Biology

Gene-splice harvest: Fertility hormone

A human hormone used in treatment of reproductive problems has been synthesized with recombinant DNA techniques. Integrated Genetics, a biotechnology company in Framingham, Mass., recently announced production of the hormone called human chorionic gonadotropin (hCG). It was synthesized and secreted by genetically engineered mammalian cells growing in laboratory culture. Integrated Genetics reports that the hormone produced was more pure than, and as potent as, commercially available hCG from urine of pregnant women.

Human chorionic gonadotropin is the most complex molecule yet elaborated by cloned genes introduced into foreign host cells, according to the company. Two subunits, encoded by different genes, must each be trimmed from precursor molecules, and a complex series of sugars must be added to each subunit before they are combined. The protein synthesizing machinery of the mammalian cells carries out these processes.

The company predicts the new technique, for which patents are pending, will lead to less expensive and more abundant human fertility hormones. Integrated Genetics is also working out methods to produce luteinizing hormone and follicle stimulating hormone. The hormones so produced are expected to be more uniform than those now available, allowing for better controlled therapy and fewer multiple births. The technique is expected to aid research on hormone biochemistry, such as determining the roles of the added sugars, and attempts to modify hCG to produce forms with improved or novel actions.

Current therapeutic uses of hCG include treatment of hormone imbalances and infertility in both men and women. It is also used to prevent some types of miscarriage and, in *in vitro* fertilization procedures, to control the timing of egg development before the eggs are removed from ovaries. The hormone is also administered to young boys to enhance the success of procedures that correct undescended testicles. Integrated Genetics calculates that the three human fertility hormones represent a current world market of more than $25 million and a potential market of at least $50 million per year.

Proud papa frog protects eggs

Father is the primary caretaker of young Puerto Rican forest frogs. Mother departs long before the eggs hatch; the father frog tends the eggs, guarding against predatory neighbors and desiccation, 23 hours a day for two to three weeks. This picture of paternal devotion arises from the observations of F. Harvey Pough of Cornell University in Ithaca, N.Y., who has been studying the frogs, called coqui, for five years. "We believe that the male keeps the eggs moist while sitting on them either through osmosis or by urination—we're not sure which," Pough says.

The coqui are the most abundant vertebrates in the Puerto Rican tropical forest. The frogs are avid hunters at night, but are vulnerable to desiccation during the day. Pough and Margaret Stewart of the State University of New York at Albany have discovered that the size of the coqui population is controlled by the number of sites available for daytime retreat.

Pough is concerned that human activities affecting the coqui habitat may upset the ecological balance of the tropical rain forest. "Fewer retreats would lower the frog population, which could increase the insect population because frogs are major predators upon insects," Pough says. Pough and Stewart also are measuring the metabolic rates of the frogs as a key to energy flow in the forest.

Nutrition

Irradiation—it cuts the gas

Flatulence. It's something with which bean lovers have had to learn to live. Certain oligosaccharides — chains of two to 10 sugars — are the primary culprits. Because the body lacks the enzymes needed to break these sugar chains into forms that can be metabolized, the sugars pass on to the lower intestinal tract where anaerobic bacteria feast away on them. And as they do, these bacteria produce that bloating gas. Scientists have sought ways to make the beans' offending oligosaccharides more digestible. And now a pair of researchers at the Bhabha Atomic Research Centre in Bombay, India, report success in the January JOURNAL OF FOOD SCIENCE. Using cobalt-60 sources, V.S. Rao and U.K. Vakil irradiated seeds from the legume *Phaseolus areus* with gamma rays. Known generically as green gram, these beans are close relatives to the common snap bean and dry bean.

In one experiment, mature dry seeds were irradiated at dose levels of 1 to 10 kiloGray (kGy)—equivalent to 0.001 to 0.01 rads — and germinated after being stored for two to four weeks. In another test, seeds were soaked in distilled water for 16 hours before irradiation. Finally, an aqueous solution of pure raffinose — one of the nondigestible oligosaccharides — was irradiated and then analyzed for signs of breakdown.

In green gram, 40 percent of the naturally occuring oligosaccharides are sucrose, 34 percent stachyose, 15 percent raffinose, and 10 percent verbascose. Irradiation did not alter sucrose appreciably, but it did cut verbascose by 18 percent and 30 percent at doses of 2.5 and 10 kGy respectively. The most potent flatulence-producing sugars, stachyose and raffinose, broke down faster; at doses of 2.5 kGy, 50 percent of these sugars were decomposed. Finally, breakdown of raffinose in a liquid solution was proportional to dose—15 percent at 1 kGy, 45 percent at 10 kGy. According to the authors, it appears that "radiation forms weak points in the chain molecules of sugars," which make them susceptible to cleavage into more digestible units by enzymes.

Potato dilemma: To bake or to fry?

Nutritionally, baked potatoes are better than fried, a pair of Cornell University food scientists report. And their assessment doesn't even deal with the issue of cholesterol or fat. Using three locally grown varieties of potatoes (Katahdin, Chipbelle and Rosa), Rathy Ponnampalam and Nell Mondy characterized the protein, amino acid and nitrogen content before and after cooking. Because of the growing popularity of fried potato skins as a restaurant offering, the scientists also divided each half potato sampled into pith (roughly the inner 60 percent) and cortex tissue (the remaining outer portion — typically the part sold to restaurants for serving as fried skins).

The researchers found that frying decreased skin-area amino-acid content by 45 percent and pith-area amino acids by 36 percent. Nitrogen — related to the protein content — also dropped dramatically after frying. As a result, protein content averaged across the varietal strains dropped 43 percent in the skin area verses 22 percent in the pith.

By contrast, amino acids in the skin region were reduced a mere 5 percent by baking, and baking actually elevated their levels in the inner pith by 13 percent. Baking similarly cut protein levels 10 to 20 percent in the skin, yet increased pith protein by 8 percent in Katahdin and 20 percent in Chipbelle (for Rosa, pith protein fell 2 percent after baking). Ponnampalam explains that as conventional baking slowly heats the potato from the outside in, "some of the proteins move from the outside [tissue] to the inside pith."

It's not uncommon for baked-potato eaters to scoop out the center portion, leaving the skin area behind as scrap. But data reported by the researchers in the January JOURNAL OF FOOD SCIENCE show that the skin area usually has a higher proportion of proteins and amino acids—even after baking.