

# Gene Cuisine on the Menu

By STEVE STERNBERG

If Charles Darwin and Gregor Mendel could tuck in their napkins, take up their forks, and enjoy a 21st-century dinner together, they might marvel at how much of their work went into the dishes arrayed before them.

Over salad, they might praise the tomatoes, genetically engineered to stay fresh, firm, and juicy without losing their taste. Or the lettuce, fortified with the genes responsible for broccoli's rich concentration of nutrients. Or the dressing, made with canola oil that was bioengineered to have the low saturated fat content of olive oil.

For the entree, the esteemed biologists might relish pork from pigs dosed with a recombinant growth hormone that reduces its fat content by a third. The corn has been engineered to express a toxin that protects it against borers. Even the bread is made with recombinant wheat, a strain enriched with the genes for gluten proteins once found only in premium varieties.

Dessert is not Death by Chocolate but Bananas Immortalité, which delivers a tasty dose of hepatitis B vaccine.

Sound impossible? It's true that science is not likely to raise Darwin or Mendel from the dead. As for the courses served—geneticists are already setting the table.

Using the new tools of biotechnology, innovative thinkers have usurped the power of genetic recombination from nature and altered in dramatic ways the traits to be expressed by future generations of some food crops. Indeed, they have already produced some of the items on this futuristic menu. By the end of last year, federal regulators had approved recombinant strains of canola, potatoes, soybeans, squash, corn, and both full-sized and cherry tomatoes. Even the vaccine-bearing banana is a reality, on the brink of a preliminary test in 12 volunteers. Thirteen other recombinant vegetables await government approval—a courtesy, not a requirement under federal rules, which view many genetically engineered plants as equivalent to hybrids made by other means.

Although breeders have been genetically improving plants for centuries, the new foods differ from ordinary hybrids. Many products contain genes from other species or genes that did not exist until they were constructed in a laboratory. Consider the MacGregor Tomato by Calgene Fresh of Evanston, Ill. It bears a lab-made antisense copy of the tomato's putrefaction gene. This new antisense gene, which cancels out the activity of the normal version, prolongs ripeness, so the fruit can be harvested late, when it is most delicious.

Over brandy, as yet unimproved by biotechnology, Darwin and Mendel might express some reservations about the

unearthly bounty they've just dined upon.

"Could you have conceived of such a feast when you were working with the simple pea?" Darwin might ask.

"I gave them Pandora's box—they opened it," Mendel replies.

Modern geneticists certainly harbor some concerns. A report in the February *BIO SCIENCE* notes that genetic engineering may lead to unintended consequences, including the transfer of recombinant genes from crops to their wild relatives, the development of new weed species, and the creation of ecological imbalances among insect species by transferring genes that code for proteins toxic to one species but not another.

Gene manipulation may also create animals with characteristics that could have a damaging impact if the genes escaped into larger populations. For instance, the low-fat hogs have maldeveloped limbs that retard their mobility. Fish now being developed to grow faster and produce more offspring may have an adaptive advantage over their wild cousins, ultimately reducing genomic diversity.

Ronnie Cummins, director of the Pure Food Campaign in Washington, D.C., which opposes genetically engineered foods, fervently hopes that scientific obstacles and consumer resistance will doom the fledgling industry by discouraging investors from risking money on long-shot products.

Not every company that has invested in biotech foods is a struggling start-up, however. Monsanto Co. of St. Louis, Mo., and Ciba-Geigy Corp. of Summit, N.J., are among several Goliaths that have invested in efforts to boost the quantity of food production by assuring

greater yields and less spoilage.

Pressure to accomplish these aims will most likely increase in coming years, driven by the uncontrolled growth of the world population and a shortage of arable land. Charles J. Arntzen of the Boyce Thompson Institute for Plant Research in Ithaca, N.Y., contends that genetically engineered foods "are part of the continuum we've been on since the 1940s—trying to develop new ways to produce more food of better quality." Arntzen's institute has pioneered the vaccine-bearing banana, implanting in it the genes that code for elements of the hepatitis B virus' protein coat. The fruit is intended as a practical, inexpensive way of vaccinating impoverished children.

Gerald E. Gaull, director of the Center for Food and Nutrition Policy at Georgetown University in Washington, D.C., offers another example that might make children's eating more healthful: a potato with a surfeit of starch, which would soak up less fat while being transformed into French fries or potato chips.

"What's next?" Darwin might well wonder.

Replies Mendel, "A new pea?"

□



Dan Skripickar

1990 Big Bang confirmed

1990

Gene therapy used in human

1992

First detection of a planet outside solar system

1992

Dioxin recognized as a hormone-mimicking pollutant

1992

Imprint of primordial cosmic fluctuations found

1994

Mutant gene identified in breast cancer

1996

Ancient Martian meteorite may contain primitive bacteria fossils

1997

75TH ANNIVERSARY OF SCIENCE NEWS

1996

Sequencing of yeast genome completed

1993–1994 Fermat's last theorem proved