from outmoded fossil-fueled plants is far developed, and could be installed in the near future, if the demand for this were insistent." The answer to energy needs, they say, is to continue to rely on fossil fuels instead of getting a larger percentage of energy from what they view as the hazardous nuclear plants.

**Hearings on the** NPC before a Senate subcommittee chaired by Sen. Lee Metcalf (D-Mont.) last week strongly suggested there is a paralysis in creating options for United States energy policy, partly because such policy is really a function of industry. ". . . A central article of faith [of the NPC]," said Prof. Robert Engler, political scientist with the City University of New York and author of the *Politics of Oil*, ". . . is that Government must not become involved in any use planning of energy resources . . . [and] that no published study by the NPC leave the impression that industry has not been thinking in long-range terms and wisely for the commonweal."

Whether or not energy industries actually make United States energy policy, there seems little doubt they fail to perceive a broad range of options. That such options will increasingly be needed was stated succinctly by Dr. Harvey Brooks, dean of engineering and applied physics at Harvard and member of the President's Science Advisory Committee, before the Davis subcommittee. He spoke of the vast unmet needs for research, development and application in social and environmental areas, needs which could be partly met by the now unemployed defense and aerospace engineers. Then he looked at the future:

"Within the next 60 years, mankind will have to come to a new equilibrium with its environment. Many current increasing trends, from population to per capita energy consumption, will have to saturate or slow down drastically. The management of this transition represents an enormous challenge to science and technology as well as to political wisdom. To continue [to leave our brainpower idle] only means we are prepared to sacrifice the future for the sake of present comfort and convenience." □

M 82 AND NGC 253

## Hydroxyl in two other galaxies

The universality of physical effects is one of the important questions in cosmology. For centuries astronomers and physicists have wondered whether physical laws deduced from phenomena found on earth and in the solar system can be applied without change to distant galaxies and whether distant galaxies are made of the same matter (there are persistent suggestions that some may be antimatter) as our own. In the absence of evidence to the contrary, scientists generally assume the universality of physical laws, but there are those who warn that this assumption should not be taken for granted.

**Lately,** with the discovery that various chemical molecules inhabit the interstellar space of our galaxy and betray their presence with radio waves, a possible means of testing the universality of chemistry came to hand. It has been taken up, and the hydroxyl radical (OH) has now been discovered in the interstellar space of two other galaxies.

The work was done by Dr. Leonid N. Weliachew of the Meudon Observatory in France, who is visiting the California Institute of Technology. Using the radio interferometer at Caltech's Owens Valley Observatory, he found OH in the galaxies M 82 in the constellation Ursa Major and NGC 253 in the constellation Sculptor.

Hydroxyl makes its presence known with radio waves of about 18 centimeters wavelength. It may emit the waves if it is hot enough or it may absorb them from the radiation of some source lying behind it.

Hale Observatories

*Chemistry in galaxies: OH in M 82.*

The most powerful OH emitters in our galaxy, if placed in the Andromeda Nebula, the nearest galaxy to our own, would be beyond the detection limit of presently available instruments, says Dr. Weliachew. He therefore decided to try to find OH by its absorption and chose two galaxies that have strong radio sources in their centers. Absorption by OH clouds lying between the centers and the edges of the galaxies showed up as slight dips in the spectra of the centers.

The discovery probably means that interstellar chemistry of the sort familiar in our own galaxy is a widespread characteristic of galaxies, and it lends support to the assumption that the physical laws we know are universal. □

RETURN TO ACADEMIA

## McElroy leaving NSF

The coming departure from the Washington scene of the top man for the National Science Foundation, the agency most concerned with the health of basic scientific research in the United States, is not news to gladden the hearts of academic scientists. It is not all to his doing, but in the two years since Dr. William D. McElroy took over the helm at NSF, the agency's Congressional visibility and appropriated funds have risen considerably. Dr. McElroy last week was named by the University of California regents to become chancellor of the university's San Diego campus at La Jolla. He will stay with NSF until next Feb. 1, to oversee planning for the 1973 budget.

**In the last** few months NSF has been partially rebuffed for its proposals to reduce science education support in favor of more applied science research, but Dr. McElroy says his decision to leave is in no way related to those criticisms. "I have been pleased with my interactions with OMB [Office of Management and Budget] and Congress," he says. "I wasn't dissatisfied at all."

When President Nixon appointed him director in mid-1969 Dr. McElroy says he told colleagues he intended to stay only two or three years before returning to academic life. "I've enjoyed it," he says of his Washington stint. "It was new and different, and it was fun." But the return to academia beckoned. "I like working with academic people. It's a challenging and interesting life, even at the administrative level." The chancellorship of the modern, new San Diego campus, with its strong emphasis on science, was attractive. "When you're 54 and something like this comes along, you take it."

What his departure may mean for NSF is far too early to tell. Dr. McElroy had succeeded Dr. Leland Hayworth, who was well liked but considered by some to be overly mild mannered for the aggressive necessities of Washington influence-seeking. Dr. McElroy was welcomed in part for his outgoing warmth and affirmativeness. He is generally regarded as having been successful in scientific politics.

"I am sorry to see Dr. McElroy leave the National Science Foundation, for I feel that he has amassed a remarkable record of achievement there and has proven himself to be an administrator of the first magnitude," says Rep. John W. Davis (D-Ga.). Davis is chairman of the House Subcommittee on Science, Research and Development, which authorizes funds for NSF. Dr. Philip Handler, president of the National Academy of Sciences,

NSF

*Dr. McElroy: I have enjoyed it.*

likewise expressed regret at McElroy's departure.

Davis commended Dr. McElroy "for the legacy which he leaves to his successors," and Dr. McElroy himself says he thinks NSF is on a good course. But the subcommittee and its parent Science and Astronautics Committee have been troubled by NSF's expressed desire to play a larger role in supporting problem-oriented research, and a broad committee inquiry into the policy issues is intended during the coming year.

**Both** House and Senate groups have recommended only a portion of the increase in funds NSF sought for its Research Applied to National Needs (RANN) program, while restoring most of the cuts NSF proposed in institutional support for science and science education support. But despite the internal budgetary shifts, the agency is assured of a substantial total increase in funds for fiscal 1972. The House on June 30 approved an NSF appropriation of $585 million, $71 million more than the agency received last year. This week the Senate, as a result of an amendment offered by Sen. Edward M. Kennedy (D-Mass.) and two others, voted an appropriation of $648 million, $25 million more than NSF requested. House-Senate conferees were to meet later in the week or early next week. □

DRUG DETOXIFICATION

## Isolation of liver enzyme

A liver enzyme essential not just for steroid and lipid metabolism but also for the detoxification of a wide spectrum of foreign compounds—marijuana, alcohol, pesticides and sundry drugs—has drawn increasing attention from biochemists in the past few years. The enzyme is called Cytochrome P-450. Cytochromes, like hemoglobins, are red-pigment proteins that participate in cell oxidation reactions. The "P" stands for "pigment," and the "450" for the wavelength (in nanometers) most strongly absorbed by a combination of the enzyme and carbon monoxide.

It had been known for some time that a liver pigment reacts with carbon monoxide, and some Japanese scientists first identified it by spectral methods in 1962 and named it Cytochrome P-450, but no one had managed to isolate a biologically active enzyme. Nearly all other known liver cell enzymes (some hundred) are located in the liver cell cytoplasm and are soluble and so are easily isolated. But Cytochrome P-450 is tightly bound to the inner membrane network of the liver cell. Now, a biochemistry team at the University of Michigan Medical Center at Ann Arbor, headed by Dr. Minor Coon, has succeeded in isolating the entrenched red enzyme.

**Actually** Dr. Coon and his colleagues have managed to extract not only a catalytically active P-450 from the liver cell membrane, but also a phospholipid and a reductase enzyme. Apparently the triumvirate is needed to attack foreign compounds; P-450 cannot go it alone. Dr. Coon's team found this to be the case after applying the isolated compounds separately on foreign material in a tissue sample.

Dr. Coon sees the discovery of the phospholipid's role in the action of Cytochrome P-450 as almost as crucial as the isolation of P-450. For, while it is known that 40 percent of the endoplasmic reticulum is comprised of fatty molecules, no one suspected that these molecules might participate in the liver cell's war against foreign materials.

The Ann Arbor biochemists will next attempt to identify the precise structure of Cytochrome P-450. Such characterization, they believe, could eventually assist physicians in drug therapy. "Drug administration at this time is pretty hit-and-miss," Dr. Coon explains. "A physician can only guess in advance how much of a drug to give. A heavy drinker, for example, will have built up large amounts of P-450 to detoxify the large quantities of alcohol he consumes, and if the doctor doesn't know he's a heavy drinker, the amount of drug given will probably be quickly detoxified and produce less than the desired effect on the patient." But if the Michigan researchers can figure out P-450's structure, they may then be able to devise a method whereby physicians can analyze patients for Cytochrome P-450 activity prior to drug therapy, thereby better estimating an effective drug dosage.

Characterization could also eventually show up inherited P-450 structural differences in the population. □

SIMPLER AT HIGH ENERGY

## Proton-proton collisions

About a year and a half ago Dr. Richard P. Feynman presented a new suggestion about the probabilities of forming new particles in certain kinds of collisions at high energy. If true, it would give hope that the general laws governing particle behavior under the influence of the strong nuclear force are simpler than was feared and may be easier to dig out of the mountains of data being accumulated. Dr. Feynman's suggestion has now been confirmed, for protons, by one of the first experiments with the new Intersecting Storage Rings at the CERN laboratory in Geneva.

**Basically,** his proposal is that for what he calls inclusive experiments the probability of producing new particles becomes independent of energy when the energy gets very high. (At about the same time Dr. C. N. Yang of the State University of New York at Stony Brook made a similar suggestion.)

An inclusive experiment is one in which the experimenters look for one particular resulting particle with specified properties, although the collision also produces a variety of other particles. This is often written schematically as A plus B yields C plus anything else. About 95 percent of all proton-proton experiments, a most important class of interaction, are inclusive.

The interactions studied in the CERN ISR are proton plus proton yields pi meson plus anything else. The experimental set-up measured the rates at which pi mesons with different amounts of forward momentum were produced. From this the cross sections could be calculated. When they were compared graphically with results previously obtained at lower energies, all the points fell on the same curve. This, says a CERN spokesman, is a striking confirmation of Dr. Feynman's prediction. The experimental data are reported by Drs. L. G. Ratner of Argonne National Laboratory, R. J. Ellis and G. Vannini of the University of Bologna and B. A. Babcock, A. D. Krisch and J. B. Roberts of the University of Michigan in the July 5 PHYSICAL REVIEW LETTERS.

Some effects of Dr. Feynman's idea can be observed even at much lower energies. One corollary question is whether the nature of the incoming particle makes a great difference in the results. Do the results of various kinds of particles striking a proton show similar patterns? This was tested at Brookhaven National Laboratory by Drs. M. S. Chen, R. R. Kinsey, T. W. Morris, R. S Panvini, L. L. Wang and T. F. Wong of Brookhaven, S. L. Stone, T. Ferbel, P. Slattery and B. Werner of the University of Rochester and J. W. Elbert and A. R. Erwin of the Univer-