the obesity story. Only in the 1970's did Scandinavian adoption studies confirm that a vulnerability to alcoholism is highly heritable. Now Schuckit is looking at a high-risk group—sons of alcoholics—to try to locate predictive factors. He has found that while they do not differ biologically or psychologically from controls prior to taking a drink, the sons of alcoholics get less "high" according to both subjective and objective measures such as body sway. They also show more rapid decreases in cortisol and prolactin, two chemicals that rise with alcohol intake. But, as Schuckit indicated, even if a chemical "marker" for vulnerability to alcoholism is found, the mental health system will always be intimately involved with treatment and prevention.

Infants, like kittens, may be innately fearless or inhibited.

As these speakers made clear, biological etiology does not automatically imply primary reliance on biological treatment interventions. In Alzheimer's disease, for example, Gene Cohen of NIMH related that psychiatric treatment can make major inroads on accompanying symptoms such as depression and delusions. And Gerard Hogarty of Western Psychiatric Institute and Clinic in Pittsburgh reported results of a "family psychoeducational study" showing that high relapse rates that afflict schizophrenics despite drug therapy can be avoided with carefully orchestrated family therapy.

Speakers at the meeting waxed enthusiastic about the current "golden age" of brain research, advances in imaging technology, refined biochemical measurements, new families of psychotropic drugs, and the increasing sophistication in diagnosis. Herbert Pardes of Columbia University College of Physicians and Surgeons quoted Lewis Thomas to the effect that "the decades ahead will almost certainly revolutionize all our earlier notions about the brain and the mind that it operates or that operates it."

But as psychiatrist David A. Hamburg, president of the Carnegie Corporation, pointed out, mental health must be addressed at all levels—from the cell to the organism to populations—and warned that some social sciences are being as badly ignored today as genetics was 40 years ago. So nature versus nurture is beside the point. The relevant questions have to do with which levels of inquiry will produce the most fruitful results. ■

CONSTANCE HOLDEN

Pentagon Plans New Antisatellite Tests

The political outlook for the program has improved, although a new report by the General Accounting Office is beginning to stir up trouble

THE U.S. antisatellite (ASAT) weapon program, hobbled last year by congressional opponents, will soon be reinvigorated if the Pentagon gets its way. Legislation proposed by the Reagan Administration and approved by the Senate Armed Services Committee will provide an infusion of $113 million in new funds, as well as authorization for a new round of tests against targets in space.

Many of the opponents, who persuaded Congress to ban such tests last year, concede that the outlook for the program is now much more favorable. Previously, they had garnered support from those who doubted whether the ASAT would work, as well as those who feared it would work too well. Senior Air Force officials conceded that ASAT suffered from various technical ailments and called it one of the most difficult military development programs ever undertaken.

But now, after an intense round of internal criticism, the program has been reorganized and obtained new management. ASAT production has been postponed, research has been stepped up, and a new effort has been devised to increase reliability and quality control. Integrated chips in the ASAT will be modernized, its computer software and electronics will be improved, and its propellant will be modified in an effort to avoid additional technical embarrassment. The goal is to possess a device, no bigger than a breadbox, capable of streaking into space at enormous speed and running head-on into Soviet satellites.

Congressional opponents, led by Representatives George Brown (D–CA) and Norman Dicks (D–WA), thought they had stymied this goal forever by successfully enacting a ban on ASAT tests against space targets, contingent on the observance of a testing moratorium by the Soviet Union. But they were shocked to learn from lawyers at the General Accounting Office (GAO) a month ago that their ban is temporary, not permanent, and good only through the end of the current fiscal year.

Since then, they have been scrambling to resuscitate the coalition of arms and waste controllers who voted to terminate the program on the last go-around. Their principal weapon is another recent GAO report which suggests that the new ASAT reorganization is a bust. Details of the 36-page report, dated 11 June, are scarce because it has been classified "Secret" by the Pentagon. But among its conclusions are the following:

- Although the program's overall size has been drastically reduced under the reorganization, its cost—roughly $4 billion—will still be much higher than promised. Based on total expected research, development, operations, and maintenance expenses, the cost of each ASAT weapon will in fact be roughly $110 million, nearly as much as some of the satellites in the target set, and more than 50% above last year's estimates and 350% above initial expectations.
- Due to various deployment constraints, the ASAT will under some scenarios be incapable of quickly destroying the Soviet satellites considered most worrisome by the United States. In addition, it may be incapable of reaching the required altitudes because of limitations in the power of the F15 jet fighters from which it is launched.
- Internal disagreement about the program persists, with one branch of the Air Force, concerned with weapons reliability, arguing that the test program is too meager, and another, concerned with its development and cost, insisting that it is adequate. Brown, who declines to comment on the GAO report in detail, concludes that it "shows that the ASAT program is way over budget, way behind schedule and unable to meet its mission requirements. If Congress gives this program the go-ahead, we'll end up with a multi-billion-dollar boondoggle that's obsolete the day it's deployed."

An Air Force official, connected with the space defense program, vigorously contested these criticisms in an interview with *Science* that was approved by the Air Force Secretary. "We simply don't think it's a problem," was the official's refrain in addressing each of the GAO complaints. He does not dispute that a year ago the program was in

poor shape. Engineers at the Vought and Boeing corporations, following a written presidential determination that the ASAT should be developed "as soon as possible," were struggling to prepare for production even as tests revealed numerous design defects. Several motors exploded, the cryogenic cooling system for an infrared sensor malfunctioned too often, and a space test was accidentally terminated when the ASAT failed to separate from its booster.

Last summer, however, then Air Force Under Secretary Edward Aldridge ordered an independent audit of the program, and ultimately decided that production should be postponed because the design was unfinished and the production process was undefined. In addition, he noted, the Soviet threat had changed, with some satellites moving to higher orbits and others being deployed at higher orbits to serve new functions.

As a result, the program was explicitly divided into two phases, with the near-term effort aimed at the "highest priority" low altitude Soviet targets and the far-term effort aimed at somewhat higher altitude satellites using spin-off "Star Wars" technologies such as ground-based lasers and ground-launched kinetic kill vehicles. "As the threat changes, new development efforts should be anticipated," says the official justification for the 1987 budget. "This is a continuing program."

An ambitious ASAT testing schedule has been set, involving five launches over the next 15 months. The first two will be aimed at stars that appear just above the earth's horizon, amidst a great deal of background clutter, as a rough test of the weapon's capabilities against low-altitude Soviet land and ocean reconnaissance satellites, considered to be among the highest priority targets. According to the GAO report, an organization known as the Air Force Operational Test and Evaluation Center, or AFOTEC, located in Albuquerque, has criticized these plans, noting that the tests would be more realistic if they were conducted against a special instrumented balloon created to mimic the orbital characteristics of the key satellites.

A total of eight tests are planned against balloons, including three next year, but apparently none will be in the range of 160 to 275 kilometers where the primary target satellites orbit. The reason is that the balloon, which lacks substantial orbital maneuvering capability, is incapable of sustained flight in an environment with such high atmospheric drag. As a result, according to the GAO report, "AFOTEC believes the test results against the [balloons] . . . may be of limited value in projecting the system's performance in an operational environment."

The organization recommends that the total number of tests be expanded from 12 to 15 to help overcome this deficiency, but the ASAT program managers have thus far refused to budge. They claim that computer simulations have provided ample evidence of ASAT effectiveness at low altitudes, and that, in any event, modifications to the target balloons or additional space tests would be too expensive. They also point to the successful destruction of Solwind, an aging U.S. scientific satellite, on 13 September 1985, despite the fact that it had a low infrared signal.

"There are some situations in which we have trouble [destroying high priority targets]."

The GAO report raises several other serious concerns, however, including the potential ease with which Soviet satellites might maneuver out of view of U.S. sensors, and thus escape an ASAT attack for days or weeks. The problem stems in large measure from the fact that the target coordinates for the weapons must be supplied more than hours before an attack. If, during this period, the Soviets are able to slow the movement of their vulnerable satellites or substantially change their altitude, the coordinates may be useless.

The situation is not clear-cut, because the Soviets may not know when the United States is planning an attack and ultimately, the maneuvering Soviet satellites would exhaust their fuel supplies. But the problem is clearly exacerbated by a recent Pentagon decision to restrict ASAT deployment to a single site in Langley, Virginia, rather than a site in Virginia and a site in Seattle, Washington, in order to cut costs; this effectively halves the number of maneuvers that Soviet satellites must undergo. It is also exacerbated by the fact that in a serious military alert, at least seven major U.S. ground-based radars that presently help track satellites will instead be charged with tracking ballistic missiles.* Although other sensors would remain on duty, the result of this transfer would be to limit the number of times that Soviet satellites could be observed, and ultimately to degrade the accuracy of the orbital coordinates fed to the ASAT, according to the GAO.

The report goes on to observe that "the priority of a specific satellite may dictate committing an ASAT with less accurate target information, [but] this commitment would be made with less confidence in the probability of killing the satellite and [it would] increase the number of ASAT missiles needed to ensure a kill." Unfortunately, it says, as part of the cost-cutting drive, the Air Force also reduced the total number of ASATs to be produced from 112 to 35, with the result that the extra missiles might not be available.

The Air Force official is vague about the magnitude of this problem, but he does not deny that it exists. For "resident objects" or existing satellites, adequate information will probably be available, he says. But replacement satellites, launched on short notice, pose special problems because some can begin spying within one or two earth orbits, and prompt destruction may be impossible. "We think we can handle a significant amount of them, but it is of course dependent on the scenario. With a one base system, there are some situations in which we have trouble because of coverage deficiencies. And obviously, if a satellite has moved out of view, we won't be able to catch it." But he emphasizes that some of the Soviet maneuvers might be caught, and some may degrade the usefulness of the satellites. "We will be able to meet the near-term requirement," he says, "so long as each satellite is not maneuvered" just before it orbits over Langley.

Finally, the GAO report is also critical of the fact that under some scenarios, the engines of the F15 jet fighters from which the ASAT is launched may not be powerful enough for the weapon to be able to reach its target. Typically, the jets must accelerate to a high rate of speed before a launch so that the ASAT can obtain sufficient loft, and to do so, they must be specially "tuned"; but they cannot remain "tuned" indefinitely, because the engines would soon be ruined (and the fighters have other responsibilities). One official compares it to "running a high-performance car engine at the redline," and says that it has been a source of considerable concern to the Tactical Air Command, which operates the planes.

Unfortunately, says the GAO, it is impractical to increase thrust levels "on a contingency basis because there is no assurance that the engines can be tuned . . . quickly enough" to meet the operational requirements—thus raising the possibility that new engines might have to be installed at considerable cost. The ASAT program official responds that the existing engines can probably be tuned in such a manner that no degradation occurs, "although we concede that this has not yet been proven." Additional tests are under way.

Many of these issues are expected to surface in the congressional deliberations that begin in late July. A final decision is expected by autumn. ■ **R. JEFFREY SMITH**

*The radars are located in Greenland, England, Alaska, California, Maine, Georgia, and Texas.