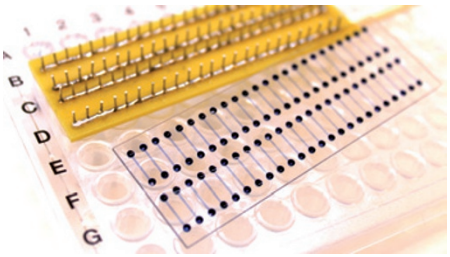
PROTEIN CHEMISTRY

A new Western front

Proc. Natl Acad. Sci. USA **109,** 21450–21455 (2012)



The Western blot is a highly sensitive analytical technique that is used to identify specific proteins. Unlike simple chromatographic techniques such as size-exclusion chromatography, Western blots separate and identify different entities based on a combination of two properties, namely molecular size and how strongly they are bound by a particular antibody. Despite the undoubted sensitivity, Western blots suffer from several drawbacks — they are quite labour intensive, not suitable for high-throughput, and the process can be slow.

Now, Alex J. Hughes and Amy E. Herr, both at the University of California at Berkeley, have developed a microfluidic version of the Western blot technique. Their method allows for 48 simultaneous runs on a single chip and greatly reduces the volume of expensive antibody reagents used and the time required to detect a target protein. The chip is laid out with a series of individual microchannels that are filled with a polyacrylamide gel and connected to electrodes at both ends. For each micro-Western blot, the mixture of proteins is added to a channel and separated by molecular size using gel electrophoresis. Instead of blotting the proteins to a separate membrane — as is normally required in a Western blot — the gel is irradiated with UV light triggering a photo-reaction in which benzophenone groups in the gel covalently bond to the proteins and thereby immobilize them. Antibody probes are then added to the microfluidic channel and electrophoretically migrated along it until they bind to their target or pass through the gel.

The microfluidic approach works with multiple antibodies, including the normal arrangement of primary and secondary ones. The highly selective primary antibody binds solely to the target protein, and the secondary antibody — which is modified to contain a detection label — binds to the primary antibody. This combination enables selective detection of the target protein. The sample separation and probing are completed in 10 to 60 minutes. Hughes and Herr say the process offers near-complete analyte capture and is capable of detecting low picomolar concentrations. *RJ*

SYNTHETIC METHODOLOGY

Better borylation

J. Am. Chem. Soc. **134,** 19997–20000 (2012)

Arylboronates are widely used in chemical synthesis and can be prepared in a number of different ways. One approach is to react

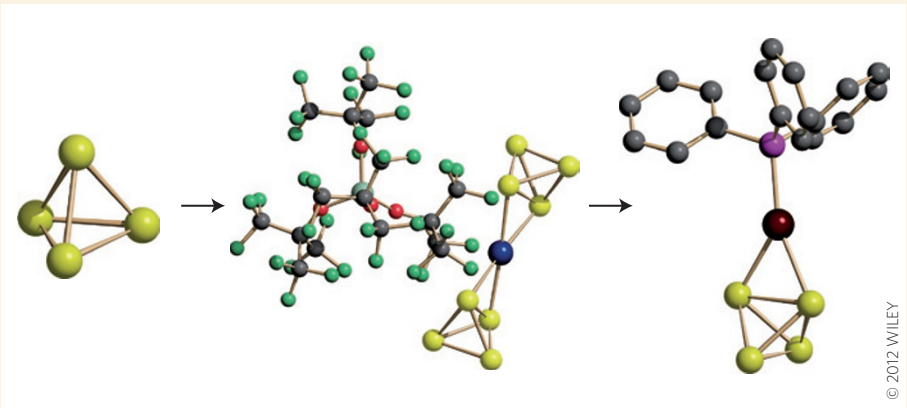
ARSENIC COMPLEXES

Mellow yellow

Angew. Chem. Int. Ed. http://doi.org/fz9mfg (2012)

Arsenic has three main allotropes: the grey one whose atoms adopt a layered arrangement, the yellow one that consists of As_4 tetrahedra, and the black amorphous form. Yellow arsenic is the most toxic and the most unstable; it decomposes quite readily, especially when exposed to light. It resembles the white allotrope of the lighter pnictide phosphorus — also a toxic and unstable tetrahedral species — but unlike P it can't be stored in solution owing to its greater instability. It is still possible to use As_4 in chemistry by freshly preparing it from the grey allotrope — but its light-sensitivity makes working with it particularly challenging.

For these reasons, there has been limited research on the reactivity, properties, and potential uses of yellow arsenic. Now, a team of scientists in Germany led by Manfred Scheer at the University of Regensburg have prepared a relatively stable silver complex featuring two As_4 ligands. The complex can be stored at −30 °C without decomposing and can be used as an As_4 transfer agent (pictured). Reaction of a silver(I) salt ($[Ag(I)(CH_2Cl_2)]$(pftb), where pftb is perfluoro-*tert*-butoxy-aluminate, $Al\{OC(CF_3)_3\}_4^-$) with freshly prepared yellow arsenic produced the salt $[Ag(I)(As_4)_2]$(pftb). The compound, which is stable in light, was characterized by electrospray ionization mass spectrometry, Raman spectroscopy and X-ray single-crystal diffraction; theoretical calculations also provided further insight into its structure. In the same way as As_4 resembles P_4, $[Ag(As_4)_2]^+$ exhibits a linear structure and an electron density that are similar to those of its phosphorus counterpart.



The two As_4 ligands are attached to the silver centre through side-on coordination. Despite some slight distortions caused by their interaction with the silver atom, both As_4 tetrahedra remain essentially intact, which means they are only weakly coordinated. This weak interaction enables $[Ag(As_4)_2]^+$ to act as a source of As_4 — something that is impractical with As_4 in its free form. On reaction of $[Ag(I)(CH_2Cl_2)]$(pftb) with the gold complex $(PPh_3)AuCl$ in stoichiometric conditions, one As_4 ligand was transferred to the gold centre to form $[(PPh_3)AuAs_4]^+$, also obtained as a salt with pftb. *AP*