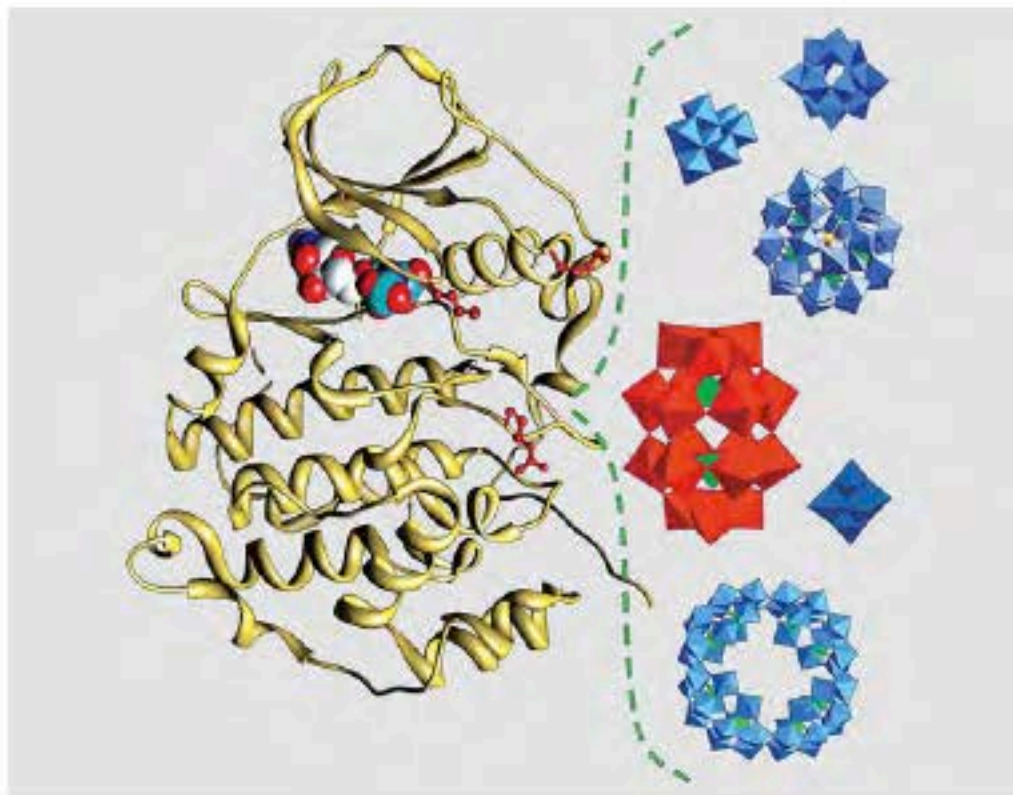


Molybdenum to treat cancer?

A team of chemists and biologists has discovered that polyoxomolybdates can inhibit the deregulated enzymes that cause cancers. Could a metal known for its industrial applications help to cure cancer?

Cancer-inhibiting compound

The discovery took the researchers by surprise. Life sciences research biologists of the CEA (a French research institute) and chemists of the Pierre and Marie Curie University in Paris had teamed together to take a close look at compounds called polyoxo-



Targeting the protein kinase (left) with polyoxometalate (right).
Photo: CNRS Photothèque / Bernold Hasenknopf.

Source: Renaud Prudent, Virginie Moucadef, Béatrice Laudet, Caroline Baratte, Laurence Lafanechère, Bernold Hasenknopf, Joaquim Li, Sébastien Bareyt, Emmanuel Lacôte, Serge Thorimbert, Max Malacria, Pierre Guzerh and Claude Cochet, "Polyoxometalates as protein kinase CK2 inhibitors," *Chemistry & Biology* 15 (2008), 683-692.

metalates which are aggregates of metal ions (molybdenum, tungsten and vanadium) and oxygen. In doing so they stumbled on a property they had not been looking for: they discovered that the compounds had a powerful inhibiting effect on the CK2 human protein kinase, an enzyme that, when deregulated, is active in many cancers, including leukemia, lung cancer and prostate cancer. The highest inhibition was observed for the phosphomolybdate $K_6[P_2Mo_{18}O_{62}]$. This enzyme is receiving close attention from biologists who, in their quest for inhibitors, test millions of molecules per year from the combinatorial libraries of specialized institutes.

Serendipity

The results of the research were unexpected. Claude Cochet, Research Director of the CEA and a biologist, said: "While inhibiting molecules mostly result from organic syntheses, this is the first time an inorganic compound has demonstrated an inhibiting effect." And Bernold Hasenknopf, from the Paris Institute of Molecular Chemistry, commented: "This discovery is, as is often the case, the result of a happenstance. This purely biological application of a polyoxomolybdate is entirely new, for we were above all exploring the traditional application of these molecules, in particular for catalysts or materials." The polyoxomolybdates are compounds of molybdenum in its highest oxidation state, molybdenum(VI). They are soluble in water, giving an aqueous solution that can be used by biologists. The next steps in the research will consist of cellular tests and the first experiments on animals. The research opens the way to new approaches in the design and application of future anti-cancer drugs.

First stainless steel lined swimming pools in France

The Vichy Water Sports Centre, located in France's famous spa resort, was opened to the public this summer, and is the first centre constructed in France equipped with 100% stainless steel pools. Chlorine content was a decisive factor in the choice of corrosion-resistant moly-grade materials. In addition to simple maintenance, stainless steel allowed the architect to use his imagination in shaping the pool's design. Now, dozens of local communities have shown interest in using stainless steels to refurbish their pools.

Nearly 40 years ago Austria opened its first all stainless steel swimming pool. Since it was first filled with water, it hasn't needed any refurbishment. Now France is following suit, opting for the innovative, economical and sustainable solution offered by stainless steel for the renovation and con-

struction of its water sports centres. After the refurbishment of a pool for the commune of Saint Bonnet de Mure, Rhône in March 2008, the city of Vichy opened a new outdoor Olympic-size swimming pool, along with indoor amusement, learning and wading pools. In total, 2,150 square metres →

(23,142 square feet) of water surface are enclosed by more than 65 tonnes of stainless steel. The stainless steel is made of about 70% recycled material. Moly-grade austenitic stainless steels were chosen for their superior corrosion resistance in the chlorine-rich environment. The walls and bottoms of the pools and areas exposed to splashing or warm indoor humidity, such as handrails and ladders or the amusement pool's slides, are all made from Type 316 stainless steel, supplied by ArcelorMittal.

Vibration of light

Architects have long been interested in using stainless steels in swimming pools, but it was the change in swimming pool material regulations that finally enabled these first two projects to move ahead in France. Jacques Rougerie, designer of the Vichy pools, heads a practice specializing in futuristic marine architecture, and water-related design is clearly his vocation. His commitment is almost lyrical: "Stainless steel contributes to setting a new scene with its "vibration of light" phenomenon that enables us to rethink the design of the place itself. It provides colour and expression like no concrete swimming pool can. For an architect, this is fabulous! For example, we capped the indoor pool with a blue-tinted polycarbonate dome that is reflected on the submerged metal surfaces, thus giving



The Bellerive-sur-Allier swimming pool, Vichy. It was the first Olympic-size swimming pool in France ever to be built of stainless steel. Photo: Jacques Rougerie.

swimmers a sensation of incomparable weightlessness. Stainless steel also provides more flexibility in imagining highly varied forms."

A giant pot

But a solid and rational technical argument follows immediately: "All pools have leakage problems. With a stainless steel pool, the water is contained much like water in a cooking pot! Furthermore, project execution is much simpler and shorter than with traditional tiled concrete. Finally, the gain in terms of sustainable development is incontestable: →

The Bellerive-sur-Allier swimming pool, Vichy. The stainless steel lining allows the designer to create complex shapes that are difficult to realize with other building materials. Photo: Jacques Rougerie.



a hygienic, ecological (recyclable) material that requires less maintenance than conventional solutions, and is much longer-lasting." But the architect knows how to be modest: "It is the advice and recommendations of the pool manufacturer that convinced me of the advantages of the material." Since the inauguration, dozens of French local authorities have expressed an interest in using stainless steels in swimming pools, both for renovations and for new projects.

Vichy Water Sports Centre fact sheet

Commissioned by	Vichy Val d'Allier
Designer	Jacques Rougerie (www.rougerie.com)
Execution	Baudin Châteauneuf and HSB France (a subsidiary of the Hink Group, Austria)
Grades	1.4404 (316L), 1.4571 (316Ti) and 1.4401 (316) recycled stainless steel
Supplier	ArcelorMittal

A dose of moly can go a long way

People thought steel was out of the race in cycling performance. But nothing could be further from the truth, thanks to a hidden dose of molybdenum that puts the muscle in new bicycles.



The Parisian Velib'. The renaissance of all-steel bicycles comes with the development of city fleets.

In the ultra-competitive world of professional cycling, doping may allegedly help a competitor to propel the pedals forward, but many have come to regret that choice. By contrast, in the everyday world of recreational and commuter cycling, a little "doping" of the steel used in these bikes brings benefits to all.

To be sure, carbon fibre is the material of choice in the racing world, especially in international races like the Tour de France. Light, strong, and flexible, it's a sure winner in this esoteric world. However, its price puts it out of reach for most users. Outside the professional cycling world, new types of stronger bicycles have been developed for extreme uses: these include mountain bikes which have to withstand the bumps of off-road trails, the "teen" version BMX for skate parks and dirt tracks, and especially the free-service bicycles now appearing in cities like Brussels, Paris, Lyon, Montreal and Melbourne. Bikes are back and are vying for position with the automobile on the streets of our cities.

A highly effective anti-fatigue potion

With this need for stronger bikes, moly-grade steel is also back as a bicycle frame material. Why? Its relative lightness, flexibility, lower price than its all-carbon or aluminium competitors, and its proven robustness combine to make it an ideal material. In fact, chrome-moly steel has become the standard material for city bike fleets designed to resist the hazards of urban riding and improper handling by the occasional rider.

The most highly performing grades (for example CrMo 4130, also called "Cromoly,") combine chromium, manganese and molybdenum. With 1% Cr and just under 1% Mo, 4130 offers the best combination of performance and cost for components requiring resistance to fatigue failure caused by the repeated shocks of heavy use. It is found in well-known applications like the handlebars (nearly indestructible, curved, ribbed inside, and heat-treated) and the frame. It also replaces aluminium in many other parts where its small weight penalty is less important than price and reliability. This is the case for components like the crankset with its chain wheel; the fork; the brake and gear cables; the chain, bolts, and spokes. Wheels and spokes are the parts most highly stressed and most subject to shock and corrosion, so moly's benefits are most appreciated here.

The comeback of the "All-Steel Bicycle"

So thanks in part to a magic formula containing molybdenum, alloy steel is once again racing ahead in bicycle technology, even if cycling champions aren't ready to trade in their carbon-fibre bikes. Mo is found mostly in the new-look bicycles of city fleets, mountain bikes or BMXs. They are on their way to giving British manufacturer Raleigh's catchphrase "The All-Steel Bicycle" new meaning. But not just any steel is used: it is moly steel we speak of, the only one that really makes the grade.