Biology

What do you suppose B-forces make?

There's an old Air Force myth that says fighter pilots are more likely to sire daughters than sons. The movie "Top Gun" ends before we get to find out, but recent research suggests that the myth may be true.

Bertis Little, assistant professor of obstetrics and gynecology at the University of Texas Southwestern Medical Center in Dallas, began to believe the myth after leafing through a war-college yearbook and looking at the ratio of girls to boys among the offspring of Air Force pilots. The preponderance of girls inspired him to initiate a controlled study to identify the cause of the disparity.

That study, recently reported in AVIATION, SPACE AND ENVIRONMENTAL MEDICINE (Vol.58, No.7), suggests that the fathering of females may be a consequence of exposure to high G-forces – intense gravitational forces that pilots encounter in high-speed aircraft.

Little found that nontactical pilots – those who fly such planes as transports and heavy bombers with little exposure to G-forces – have approximately equal numbers of sons and daughters. Astronauts, however, had 57 percent females, and tactical pilots had 62 percent females. On average, high-G pilots and astronauts had 10 percent fewer male offspring than did low-G officers.

The study doesn't prove that G-forces are gender determinants, Little says, but "it does suggest an association between the high-G exposure and reduced male to female ratio."

He is currently doing NASA-sponsored research on the sperm cells of mice that have "flown" at high G in a centrifuge, to see if male and female chromosomes may show different viabilities under such conditions. He notes that no research has been done on the effects of high-speed, high-altitude flight on women.

Bugs bite the dust on bitter pill

Imagine a soft, gelatin capsule about the size of a vitamin pill, but filled with hundreds of microscopic, parasitic worms. The worms, a variety of nematode, are the "active ingredient" in a newly patented agricultural pest-control system. Although not yet commercially available, the "pills" have been shown in preliminary tests to be effective against such pests as fire ants, termites and corn rootworm.

It's been known for years that parasitic nematodes can be useful as biological controls. When consumed by an insect pest, the nematode releases a variety of bacteria that are deadly to the insect. But with 2 billion to 3 billion nematodes required per acre for control, distributing them is a problem. The new method "sort of puts them in a state of sleep" inside easily distributed gelatin capsules, according to Robert J. DeDominic of Plant Genetics, the Davis, Calif.-based biotechnology company that developed the system. He says the innovative delivery system has great potential "if we ever get people to start producing these nematodes in great enough quantities."

Indeed, the friendly nematode is in short supply. According to Art Kushner, a vice president of Biosis, a Palo Alto, Calif. mass-producer of nematodes, it's difficult to grow nematodes in large quantities. The company is experimenting with growing them in a 7,500-liter fermentation container, with hopes of producing 100,000 nematodes per milliliter. However, he says, "we think we'll have to grow them at a density of 200,000 to 300,000 per milliliter to get competitive with chemical controls."

He adds that partly dried, living nematodes may prove more useful than the gelatinized ones, as the latter need to be refrigerated. "Some people may have a problem sticking these in their refrigerator next to a piece of Jarlsberg cheese."

Technology

Much more than *War and Peace*

A typical magnetic disk, 3.5 inches across, used for storing computer data can carry about 200 million bits of information. That's enough storage space to hold a hefty novel and still have room to spare. Scientists at IBM's Almaden Research Center in San Jose, Calif., have now developed an experimental magnetic disk that points toward future storage disks that potentially could each hold 10 billion bits of information – the equivalent of 620,000 double-spaced typewritten pages. Such an improvement in storage capacity would keep magnetic disks competitive with optical methods of storing information.

On a magnetic disk, information is stored in tiny magnetized cells arranged along microscopic, circular tracks similar to the concentric grooves on phonograph records. The IBM scientists used an electron beam to define a pattern of cells on a thin film of a cobalt alloy deposited on a smooth surface. An etching process removed all excess magnetic material, leaving just square cells, each only 0.5 micron wide. By changing the magnetization of these cells, the researchers were able to record, read and erase information.

By experimenting with such small magnetic cells, the researchers learned that the behavior of magnetic regions in narrow tracks is similar to that of the much larger regions now found on conventional magnetic disks. The decrease in size seems to have little effect on the predictability of the magnetization process. The experiments also hinted that even smaller magnetic cell sizes may be attainable.

Electrolyte looks good on paper

A typical electrochemical cell consists of two electrodes separated by an electrically conducting material known as an electrolyte. For example, a car battery has lead/lead-oxide electrodes and a liquid electrolyte consisting of dilute sulfuric acid, while an ordinary flashlight battery has zinc and carbon electrodes in a solid electrolyte largely made up of manganese dioxide grains. Now Japan's Matsushita Electric Industrial Co. has developed what the company claims is the world's first solid electrolyte in the form of a paper.

The paper electrolyte is made by mixing an insulating polymer dissolved in an organic solvent with a solid inorganic electrolyte in powder form. The resulting slurry is then coated onto a sheet and dried. This new electrolyte material, which can be manufactured to be as thin as a few microns, has the flexibility of paper, allowing it to be molded or shaped for particular applications in batteries and other electrical devices. It can carry a variety of electrically charged species, including silver, copper and lithium ions. The paper electrolyte is stable over a temperature range between -60 and 100° C., and unlike liquid electrolytes, it can't leak.

Pitter-patter patterns

Rain falling on ocean surfaces generates characteristic noises that alter the spectrum of sounds usually encountered underwater (SN: 1/4/86, p.4). Now H.C. Pumphrey of the University of Mississippi in University offers an explanation for how this noise is produced. He suggests that the noise is created by oscillations of bubbles generated by the impact of raindrops of a certain size.

Pumphrey first studied the sound produced by a single drop striking a liquid surface. He found that the sound consisted of a sharp spike emitted when the drop first strikes the surface and then a decaying wave emitted when an air bubble is formed. By gently spraying water onto a large tank, he found that he could produce a noise spectrum similar to that observed for ocean rainfall. The addition of a surfactant to lower the water's surface tension stopped bubble production, and the main spectral peak seen in typical rainfall noise disappeared.