the aryl substituents (*14*). However, highly electronically stabilized systems can be criticized as no longer being true silyl cations, as the charge is delocalized away from silicon to the substituent atoms. But there is another, quite effective way to delocalize the charge symmetrically among atoms of the same type.

Jemmis *et al.* (*15*) proposed placement of three germanium atoms in a three-membered $Ge_3H_3^+$ ring (scheme **3a**), where the positive charge would be shared. If planar, such ring systems are known to be aromatic, that is, they enjoy extra stabilization due to the two π-electron delocalization. Although a second cyclic $Ge_3H_3^+$ isomer with bridging hydrogens is even more stable than the compound in scheme **3a**, groups other than hydrogen would not be expected to bridge. The authors concluded, "our results suggest new opportunities for the experimental observation of free cations of the heavier group 14 elements" (*16*).

This is exactly what Sekiguchi *et al.* (*1*) have achieved. The x-ray structure of tris (tri-*tert*-butylsilyl)cyclotrigermenium tetraphenylborate $[(^tBu_3SiGe)_3^+BPh_4^-$, where Bu = butyl and Ph = phenyl] (scheme **3b**) shows a virtually symmetrical three-membered cation ring and a remotely situated anion (the nearest distance between a Ge and a phenyl C atom is over 4 Å, which precludes any covalent interaction). The average Ge-Ge bond length, 2.3264 Å, is quite close to the 2.361 Å separation predicted for scheme **3a** by the theoretical computations.

Although the bulky $(t\text{-butyl})_3Si$ substituents in scheme **3b** undoubtedly hinder the approach of the anion, our further computations on the parent ion, **3a**, indicate that the interaction with nucleophiles is sharply reduced. Hence, as in the new Lambert silyl cation, scheme **2**, both steric hindrance and electronic stabilization contribute to the attainment of the long-sought goal: free silyl and germanyl cations in condensed phases.

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VACCINES

Pax Polio

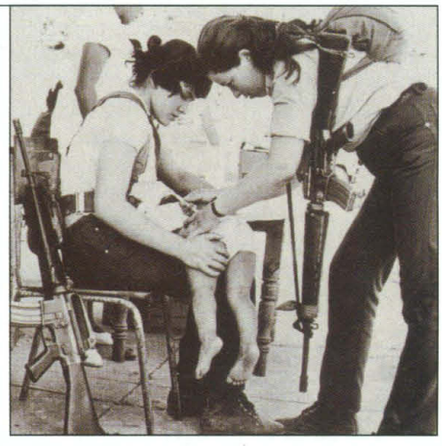
Harry F. Hull

Our dictionary defines millennium both as a period of a thousand years and as "a hoped for period of joy, peace, serenity, prosperity, and justice" (*1*). In both senses of the word, one of the early achievements in the approaching millennium will be the global eradication of poliomyelitis. Polio eradication will eliminate disease, reduce disability, and produce direct savings of at least $1.5 billion per year (*2*). The eradication initiative has also led combatants to lay down their arms.

In 1988, the nations of the world established a goal of global polio eradication by the year 2000. Progress since then has been exceptional (*3*). Reported polio cases have declined by 80% since 1988. Wild polioviruses were eradicated from the Western Hemisphere in 1991. Eradication is close in China. In an unprecedented display of international cooperation, 18 contiguous nations of the Middle East, Caucasus, and the Central Asian Republics, including current and former combatants, united in 1995 to conduct Operation MECACAR, immunizing 56 million children. Almost half the world's children under 5 years of age were immunized during polio campaigns in 51 countries that year. India immunized 93 million children on a single day in January 1996.

Although the strategies are proven effective (*4*), not all the tools necessary for eradication are in place. An estimated $600 to $800 million still need to be mobilized. Political commitment remains weak in several countries where the disease is highly endemic. Probably the greatest threat to polio eradication, though, is war and civil strife. As clinics are destroyed, health workers killed, and the civilian population turned into refugees, war zones become fertile fields for epidemics. The last case of polio in the Americas was a Peruvian boy who was not fully immunized because the local clinic had been destroyed by guerrillas. In Afghanistan, decades of war have resulted in less than 20% of the children being immunized. Wild poliovirus was recently reintroduced into Iran from Afghanistan.

During armed conflict, mass immunization campaigns are not just a requirement for polio eradication, they may offer the only means of reaching vulnerable children. The polio eradication initiative has been the stimulus for a number of remarkable cease-fires for immunization. Starting in 1985, days of tranquillity were observed each year in El Salvador so that children could be vaccinated against polio and other diseases (see figure). In 1993, the Philippine Secretary of Health personally negotiated with rebel leaders, giving them vaccine to immunize their own children. Truces between the Tamil Tigers and the Sri Lankan army were observed in 1995 and 1996, with polio vaccine passed across the front lines dur-



An excuse for peace. Measles immunization during days of tranquillity in El Salvador. [Photo courtesy of UNICEF]

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ing the November 1995 assault on Jaffna. Cease-fires have been declared in Sudan for both polio and dracunculiasis eradication, expanding health truces beyond immunization.

Days of tranquillity permit warring parties to disengage and provide a glimpse of peace, but also give both sides a common goal to serve as a starting point for future negotiations. The resolution of conflict with incorporation of the rebels into the national army in El Salvador and, recently, in the Philippines provides evidence that days of tranquillity can be the first of many steps toward a lasting peace. Polio eradication activities must be conducted amidst current and future conflicts around the world. We are confident that there will be more truces and polio will be eradicated. The challenge for science is to continue the development of tasks and tools that can serve as instruments of peace.

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IMMUNOLOGY

Asthma: An Epidemic in the Absence of Infection?

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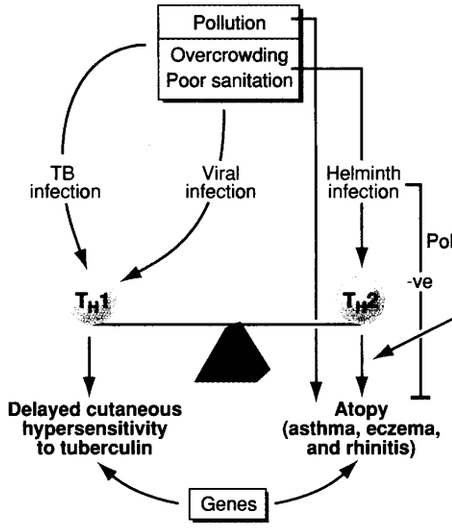
Asthma is a chronic and debilitating disease, causing swollen and inflamed airways that are prone to constrict suddenly and violently. Asthmatics have attacks of shortness of breath and wheezing that can be life-threatening or even fatal. The prevalence of asthma in Westernized societies has risen steadily this century, doubling in the last 20 years (*1*). Asthma now affects one child in seven in Great Britain, and in the United States it causes one-third of pediatric emergency-room visits. Asthma is familial, and genome-wide searches by our group and others have shown that many genetic loci predispose to the disease (*2*). It is unlikely, however, that the genetic makeup of stable populations can change significantly within one century, so the probable cause of the epidemic must lie in the environment. In this issue of *Science*, Shirakawa and his colleagues (p. 77) present evidence for a novel environmental cause of asthma (*3*).

Asthmatic airway inflammation is initiated by immunoglobulin E (IgE)–mediated allergy ("atopy") to airborne proteins ("allergens"). For asthmatics, the most important source of allergens is the house dust mite. These mites thrive in warm, moist conditions and are ubiquitous in human bedding. There is a dose-response relation between exposure to mite antigens and asthma, and a plausible but unproven case can be made for increasing levels of mite in modern heated homes (*1*). In Japan, asthma has increased just as the population has moved away from the traditional bare and well-ventilated house to Western-style buildings. In Arizona, however, the dry heat means that mite allergy is rare, yet asthma is as common in Tucson as elsewhere in the United States. This suggests that the innate ability to become allergic can readily find alternative antigens.



An advantage of infection. Atopy (asthma and other allergic diseases) is reciprocally related to immunity to tuberculosis (as measured by delayed cutaneous hypersensitivity to tuberculin) (*3*). If an individual has predominantly T_H2 T cells, the T_H2 phenotype interacts with environmental allergens to produce atopic disease. Infections may alter the balance between T_H1 and T_H2 phenotypes. The clean living conditions of Western society, by reducing the incidence of infection, may tip the balance toward the T_H2 phenotype and predispose to asthma.

Air pollution may aggravate existing asthma but is not responsible for the asthma epidemic (*1*). Comparisons have been made between the prevalence of asthma and allergy in highly polluted Leipzig in East Germany and clean Munich in the West (*4*). Surprisingly, the prevalence of asthma and skin tests to common allergens was lower in the East. Similar comparisons between Sweden and polluted Poland show the same phenomenon (*5*). The German investigators also found that the prevalence of asthma was lower in the youngest children of large families than in children high in the birth order (*6*).

These results suggest that asthma prevalence has increased because of something lacking in the modern environment, rather than through the positive actions of some toxic factor. Respiratory and other infections are much more common in polluted and crowded Eastern block countries than in the West, and younger children get more infections from their siblings than single or older children. Childhood infections may, therefore, paradoxically protect against asthma. The study by Shirakawa *et al.* on children in Japan focuses on tuberculosis as a key infection influencing asthma prevalence (*3*).

Inflammation is modulated by helper T (T_H) lymphocytes. T lymphocytes may be classified into T_H1 and T_H2 types, according to the pattern of their cytokine production (*7*). T_H1 cells secrete interferon-γ (IFN-γ), interleukin-2 (IL-2), and lymphotoxin, whereas T_H2 cells secrete IL-4, IL-5, IL-6, IL-10, and IL-13. T_H1 cells enhance cellular immune responses, and T_H2 cells favor the humoral response. Although the T_H1/T_H2 classification is an oversimplification, cells exhibiting the T_H2 phenotype upregulate IgE production and are prominent in the pathogenesis of airway inflammation and asthma.

As in other modern societies, infection with *Mycobacterium tuberculosis* (Mtb) has declined steadily in Japan during this century. This is in part due to a comprehensive program of inoculation with attenuated bovine tuberculosis vaccine bacillus Calmette-Guérin (BCG), which is administered at 3 months of age. Children are tested for delayed hypersensitivity to tuberculin (DHT) at 6 and 7 years of age and are re-inoculated with BCG if the skin test is negative. Final skin testing is carried out on all children when they are 12. Shirakawa *et al.* studied 867 children after the age of 12 and showed a clear negative relation between DHT responses and two parameters—the presence of asthma and the serum IgE concentration.

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