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Medical batteries

Dark arts

A bodily pigment may have industrial uses

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SINCE their invention two centuries ago, batteries have been made from many things. The first were of copper and zinc. Today, lithium is preferred for a lot of applications. Lead, nickel, silver and a host of other materials have also been used. Until recently though, no one had tried melanin, the pigment that darkens skin and protects it against ultraviolet light. But, as he reported this week at a meeting of the American Chemical Society in Philadelphia, Christopher Bettinger of Carnegie Mellon University, in Pittsburgh, has now done just that. His purpose is to create a battery safe for use in the human body.

Melanin is not, at first sight, an obvious battery ingredient. It is a complicated molecule composed of carbon, oxygen, nitrogen and hydrogen. To synthesise it on

an industrial scale would surely require biotechnology rather than conventional chemistry. But it does have the ability to capture and release positively charged ions, known as cations. Batteries depend on the movement of ions, so this property is a good start. On top of that, being a normal ingredient of bodies, melanin is not toxic. This is in contrast to many conventional battery ingredients, including most of those listed above. If melanin were to leak out of an implanted medical device, it would simply be mopped up by enzymes.

The battery Dr Bettinger has come up with has a melanin cathode, an anode of sodium titanium phosphate, which is also non-toxic, and an aqueous electrolyte that can be charged with any soluble cation desired. He has experimented with ions of sodium, potassium, rubidium, caesium, magnesium, aluminium and iron. Most of the resulting batteries had modest voltages (between 0.5 and 0.7 volts) but stored enough energy to power one-shot ingestible devices such as capsule endoscopes (pill-shaped machines which can look at parts of the alimentary canal that conventional endoscopy cannot reach) or drug-delivery systems designed to release their payloads at a particular place in the gut.

Intriguingly, though the uses Dr Bettinger has in mind do not need a rechargeable battery, one of the experimental models his team produced—that containing magnesium—could be recharged. This goes against conventional wisdom, for previous attempts to make a rechargeable magnesium battery have failed. Given the abundance and cheapness of magnesium, that may be useful information for

battery engineers seeking to outdo modern lithium-ion batteries. If so, then melanin or something like it might find itself in very heavy demand indeed.