Abstractions

LAST AUTHOR

Even with a lower food intake, many dieters just can't seem to lose weight — perhaps because their bodies aren't burning it off. Yi Zhang, a biochemist at the University of North Carolina at Chapel Hill, and his colleagues have discovered that loss of a specific enzyme causes obesity in mice by snuffing out the body's ability to burn energy but leaving appetite unaffected. On page 757, the authors show that the enzyme, Jhdm2a, helps to control the expression of metabolic genes. Loss of the enzyme's function causes a metabolic defect that makes mice accumulate fat. Zhang tells *Nature* about finding a new pathway involved in obesity.

How did you discover this enzyme's function in metabolism?

We study the role that the modification of histone proteins has in the regulation of gene expression. Histones are a class of proteins required to organize DNA into chromosomes, and Jhdm2a is an enzyme that modifies histones by removing methyl groups from specific locations. By testing mice in which the *Jhdm2a* gene had been knocked out, we had previously learned that the Jhdm2a protein is required for sperm maturation. To our surprise, when these knockout mice got older, they grew much fatter than their littermates. We began to notice this when they were about three months old, and by six months old they were significantly obese.

How did you connect the obese animals' condition to defects in metabolism?

First, we checked whether the knockout mice eat more than their littermates, and found that they don't. So then we turned to thinking about energy expenditure — we figured that the obese mice must be expending less energy. We found that the expression of certain metabolic genes was defective in these mice, leading to lowered fat-burning.

Was reduced energy expenditure the only result of the enzyme's absence?

No, the mice also exhibited defective heat generation, or thermogenesis. Normally, mammals have a mechanism for maintaining body temperature in a cold environment. But *Jhdm2a*-knockout mice cannot maintain their body temperature in the cold.

What do your results mean for human dieters?

Some people say that even if they just drink water they gain weight. There might be a good reason; maybe such people have a low basal metabolic rate because they have a defect in this gene, or in genes performing a similar function. An agonist that can enhance the function of this protein could potentially be useful in increasing basal metabolism. ■

MAKING THE PAPER

Wenjie Shen

Altering the shape of catalyst particles can boost their activity.

Chemical catalysts that mop up toxic pollutants created by vehicle use and other human activities have made a difference to the environment, but there is still ample room for improvement. For example, the metal oxides currently used to catalyse the oxidation of carbon monoxide (CO) to carbon dioxide (CO_2) are only active at temperatures much higher than ambient. Wenjie Shen, a physical chemist at the Chinese Academy of Sciences' Dalian Institute of Chemical Physics, has found that changing the shape of one metal-oxide catalyst renders it practical for use at low temperatures. The discovery may lead to ways of producing more efficient catalysts for a broad range of reactions.

Researchers have known since the 1970s that tricobalt tetraoxide (Co_3O_4) can catalyse CO oxidation at low temperatures, but only under artificially dry conditions. The catalyst works by binding CO at its active sites, which contain Co^{3+} cations, so that CO can react with nearby oxygen molecules. But, explains Shen, "at low temperatures, the active sites eventually become occupied by water molecules and can no longer bind CO". This severely limits most practical applications of this catalyst.

Most metal-oxide particles are spherical, with their active sites located in 'dents' on the sphere's surface. "The exposed active sites are limited in these particles," says Shen, who several years ago had the idea that changing the particles' shape might increase the number of active sites. "I had been following the material sciences field. There were many reports of metal and metal-oxide particles designed with different shapes that had altered properties," he explains. "I thought that the same concept could be applied to the design of solid catalysts."

Shen and his colleagues tested a number of strategies for synthesizing Co_3O_4 particles under various conditions in the hope of building different shapes. They eventually produced tiny rods, 5–15-nanometres wide by 200–300-nanometres long. "We immediately tested these in CO oxidation," says Shen. "Right away we were surprised by the results."

In contrast to the spherical particles, which perform poorly at low temperatures, the nanorods could convert 100% of CO in a flowing stream of gas. The rods' activity lasted for 6 hours at very low temperatures — down to −77 °C. Importantly, the nanorods maintained their high level of activity and stability at temperatures up to 400 °C, as well as in gases containing a lot of water and CO_2 — conditions that mimic the exhausts of cars.

Excited by the results, Shen and his co-workers examined why the nanorods were so active. Detailed transmission electron microscope images revealed that the nanorod shape exposes one specific crystal plane that makes up about 41% of the total surface area of the particle and consists primarily of Co^{3+} active sites.

The work not only paves the way for designing the next generation of catalysts for reducing CO in the air but, more generally, demonstrates that particle shape is a crucial parameter to consider in the design of high-efficiency metal-oxide catalysts. "This discovery is very exciting. Until now, researchers emphasized the importance of particle size in making catalysts more effective," says Shen. "But now we know that morphology should also be considered. By controlling the morphology you can quantitatively design and enrich the active sites." ■

FROM THE BLOGOSPHERE

Preliminary data are in for a *Nature Neuroscience* peer-review experiment (http://tinyurl.com/cs95jo). Last year, the journal joined the Neuroscience Peer Review Consortium, a group of journals that have agreed to offer authors the option to transfer peer reviews of manuscripts to another journal when a manuscript is no longer under consideration at the first journal. The consortium's goals include speeding up publication and reducing the burden on reviewers.

In an April editorial, the journal's editors share that only a handful of transfers have taken place, all of them from *Nature Neuroscience* to the *Journal of Neuroscience*. The transfers represent less than 1% of manuscripts rejected after review. Authors who participated reported a saving of time and effort for papers that were eventually published, even when new referees were chosen. There were no transfers to *Nature Neuroscience* from other journals.

More data will be needed to determine whether the group is meeting its goals, but the editors hope that transfer rates may increase as more authors become aware of the consortium. ■

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