INSIDE THIS WEEK: A 14-PAGE SPECIAL REPORT ON AGEING

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Iran's agony

The mystery of Mrs Merkel

Asia's consumers to the rescue?

The Greeks and those marbles

Evolution and depression

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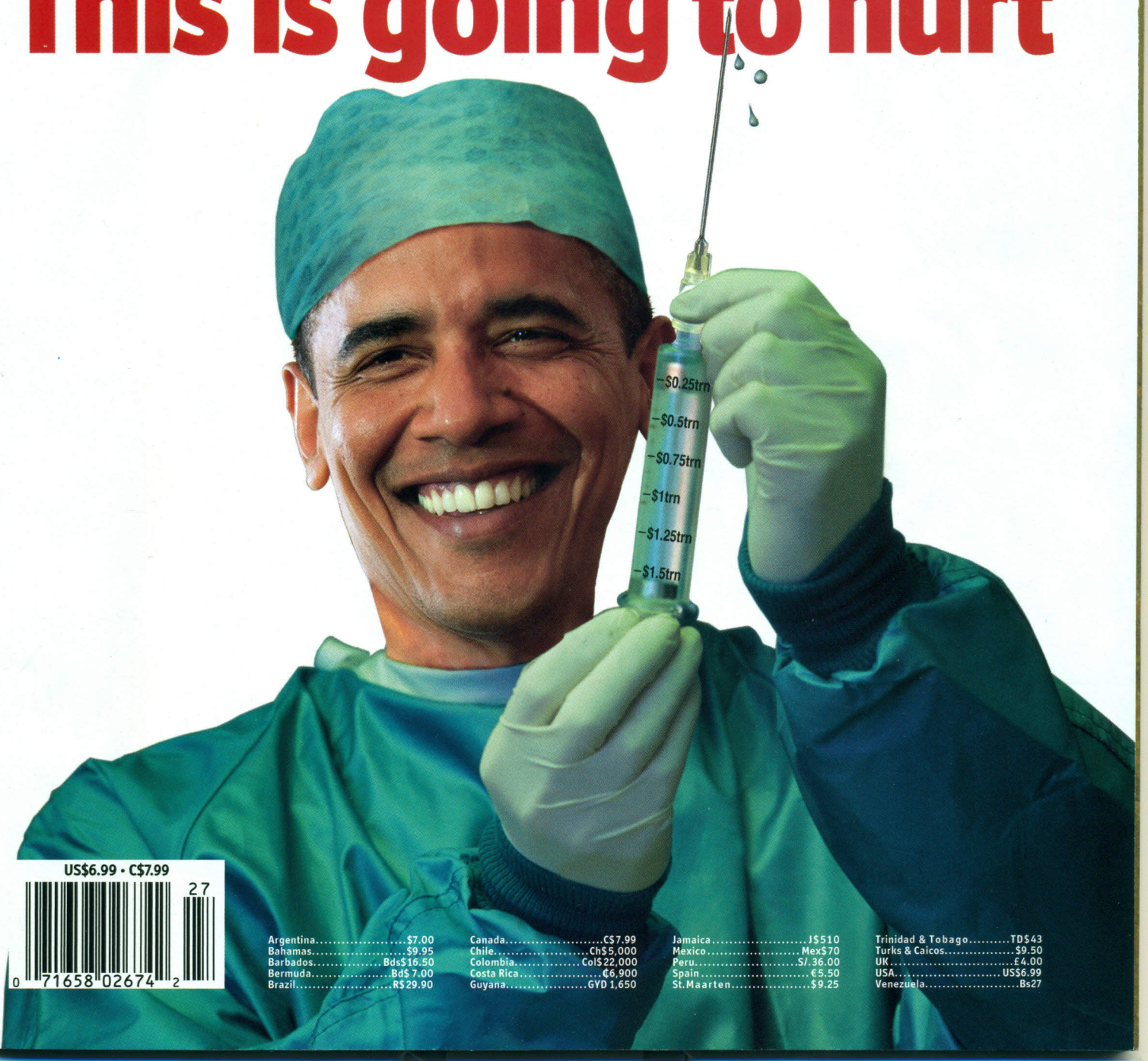

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Lightweight dinosaurs

Not so terrible

Prehistoric monsters may not have been as monstrous as once believed

DINOSAURS—terrible lizards, to translate their name into English—were big. Of course, there were many small ones, too. But what caught the public imagination in the 19th century, when the first of them were dug up, and has not let go of it since, is the idea that some dinosaurs were unfeasibly huge; the largest animals, by a long chalk, ever to walk the face of the Earth.

Gary Packard of Colorado State University and his colleagues do not deny that creatures like *Apatosaurus*, *Brachiosaurus* and *Diplodocus* were big—and bigger than any terrestrial mammal. But they do question just how big. In a study published this week in the *Journal of Zoology*, they examine the method traditionally used to estimate the weight of extinct animals from their fossilised bones and find it wanting. Their revised version has slimmed some of the giants by 50%.

A specimen of *Apatosaurus* (better known to many laymen as *Brontosaurus*) that had been examined using the previous method is now thought to have weighed 18 tonnes rather than 38 tonnes—the equivalent of only about three fully grown African elephants, instead of seven. A *Brachiosaurus* slimmed down from 32 tonnes to 16. Even a slender *Diplodocus*, once believed to have tipped the scales at five and a half tonnes when alive, has lost a tonne and a half from its weight.

Working out an animal's mass from the size of its bones is not, of course, an exact science. But it is possible to use the weights and bone sizes of existing species to make mathematical models of the relationship. The problem comes when these models are used to extrapolate beyond the range of reliable data (ie, of living animals whose weight is known). Since the largest dinosaurs have skeletons a lot larger than any living terrestrial species, such extrapolation is fraught with difficulty.

Dr Packard and his colleagues argue that the most widely used model has got the extrapolation wrong. It uses what are known as logarithmic transformations to cope with changes in the relationship between bone size and weight. This works well enough for smaller animals, but it predicts that an elephant should weigh one and a half times as much as it actually does, and that deviation is likely to be much larger for a *Brachiosaurus*, *Apatosaurus* or *Diplodocus*.

Svelte!

Dr Packard's model gets round this by abandoning simple logarithmic transformation in favour of a more complicated, so-called nonlinear model. This fits the data for existing large species better and so, he concludes, may provide a better estimate of the weights of large extinct ones.

Of course, no one can know for sure. Despite the confident depiction of them in films such as "Jurassic Park", the reconstruction of dinosaurs is subject to constant re-interpretation. But even at a mere 18 tonnes, *Apatosaurus* would still have been an awesome sight. ■

The evolutionary origin of depression

Mild and bitter

Depression may be linked to how willing someone is to give up his goals

CLINICAL depression is a serious ailment, but almost everyone gets mildly depressed from time to time. Randolph Nesse, a psychologist and researcher in evolutionary medicine at the University of Michigan, likens the relationship between mild and clinical depression to the one between normal and chronic pain. He sees both pain and low mood as warning mechanisms and thinks that, just as understanding chronic pain means first understanding normal pain, so understanding clinical depression means understanding mild depression.

Dr Nesse's hypothesis is that, as pain stops you doing damaging physical things, so low mood stops you doing damaging mental ones—in particular, pursuing unreachable goals. Pursuing such goals is a waste of energy and resources. Therefore, he argues, there is likely to be an evolved mechanism that identifies certain goals as unattainable and inhibits their pursuit—and he believes that low mood is at least part of that mechanism.

It is a neat hypothesis, but is it true? A study published in this month's issue of the *Journal of Personality and Social Psychology* suggests it might be. Carsten Wrosch from Concordia University in Montreal and Gregory Miller of the University of British Columbia studied depression in teenage girls. They measured the "goal adjustment capacities" of 97 girls aged 15-19 over the course of 19 months. They asked the participants questions about their ability to disengage from unattainable goals and to re-engage with new goals. They also asked about a range of symptoms associated with depression, and tracked how these changed over the course of the study.

Their conclusion was that those who experienced mild depressive symptoms could, indeed, disengage more easily from unreachable goals. That supports Dr Nesse's hypothesis. But the new study also found a remarkable corollary: those women who could disengage from the unattainable proved less likely to suffer more serious depression in the long run.

Mild depressive symptoms can therefore be seen as a natural part of dealing with failure in young adulthood. They set in when a goal is identified as unreachable and lead to a decline in motivation. In this period of low motivation, energy is saved and new goals can be found. If this mechanism does not function properly, though, severe depression can be the consequence.

The importance of giving up inappropriate goals has already been demonstrated by Dr Wrosch. Two years ago he and his colleagues published a study in which they showed that those teenagers who were better at doing so had a lower concentration of C-reactive protein, a substance made in response to inflammation and associated with an elevated risk of diabetes and cardiovascular disease. Dr Wrosch thus concludes that it is healthy to give up overly ambitious goals. Persistence, though necessary for success and considered a virtue by many, can also have a negative impact on health.

Dr Nesse believes that persistence is a reason for the exceptional level of clinical depression in America—the country that has the highest depression rate in the world. "Persistence is part of the American way of life," he says. "People here are often driven to pursue overly ambitious goals, which then can lead to depression." He admits that this is still an unproven hypothesis, but it is one worth considering. Depression may turn out to be an inevitable price of living in a dynamic society. ■