Mark Baldwin: A former dancer with the Rambert Dance Company and its artistic director since 2002, Baldwin has focused on work that encourages collaboration with other art forms, and even with science. (Photo: Simon Weir.)

than small ones, and that the method doesn't work when the tube contains sawdust instead of water.

Together with Bird and her student Lucy Cheke, Clayton transferred the Aesopian experiment to jays, demonstrating that the ability to use tools is a wider phenomenon in the corvid family, and not restricted to the *Corvus* genus. Confronting the jays with a range of variations of the experiment, the researchers also tried to establish what goes through the birds' minds. The model that best predicts their behaviour states that they tend to do whatever achieves the movement of food towards the point where they can reach it, and that their action is to some extent influenced on causal connections, but not reliant on it.

Clayton's group has also demonstrated that corvids can plan for the future in ways that were thought to be unique to humans (Nature (2007), *445*, 919–921). In their most recent publication, Cheke and Clayton show that Eurasian jays can distinguish two separate future needs and plan for them accordingly, even if it conflicts with present motivations (Biol. Lett. online November 2, 2011, doi: 10.1098/rsbl.2011.0909).

From her work with apes and children, Clayton can appreciate how clever the jays and other corvids are. "Children typically reach this level at the age of seven," she says. Surely that's worth dancing about.

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Q & A

Susan Healy

Born in New Zealand, Sue's secondary schooling was at Feilding Agricultural High School (where she regrettably did not learn to shear a sheep), which was followed by a BSc (Hons) in Zoology and Physiology at the University of Otago in Dunedin. A Junior Research Fellowship at St John's College, Oxford came after a DPhil in Zoology also at Oxford. Now in a joint appointment between Biology and Psychology at the University of St Andrews, Sue works on a range of areas in animal cognition, including spatial memory, sex differences, decision making and nest building.

What turned you on to biology in the first place? I am not one of those people who was a biologist-in-the-making from my earliest years. I went to the University of Otago to be a medic, but had the good fortune to be taught by a number of engaging biology lecturers in my first year. Coupled with enjoying university life to its fullest, by the end of that first year I was no longer interested in pursuing a medical career; zoology it was. In the second half of my degree, I was even more fortunate to make friends with a bunch of people with whom I talked and argued science all the time. On one occasion we took the test tubes from our parasitology lab to the pub next door, where the requisite shaking (of the tubes) could be done whilst imbibing gin and tonic and arguing about science. Things might have been very different though had I not gone to the UK in 1985. My plan had to been to work and travel around Europe before returning to New Zealand to do a Ph.D. My first job was as a research assistant to John Krebs in Zoology at Oxford. He very generously proceeded to fund my Ph.D. and the rest is history: I left home with a backpack and ended up with a beautiful house and a large garden in Fife.

What is the best advice you've been given, and what career advice would you offer? David Haig told me once to stop reading my talks, which is a piece of advice I have never looked back from. But perhaps even more tellingly, I was told, well into my career, to stop apologizing in those talks. I used to

deliver my science rather cautiously, but as I became more confident that I was doing science that others found compelling, I found it easier to be more positive. I now enjoy giving talks far more. I also realized that I needed to deal with rejection better, especially with rejected papers. Now, my advice would be to learn to deal with rejection early: it will happen and those who get over it soonest and who learn to take positively from it will be successful.

If you knew then what you know now, would you still pursue the same career? Oh yes. I have a career I would not swap for any other. The constant intellectual engagement, the satisfaction of scientific curiosity, and opportunities for travel off the beaten track mean I have almost never experienced the 'Monday morning' effect.

What do you think are the big questions to be answered next in your field? The next big question is one that has been around for a long time: has natural selection shaped our cognitive abilities? As an 'adaptationist' I have no doubt that the answer is 'yes', but not everyone agrees, and there is remarkably little compelling support for this hypothesis. Perhaps one of the central problems has been defining and quantifying the traits that make up cognition. Much of my work, in the lab and the field, tries to address this first step. Only then will we be able to make progress on linking cognition to evolutionary fitness more broadly. I am especially interested in making the transition to 'real' (as opposed to 'lab') animals and their cognitive abilities in the 'real' world. But even when we have good proxies for cognition in the

field, such as memory for food stores in tits, making the crucial links with fitness has been difficult and at times controversial.

Why are there not more women in science? As an undergraduate, I was told by an ageing male lecturer that women who 'got on' in science had blonde hair, blue eyes and A grades. Usefully, back then I could tick all those boxes! However, when I finally looked at who had jobs in the department I realized that women did not stay on in zoology in spite of making up half of the undergraduate contingent. Now, I number amongst the older women at the conferences I attend, even though men of my age are still considered 'mid-career'. There are multiple explanations for this gender bias, and the more I research sex differences myself, the more comfortable I am that some of those differences exist. After all, from the neck down there is little dispute or concern over differences between males and females. However, the idea that a CV with a woman's name on it will be viewed less positively than the same CV bearing a man's name shames us all. We need to reach a state where gender does not contribute to decision making in any context. Women as well as men must play a role in this. For example, the comment that 'I don't want to get a job just because I am a woman' is one that women should be wary of producing. After all, at least some of the men surrounding us got their jobs because they were men! Whilst most of my 'insights' into this issue are best kept for sharing over a glass of wine, one point I would stress concerns confidence. In my own career, I will be forever grateful to people like Nicola Grimmond and Alison Mercer at Otago, who gave me the confidence to consider myself good enough to do the job. Unfortunately, confidence is not easily taught. However, I do make an attempt on a more local level to encourage my students' self-confidence. I look forward to seeing the young women I know being able to make confident career decisions on their own, rather than just because they were lucky enough to have the right people encourage them just at the right time.

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Quick guide

Stress

Carl Procko and Shai Shaham

Why do organisms respond to environmental stress? Organisms are adapted to particular environments; however, the environment in which an organism finds itself is rarely static, and may exhibit daily and seasonal fluctuations. Without the benefit of an air-conditioned home or a well-stocked refrigerator, most organisms must sense environmental changes and respond accordingly to optimize metabolism and growth. Environmental stressors, such as temperature extremes or nutrient limitations, pose an additional problem: how to survive and maximize reproductive success in unfavorable conditions that may otherwise be lethal.

Can development be altered by stress? Many organisms have evolved developmental strategies to persist under high stress conditions. For example, some organisms enter a specialized, stress-resistant state that permits both the temporal avoidance of the environmental insult and also the dispersal of the organism from one environment to another. Bacteria are a good example: in response to nutrient depletion, some species become endospores (Figure 1A), metabolically-inactive cellular structures, with a thick, multi-layered protein coat and a dehydrated core. Specialized proteins,

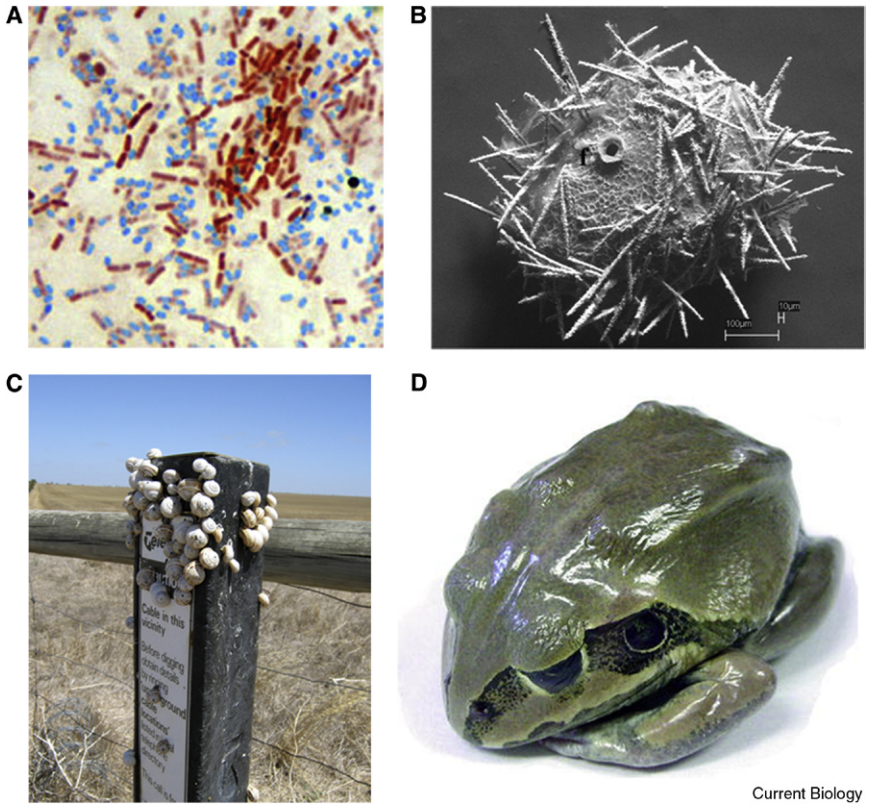

Figure 1. Coping with stress: from bacteria to vertebrates.
(A) Bacterial endospores of the *Bacillus* genus (blue) derived from vegetative cells (red) in response to nutrient depletion. Reproduced with permission from Zayaitz, A., and Hussey, M.A. (2007). (B) Scanning electron micrograph of a sponge gemmule (*Duosclera mackayi*). Gemmules are protected from environmental insults by a collagenous coat, sometimes containing glass spicules. Reproduced with permission from Annesley, J. *et al.* (2007). (C) In periods of high heat and low water, some species of land snail such as *Theba pisana* (pictured) avoid desiccation by entering a state of dormancy, termed estivation. Estivating snails are frequently found atop posts and vegetation, where the temperature is cooler than the soil surface. Port Vincent, Australia; photo: M.R. Procko. (D) The frog *Cyclorana australis* also estivates during periods of low water availability. In addition to lowering its metabolic rate, the animal burrows underground and produces a hardened cocoon from shed layers of epithelial cells (pictured) to avoid desiccation. Reproduced with permission from Withers, P.C., and Cooper, C.E. (2010).