question Bourne's medical and political judgment, given his position but, more to the point, poses a serious question aboout the "hypocritical system" that drove him to such lengths in the first place in the name of confidentiality. Nothing in Bourne's response suggests that he sees any duty as presidential health adviser to change the fact that psychiatric treatment might imperil one's chances of getting security clearance or to create a climate that allows individuals to seek therapy without fear of being stigmatized.

Instead, he took the occasion to observe that "If I hadn't worked in the White House, no question would ever have been raised about this," and to try to justify his action by distorting the American Medical Association's code of ethics. "Section 9 of the Principles of Medical Ethics prevents a doctor from revealing the confidences entrusted to him 'in the course of medical attendance,' " he said in an official statement that looked like a deliberate effort at distortion because of what it left out. The full AMA principle reads, "A physician may not reveal confidences entrusted to him in the course of medical attendance or deficiencies he may observe in the character of patients *unless he is required to do so by law*" (emphasis added).

Bourne also has come under attack for choosing Quaalude rather than some other sedative for his patient, even though, as he has pointed out, 1.3 million Quaalude prescriptions were written last year. It is a difficult question for an outsider to judge, but it it true that many physicians have turned to other drugs in place of Quaalude. According to scientists knowledgeable in the field, Quaalude was believed to have advantages over barbiturates, especially with respect to REM or deep sleep. As one pharmacologist put it, "Barbiturates knock the hell out of REM sleep. Theoretically, Quaalude doesn't, but that assumption doesn't seem to be holding up. In any event, there are a number of perfectly good sleeping pills that aren't controlled substances."

Whether Bourne's choice of Quaalude was medically sound or not, he was plainly irked by the fact that within 24 hours of the fictitious prescription story's breaking, newspapers were full of stories questioning his medical judgment as well as his legal and ethical behavior. His letter of resignation suggests he departed the White House beset by the "seige mentality" other Administrations have felt but without acknowledgement that it was his own actions that were his untimely undoing. He wrote:

Dear Mr. President:

I regret that I must tender you my resignation. You are aware of the difficulty which I face regarding a prescription written in good faith to a troubled person. I believe that you have known me long enough to know that even though I make mistakes, they are of the heart and not of the mind. . . .

Last evening . . . and this morning I watched and read the press and television reports of my problem. In the last 18 hours, I have seen law enforcement officers release to the world the name of my patient, other articles containing the grossest innuendo and obviously emanating from law enforcement sources, a prosecuting attorney discuss my case on national television, references not merely to the wisdom of my medical judgment, and articles about the abuse of methaqualone with no mention of the 1.3 million physician prescriptions for the medication last year. Now the attacks move from my medical conduct to my personal conduct.

Underlying all of these developments are constant and unrelenting attacks upon me by those who seek to hurt you through my disparagement. . . .

I presume that somehow the traditional system of justice will work toward my vindication. Finally, my friend, I know that you know that it is ever more difficult for people of good will to enter public service. . . .

I fear for the future of the nation far more than I do for the future of

Your friend,
PETER G. BOURNE

Although Bourne has resigned, the episode is not yet over. Legal questions remain to be resolved but, more important, are questions about what will happen in the White House with respect to drug policy, initiatives in international health, and other matters in which Bourne was so active. As yet, there is no word on that.—BARBARA J. CULLITON

American-Soviet Relations: The Canceled Computer

The art of reprisal, as understood everywhere from childrens' playgrounds to the arenas of international politics, requires being nasty enough to your opponent for what he did to you that you don't lose face with your friends, yet not being so mean that you drive him to the next step in the reprisal cycle.

The White House's recent actions against the Soviet Union—killing the sale of a largish computer and canceling visits to Moscow by the President's science adviser and others—seem well calculated to this end. The measures accord with the widespread preconceptions that the Soviet Union desperately needs American computers and scientific exchanges, and yet they in fact do the Russians no substantive damage.

But the reprisals, even if politically necessary, are not cost free. Sale of the $6.8 million Sperry-Univac computer to Tass, like any other item of trade, would have been mutually beneficial, and its cancellation has disturbed the computer industry and the Commerce Department alike. Commerce Secretary Juanita Kreps is said by an aide to have agreed to Carter's actions only with grave reservations. As for scientists, though deeply concerned about Shcharansky and the more important case of Yuriy Orlov, they are far from wishing to see exchanges with the Soviet Union brought to a halt.

Trade restrictions have often been the government's first thought when desiring to express disapproval with other countries. This is less widely regarded as an excellent policy now that America no longer enjoys an abundantly positive balance of trade. "No longer can we afford to cut off exports as a first reaction to not liking someone. For knee-jerk reactions, we really ought to think of something less out of the imperialistic mode," says a Treasury official concerned with raising exports.

Computer exports to the Soviet Union have long been regarded with particular suspicion in Congress. One fear is that the transfer of technology will help the Soviets catch up in an area where they are perceived to be far behind. Another is that the Russians will surreptitiously divert their openly purchased American computers to military uses.

Neither apprehension is unreasonable

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in theory. But the practice is more complex. Five years ago, American analysts reckoned that the Soviet Union lagged 5 to 10 years behind the United States in computer technology, while the Russians suggested the lag was 2 to 3 years. The gap is now so much smaller that some experts find it hard to quantify. The ES 10-40, a Russian Ryad series computer built in East Germany, "is about the equivalent of last year's IBM, so they are not that far behind in central processor technology but they are behind in memory storage and peripheral devices," says one computer industry expert.

According to the same expert, the Russians can build what they have to: "If they really need it, they can do it." Much computer logic is nowadays built into integrated circuits or "chips" which are commercially available. "Once you get the chips, you can build yourself a machine. So in essence, if you deny a machine to the Soviets, you force them to buy the parts and put the machine together themselves," says an industry official.

The computer industry, though probably as well informed as anyone about the Soviet state of the art, has its own reasons for contending that sales to the Russians can do no harm. Sales of computers, particularly advanced machines, are scrutinized by an elaborate bureaucratic machinery. An interagency committee, with representatives from the Departments of Commerce, Defense, the CIA and others, judges whether sales should be allowed according to an ever-changing list of criteria which depends on the Soviets' perceived capabilities in computer technology. The computer industry complains that the Defense Department, with its conservative views on letting militarily significant technology abroad, holds the dominant voice on the committee. Maurice J. Mountain, the Pentagon's director of strategic trade, says there has been no judgment since 1974 in which the Defense Department failed to concur.

If an application is approved by the interagency committee, it is then submitted to a shadowy international group known as COCOM, or the Coordinating Committee on East-West trade. The members of COCOM, which meets weekly in Paris, are NATO countries, plus Japan and minus Iceland.

Rumors suggest that COCOM meetings are not entirely given over to sweetness and reason. The West Germans are suspected of having held up sale of a CDC computer to the Russians in order to gain chips to cash in with the Soviet Union when they raised their objections. The Japanese sold a large computer for seismic analysis to the Chinese after the United States had told American companies not to fulfill the order. The Japanese suspect that the Americans held up for 2 years their sale of a meteorological computer to the Chinese until IBM could catch up in China.

Computers that pass both the interagency comittee and the COCOM hurdles are usually sold to the Soviet Union under stipulations designed to prevent diversion of the machine to military pur-

Scientists Want Soviet Contacts Kept

"We understand that because of the present political climate most of the participants and speakers at the Sixth International Conference on Atomic Physics from Western Europe and from the United States do not now plan to attend our conference in Riga," stated a telegram sent by the American, European, and Japanese organizers of the conference to their Soviet counterparts on 17 July. The cable went on to suggest that the conference be declared canceled and regretted the loss of opportunity for scientific contacts.

Such actions by individuals or groups of scientists on behalf of beleaguered colleagues have become increasingly frequent as the Soviet Union clamps down on its human rights movement. But recently scientists have become concerned that the process may get out of hand and all exchange may be severed by government mandate. Steps in this direction include the cancellation of the trip to Moscow by White House science adviser Frank Press, and moves in Congress to place legislative restrictions on science.

One fear is that scientific exchange may be made to bear the brunt of future expressions of displeasure with the Soviet Union. Wheat farmers have the clout to prevent a cutoff of grain shipments, industry can protest trade restrictions, but there is no immediate lobby to protect scientific exchanges.

Scientific groups have begun to make plain their desire that they be left to conduct protests in their own way and without government patronage or direction. "As for scientific exchange and its rules, we believe these matters are best left to the scientific community and to the consciences of its individuals. The result of leaving these matters to scientists will be, we believe, an optimum combination of protest and boycott on the one hand, and of continuing contact on the other," Federation of American Scientists director Jeremy Stone told a House committee hearing on the Shcharansky trial.

"Individual members and institutions in the American scientific community can decide for themselves what limits to set on the quality and extent of their exchanges with the Soviets and they are doing precisely that. They do not need, nor want, governments to preempt those decisions," AAAS executive officer William Carey told the same committee.

Stone several years ago took the lead in mounting active protests on behalf of imprisoned Soviet scientists, and prompted the National Academy of Scientists, long averse to public protest, to do likewise. The development has occasioned what sometimes looks like a reversal of roles. NAS president Philip Handler recently condemned the sentence passed on physicist Yuriy Orlov in a public statement as strong as those made by the Federation of American Scientists. Meanwhile at the House hearing on Shcharansky, Stone sounded as statesman-like as the Academy in describing what he called "the limits of responsible activism." One such limit was the suggestion that it "is not responsible for the U.S. government in future to make such a point at such high levels of individual cases because it will too often lead to still worse treatment of those cases."

As for intergovernmental relations, some scientists believe that severing exchange agreements would serve only to harm the United States without influencing the behavior of the Soviet Union. "Science gives us an important window into what is going on," says a former high science official. As for the benefits of canceling science adviser Press's visit to Moscow, "I have very serious doubts as to whether there will be any effect," the same official says.—N.W.

poses. American technicians may have the right of access to the machine at any time, with the right to take "core dumps,"—transcriptions on tape of the computer's memory content. The tapes are then analyzed by the National Security Agency. Although there are a few unresolved suspicions, in no case have the Russians ever been caught cheating.

The Sperry-Univac machine which Carter canceled on 16 July would have been used by the Soviet agency Tass to handle the requirements of the 1980 Olympic games. Even without White House intervention, it is not certain that the sale would have been approved either by the interagency committee or by COCOM. The application has been with

Briefing

Post-Apollo Astronauts Train for Shuttle

NASA has 35 new astronauts. The first new class selected in 11 years began training on 1 July at the Johnson Space Center in Houston. They are expected to provide crews for the space shuttle, the aircraft-like sine qua non of NASA's manned program in the 1980's. The new hands join 27 active astronauts including veterans of Gemini, Apollo, and Skylab missions.

In this round of selections, NASA makes more points as an equal opportunity employer than it did in its earlier days. Six of the new astronauts are women, three are blacks, and one is a Japanese-American. Previous crops ran strongly to type—white males with either test-pilot or fighter-pilot backgrounds and a few "scientist-astronauts" with science Ph.D.'s and some flying experience. Women have not yet crashed the pilot-astronaut barrier; all six are "mission specialists," a new nonpilot breed of astronaut.

The new astronauts are divided between the categories. Fifteen will be pilot-astronauts whose duties will be much like those of their predecessors. Twenty are to be trained as mission specialists, who according to NASA's description will actually be a new category of generalists who "will have overall responsibility for the coordination, with the commander and pilot, of space shuttle operations in the areas of crew activity planning, consumables usage, and other space shuttle activities affecting experiment operation."

As with their predecessors, NASA could be highly selective in choosing the new astronauts. Those appointed were picked from among more than 8000 applicants and 208 finalists. The average age of the new group is the early 30's. The mission specialists, typically, have advanced degrees in technical fields; one woman is an M.D. The training program will be similar to that undergone by earlier groups of astronauts. All are in excellent health. But the physical training regimen is not expected to be quite as rigorous since the space shuttle is regarded as providing a somewhat more benign environment than earlier spacecraft.

The 35 face a 2-year program of intensive training. During the first 6 months about half of each working day will be devoted to classes in theory in subjects ranging from orbital mechanics to navigation and electronics. This will be combined with activities aimed at developing flight skills. The group will then move on to training focused on the space shuttle.

The new astronauts should finish their initial training in 1980 at about the time flight testing of the space shuttle is winding up. The first shuttle crews are expected to be drawn from the group of 27 experienced astronauts. When operational flights begin after the turn of the decade the basic shuttle crew will be two pilots and a mission specialist, with as many as seven in the crew for "big" missions. That is when those among the 35 who stick with the program are expected to get their chance.

Detour on the Road to Brave New World

The "test-tube baby" case, which recently went to trial in New York, has given new impetus to the discussion of the rules governing human experimentation.

The civil suit for $1.5 million against Columbia University, Columbia Presbyterian Hospital and its director of obstetrics and gynecology was filed in 1974 in behalf of a Florida couple. John Del Zio and his wife Doris claim they suffered "severe personal injury" when Dr. Raymond Vande Wiele of Columbia intervened in a planned effort by the Del Zios to have a child by "embryo transfer," a process by which a human egg is fertilized outside the body and implanted in a woman's uterus with the expectation that the pregnancy will then proceed normally. Ova were removed surgically from Mrs. Del Zio on 13 September 1973, mixed with sperm from her husband, and stored in a flask in an incubator. The next day Vande Wiele ordered the flask removed from the incubator.

Interest in the case has been heightened by the imminent prospect of the first recorded test-tube baby being born to a British housewife, Lesley Brown of Bristol. The Del Zios have been quoted as saying they had hoped to become the first parents of such a child.

Lawyers for the Del Zios have taken the line that Vande Wiele halted the procedure because of personal animosity toward one of the Del Zios' physicians, Landrum B. Shettles, a veteran of reproduction research who had been on the hospital staff for 27 years, but who retired subsequent to the 1973 incident.

Defense lawyers have questioned the scientific soundness of the methods employed in the case. They also argue that Vande Wiele stopped the procedure because approval had not been given by the committee formed to decide on questions of human experimentation in the hospital. Vande Wiele has also been reported as telling colleagues that National Institute of Health rules prohibited such research.

The official line on in vitro fertilization involving humans, which is the specific technique at issue, appears to be somewhat fuzzy. In 1973 when the incident took place, most major hospitals, including Columbia Presbyterian, had human experimentation review boards, but there was no formal Department of Health, Education, and Welfare (HEW)-NIH requirement that all such research proposals should be submitted to them. It was not until July 1974 that HEW rules requiring such reviews went into effect.

In recent years, NIH has been observing a moratorium on funding of in vitro fertilization studies, but there is no federal rule or law against experimentation with laboratory fertilization. In September, the HEW Secretary's Ethics Advisory Board is scheduled to consider whether or not the department should begin funding in vitro fertilization work on humans.

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the committee since the fall of 1977. A Sperry-Univac official says that the machine "would not have exceeded the present COCOM criteria" and that both Control Data Corporation and IBM have sold larger machines to the Soviet Union. But Carter, in a news conference on 21 July, stated that the machine "would have provided a quantum leap in computer capability, multiplying the speed of the computer I think 20 fold." The President also observed that the capability was "far in excess" of what Tass's stated purpose required.

The White House may have figured that if the sale was going to be nixed anyway, whether by the interagency committee or COCOM, there was nothing to

Briefing

Meanwhile, for reproduction researchers, the Del Zio case and the impending blessed event in Britain have brought the ethical and scientific questions surrounding such experimentation to the boil.

NRC Study Tracks Trends in Doctorates

A sort of summa of surveys of doctorates awarded in America has been published by the National Research Council. *A Century of Doctorates* is the seventh in a series of studies done since 1948 on recipients of doctorates and of the institutions which award them. The study actually covers a bit more than a century, because it begins with 1861, when Yale handed out the first doctorates in this country, and extends to 1974.

Since 1875 the number of Ph.D.'s has grown at an average annual rate of 7 percent, so that output has roughly doubled in every decade although fairly heavy fluctuations were caused by the two World Wars and the Depression. Figures for the 1970's show a leveling off at about 33,000 a year, so it appears that after a long run of exponential growth, the curve may be taking a new turn.

The survey includes not only Ph.D.'s but all "third level degrees." The single field in which the largest number of degrees has been awarded annually in recent years has been education—some 7219 in 1974. In the aggregate, a slightly larger number has been awarded in the cluster of disciplines grouped under the "EMP" heading (for engineering, mathematics, and physical sciences)—a total of 7928 in 1974. Doctorates in behavioral sciences numbered 6333 in 1974, in life sciences 5013, and in humanities 5078. Doctorates in professional fields (M.D.'s not included) amounted to 1486.

The survey's authors note that since 1940, the fields growing faster than the 7 percent average rate have been education (11 percent) and engineering and psychology (8 percent). They note that "these three fields have a large 'applied' component relative to that typical of the slower-growing fields." By contrast, since 1970, the proportion of Ph.D.'s in natural sciences has declined.

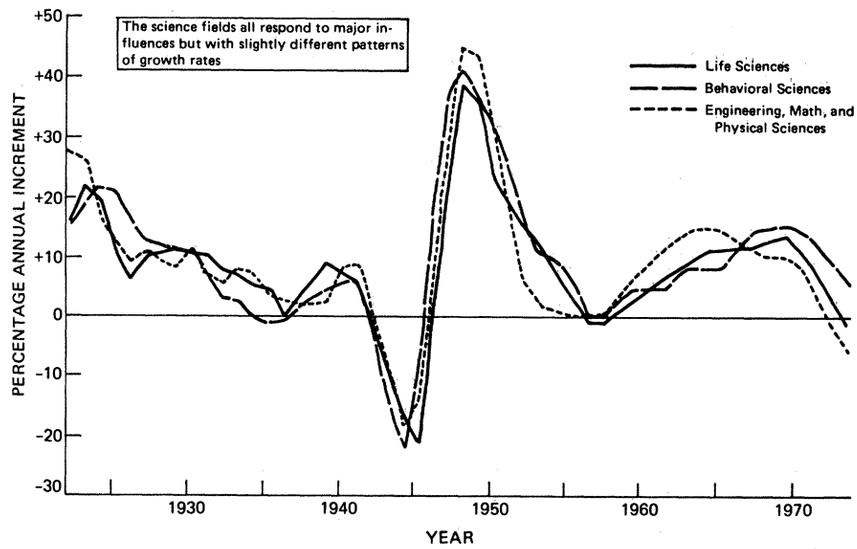
Not surprisingly, the number and percentage of degrees granted to women is shown to have increased rapidly in recent years. From under 10 percent in the years 1950–1954, when the backlog of male World War II veterans was jamming Ph.D. programs, the percentage of doctorates won by women rose to 12 percent in 1965–1969 and then soared from 13.9 to 20.5 percent in 1970–1974, and is still on the rise. Women apparently continue to be drastically underrepresented in EMP fields and dominant in education—the ratio of women to men receiving education doctorates is put at 6 to 1.

Longitudinal data on doctorates earned by members of racial minorities is limited since federal law prohibited racial designations in the keeping of statistics until recently. Available data do show that blacks are severely underrepresented among winners of doctorates except in education.

As for the institutions granting doctorates, their number increased steadily after World War II and their geographic spread became, relatively, much more even. From 107 institutions granting doctorates in the early 1940's the number rose to 208 in the early 1960's and continued to rise. The hegemony of the Northeast was challenged first by Midwestern universities, then by institutions on the Pacific Coast and in the Rocky Mountain states. These in turn have been almost overtaken by institutions in the South.

Hints of shifts in the general economy and in the academic marketplace are found in data showing an upswing of employment of new science Ph.D.'s in business and industry. Through the 1960's the trend of such employment was downward but since the early 1970's there has been a reversal, most sharply it seems for Ph.D.'s in engineering, chemistry, and physics.

The survey cuts off in 1974, so while it hints at the trends associated with energy problems, inflation, and the demographic downturn, it does not fully suggest the traumas in store for Ph.D.'s. The subtitle of *A Century of Doctorates* is Data Analyses of Growth and Change. The next study in the series may well show less growth and more change.



Growth increments in doctorates granted in three science fields. [Source: National Research Council, Commission on Human Resources]

John Walsh

lose by making denial of the computer the politically necessary tit for tat for the Shcharansky trial and other untoward incidents.

In the wider context, restrictions on trade with the Soviet Union are of doubtful value. Conservatives have always been inclined to agree with Lenin, who observed in a well-known passage that "The capitalistic economy plants the seeds of its own destruction in that it diffuses technology and industry, thereby undermining its own position." A different, and perhaps more sophisticated, viewpoint is that to deny specific items to a country as technically capable as the Soviet Union only compels it to build the product itself: better, on this view, to sell the Soviets whatever they desire in order to foster a technological dependence.

Theory apart, the facts are that the balance of trade with the Soviet Union has been in the United States' favor. In 1976 the Russians imported the $2 billion of goods from the United States, of which about 60 percent was grain, and exported only $0.5 billion worth. Trade restrictions only assist the Russians to reduce this imbalance. But sale of the Sperry-Univac computer was not canceled for economic reasons. As a White House official explained, "This was a political call."—NICHOLAS WADE

Endangered Species Act Survives Senate Hunters

The U.S. Senate last week preserved the life of the Endangered Species Act for three more years. Although the act was widely criticized as a result of the controversy earlier this year involving the snail darter and the Tellico Dam in Tennessee (*Science*, 12 May), the Senate renewed the measure by a vote of 94 to 3 and by similar margins defeated a number of debilitating amendments. The strength of the support for the act is expected to carry over into the House of Representatives, where it will be taken up in mid-August.

The vote on the Senate floor was a victory for environmentalists, who had been lobbying feverishly in favor of the bill, and for the chairman of the Subcommittee on Resource Protection, Senator John Culver (D–Iowa). By permitting a series of minor changes and objecting strenuously to the major ones, Culver was able to shepherd the bill through several days of debate in almost exactly the form that his subcommittee had approved it. Important support was provided by Senator Howard Baker, a Republican member of the subcommittee and a representative of the state where the $116-million Tellico project was bested by the 2-inch darter.

Together, Culver and Baker got the subcommittee, and ultimately the Senate, to pass the only major amendment to the act, one which removed the objections of development-oriented congressmen that the act was inflexible, and which would also prevent developers from slipping their projects through loopholes. Under the amendment, a Cabinet-level committee could be petitioned to exempt specific projects from the act's provisions, but only if an otherwise irre-

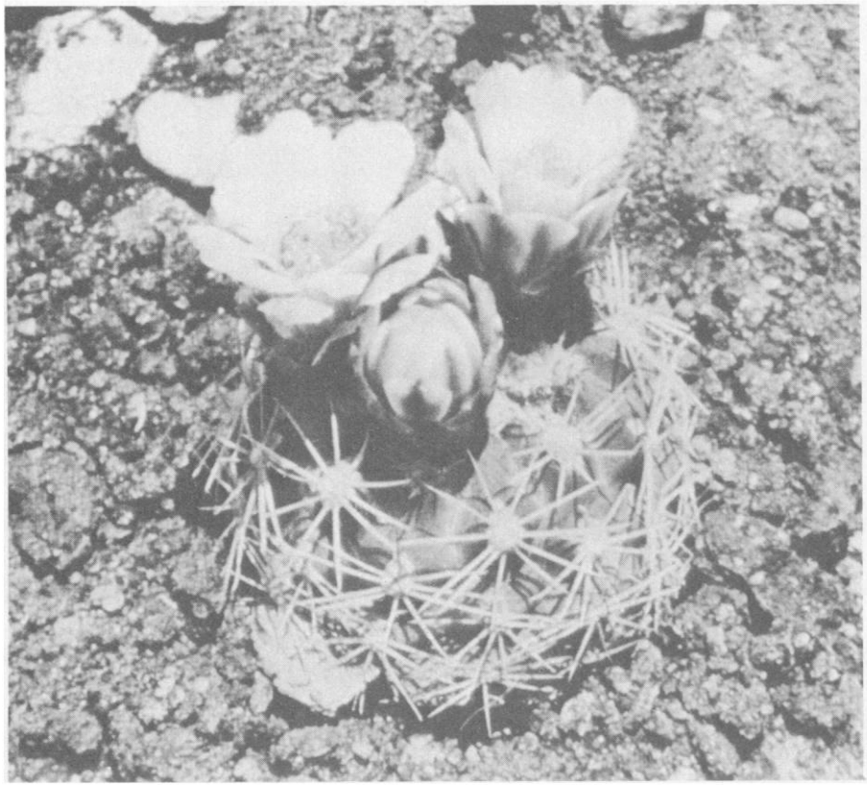


Photo by Gary Lyons

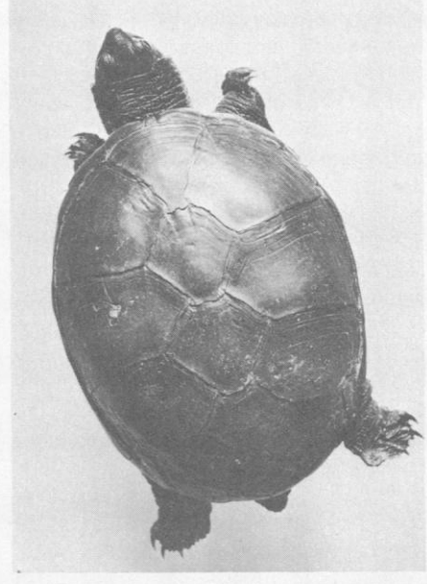


Photo by Illinois Natural History Survey

Renewal of the act will facilitate protection of the 2-inch mesa cactus (left), threatened by strip-mining in Colorado, and the Illinois mud turtle (top), a relict species with 200 surviving members threatened in the Midwest by the drainage of land for agriculture.

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