

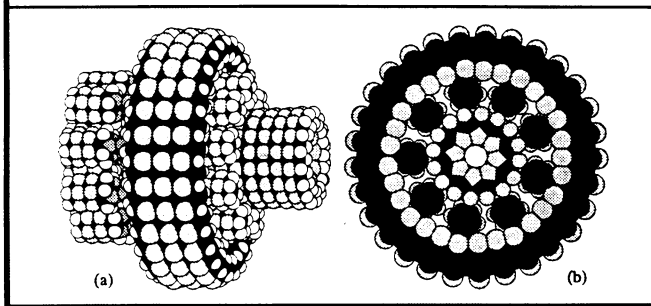
Molecular tools for nanomanufacturing

Although most people find unfathomable the concept of assembly lines that fit into a space no wider than a human hair, a small group of California scientists thinks molecular manufacturing could some day revolutionize the factory floor.

Toward this goal, two of these researchers have developed computer software to design and test molecular gears and bearings. These simulated components represent the first steps toward building machines that assemble parts atom by atom, molecule by molecule, says Ralph Merkle of the Xerox Palo Alto (Calif.) Research Center. He described these components last week in Palo Alto at the First General Conference on Nanotechnology.

Since the first nanotechnology confer-

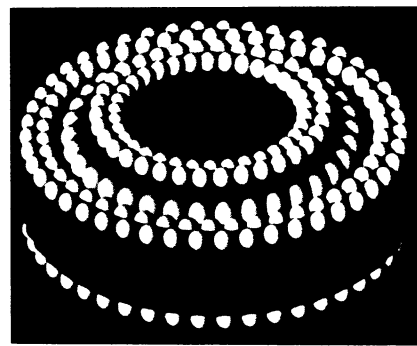
Planetary gear from side (a) and top (b).



ence in 1989 (SN: 11/4/89, p.295), researchers in many fields have demonstrated or observed ways to manipulate atoms and molecules and to make nanoscale modifications in their materials. But those advances have not yet captured the true spirit of nanotechnology or, in particular, of molecular manufacturing, says K. Eric Drexler, who heads the Palo Alto-based Foresight Institute.

"In molecular manufacturing, the making of the material and the making of the component [are] one and the same," says Drexler, who helped develop the simulated bearings. He has proposed that modified atomic force microscopes will represent the first-generation molecular machines. Fitted with tips that grab and move particular atoms or molecules, these microscopes will build invisible robotic arms and molecular assemblers that will eventually manage nanoscale factories.

So far, Drexler and Merkle have succeeded in simulating just a few components — a bearing and a speed



Simulated bearing constructed of precisely placed atoms, including sulfur (yellow), which coats the inner ring.

reduction, or planetary, gear — of the thousands needed for these devices.

"We can't do it now, but it's really important to assess how close we are to building such a structure," comments Michael Kelly, a materials scientist at Stanford University.

With the simulations, "we've been increasing our confidence that molecular-level structures are feasible," says Merkle. For example, their results indicate that the bearing's two-layer carbon rings, whose atoms arrange like those in a diamond, will bend to form a hoop without losing that diamond-like arrangement. They also determined the bearing's ideal ring sizes. — E. Pennisi

Images: Drexler & Merkle

Contacts: Disposables still pose eye risk

Since entering the market in 1988, disposable contact lenses have come to account for one in five new prescriptions for contacts. For convenience, a person can wear a pair for one to seven days without removal or cleaning. Physicians expected that the lenses' short life and minimal handling would translate into less ulcerative keratitis. But two new studies now find that patients wearing disposable lenses have higher rates of this eye inflammation than people with other kinds of contacts.

Associated most frequently in a number of studies with soft contact lenses — especially extended-wear varieties, which can be worn overnight — this corneal disease can result in permanent loss of vision.

One of the new studies focused on 42 individuals diagnosed with ulcerative keratitis by two Michigan ophthalmologists, John F. Stampler and David D. Verdier of Grand Rapids. Together with Oliver D. Schein of Johns Hopkins Hospital's Wilmer Eye Institute in Baltimore and his co-workers, the Michigan doctors compared each keratitis sufferer with five other contact-lens wearers who had been prescribed their lenses — of any type — by the same practitioner at the same time.

They found "that the disposable lenses

posed an ulcerative keratitis risk 14 times higher than daily wear [of nondisposable soft contacts]," according to Patricia Owens Buehler, who led the study. That wasn't surprising, because a 1989 study that Schein directed found a similar risk for extended-wear, nondisposable soft contacts (SN: 9/23/89, p.197), says Buehler, now at the Oregon Health Sciences Center in Portland.

The seven-fold higher risk of keratitis associated with disposable versus nondisposable extended-wear soft contacts "was unexpected," she says.

This and a related study appear in the November ARCHIVES OF OPHTHALMOLOGY. That second study compared rates of eye problems in 323 contact-lens wearers entering Moorfields Eye Hospital in London over three months. Unexpectedly, its authors note, "extended- and daily-wear disposable lenses were associated with higher risks of keratitis than other lens types, including conventional extended-wear lenses."

Buehler's team is now sifting through data on wearing schedules and hygiene practices from its study trying to explain why more disposable wearers developed keratitis. She believes overnight wear will explain most of the disposables' risk. "We know that wearing [soft] lenses overnight,

as most people do with disposables, increases your risk of this disease," she notes. And she says that while virtually all disposable wearers leave their lenses in overnight, only 50 percent of people with soft extended-wear lenses do.

"The problem with wearing soft lenses overnight — disposable or not — is that none allows the full amount of oxygen to reach the cornea and keep it from swelling," notes Houston ophthalmologist James E. Key II. At the American Academy of Ophthalmology's annual meeting in Dallas last week, he reported that no soft lens yet allows sufficient oxygen to reach the eye when lids are shut during sleep. Only rigid, gas-permeable lenses, which aren't nearly as comfortable to sleep with, let in enough air, he says.

With the exception of keratitis, disposables pose less risk of eye problems than other soft lenses, several studies show. And even for patients wearing soft lenses overnight, the absolute risk of keratitis remains less than 1 percent, says Peter C. Donshik, a West Hartford, Conn., physician and president of the Contact Lens Association of Ophthalmologists.

The two main points, Donshik emphasizes, are to disinfect any lens that will be reused — even a disposable — and for contact-lens wearers to call an ophthalmologist immediately if they develop the red, painful, or blurry eyes that may signal keratitis.

— J. Raloff