Technology

The fin: From dolphin to ship

As any skin diver knows, the waving fin is a very powerful, efficient means of propulsion through water—much more efficient, it turns out, than the conventional screws now used to propel boats. Designers have long dreamed of adapting this system for transportation, but the mechanical complexities of creating practical fins for large ships have so far remained insurmountable.

Now the problem may have been solved by some scientists at the Berlin Technical University who carefully analyzed fin motion of a trained dolphin in films. Their work is reported by the German Research Service.

Called a "rocket lever propeller," the mechanical fin consists of a rod and paddle mounted between powerful springs that keep it swinging back and forth like a kitchen door. Engine power is added to overcome friction and water current resistance, driving the vessel forward. As a measure of its efficiency, the ratio of thrusting power to weight in the novel system is nearly four times greater than that of a conventional screw.

A fin-propelled boat has already been successfully tested on the Spree River, proving the rocket lever propeller both powerful and versatile—direction of motion can be changed quickly by varying the angle of the fin. The developers see the new system finding greatest applicability in a situation where great thrust, rather than speed, is essential, as in propelling floating cranes and ferries.

Miniaturizing visual systems

Television is fine for visualizing a scene as long as size, cost, power consumption and weight are no problem, and if there is plenty of light. But where such considerations must be taken into account, a new technology—called charge-coupled devices, or CCD, for short—may find important applications.

Not surprisingly, some of those applications are military ones, and Navy physicists W. D. Baker, D. F. Barbe and L. W. Sumney review the status of the developing technology in the December NAVAL RESEARCH REVIEWS.

CCD's consist of a slice of silicon on which has been deposited layers of metals and insulating material, sectioned into a myriad of tiny cells. As light falls on each cell, electric charge is built up proportional to the amount of light. In this way, visual information equivalent to the resolution of a full-sized TV set can be recorded and stored on a semiconductor chip about a half-inch square.

These chips can be mass produced at low cost; they record good images with little noise from very dimly lit scenes, use little power and are so tiny that their own weight and size are practically negligible compared with that of the lenses required for imaging. Besides storing visual information, they can be used in computers as digital memory units, at a cost of one-tenth to one-hundredth that of other solid state technologies. CCD units could thus replace the much larger magnetic disks and drums as auxiliary memory units, at lower cost and much faster access time.

Military applications include guidance systems for bombs and missiles, and target recognition, but other uses will equally well benefit civilians. CCD's could be used in pollution detection and monitoring, earth resource detection, navigation, automatic character recognition and star mapping. Their very simplicity yields two additional benefits: little extraneous signal and a long, reliable use-life, making their rapid introduction to communications systems likely.

Biomedicine

Changing your Type A personality

Persons who are aggressive, competitive and tense—a so-called Type A personality—have been found to be more prone to heart attacks than persons with more easy-going personalities. Changing Type A behavior isn't easy, but it is possible. For instance, yoga and relaxation can reduce blood pressure, Chandra Patel of Croydon, Surrey, England, reports in the Jan. 11 LANCET.

Twelve patients with high blood pressure came to Patel three times a week for three months for psychophysical relaxation exercises based on yoga principles and reinforced by biofeedback instruments. The patients then continued relaxation exercises at home for nine more months. Patel followed their blood pressure during this time, and compared it to that of control patients with high blood pressure. He found that the exercises did reduce blood pressure.

When some of the patients on relaxation exercises had trouble disciplining themselves to regular practice, Patel suggested they use red traffic lights and ringing telephones and door bells as signals to quickly check for tension and relaxation. These checks were found to be an effective substitute for regular exercise sessions.

Chromosomal defects and disease

Several pieces of evidence suggest that abnormalities of a specific chromosome may be associated with specific diseases. Abnormalities in chromosome 14 have been linked with Burkitt's lymphoma and other diseases of the lymphatic system. The genes of a particular cancer virus have been located on chromosome 7 in human cells made cancerous by the virus. Human chromosome 19 carries the gene for the polio virus receptor.

Now more evidence that specific chromosomal abnormalities may underlie specific diseases is reported in the January PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES by Janet D. Rowley of the University of Chicago. Rowley has found frequent chromosome 8 abnormalities, and occasional chromosome 7 and 9 abnormalities as well, in patients with leukemia and other blood diseases.

The frequent occurrence of a chromosome 8 abnormality, Rowley suggests, may be the result of a particular genetic defect on this chromosome. Other investigators have found that the gene that codes for a particular enzyme may be located on this chromosome, and patients with anemia show an abnormal amount of the enzyme. Or chromosome 8 may be the site for the insertion of a cancer virus.

Chemicals behind the nerve impulse

Nerve impulses are transferred from neuron to neuron by acetylcholine, dopamine or other chemical transmitters. But what exactly releases a chemical transmitter from the presynaptic membrane of the nerve cell? Past experiments have ruled out potassium and sodium ions as triggers of transmitter release. One experiment strongly suggested that calcium ions might cause transmitter release. When two investigators blocked potassium activation at the presynaptic membrane, the membrane generated a calcium-dependent nerve impulse that was accompanied by transmitter release.

Now Rodolfo Llinás and Charles Nicholson, neurobiologists with the University of Iowa, report in the January PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES that they have directly related transmitter release with an influx of calcium through the membrane and into the neuron.

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