



Forging rhinoceros horn

## Fooled you

A realistic knock-off that may wreck the rhino-horn market

RHINOCEROS HORNS are big business. Traditional Chinese medicine uses them to treat rheumatism and gout, even though they have no actual pharmaceutical properties beyond placebo. And Yemeni craftsmen carve them into dagger handles. A kilogram can thus command as much as \$60,000, so there is tremendous incentive for poachers to hunt the animals. Since almost all rhinoceros populations are endangered, several critically, this is a serious problem. Some conservationists therefore suggest that a way to reduce pressure on the animals might be to flood the market with fakes. This, they hope, would reduce the value of real horns and consequently the incentive to hunt rhinos.

That would require the fakes to be good. But Fritz Vollrath, a zoologist at Oxford University, reckons his skills as a forger are up to the challenge. As he writes in *Scientific Reports*, he and his colleagues from Fudan University, in Shanghai, have come up with a cheap and easy-to-make knock-off that is strikingly similar to the real thing.

The main ingredient of Dr Vollrath's forged horns is horsehair. Despite their differing appearances, horses and rhinos are reasonably closely related. Horses do not have horns, of course. But, technically, neither do rhinos. Unlike the structures that adorn cattle and bison, which have cores made of bone, the "horns" of rhinoceros are composed of hairs bound tightly together

High-tech rugby

## Computer says: offside

Sensors, data and the self-policing rugby match

RUGBY UNION, it is often said, is a game for thugs that is played by gentlemen. "Played by lawyers" might be a more accurate dictum. The rules are famously complicated. Scrum—organised shoving matches between the two teams' burliest members—are regarded as a dark art even by other players. Open, running play can be stopped and wound back for any number of arcane infringements. The recent Rugby World Cup competition, held in Japan, is regarded as a big success by those keen to boost the sport's popularity. But it was marred by arguments about how to interpret complicated new rules forbidding dangerous shoulder charges and high tackles. (World Rugby, the game's governing body, offers referees a handy flowchart to memorise, which provides for eight possible outcomes.)

All this is an irritant to players and referees, and a turn-off for viewers, who struggle to follow the action or work out why a particular decision was made. But a British firm called Sportable thinks it might be able to improve things, by wiring up rugby players—and rugby balls—with high-tech sensors.

Sportable was founded in 2014 by Dugald Macdonald and Peter Husemeyer, a pair of rugby-mad South Africans. It makes lightweight, sensor-stuffed garments that can be worn under a jersey

and which measure impact forces in 80 separate places on a player's body. The sensors are attached to transmitters that communicate with receivers at the edges of the playing field. By monitoring the time it takes for signals to arrive at different receivers, and applying a little mathematics, it is possible to work out where a player is on the pitch at any given moment, and how quickly he got there.

Such data, says Mr Macdonald, are attractive to teams looking for an edge over the competition. Previous efforts have relied on the Global Positioning System of satellites, which offers much lower accuracy. The firm has tested its technology with several professional clubs, including Saracens, the reigning champions in the English Premiership.

Where the fun starts, though, is when similar sensors are put into the ball. It can then, metaphorically, squawk if passed forward (which is illegal in rugby), and there will be no doubt, by comparing the positions of ball and player, when a player is offside. A smart ball will be able to monitor other rules, too. It was, for instance, tested successfully in a five-a-side version of the game called Rugby X, in which you are not allowed to kick the ball higher than ten metres. Since few referees are equipped with theodolites, enforcing this rule has been hard. Now it is easy.

by a mixture of dead cells.

Examination under a microscope showed that hairs collected from horses' tails had similar dimensions and symmetry to those found in the horns of rhinos. They also shared a spongy core structure. Horse hairs had a scaly layer that was absent from those of the rhino, but the researchers were able to strip this away with a solution of lithium bromide.

The next task they tackled was making a suitable binding matrix. This, Dr Vollrath and his coauthor Mi Ruixin made from a fibrous protein-rich glue of the sort produced naturally by spiders and silkworms. They bundled the treated horse hairs as tightly as they could in a matrix of this glue, and then left the bundles in an oven to dry.

The result was a material that, with some polishing, looked like rhino horn. Specimens on the black market are, however, inspected carefully before sale, so for the false horns to be effective they would need to stand up to closer scrutiny than the naked eye. To this end, Dr Vollrath and Dr

Mi decided to test their product in detail.

DNA analysis would certainly reveal fakes, but such analysis is complicated and therefore hard to do in the sorts of back rooms in which rhino-horn sales tend to take place. The forgeries passed other tests with flying colours, though.

First, fake and real horn looked the same when examined under a scanning electron microscope. Next, they behaved similarly when tested by a technique that compared their capacity to absorb heat. Finally, when stressed or strained and then relaxed regularly for long periods, to probe their underlying mechanical properties, the results for real and false horn were indistinguishable.

Whether using clandestine means to launch impeccable fakes onto the rhinoceros-horn market would truly reduce prices and sabotage demand remains to be tested. But it might. It is an old trick in warfare to flood the enemy with forged, worthless money. Something similar may yet help save the rhino. ■