

Down from the mountains, down from the ivory tower

MOUNTAINEER ARLENE BLUM FINDS A NEW CHALLENGE

Arlene Blum calls it her “Rip Van Winkle” moment. It happened in March 2006, almost 30 years after her research with Berkeley biochemist Bruce Ames helped ban mutagenic fire-retardant chemicals from children’s sleepwear. In particular, their seminal papers in *Science* magazine in 1977-78 documented the toxicity of chlorinated and bromated versions of a phosphate compound called “tris.”

with a shock of recognition. “I felt like Rip Van Winkle waking up after a 30-year slumber,” she says. “One of the chemicals in the sketch was tris—the same potential carcinogen that had been banned from children’s sleepwear in the 1970s.

“What was I supposed to do,” Blum wondered, “just shrug my shoulders and tell them they should read my papers in *Science* from 30 years ago?” Blum, who blazed trails as a pioneer of women’s mountain climbing, instead decided to take a different route. “It’s pretty obvious that just doing the science on flame retardants isn’t sufficient to affect policy decisions,” she says. “I wanted to use my knowledge and love of chemistry to inform people about these potentially toxic chemicals in their furniture. I decided I wanted to be both a scientist and a policy advisor.”

Dual roles for scientists are nothing new. Academic researchers have been called upon for centuries to be scientists and educators. The Bayh-Dole legislation of 1980, named for U.S. Senators Birch Bayh and Robert Dole, allowed universities to patent and license discoveries based on federally funded research. Since Bayh-Dole, university technology transfer and faculty start-ups have skyrocketed, and faculty members are increasingly asked to be both scientists and entrepreneurs.

Says Blum, now a visiting scholar at Berkeley’s Center on Institutions and Governance, “Public policy decisions are often based on complicated science. But in the name of objectivity, scientists have backed away from being involved in the policy arena. But if scientists can come down from the ivory tower to be business people, then I think it’s even more important for them to come down to be policy advisors. If scientists are too busy to provide



Blum in 1976 with Mt. Everest in the background, from the 18,000 foot Kala Patar. On this American Bicentennial expedition, Blum would climb to camp IV on Everest at 24,500 feet, setting an altitude record for an American woman.

In the 1970s, Blum, a mountain climber who had earned her Ph.D. in biophysical chemistry with Ignacio Tinoco, split her time between research and climbing. When President Reagan took office in 1980, it became clear that the regulation of potentially harmful chemicals was not on the political agenda. Blum decided it was a good time to set aside her research, heed the call of the hills, and depart for a ten-month-long trek across the Himalayan mountain range. In the following decades she led treks to the Himalayas and Australia’s Great Barrier Reef, traveled across the United States giving speeches

and leadership seminars, designed a Nepali language course still used by the State Department, wrote two books, and raised a daughter in her home near the top of the Berkeley hills.

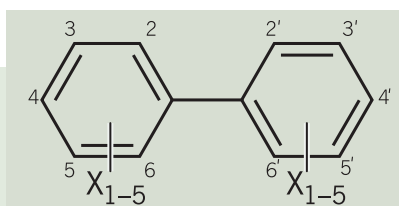
Blum’s scientific curiosity and her concern about the environment led her to attend a March 2006 meeting on the emerging field of green chemistry. There she had a conversation with an executive director of the polyurethane foam industry, who began to sketch the structure of some of the chemicals used as flame retardants in foam cushions. Blum looked at the sketch

their objective expertise, lobbyists are happy to fill the vacuum.”

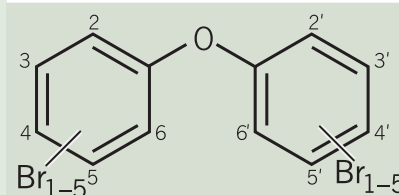
Long before Blum could come down from the ivory tower and her beloved mountains, she first had to learn to climb them. She earned her Ph.D. while simultaneously developing the skills to ascend Denali, Annapurna, and Everest, overcoming both the physical challenges of the mountains and the barriers she faced as a woman. She began climbing as an undergraduate at Reed College, in Portland, OR, in the early 1960s. In her recent memoir, *Breaking Trail*, she speculates that she craved the focus and camaraderie of climbing to high places. After a lonely year as a graduate student at MIT, where she was one of very few female students in a conservative and hostile environment, Blum happily switched to Berkeley with the help of **George Pimentel**, who was then the chair of the Berkeley chemistry department.

Blum arrived in Berkeley in the fall of 1967 and quickly joined the research group of Tinoco, a climber himself who had heard of her abilities and whose office walls were covered with photos of the High Sierra. By the end of 1970 she had passed her Ph.D. qualifying exams and had climbed to the top of Denali in Alaska, the highest peak in North America, as deputy leader of the first team of women to attempt the summit.

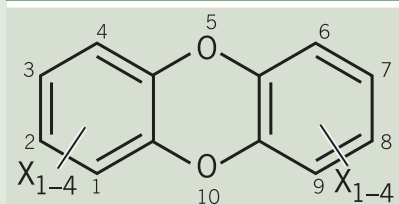
The decade of the '70s was a whirlwind of activity. Blum completed her Ph.D. at Berkeley in 1971, and after a 15-month-long round-the-world climbing trip, started a postdoctoral appointment at Stanford in 1973. As part of the U.S. Bicentennial expedition, she climbed to camp IV on Mt. Everest in 1976, setting an altitude record for an American woman of 24,500 feet. In 1978 she led the first American and also first women's team to attempt Annapurna,



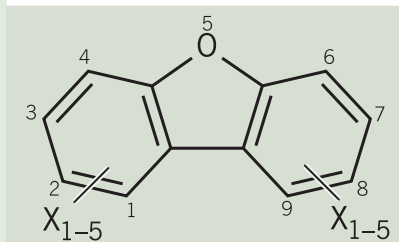
PCBs (X = Cl) and PBBs (X = Br)



PBDEs



Dioxins (X = Cl or Br)



Furans (X = Cl or Br)

Polybrominated diphenyl ethers (PBDEs), used extensively in fire retardants, are chemically similar to known toxins such as polychlorinated biphenyls (PCBs), dioxins and furans.

one of the most dangerous of the 8,000+ meter peaks in the Himalayas. Two members of the team reached the summit, but two more died trying. Blum documented the expedition in her first book, *Annapurna: A Woman's Place*.

It was another death—the loss of her friend and climbing partner Bruce Carson in 1975—that did the most to shape Blum's future and eventually bring her down from the high mountains. While on a deceptively routine climb to the top of an Indian peak named Trisul, Carson fell through the lip of a cornice at the summit. His body was never found.

Blum was devastated. When she returned to California, she spotted on her bookshelf a copy of an account of the first expedition

to Trisul in 1907. In it she found an accurate description of the dangerous cornice that took Carson's life. "I was overwhelmed with regret and self-reproach," Blum later wrote about the event. From that day forward, Blum "wanted to do practical research that would have a direct positive impact on the world. My work would be dedicated to the memory of Bruce Carson. I learned the hard way that good research saves lives."

At Berkeley, Blum is working to involve more scientists, especially chemists, in public policy issues. She has also been providing scientific advice on Assembly Bill 706. Sponsored by San Francisco's Mark Leno, the bill would ban two classes of potentially toxic fire retardants from furniture in California, unless the manufacturer can prove their safety. *Los Angeles Times* and *SF Chronicle* editorials endorsed the bill, as did most of the state's firefighters and environmental groups. Blum recently published a commentary in *Science* magazine about the fire retardants, and she is organizing a series of meetings to bring together industry, government, and academic experts to discuss how to improve fire safety without relying on potentially toxic chemicals.

California began regulating the flammability of furniture and other home furnishings in the aftermath of the 1906 San Francisco earthquake and fire. In the 1980s furniture manufacturers began adding the fire-retardant pentaBDE (member of the family of polybrominated diphenyl ethers) to foam cushions to meet the California standards. In 2003, after reports showing the negative health effects of pentaBDE, the state backtracked and banned the fire retardant. Eight other states and the European Union also banned pentaBDE. In 2004, the U.S. manufacturer voluntarily ceased production.

The replacements included chlorinated tris, one of the chemicals Blum and Ames had

COURTESY OF ARLENE BLUM AND SCIENCE MAGAZINE

warned against in the 1970s. AB 706 would ban tris and the other most toxic fire retardants, including PBDEs. “The irony,” says Blum, “is that there is no evidence that California’s mandating the use of fire retardants has improved fire safety. Death and injury from home fires have declined in other states at about the same rate as in California, due mostly to better building codes, smoke alarms, and a reduction in smoking. The new laws in California and other states requiring fire-safe cigarettes will also help a lot to further reduce fire deaths.”

California’s very strict standards for fire safety in institutional furniture—furniture used in hospitals, sports arenas and other public places—are often met by using barrier materials and other design advances without



Blum testing for traces of brominated fire retardants in furniture foam with an x-ray fluorescence analyzer.

resorting to potentially toxic fire retardants. The institutional standards, unlike the standards for homes, require evaluation of the safety of the piece of furniture as a whole, not its individual components. This gives furniture manufacturers the flexibility to incorporate fire safety into the design of the product, instead of relying on adding possibly hazardous chemicals.

No one knows what the long-term health effects are from chronic exposure to PBDEs, tris and other toxic fire retardants. However, a Consumer Product Safety Commission risk analysis suggests 1,200 additional cases of cancer annually from exposure to tris in furniture foam if it were to be used nationally. According to the U.S. Department of Health and Human Services Agency for Toxic Substances and Disease Registry, “Because PBDEs dissolve readily in fat, they can accumulate in breast milk and may be transferred to babies and young children. Exposure to PBDEs in the womb and through nursing has caused thyroid effects and neurobehavioral alterations in newborn animals.”

Scientists at the U.S. Environmental Protection Agency found that “cats are highly exposed to PBDEs; hence, pet cats may serve as sentinels to better assess human exposure and adverse health outcomes related to low-level but chronic PBDE exposure.” (*Environmental Science & Technology* 15 August 2007). They suggest exposure to PBDEs may explain a new epidemic of feline hyperthyroidism. The EPA study points out that “certain regions (such as the state of California) were more proactive in incorporating flame-retardant materials to decrease risk of fire. This may explain the disproportionate increase of hyperthyroid cats at California’s veterinary teaching hospital in the 1980s.”

To gauge the extent of the problem for herself, Blum borrowed a portable x-ray fluorescence analyzer and invited acquaintances and neighbors to bring their foam

furniture cushions to be tested. She detected high levels of bromine in her own furniture and in many of the foam cushions she tested. Says Blum, “House cats and human babies share similar environments and habits. Both are exposed to household dust, and some of that gets ingested—cats lick themselves, and babies mouth all sorts of objects. PBDEs are endocrine disruptors. The EPA study finds early evidence that they are related to this mysterious epidemic of hyperthyroid disease in cats. So what are they doing to our kids? We need to find out.”

Blum has found her new mountain. The same drive that led her up some of the world’s toughest peaks has motivated her to write, organize seminars, and give presentations to policymakers. As she explains in her commentary in *Science* (12 October 2007), “Although smoking and fire deaths are rapidly decreasing in the United States, proposed new flammability regulations could add tens of millions of additional pounds of potentially toxic fire-retardant chemicals to bed clothing, pillows, and foam within upholstered furniture. Fire retardant chemicals in our homes should not pose a greater hazard to our health and environment than the risk of the fires they are supposed to prevent.”

“Looking back,” says Blum, “I think the problem is that the federal government dropped the ball three decades ago. Just think how much we would know about the safety of fire-retardant chemicals and alternative technologies if the motivation and funding had existed to study them during the last 30 years. But it’s not too late. My training as a chemist at Berkeley is giving me the opportunity to help protect human and environmental health. I’m very grateful and I’m encouraging my daughter, a college sophomore who wants to make the world a better place, to major in chemistry. I am a big fan of green chemistry, and I’m more excited about chemistry now than I ever have been.”