concept is also reminiscent of, but not identical to, biocatalytic deracemization of racemic alcohols[6].

Organic chemists profit from an ever expanding toolbox of synthetic catalysts and biocatalysts. The optimal choice for a reaction depends upon a number of issues, including practical factors associated with downstream workup and (bio)process engineering[7]. Enzymes are often assumed to be 'green' catalysts because they are active under mild conditions, but in fact they are not always ecologically[8] and economically superior to transition metal catalysts or organocatalysts. In order to assess whether a given biocatalytic process is truly green, the Sheldon E-parameters need to be computed for each case, which include such factors as the type and amount of solvent required for extracting the products[8]. Nevertheless, developing new synthetic methods with different advantages (and disadvantages) can offer useful alternative routes to difficult products, and creating new synthetic choices is always a worthwhile endeavour. ❐

Note added in proof: After this News & Views was written, a study (ref. 9) was published that independently describes the same concept with an emphasis on the conversion of racemic secondary alcohols into enantiopure amines.

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References

1. Nugent, T. C. *Chiral Amine Synthesis: Methods, Developments and Applications* (John Wiley & Sons, 2010).
2. Kohls, H., Steffen-Munsberg, F. & Höhne, M. *Curr. Opin. Chem. Biol.* **19,** 180–192 (2014).
3. Au, S. K., Bommarius, B. R. & Bommarius, A. S. *ACS Catal.* **4,** 4021–4026 (2014).
4. Mutti, F. G., Knaus, T., Scrutton, N. S., Breuer, M. & Turner, N. J. *Science* **349,** 1525–1529 (2015).
5. Paetzold, J. & Bäckvall, J. E. *J. Am. Chem. Soc.* **127,** 17620–17621 (2005).
6. Schrittwieser, J. H., Sattler, J., Resch, V., Mutti, F. G. & Kroutil, W. *Curr. Opin. Chem. Biol.* **15,** 249–256 (2011).
7. Woodley, J. M. *Curr. Opin. Chem. Biol.* **17,** 310–316 (2013).
8. Ni, Y., Holtmann, D. & Hollmann, F. *ChemCatChem* **6,** 930–943 (2014).
9. Chen, F. F., Liu, Y.-Y., Zheng, G.-W. & Xu, J.-H. *ChemCatChem* http://doi.org/f3jqvh (2015).

2015 NOBEL PRIZE IN PHYSIOLOGY OR MEDICINE

Punishing parasites


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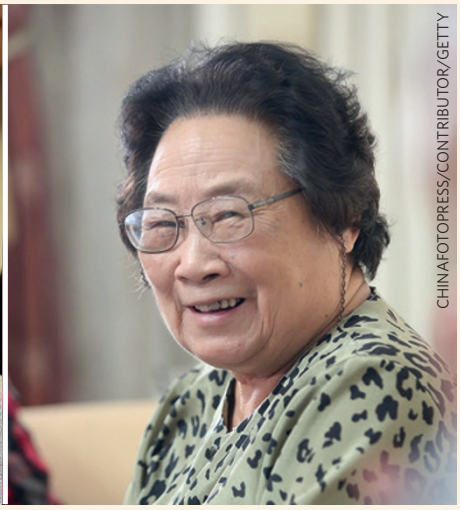
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The discovery of two medicines that have — in the words of the Nobel Assembly at Karolinska Institutet — "revolutionized the treatment of parasitic diseases" has resulted in the award of the 2015 Nobel Prize in Physiology or Medicine to William C. Campbell, Satoshi Ōmura and Youyou Tu (pictured left–right). Parasitic diseases affect a huge number of people, but they are more common in the poorest parts of the world. Campbell and Ōmura were jointly awarded half of the prize for their work on a therapy against infections caused by roundworms. The other half of the prize was awarded to Tu for her discovery of a new therapy against malaria.

Ōmura, from Kitasato University, Japan, is an expert in culturing bacteria and isolating the chemical compounds they produce. He isolated new strains of *Streptomyces* — a group of soil-dwelling bacteria well-known for producing antibacterial compounds — that showed promising activity against harmful microorganisms. He gave these strains to a team led by Campbell — an expert in parasite biology who was then working at the Merck Institute for Therapeutic Research in Rahway, New Jersey, USA. Campbell was able to implicate avermectins as partially responsible for the antiparasitic activity. Development of this series of compounds led to the production of the drug ivermectin, which is used to treat onchocerciasis (widely known as river blindness) and lymphatic filariasis (which causes elephantiasis).

Youyou Tu led a research program to identify bioactive compounds from traditional Chinese medicines. Their search for antimalarial compounds — motivated by the increasing ineffectiveness of quinine and chloroquine — eventually led to the isolation of artemisinin from the wormwood plant (*Artemisia annua*). Like many bioactive natural products, isolating sufficient material from the plant can be problematic. Therefore most artemisinin is now produced by a semi-synthetic method: the unusual peroxide structure — thought to be responsible for the drug's mechanism of action — is introduced by a chemical oxidation of artemisinic acid, which is itself produced by a specially engineered strain of yeast.

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