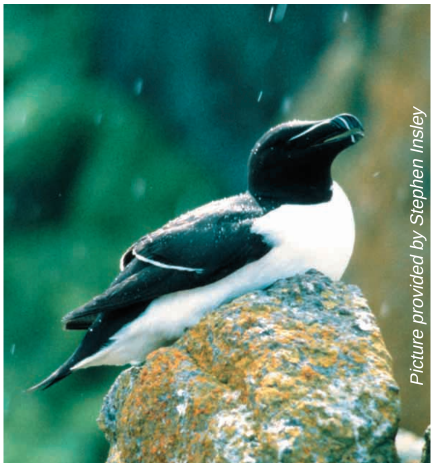
Inside JEB, formerly known as 'In this issue', is a weekly feature, which highlights the key developments in the *Journal of Experimental Biology*. Written by science journalists, the short reports give the inside view of the science in JEB.

Inside JEB

DAD'S ALL EARS FOR RAZORBILL CHICKS



Picture provided by Stephen Insley

One newly hatched chick looks much like another: even their parents can't tell them apart. But as Steve Insley explains, that isn't necessary for many species; they only need to begin recognising their chicks once there is a chance that the youngsters might get mixed up with someone else's brood. Until then it's good enough to find the right nest. But once the youngsters take to their wings, it's a different story, and this is the point when many parents begin to distinguish their chicks from the youngsters next door. But not all parents take equal responsibility for their recently fledged chicks. When young razorbills leave the nest, it's not mum, but dad, who takes them out on their first foraging trips at sea. Insley wondered if this might affect which parent could recognise their young. Could there be sex-related differences in the parent's ability to recognise their own young? Insley set out to the windswept Gannet Islands off the North American Labrador coast to see if there was a difference between male and female razorbill's ability to recognise their own young. After weeks of patiently watching adult razorbill's reactions to fledged chick's voices, Insley was amazed to discover that there is a sex bias in the bird's ability to recognise their own chicks' voices; fathers responded enthusiastically but mothers did not (p. 25).

Insley teamed up with Rosana Paredes and Ian Jones, who were already working on the islands with the birds. First Insley and Paredes had to work out how to uniquely identify each adult bird by using hair dye without 'spooking' the birds. Only then could Insley begin recording the cries of both the chicks and adults. But even on a clear day, the elements conspired to disrupt the recordings with the recordings picking up high levels of background noise from the wind and the sea.

Once Insley had a satisfactory set of bird-call recordings from adults and chicks, he began testing whether the birds responded to each other. First he played the cries of nearly fledged chicks to their parents and strangers. He recorded the adult bird's responses to the recordings. He explains that the adults reacted in several ways when they heard their chicks, but the most reliable indicator that the adult had recognised a chick was that the adult called back. Insley was elated when he realised that fathers mainly responded to their own chicks, usually remaining silent when they heard an unrelated chick, but the mothers were indifferent to all of the chick's recordings, whether or not they were related.

Were the females ignoring the chicks, or were they unable to respond to the recorded bird's cries? Insley knew that the parents often duetted together when they returned to the nest, so he tried playing the females the sounds of their partners' voice. This time the females showed more interest, and responded to the male's sounds. So the females could respond to a recorded sound that they recognise, but there could be several other reasons why they don't respond to their own chicks.

Having found that there is a link between the males' behaviour and their ability to recognise their young, Insley is keen to see what impact this has on the razorbill's paternalistic society.

10.1242/jeb.00091

Insley, S. J., Paredes, R. and Jones, I. L. (2003). Sex differences in razorbill *Alca torda* parent–offspring vocal recognition. *J. Exp. Biol.* **206**, 25-31.

SQUIRRELS CHOOSE TO COOL BY WARMING

When the days draw in and the temperature begins to fall, many mammals prepare to survive the cold winter when food is scarce by dropping their metabolism and becoming torpid. But some animals can also slip into torpor when their environment becomes hypoxic, dropping their temperature and metabolic rate until the oxygen levels return to normal. Glenn Tattersall is intrigued by the physiological changes that overcome the ground squirrels as the oxygen level drops. He wondered if the animal's drop in temperature is because the tiny creatures reset their body temperature to a lower level, or because they simply can't make enough heat to stay warm when they reduce their metabolism. In this issue of the *J. Exp. Biol.* (p. 33), Tattersall describes how the animals modulate their temperature as they descend into torpor and recover later, which suggests that the ground squirrel's cooling is a matter of choice, rather than the physics of their matter.

Tattersall decided to see whether the squirrels regulated their body temperature in response to an environmental factor that he had control over: oxygen. He decided to monitor the squirrel's surface temperature and metabolic rate as he varied the oxygen level in a respirometer. The biggest problem was building a squirrel-sized respirometer from material that didn't absorb their infrared signature; until Tattersall finally hit on the idea of using a Ziploc bag to make an infrared window! Dropping the oxygen to 7%, he watched the squirrel's metabolic rate fall as their bodies began radiating heat. Within moments of the oxygen decline, the animal's ears, nose and feet began glowing, as the animal's diverted their blood supply to rapidly dump heat into the environment and cool their core.

However, when he returned the oxygen level to 21%, the squirrel's surface showed no sign that the tiny creatures had reignited their central heating. Tattersall repeated the experiments at several environmental temperatures, and noticed that the colder the ambient temperature, the greater the drop in the squirrel's metabolic rate. He explains that this suggests that as the oxygen level falls, the squirrels suddenly change their temperature set point, dropping their metabolic rate and turning off heat generation. Once the animal's metabolic rate has fallen, it must dump body heat as fast as possible.

Although adult humans appear not have the metabolic flexibility to change their temperature set point, newly born babies might. Many premature infants have severe breathing problems soon after birth and often become hypoxic. Tattersall explains that if this is the case, the tiny babies could have a lower temperature set point like the ground squirrels, so clamping their body temperature at 38°C could face struggling infants with a severe metabolic challenge. So understanding how North American ground squirrels choose to cool could help clinicians treat some of their most vulnerable patients.

10.1242/jeb.00092

Tattersall, G. J. and Milsom, W. K. (2003). Transient peripheral warming accompanies the hypoxic metabolic response in the golden-mantled ground squirrel. *J. Exp. Biol.* **206**, 33-42.

MACARONIS STAY WITHIN THE LIMIT

Picture provided by Jonathon Green

The only thing that penguins haven't learned to do since they returned to the sea is breathe under the icy water; they still have to come back to the surface after a foraging dive to breath. Unable to replenish their oxygen supplies while submerged, penguins have adapted to conserve the oxygen from their last breath, to last the duration of a dive, which for some species can be over 20 minutes. Pat Butler is fascinated by the energetics of penguin diving, and he wonders 'how they manage to stay under water so long?' Over the years, he has found that many species drop their heart rate and take advantage of the cold to conserve energy and their limited oxygen supply during long dives in their natural environment. So in 1999, his team returned to the Antarctic to see how macaroni penguins deal with the problem, and discovered that unusually, these birds don't appear to use a drop in their body temperature to extend the length of a dive (p. 43).

Jonathon Green worked with the macaroni penguins at the British Antarctic Survey Base on Bird Island. He explains that the birds are 'feisty, argumentative and bad tempered, but have a great affection for their [life long] partner'. He adds that they are only easy to approach when they are incubating or brooding their young. Green collected 15 females, and carefully fitted each bird with one of Tony Woakes' tiny data loggers. He says that the birds recovered quickly from their surgery, and soon returned to the water, where the data loggers began recording their diving behaviour, as well as their heart rate and body temperature.

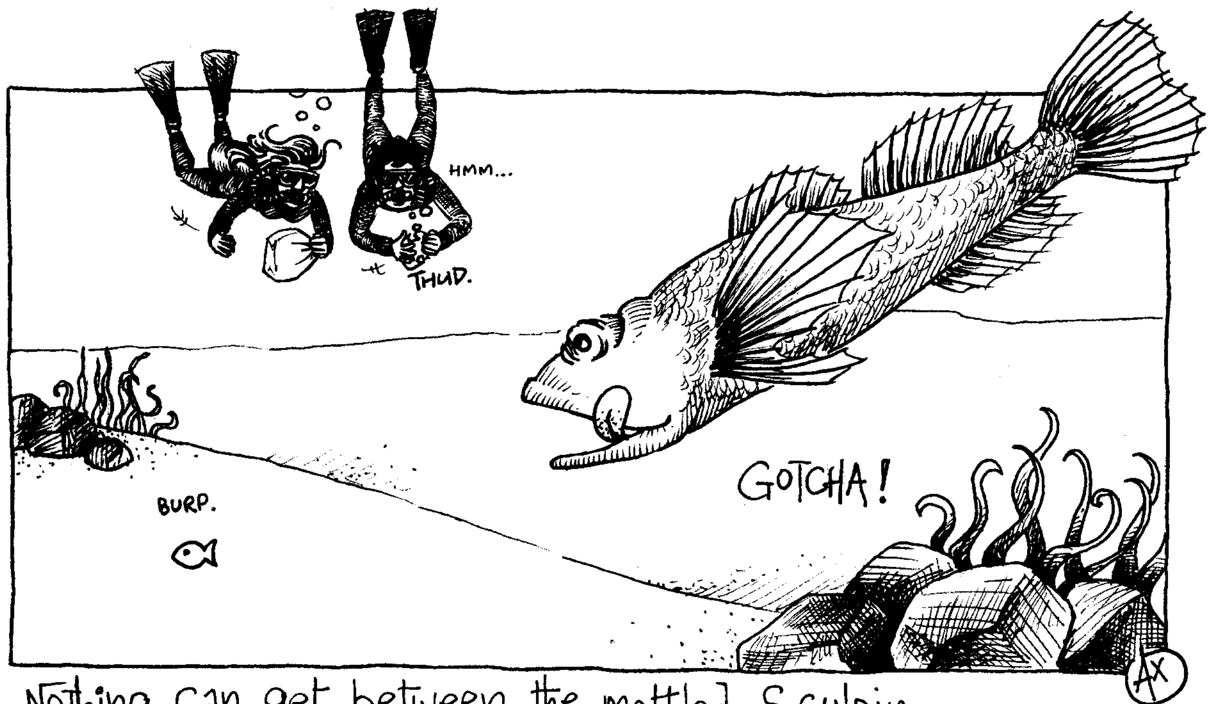
Knowing how the birds' heart rates varied over the duration of each dive, Green estimated the amount of oxygen that the penguin consumed while diving, and found that most of the birds returned to the surface within two minutes, before they exhausted their oxygen stores. Butler explains that when a bird extends the duration of a dive, the penguin reduces its heart rate and body temperature to conserve oxygen until it returns to the surface. When Green looked at the bird's heart rate, it had dropped slightly while the birds were diving. But when he analysed the bird's body temperature in relation to the dive's duration, the birds weren't making use of the drop in their body temperature to extend the length of their dives! Butler admits that this surprised him. The birds get colder over periods when they dived repeatedly, but their ability to stay submerged longer was not improved by cooling.

Butler explains that understanding the energetics of these fascinating birds is a crucial component of the Antarctic's complex ecology. Knowing how much energy an animal uses in the course of a day can be translated into the amount of food that it consumes. With many species already competing to survive in the Antarctic's finely balanced ecosystem, understanding how each creature relates to its environment is essential if we are to minimise man's increasing impact on one of the planet's greatest wildlife sanctuaries.

10.1242/jeb.00093

Green, J. A., Butler, P. J., Woakes, A. J. and Boyd, I. L. (2003). Energetics of diving in macaroni penguins. *J. Exp. Biol.* **206**, 43-57.

PICKING UP THE VIBES



Nothing can get between the mottled Sculpin and its prey...

Listening to a gently babbling brook might be restful if you're on the bank, but spare a thought for the riverlife beneath the surface. Fish that live in the noisy water detect the water's movements with sensory organs distributed on the skin. But when fish are hunting, can they distinguish the tiny vibrations produced by prey from the constant roar of flowing water? Knowing that there are two different types of sensory receptors in the fish's lateral line flow detection system, Max Kanter and Sheryl Coombs at the Loyola University of Chicago predicted that Lake Michigan mottled sculpin would still orient in the direction of an artificial prey, even when the current was as high as 8 cm s^{-1}. The team analysed mottled sculpins' responses when they increased the flow through a tank, and how the fish reacted when they generated vibrations to simulate prey. As the current increased the fish oriented in the upstream direction, but could they still respond to the weak vibrations of an artificial prey at their side? Amazingly they could! The fish were filtering out the low frequency noise of the rushing water, to pick out the tiny prey vibrations above the background din (p. 59).

10.1242/jeb.00094

Kanter, M. J. and Coombs, S. (2003). Rheotaxis and prey detection in uniform currents by Lake Michigan mottled sculpin (*Cottus bairdi*). *J. Exp. Biol.* **206**, 59-70.

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