Genetic selfishness in an all-male club

Frogs and snails and puppy-dogs' tails may make little boys, but in the wasp *Nasonia vitripennis*, a selfish chromosome apparently can dictate which offspring will be male. Scientists report that an extra chromosome carried by males of the species somehow destroys the other paternal chromosomes – thus enhancing its own transmission but resulting in all males.

A tiny, parasitic wasp that lays its eggs in the pupae of flies, *N. vitripennis* normally produces only females from fertilized eggs and only males from unfertilized eggs. If an extra chromosome called *psr* (paternal sex ratio) is present in the sperm, however, all five of the normal chromosomes contributed by sperm disappear after fertilization. With its "fertilized" status canceled, the egg then becomes a male capable of making more *psr*-containing sperm.

Uzi Nur and other researchers at the University of Rochester in New York report in the April 22 SCIENCE that, "because the *psr* chromosome enhances its transmission by eliminating the rest of the genome, it can be considered the most 'selfish' genetic element yet described."

Because it is an extra chromosome not found in normal wasps, *psr* is classified as a supernumerary chromosome, or "B" chromosome. Scientists have found B chromosomes in more than 800 species of plants and animals thus far, Nur told SCIENCE NEWS. "More often than not, they have some trick up their sleeve to enhance their transmission [to the next generation]," he says. In the mealy bug, for example, the B chromosome hitches a ride on those chromosomes that remain active whether offspring become male or female. But *psr* takes this trickery to the extreme by simply eliminating the possibility that offspring will be female.

Coauthor John H. Werren discovered the *psr* trait several years ago (SN: 3/1/86, p.134). But prior to the current study, the scientists thought a parasitic virus was causing the peculiar all-male phenomenon. Normally, female *N. vitripennis* leave about 5 to 15 percent of their eggs unfertilized to guarantee an adequate number of males. If there are several females laying eggs on the same fly, however, they adjust the sex ratio of their offspring to 50 percent males. Females can readily mandate the sex of young wasps by rationing sperm held in a special organ found in their bodies. "All these elements fighting each other for the sex ratio is a fascinating story," Nur says.

Although it is still unclear exactly how *psr* functions, Nur says he and his colleagues suspect "it's like an infection in that it tends to spread [through a population of wasps]." If this is the case, he says, mutations or unknown environmental factors may periodically stop *psr* transmission, before the all-male results extinguish the species. The scientists have found the chromosome among wasps collected in Utah, but not in those from New York. The highest observed percentage of males carrying *psr* in any specific population was 20 percent, Nur says.

Whatever keeps *psr* from destroying the species, the chromosome apparently has an ambitious "meiotic drive" of its own, says Nur. The curious phenomenon of meiotic drive occurs when a genetic component is transmitted through generations more often than would be expected under accepted genetic laws. In other words, *psr* ignores the rule that genes from both parents have an equal chance of being transmitted to the offspring.

With *psr* now characterized as a genetic element, scientists may also find the selfish DNA in other species, Nur says. Werren currently is looking at a related wasp capable of mating with *N. vitripennis*, to see whether *psr* can spread from one species to another. Nur says those experiments may show whether *psr* was derived from the normal chromosomes of *N. vitripennis*, or whether it came from cross-breeding between two species.

– D.D. Edwards

Circum(inde)cision

Circumcision is one of the oldest of elective medical procedures. In the past decade, however, mounting opposition to routine circumcision of newborns has developed. That trend is reflected in the most recent (1983) statement from the American Academy of Pediatrics (AAP) that "there is no absolute medical indication for routine circumcision."

Now, a report in the April PEDIATRICS adds a new and confusing twist to the debate.

In an eight-year study of 500 boys, researchers from the Christchurch (New Zealand) School of Medicine found that, compared with uncircumcised boys, circumcised children had five times the risk of penile problems during the first year of life. But in the years *after* infancy it was *un*circumcised boys who had more trouble. Problems included various types of penile inflammation, and were not correlated with other social or medical factors. The study fails to support strong positions either in favor of or against routine neonatal circumcision, the researchers conclude.

An AAP task force is reassessing its position on circumcision and expects to release its recommendations by the end of the year. □

Smoking: Clues to its heart effects

Though it has long been known that cigarette smoking increases one's risk of heart disease, why has remained a mystery. Now scientists at Kyoto University in Japan report some provocative clues. Their research indicates that cigarette-smoke extract can modify low-density lipoproteins (LDLs) – the so-called "bad" lipoproteins – enhancing their role in the laying down of artery-clogging plaque.

The Japanese study involved LDLs and "scavenger" cells called macrophages isolated from animals and incubated outside the body. However, writing in the April PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (Vol.85, No.7), Masayuki Yokode and colleagues conclude that if similar LDL modification occurs in humans, it "could explain the increased incidence of atherosclerosis and coronary heart disease in smokers."

The researchers extracted LDLs from the blood of rabbits and exposed the LDLs to the smoke extract, then incubated them in a petri dish with macrophages collected from mice. Similar macrophages can be found along the inside surfaces of human arteries. When blood contains too much LDL or cholesterol for the liver to filter out, these arterial macrophages interact with LDLs and "unload their cholesterol," initiating a process that culminates in the laying down of atherosclerotic plaque, according to Elliott Berlin at the Agriculture Department's Lipid Nutrition Laboratory in Beltsville, Md.

The Japanese researchers report that, compared with untreated LDLs, their smoke-treated lipoproteins not only were gobbled up more readily by the macrophages, but also stimulated the conversion of 12.5 times more LDL-cholesterol into cholesteryl ester. (This ester, Berlin points out, is the chemical form in which cholesterol is deposited in the arteries.) The Japanese researchers ended up with macrophages filled with lipids.

Atherosclerosis begins with an accumulation along artery walls of "foam" cells rich in lipids – mostly cholesteryl esters, explains Daniel Steinberg, an endocrinologist from the University of California at San Diego. Though normal LDLs won't convert macrophages into foam cells, modified LDLs can sometimes initiate this conversion. "Our work has shown that if you oxidize LDLs...you can get foam cell formation [from macrophages]," Steinberg says. But what makes the Japanese findings so "intriguing," Steinberg adds, is that the cigarette-smoke extract's potent modification of LDLs was not due to oxidation. "That's very interesting," Steinberg says, "and should be pursued." *– J. Raloff*