Cultured chimpanzees get the message

CHIMPS have for the first time been shown to pass knowledge from one individual to the next with nearly perfect accuracy through several "generations" of teacher and learner. This ability means that these apes have one of the key skills needed to create and maintain cultural differences between groups.

It has been known for many years that different groups of wild chimps behave differently, but it remained uncertain whether these behaviours represent adaptations to subtly different conditions or different traditions inherited culturally within each group. To find out, Victoria Horner, a primate behaviourist at the University of St Andrews in the UK and the Yerkes National Primate Research Center in Atlanta, Georgia, and colleagues set up a controlled experiment to test whether chimps are capable of transmitting knowledge faithfully through a chain of learners.

Horner and her team devised a box whose door could be opened in either of two ways: by lifting a flap or sliding it sideways. Then, says Horner, "we basically set up the telephone game with chimpanzees." The telephone game, also known as Chinese whispers, tests how a message changes as it is passed along a chain of people. In this case the "message" was how to get at a food reward hidden behind a flap. The team trained one chimp to lift the flap to get at the food, then let a second chimp watch the first one demonstrate the technique several times. The "teacher" was then removed, a new naive apprentice was brought in to watch the newly taught chimp, and so on. A second cultural lineage was begun with a chimp trained to slide the door instead of lifting it.

CLIVE BROMHALL/PHOTOLIBRARY

Do as I do

"In both lineages, knowledge was passed down almost perfectly through at least five teacher-learner generations"

In both lineages, the knowledge was passed down almost perfectly: through six teacher-learner generations, chimps trained by lifters always lifted, and through five generations sliders always slid (*Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.0606015103). The researchers observed only one error, a slider that lifted once out of 20 trials, but its apprentice learned to slide anyway.

The result shows that cultural learning is strong in chimps, says Horner. "If the chimps weren't learning from each other, we'd expect over a couple of generations it would degrade to a 50:50 performance. If they weren't very good at copying, you wouldn't see this almost 100 per cent accuracy." **Bob Holmes**

Hard upbringing turns stem cells into tough tissues

LIKE people, it seems adult stem cells are a product of the toughness of their environment. Biochemical cues are already known to influence what tissues stem cells develop into. Now researchers have shown for the first time that adult stem cells from bone marrow will begin to differentiate into particular cell types according to the toughness of the surrounding tissue.

Adam Engler of the University of Pennsylvania in Philadelphia and his colleagues isolated adult mesenchymal stem cells, which have the potential to turn into cartilage, bone, muscle, tendon, ligament, fat and some neurons, and grew them in three different polymer gels, each of a different stiffness. The softest was roughly the consistency of nerve tissue, the middle one was similar to muscle tissue, and the hardest was similar to bone.

When undifferentiated stem cells were placed in each of the gels – which contained no biochemical signals – they began to differentiate into the type of tissue the gels' mechanical properties most closely resembled (*Cell*, vol 126, p 677).

Fully mature cells are known to change according to their physical surroundings. For example, fibroblasts are all-purpose cells found in connective tissue that can morph to form bone, cartilage or even muscle cells, depending on the type of surface they are in contact with. "Cells respond extensively to their environment so this is an interesting result, but not a particularly surprising one," says Allan Spradling, a stem cell expert at the Carnegie Institution in Baltimore, Maryland.

Further work will be needed to test whether cells can form complex tissue structures without the help of chemical signals. It also remains to be seen whether embryonic stem cells will display similar sensitivity to the mechanical properties of their surroundings.

The finding has important implications for the development of therapies that use adult stem cells, such as injecting stem cells into the heart of a patient who has suffered a heart attack. Since damaged cardiac muscle can form scar tissue, which is fibrous and harder than healthy muscle, Engler's study suggests that the cells may form yet more scar tissue, or worse, try and form bone.

"A first approach to stem cell therapies has been simply injecting cells into injured tissues," Engler says. "That's not going to be sufficient because the cells may be entering an improper physical environment."

Spradling agrees. "This has been the dominant paradigm, but it's naive. We need to learn how tissues repair themselves and mimic that."

The finding could also have implications for tissue engineering, which often involves seeding artificial scaffolds with cells in an attempt to grow new organs. "If we had a greater range of scaffold materials available to us, we could try varying the properties of the scaffold to mimic the elasticity of the tissue we were trying to grow," says Chris Mason at the Advanced Centre for Biochemical Engineering at University College London. Michael Reilly