process called myristoylation involves the transfer of a tetradecanoyl (or myristoyl) group to a protein; however, analysing which proteins are myristoylated *in vivo*, and the timing of the modification, is far from trivial because lipidated proteins are often present at low concentrations. Now, Edward Tate and Remigiusz Serwa, along with co-workers at Imperial College London and Leibniz-Institut für Molekulare Pharmakologie, have optimized a technique used to monitor protein myristoylation by developing so-called capture reagents that can trap and identify myristoylated proteins and allow their direct detection by mass spectrometry (MS).

Their previously reported method uses metabolic labelling with an analogue of myristate to incorporate a reactive terminal alkyne into myristoylated proteins. This alkyne group provides a chemical hook by which the protein can be can then be conjugated to their capture reagents. These reagents contain a fluorophore and a biotin group, which enables the protein–capture-reagent complex to be visualized and trapped on streptavidin-conjugated beads. Tate, Serwa and colleagues have now made a new series of capture reagents containing linkers that can be cleaved by protease enzymes, which enables the direct detection of the lipidated proteins and peptides by MS. Proteases can also be used to generate protein fragments and this simplifies identification of the proteins by MS. The team therefore developed linkers that are cleaved by different proteases to enable the formation of complementary sets of peptides.

Using these capture reagents, they were able to identify a set of 87 human proteins that are myristoylated at an endogenous level in three different cell lines. Next, they monitored myristoylation during the early development of zebrafish embryos. Adding the metabolic tag in three specific time windows enabled them to probe the dynamic nature of myristoylation — and it was found to be most prominent during the earlier time periods. These studies represent the first exploration of myristoylation in a multicellular organism, as well as the first analysis of protein lipidation during the embryonic development of a vertebrate. *RJ*

MOLECULAR SENSORS

Spoiler alert

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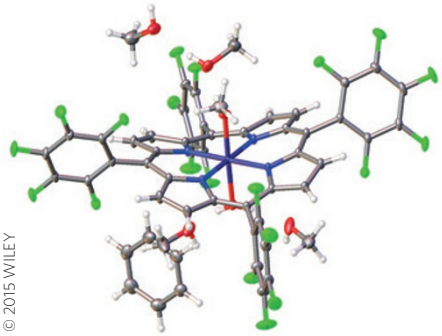
For the consumer, ignoring a food's sell-by date can result in a supermarket bargain or an upset stomach, but monitoring food spoilage is a serious issue for the



industry. As well as preventing unfit goods entering the market, identification of which items are spoilt also allows food to be sold that might otherwise have been needlessly thrown away. A key identifier of spoilt fish and meat is the generation of particularly odorous molecules, such as putrescine and cadaverine, through bacterial decomposition. A host of spectroscopic methods are able to detect these biogenic amines, but most require sophisticated equipment and a trained technician. In contrast, 'chemiresistors' can quantitatively indicate the presence of certain gases simply through an induced change in their electrical conductivity.

Now, Timothy Swager and colleagues from Massachusetts Institute of Technology, have fabricated a chemiresistive carbon nanotube–metalloporphyrin composite that is able to detect biogenic amines at sub-ppm concentrations. Chemiresistivity is a well-known property of carbon nanotubes, but here Swager and colleagues significantly increased their sensitivity by non-covalently functionalizing them, with electron deficient cobalt porphyrins — such species adhere well to the walls of carbon nanotubes and are known to have an affinity for amines. It seems that binding of amines to the cobalt centre elicits an increase in the resistivity of the underlying carbon nanotube, which is indicative of the level of exposure.

The team successfully demonstrated that they could monitor the spoilage of samples of salmon, cod, chicken and pork left out of the fridge over a four-day period. Stability under ambient conditions for an extended period of time, coupled with low-cost and high portability, renders these devices promising for commercial implementation. For example, by integrating the devices into food packaging, the foods viability could be quickly read by an automated process, without having to open the container or see the food. *TF*

Written by Stuart Cantrill, Thomas Faust, Russell Johnson and Anne Pichon.

blogroll

Those who left

What happens to students who leave graduate school without defending?

Continuing a conversation from years past (http://go.nature.com/EdBFdV) Vinylogous and Chemjobber have revisited the strain that graduate school can place on mental health. Now further into graduate school, Vinylogous has had some dark days (http://go.nature.com/GzmpbX) — with a multi-month project in ashes and friends outside of academia doing better with less effort, he even prepared a farewell speech. Rather than deliver it, he stepped back and examined the future benefits of a PhD, and the opportunity costs. Working with his supervisor, he then made changes to foster sustained health and productivity.

Some readers may have found themselves in a similar situation, and know the solution is not always the same. Chemjobber requested feedback and posted the responses under the label 'I quit grad school in chemistry' (http://go.nature.com/z5v3u6). For some it took years for their love of science to return, but many have found fulfilling outlets for their skills, whether as adjuncts in smaller centres or from lucrative careers in industry that started earlier than expected. One, LB, even returned to graduate school, finding more success in economics than chemistry (http://go.nature.com/YjDDMR).

The factors behind each respondent's departure vary in details, but often stem from either a mismatch in interest or skillset, or a toxic work environment. Each entered graduate school as an adult, responsible for their own decisions, but the effects of PIs not experienced in — or poorly suited to — management are obvious. With new reports from those who left continuing to be posted, Tehshik Yoon has called for experiences from successful graduates (http://go.nature.com/nigzoo). If you have a story to tell, let the world know.

Written by Brandon Findlay, who blogs at http://chemtips.wordpress.com and tweets as @Chemtips