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Synthetic biology

Your plastic pal

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A genetically engineered bacterium makes a greener plastic

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Now biodegradable

ONE of the most promising alternatives to plastics made from oil is polylactic acid (PLA). It is biodegradable, safe enough to be used as food packaging, can be processed like existing thermoplastics into coloured or transparent material and can be manufactured from renewable resources such as maize and sugarcane. Although PLA has been around for decades, it is only in recent years that advances in production techniques, particularly by Cargill, a big American agricultural group, have made it feasible to produce the material commercially. Now a group of researchers led by Lee Sang-yup of the Korea Advanced Institute of Science and Technology say they have come up with an even better way to make PLA, using the emerging science of synthetic biology.

At the moment PLA is usually made in two stages. First, a source of starch or sugar, which could be an agricultural by-product, is fermented to produce lactic acid—the same substance made by the body during exercise, only in this case it comes from the bacteria exercising themselves in the fermentation process. In the second stage, lactic-acid molecules are linked into long chains, or polymers, in chemical-reaction vessels, to produce PLA. What Dr Lee and his colleagues have succeeded in doing, as they report in *Biotechnology and Bioengineering*, is to produce PLA directly, in a one-stage process, in bacteria. No chemical "post processing" is required.

Their bacterial platform is *E. coli*, the workhorse species of microbial genetics. But their version has had genes from several other bacteria spliced into it. One comes from a bug called *Clostridium propionicum*, another from a species of *Pseudomonas*, and two more from *Cupriavidus necator*. Some of these genes, moreover, have been souped up, because the "wild" versions did not work well enough. The result is a set of synthetic metabolic pathways—ones that do not exist in nature—which turn the polymer out in satisfyingly large quantities.

If the process can be commercialised, the researchers believe it could greatly reduce the cost of making products from PLA. Besides food and drink packaging, PLA is already used to make some other products, such as medical devices. It also has the potential to be used to make biodegradable clothing, furnishings and hygiene products such as nappies— objects which now end up mouldering for decades in rubbish dumps. Moreover, Dr Lee thinks that with further research, genetically engineered bacteria might be capable of making other sorts of plastics and polyesters from renewable resources. Another reason, then, to wonder how much longer the Age of Oil will last.