experimental area 12,000 square meters. The chosen region must be capable of supplying 1,500 to 2,000 megawatts of electrical power, and the site must be near a river or reservoir to provide cooling water.

The plan contains no radically new departures in the technology of accelerating waveguides or bending magnets. The Soviets, who have a reputation for conservatism in such matters, have applied tested principles of strong-focusing synchrotron design.

An important new feature is what the designers call the cybernetic control. An accelerator operating at 1,000 GeV would be fiercely radioactive. If it had to shut down for adjustment, a good deal of time would be lost waiting for the residual radiation to dissipate before repairmen could be sent in. The Soviet design therefore includes sensors at various points, which will monitor performance and feed information to automatic controls.

It is to test this cybernetic principle that the 1-GeV pilot was built.

Experimentally the 1,000-GeV machine would operate in the narrowest regions of particle physics. The more energy a proton beam has, the shorter the distances at which it can view physical processes: the experimental planners talk of million-billionths and 10-million-billionths (10^{-15} and 10^{-16}) of a centimeter.

Many theories of particle physics, including the symmetry groups that have been so much discussed, could be checked at ultrahigh energies.

If other attempts fail, the 1,000-GeV machine could be used to search for yet unseen, but theoretically desirable, particles, such as quarks and intermediate vector bosons (SN: 11/16/68, p. 500).

It could be used as well to see whether there is an upper limit to the possible mass of elementary particles. Current theories say there is none, but some experimental evidence seems to show a limit at a mass equal to 5 GeV of energy, about five times as heavy as a proton.

Experiments at 1,000 GeV could also check whether physicists' present concept of space and time needs modification. The present view was developed by H. A. Lorentz, Albert Einstein and Hermann Minkowski to accommodate electromagnetic theory, and some fear it may not transfer intact to the narrow dimensions and high energies at which the strong nuclear forces operate (SN: 6/29/68, p. 621).

And finally, as Dr. Bruno Pontecorvo points out, who knows what may come up? "Many problems inevitably arise . . . after the first results of the physical experiments are obtained."

Practical justification for the machine causes the Soviet physicists no anxiety. "The history of the development of physics shows that the discovery of fundamental laws leads, as a rule, to the revolutionary advancement of engineering," say Drs. B. A. Dolgosheina, Yu. P. Nikitina and V. V. Frolova in the experimental volume.

Accelerators of similar energy have been discussed by American physicists, and some preliminary studies have been made, especially at Brookhaven National Laboratory. But at present, says Dr. Wallenmeyer, no U.S. group is working on any such detailed plan for an accelerator near the 1,000-GeV range. ◇

PGF_2 ALPHA

Contraception despite ovulation

Human reproduction is a complex and exquisitely balanced process. Governed by the flow and interaction of hormones and other chemicals that regulate the production of sperm, the release of eggs and the uterine environment in which they meet, conception will not take place in the presence of the slightest imperfection or interference with the process.

To fertilize an egg, sperm must get through the mucus barrier across the cervix. They must capacitate, become potent, in uterine fluid. They must penetrate the egg's shell or covering, called the zona pellucida.

Unless follicles in the ovaries rupture, no egg will be released. Unless conditions within the uterus are favorable, an egg that is fertilized will not be embedded in the nourishing uterine wall and no fetus will grow.

In view of this, available birth control pills that work by completely shutting down the process of ovulation are a sledge hammer approach to contraception (SN: 4/15/67, p. 349). Ever since their development nine years ago, reproductive physiologists have been looking for a less heavy-handed contraceptive drug.

One possible approach being tested by Dr. Sheldon Segal of the Population Council in New York is a tiny pill, containing a single hormone, progestin, rather than the usual estrogen-progestin combination. Although the exact mechanism of its action is unclear, there is some evidence that low dose progestins, taken every day, work by altering the consistency of mucus covering the cervix, thereby preventing sperm from getting by. However, Dr. Segal told an American Association for the Advancement of Science symposium on the control of fertility, the main drawback is that about 30 percent of women using this experimental pill have extremely irregular menses.

Another possibility, reported by scientists from the Upjohn Company in Kalamazoo, Mich., involves a chemical unrelated to traditionally used sex hormones. Called PGF_2 alpha, it is one of 16 known prostaglandins—a family of extremely potent lipid acids that exist in a variety of human tissues and have a variety of application as drugs. In their various forms, prostaglandins are thought to regulate a myriad of functions including smooth muscle activity, gastric secretions, cardiovascular behavior and reproduction.

Dr. Bruce B. Pharriss, starting with the knowledge that PGF_2 alpha constricts veins, reasoned that it might have a contraceptive effect by stopping blood flow from the ovaries, where a yellow endocrine body called the corpus luteum is formed immediately after ovulation. The corpus luteum supplies progesterone (carried by ovarian blood) to the uterine wall in which an egg is embedded if it has been fertilized. If fertilization does not occur, the corpus luteum regresses and the progesterone-starved uterine wall is shed in menstruation. If pregnancy does occur, both bodies continue to fulfil their function.

The PGF_2 alpha, Dr. Pharriss found in tests with rats and rabbits, restricts the outflow of ovarian blood, causing corpus luteum regression and menstruation even if an egg has been fertilized. Dr. Kenneth Kirton reports the same phenomenon in rhesus monkeys, explaining that the drug must be given between the eleventh and fifteenth days of the cycle, after ovulation takes place.

The potential advantage of PGF_2 alpha, Dr. Pharriss observes, is that it does not prevent ovulation. Nor does it have any apparent effect on the pituitary gland, as do estrogen-progestin combination pills. Though human trials in the United States may be a year or more away, researchers at the Karolinska Institute in Stockholm already are testing it.

Discussing the potential moral questions raised by what is, in effect, a morning-after contraceptive, Dr. Pharriss likens PGF_2 alpha to intrauterine devices which, by some poorly understood action, will also expel a fertilized egg. "This should not constitute an abortion by most persons' definitions," he declares, "because it works before implantation occurs, before you could even know whether or not an egg was fertilized."