this maternal bond and to help ensure an infant's survival. "If babies were born earlier it is clear they would need better care in order to survive ... this would involve the baby communicating its state and needs more clearly to the mother," he said.

> "Music is the very first form of intelligence to reveal itself – even before a baby is born they can recognise music and sound patterns."

"All that makes it very likely that motherese evolved as an evolutionary adaptation in response to this development. To that story we can add a large amount of modern empirical evidence for the musical nature of motherese and for the musical abilities of infants," he added.

The voice that mothers use to speak to their infants – even in the womb – contains structural musical elements such as rhythm and melody, and codes that babies and mothers can understand. It also contains cross-cultural similarities with regard to the physical gestures and movements it incorporates – an important consideration when examining the origin of music.

"The sonic-gestural vocabulary tells both mother and infant about the current physical and emotional state of the other, as well as the current state of play between them," said Parncutt. Emotions such as surprise and disappointment are learned for the first time in a social and musical context, he said. "It is about survival in that it motivates the mother to care for the infant and gives her information about the infant's needs."

The research is a stepping-off point from previous theories on musical origins; for instance, that musical talent is inherent in animal behaviour or exists simply to give us pleasure, somewhat like a drug. Other theories suggest music developed as a way for men to attract sexual partners, with the most skilled musicians being rewarded with the best mates, or that music evolved as a tool of play to help youngsters learn and acquire other non-musical skills.

We interact with music at the earliest stages of life, said Gary McPherson, head of the University of Melbourne's School of Music. "Music is the very first form of intelligence to reveal itself – even before a baby is born they can recognise music and sound patterns." Parncutt is "not just accepting something that is sexy – he's really deconstructing this whole research area," said McPherson.