2. Horton, D. E. *et al*. *Nature* **522,** 465–469 (2015).
3. Cohen, J. *et al*. *Nature Geosci*. **7,** 627–637 (2014).
4. Screen, J. A. & Simmonds, I. *Nature Clim. Change* **4,** 704–709 (2014).
5. Miralles, D. G., Teuling, A. J., van Heerwaarden, C. C. & Vilà-Guerau de Arellano, J. *Nature Geosci*. **7,** 345–349 (2014).
6. Deser, C., Phillips, A. S., Alexander, M. A. & Smoliak, B. V. *J. Clim.* **27,** 2271–2296 (2014).
7. Barnes, E. A. *Geophys. Res. Lett.* **40,** 4734–4739 (2013).
8. Shepherd, T. G. *Nature Geosci*. **7,** 703–708 (2014).
9. Mori, M., Watanabe, M., Shiogama, H., Inoue, J. & Kimoto, M. *Nature Geosci.* **7,** 869–873 (2014).

BIOCHEMISTRY

Unexpected role for vitamin B2

An enzyme has been found that alters the molecular structure of vitamin B2, adding a fourth ring to its existing three-ring system. The product catalyses new types of chemistry in concert with certain other enzymes. SEE LETTERS P.497 & P.502

CATHERINE F. CLARKE
& CHRISTOPHER M. ALLAN

Many vitamins work by expanding the biochemical repertoire of enzyme-catalysed reactions. For example, riboflavin (vitamin B2) does this for a wide variety of flavoproteins, which catalyse many of the redox reactions in central metabolic pathways and act in the electron-transport chains of cells. Two papers in this issue, by White *et al*.[1] (page 502) and Payne *et al*.[2] (page 497), report a previously unknown cofactor derived from riboflavin. The findings solve the long-standing mystery of how a pair of bacterial enzymes — and their counterparts in yeast — catalyse crucial reactions known as decarboxylations, and further expand the repertoire of enzymatic reactions.

White *et al*. relate that the molecular structure of riboflavin, which contains three rings, can be modified by the addition of a prenyl group (a hydrocarbon group containing five carbon atoms, also known as an isoprenyl group) to form a fourth ring (Fig. 1). The authors call the resulting compound prenylated flavin mononucleotide (prenylated $FMNH_2$). They used high-resolution crystal structures, biochemical studies, spectroscopy and computational calculations to characterize prenylated $FMNH_2$ and to determine how it is employed as a cofactor in decarboxylation reactions — in which a carboxylate group (CO_2^-) is removed in the form of carbon dioxide from a substrate.

Surprisingly, the enzyme that forms prenylated $FMNH_2$ is UbiX, a protein first found in the bacterium *Escherichia coli*. The authors show that UbiX works in tandem with another enzyme, called UbiD, to mediate the decarboxylation of an intermediate in the biosynthesis of coenzyme Q (see Fig. 1a of the paper[1]). Coenzyme Q is an essential lipid in the electron-transport chain and a potent cellular antioxidant[3].

How exactly UbiX and UbiD cooperate

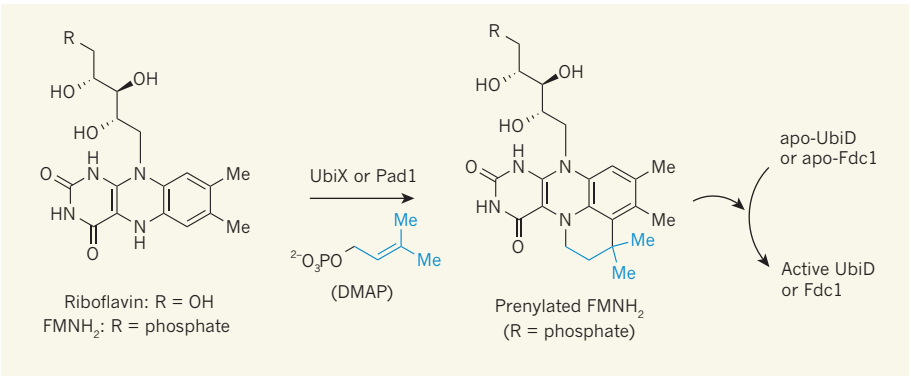

Figure 1 | Prenylated riboflavin. Flavin mononucleotide ($FMNH_2$) is a common enzyme cofactor that is derived from riboflavin (vitamin B2). White *et al*.[1] show that the bacterial UbiX enzyme and the fungal Pad1 enzyme modify $FMNH_2$ in the presence of dimethylallyl monophosphate (DMAP), a precursor of prenyl groups, to generate a previously unknown cofactor, prenylated $FMNH_2$. Payne *et al*.[2] show that prenylated $FMNH_2$ is an essential cofactor for the decarboxylase enzymes UbiD and Fdc1; apo-forms of UbiD and Fdc1 lack a bound cofactor and so are inactive. Me, methyl group.

50 Years Ago

As an introduction, I should like to touch on something which is not a unique feature of the subject of discourse. However, this is as good an excuse as any to look at the disturbing fact that communications between scientist and scientist are in a state of overgrowth or 'overpublication', while in contrast to this the writings … addressed to the non-expert are, so some believe, somewhat neglected or 'underpublished'. Of course, one does not condemn the vastly increased potentialities (5–10 times that of 1945) for scientific printing space, but the sometimes indiscriminate multiplication of the printed words, formulae and illustrations leads to overburdening of libraries, to a nightmarish frustration of the research worker who never catches up with his reading, and willy-nilly to an encouragement of unfinished and mediocre material to be published.
From *Nature* 26 June 1965

100 Years Ago

All good nomenclature should be unambiguous, and, if possible, self-explanatory. The terms *masse volumique*, *volume massique*, and *stéradian* have both these desirable qualities; no one with a knowledge of physics and French could make any mistake as to the exact meaning of the first two, and the meaning of the third should be at once self-evident to anyone who knows the definition of a solid angle. I should not expect a chemist or a botanist to have anything but a hazy idea of the meaning of *puissance massique*, but even to an ordinary French engineer it should convey its meaning instantly. An expression of this kind, far from being an "eccentricity," is a triumph of nomenclature. It *is* possible to mould language by logic; it is the only way to mould language that shall be truly scientific.
From *Nature* 24 June 1915