

ful chairman of the tax-writing House Ways and Means Committee. Mills, in the past, has been the principal obstacle to the employment of tax incentives as a stimulus to industry to make social investments. Mills objects in principle to the manipulation of the tax structure for nonrevenue-related ends. He also would insist that tax credits, or other tax incentives, show up in the budget as Federal expenditure so as not to become a back door approach to Federal spending.

Mr. Nixon has already conferred with Mills on the prospects. He wanted to know, for starters, how Mills would react to the use of a tax credit to induce industrial participation in a Federal job training program.

Mills' ultimate reaction to the proposal, when it comes up for hearings before his committee, may well determine the fate of broader tax incentives in the coming years and Mr. Nixon's ability to deliver on his promise of more private participation.

A wide variety of industries is waiting in the wings for the outcome:

- Steel, oil, chemical and other industries often identified with water pollution pressed hard last year and the year before for tax incentives—either tax credits or a write-off—as a stimulus to their investment in water pollution control facilities. They almost won it, attracting wide support in the Senate, but crumbling against the bulwark of House Ways and Means.

- Budget and economic advisers to both President Johnson and President Kennedy before him have considered the use of tax concessions to stimulate private support of research. This idea, too, was unpalatable in the House, though aerospace and electronics corporations found the idea intriguing.

In addition, besides the proposal for the training of workers, Rep. Mills' committee expects to have before it this year proposals for tax credit treatment of such diverse expenditures as the rehabilitation of gold mining property, housing in urban poverty areas, state tax payments and expenditures on higher education. The Congressional future for all of them is bleak.

Nevertheless, Mr. Nixon's new Secretary of the Interior, Alaskan Governor Walter J. Hickel, has already endorsed Federal incentives for water pollution control efforts by industry. The new Secretary of Commerce, former Budget Bureau Director Maurice H. Stans, has declared that tax incentives would be necessary for some, though not all, efforts at "marshalling the efforts of the business community" in assault on the nation's problems. And Governor George W. Romney, Secretary of Housing and Urban Develop-

ment in the new Administration, regards tax credits as a "tool we ought to take a look at."

Rep. Mills was noncommittal on the subject after talking with Mr. Nixon.

As an aide to Chairman Mills expressed it: "He's going to listen and could be persuaded, but he hasn't been in the past." His sympathy toward an incentive plan to draw private industry into the ghetto is even less likely. And Rep. Mills' supporters in Congress on this issue have declared tax incentives in such areas as research and pollution control a flat giveaway of public funds.

Joseph A. Peckman, director of economic studies at the Brookings Institution, declares that many of the tax incentive proposals would "introduce wide-open loopholes that would be exploited by sharp operators. All the proposals would greatly complicate the tax laws.

"**Tax laws** are already riddled with special provisions which should be removed in the interest of equity, simplification and improved economic performance," says Dr. Peckman. "Few of them would be tolerated if these provisions were subject to the same scrutiny given by Congress to direct appropriations."

But with Mr. Nixon's emphasis on this approach, many economists and social scientists who view tax manipulations suspiciously are guarded in their remarks. While the general opinion is that tax credits should be used only as a last resort for goals of major importance, each analyst can think of one area where they might work.

James L. Sundquist of the Brookings Institution, for instance, notes that a tax incentive might work in developing the industry of rural areas. Its value would be to hold down migration to big cities—if the country should want such a national policy.

But Sundquist, an expert on job training, opposes tax credits for employe training. "The Government would be subsidizing a lot of people and buying nothing," he says. "Job training is one of the least attractive areas for tax incentives." Recently, the National Commission on Urban Problems, headed by former Senator Paul H. Douglas (D-Ill.), said the same thing about housing, contending that tax incentives are the least efficient form of subsidy for stimulating ghetto housing construction.

The fact is that until now, little real thinking has gone into the idea of using tax policy to promote social change and betterment. But the time has come to begin. As one unhappy legal assistant to Rep. Mills says, "I don't want to think about it, but I guess I'll have to."

SOVIET PHYSICISTS

Race toward the 1,000 GeV

Of all the races in which the United States and the Soviet Union are engaged, the one with the most immediate relevance to physics is the high energy accelerator race. A more complex relationship than the space race or the arms race, the accelerator rivalry has been characterized by the presence of a third party, Western Europe, and by a fairly complete exchange of information and some exchange of personnel.

Nevertheless, at the moment the Soviets are ahead in the hardware part of the competition since they are operating the world's most energetic accelerator, the 76-billion-electron-volt (GeV) synchrotron at Serpukhov. The United States is now constructing a 200-to-400-GeV machine at Batavia (formerly Weston), Ill., and the Europeans are planning a 300-GeV machine for a still-unselected location (SN: 1/4, p. 10).

Meanwhile, the Soviets are already planning their next giant step, a 1,000-GeV machine, the like of which has never gotten beyond preliminary discussions in the United States.

The Soviet Government has not yet made any public commitment to build such a machine, and it is difficult to know how seriously to take the plans. The Russians, says Dr. William A. Wallenmeyer of the U.S. Atomic Energy Commission, are not usually very secretive about their activities in this field, but, on the other hand, one can never be entirely sure that they have revealed everything they are about to do.

Yet, two groups of highly regarded Soviet physicists have spent a good deal of their recent time preparing detailed plans, not only for the design of the machine but also for a general experimental program. The plans come in two thick volumes (AEC-TR-6936 and 6949) which the AEC has just finished translating for the benefit of interested American scientists.

The tone of the documents is confident; the compilers seem to take for granted that such a machine should and will be built. According to the leader of the design study, Dr. A. L. Mints, they have recently completed a 1-GeV pilot model to test the special control mechanisms designed for the big machine, presumably with the approval of their government.

The main accelerator ring for the 1,000-GeV machine would be 5.434 kilometers across. The designers figure the whole installation will need a site of not less than 150 square kilometers. A main experimental area would cover 75,000 square meters, and a secondary

18 january 1969/vol. 95/science news/63

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.

PGF₂ 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 PGF₂ alpha, it is one of 16 known prostaglandins—a family of extremely potent lipid acids that exist

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. ◇

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 PGF₂ 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 PGF₂ 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 PGF₂ 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 PGF₂ 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."