

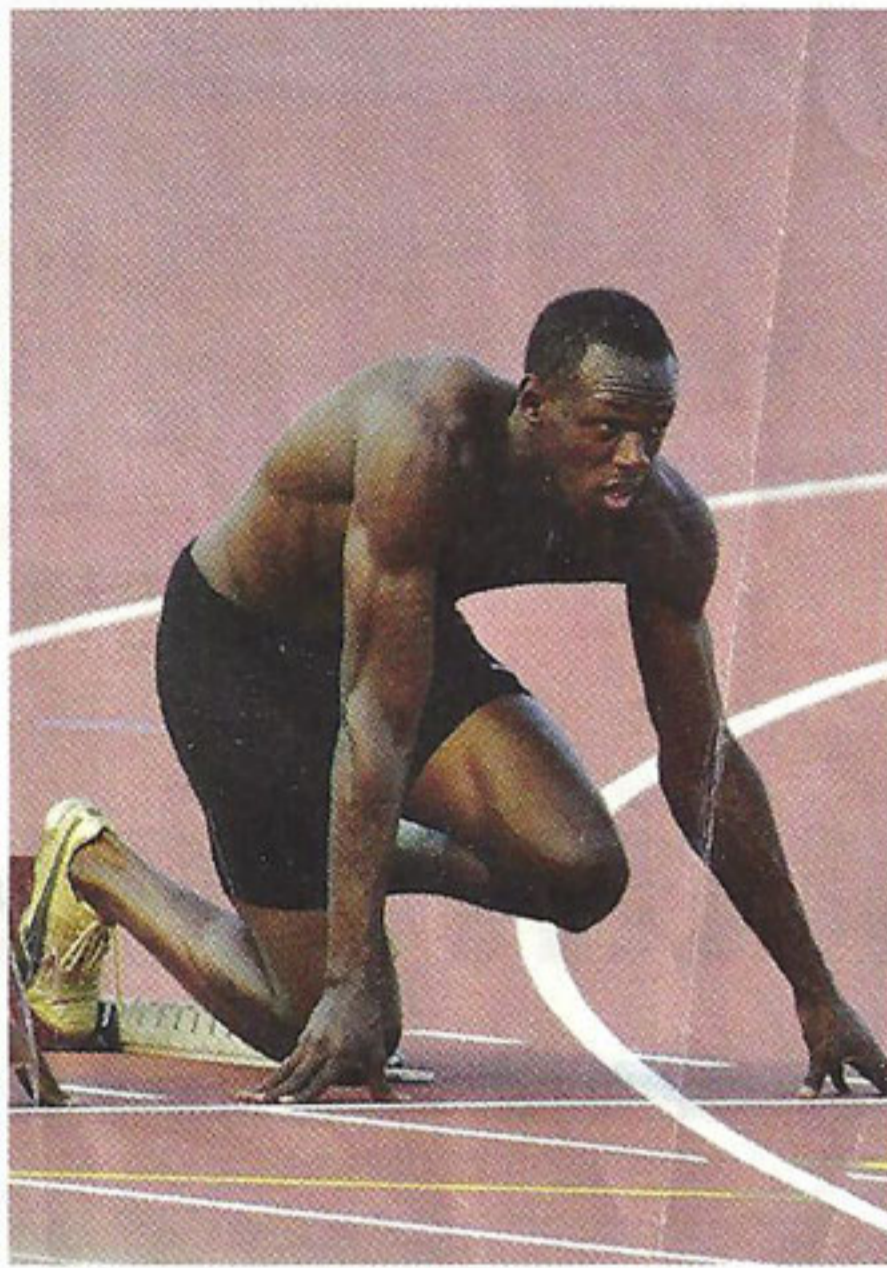
signs emerged, and its popularity waned. Now a team of researchers led by Howard Katz of Johns Hopkins University, in Baltimore, has discovered that sodium beta-alumina has other interesting electrical properties which make it suitable for building transistors.

Transistors are the workhorses of electronics. They are switches that enable one electric current to control the passage of another. Linked together on the surfaces of silicon chips, they form the logic gates that do the calculations in computers, mobile phones, television sets and other electronic gadgets.

Dr Katz and his colleagues found that, although sodium ions flow freely in the spaces between adjacent aluminium-oxide layers of sodium beta-alumina, they cannot pass through those layers. By applying a small voltage at right-angles to the layers they found they could pull the ions towards the aluminium oxide, clamping them in place and thus controlling when the current flowed—the essence of a transistor. They report their result in the current issue of *Nature Materials*.

As a bonus that could help commercialise the technology, the technique that the team used to deposit the compound is relatively straightforward and cheap. The researchers worked with sodium beta-alumina in its liquid form, which enabled them to spread it easily onto a surface in precisely the pattern required for a printed circuit. When they heated it to 400°C, it turned into a solid, transparent film.

Dr Katz has now used sodium beta-alumina to build transistors on both glass substrates and flexible, plastic ones. His team thinks its new approach will be particularly suitable for use in portable devices, because it operates at low voltages. If so, an old flame may be rekindled. ■



Anatomy and sport

Athlete's foot

Sprinters are different from other people

IS ATHLETIC prowess attained or innate? Those who have suffered the tongue-lashing of a tyrannical games master at school might be forgiven for doubting the idea that anyone and everyone is capable of great sporting achievement, if only they would put enough effort into it. Practice may make perfect, but not all are built in ways that make it worth bothering in the first place.

How to exterminate a dinosaur

This is the fossilised ornamentation of a dinosaur called *Stygimoloch spinifer*. Except that if Jack Horner of Montana State University and Mark Goodwin of the University of California, Berkeley, have their way, it isn't. As they describe in the *Public Library of Science*, they think it, and another like it, *Dracorex hogwartsia*, are actually juvenile versions of a third, *Pachycephalosaurus wyomingensis*. These findings follow the eradication of a three-horned dinosaur, *Torosaurus*, at September's meeting of the Society of Vertebrate Palaeontology, in Bristol, and the loss in recent years of many duck-billed dinosaur species. Dr Horner and Dr Goodwin argue that, like the antlers of modern deer, the skull ornaments of dinosaurs changed radically over their lifetimes and that this has led to an overestimate of the number of dinosaur species by as much as a third.

The latest evidence of this truth has been gathered by Sabrina Lee of Simon Fraser University in Vancouver and Stephen Piazza at Pennsylvania State University. They have looked at the anatomy of sprinters and found that their feet are built differently from those of couch potatoes.

Dr Lee and Dr Piazza already knew that sprinters tend to have a higher proportion of fast-twitching muscle fibres in their legs than more sedentary folk can muster. (These fibres, as their name suggests, provide instant anaerobic pulling power, rather than the sustained, oxygen-consuming effort that is needed by longer-distance runners.) They suspected, though, that they would find differences in the bone structure as well. And they did.

They looked at seven university sprinters who specialise in the 100-metre dash and five 200-metre specialists, and compared them with 12 non-athletic university students of the same height. In particular, they looked at the sizes of bones of the toes and heel. They also used ultrasonic scanning to measure the sliding motion of the Achilles tendons of their volunteers as their feet moved up and down. This allowed them to study the length of the lever created by the tendon as it pulls on the back of the heel to make the foot flex and push off the ground.

Dr Lee and Dr Piazza found, as they report in the *Journal of Experimental Biology*, that the toes of their sprinters averaged 8.2cm in length, while those of non-sprinters averaged 7.3cm. The length of the lever of bone that the Achilles tendon pulls on also differed, being a quarter shorter in sprinters.

These findings suggest sprinters get better contact with the ground by having longer toes. That makes sense, as it creates a firmer platform to push against. In a sprint race, acceleration off the block is everything. Cheetahs, the champion sprinters of the animal kingdom, have non-retractable claws that give a similar advantage.

The reason for the difference in the Achilles tendons, though, is less immediately obvious. At first sight, sprinters might be expected to have more Achilles leverage than average, not less. First sight, however, is wrong. When muscles have to contract a long way, they usually do so quickly and with little force. When contracting short distances, though, they move more slowly and generate more force. Having a short Achilles lever allows the muscles that pull on the tendon to generate as much as 40% more force than the same muscles in a non-sprinter would be able to manage.

It is possible—just—that these anatomical differences are the result of long and rigorous training. But it is unlikely. Far more probable is that the old adage of coaches, that great sprinters are born not made, is true. Everyone else, games masters included, should just get used to the idea. ■

