Biomedicine

From the meeting in San Antonio, Tex. of the Endocrine Society

Placental hormone for birth control

One of the first signs of pregnancy is the rise of the hormone human chorionic gonadotropin (HCG). This change is the basis of pregnancy tests. Now Canadian scientists propose that, with a subtle chemical modification, HCG may provide a practical means of contraception.

In its normal action HCG binds early in pregnancy to special receptors on the membranes of ovarian cells. These cells react by producing the hormone progesterone, which is essential for the continuation of pregnancy. Keiichi Kato and Malur R. Sairam of the Clinical Research Institute of Montreal have removed sugar portions from HCG molecules. They find that the partially denuded hormone binds tightly to the receptors, but it does not trigger progesterone production.

When the modified HCG was injected soon after conception, it prevented implantation of fertilized ova or terminated an already established pregnancy. When altered HCG was injected into nonpregnant rats, it reduced ovulation rates. This result is probably due to the similarity of HCG and another hormone, luteinizing hormone (LH), essential for release of ova.

If the treatment was begun later in pregnancy, when HCG and LH are no longer necessary, the altered HCG had no effect on fetal survival. The scientists say this indicates the modified HCG is not toxic.

Early menarche, more sex hormone

Women who have their first menstrual bleeding (menarche) relatively young are at increased risk of breast cancer developing later in life. Those who experience menarche before 12 years of age are twice as likely to develop breast cancer as those who have menarche at 13 years or later. Reijo Vihko of the University of Oulo and Dan Apter of the University of Helsinki in Finland now propose an explanation. An eight-year study of 200 schoolgirls revealed that early menarche is associated with several years' additional exposure to increased estrogen stimulation. In the girls who began menstruating at the younger ages, there are higher levels of estradiol, the female sex hormone secreted by the ovaries, than in the group with later menarche. This difference was apparent in data gathered both before and years after menarche. In addition, Vihko and Apter report that menstrual cycles with no release of an egg are more common among the girls who began menstruating relatively late. The time from menarche until 50 percent of cycles were ovulatory is about 1 year for the girls who first menstruated before 12 years of age; 3 years when menarche came during the twelfth year (the average for this group) and 4.5 years when menarche occurred at age 13 or older.

Sluggish thyroid in Down's syndrome

A common cause of mental retardation is an insufficiency of thyroid hormones at birth, a condition called congenital hypothyroidism. When the condition is detected, it can be treated with hormone replacement therapy. Infants with Down's syndrome, a chromosomal aberration also causing mental retardation, have an increased incidence of congenital hypothyroidism, report investigators at North Shore University Hospital in Manhasset, N.Y. Studying 1,130 Down's syndrome infants tested in a screening program, Pavel Fort and Fima Lifshitz find the incidence of hypothyroidism is about 1 percent, almost 40 times that of the general infant population. The investigators recommend that all newborns with Down's syndrome have thyroid hormone (T4 and TSH) levels determined on an initial screening and again periodically for two years. They say, "This approach followed by a prompt treatment of those found to be compromised may prevent further deterioration of these mentally compromised children."

Energy

Dung power and milk-warmed water

Should a cow heat your parlor? Can milk warm your water? To dairy farmers, these are not silly questions. Electricity costs have skyrocketed over the past decade, climbing 83 percent for Maryland milk producers, 97 percent for those in the Northeast. Tapping unconventional resources for heat and power could stretch shrinking farm fuel budgets. But one must be aware of the conditional economics associated with these alternative energy sources, note George Stevens and Herbert Brodie in the latest JOURNAL OF THE NORTHEASTERN AGRICULTURAL ECONOMICS COUNCIL (Vol. 12, No. 33). An agricultural economist and engineer, respectively, with the University of Maryland in College Park and Queenstown, Stevens and Brodie point out that electric power from manure-generated methane probably won't make economic sense for most dairy farmers.

"For the few dairymen who pay 8¢ per kilowatt-hour (kWh) [as they do in parts of Maryland] and have over 100 cows, such a system could save them money," Stevens says. However, the national average kWh-cost charged by rural-power cooperatives is only 4¢, the Rural Electrification Administration says. Moreover, Brodie notes, "If you're looking at the average dairy farmer across the country, 300 cows is a lot." (In Wisconsin, the dairy capital, many farms have only 30 to 50 animals). Yet the calculations by Stevens and Brodie show that 300 cows would in fact be needed, in regions charging 8¢ per kWh, if a farmer were to recoup within 10 years — via annual savings — the cost of the equipment that digests manure into methane and that generates electricity.

Heat reclaimers for cow's milk generally offer a better return on investment, according to James Garthe, a Pennsylvania State University agricultural engineer at University Park, Pa. Milk, about 95°F when it leaves the cow, must be cooled immediately to around 40°. A reclaimer works much like a heat pump to extract the heat from milk. In fact it is capable of heating water high enough in some cases to be used for sterilizing equipment without booster heaters, Garthe says. And if the farmer's cows produce 125 gallons of milk or more daily and the farmer has use for 200 or more gallons of 135° to 165° water, a system can usually be found that will pay back its equipment costs in three and a half years. A computer program is available at Penn State to help individual farmers determine if they can profit from such a system.

DOE's last first-generation fuel cell

Work began last month on the final stage of the Department of Energy's (DOE) program to develop a first-generation technology for commercial fuel cells to be used in the electric-power industry. In a controlled electrochemical reaction that combines hydrogen and oxygen to make water, fuel cells produce electricity directly from fossil fuels. Resembling batteries, fuel cells operate—without recharging—as long as a steady supply of fuel is fed into them and a waste-stream of unused byproducts is carried away. In the first generation of these devices, phosphoric acid separates the cells' electrodes in a role akin to that played by the sulfuric acid in today's automobile batteries.

At the heart of a fuel-cell power plant are its stacks. In the new stack being developed by United Technologies Corp. in South Windsor, Conn., 400 to 500 individual fuel cells — each with a 10-square-foot surface area—will be mounted one atop another. Capable of producing 11 megawatts of electricity, each stack would more than double the output of the nation's first prototype fuel-cell powerplant, which is scheduled to begin operation later this year. The first-generation devices are expected to have an operating life of about four and a half years, and an efficiency approaching 40 percent. DOE hopes the molten-carbonate technology being developed for the second generation will increase efficiencies another 10 percent.