Furthermore, the addict who takes heroin at the same time as he is under methadone therapy will get none of heroin's effects.

Dr. Dole reports success with 90 percent of his patients. Ten percent have been discharged from treatment, usually because of complicating factors such as alcoholism, for which methadone is useless. These patients, he says, have almost all relapsed.

Dr. Dole believes the methadone treatment experience supports the idea that there is some factor of addiction that is at least semi-permanent. Even though the opiate has been totally withdrawn for periods up to five years, methadone is still needed.

Dr. Avram Goldstein, chairman of the department of pharmacology at Stanford University, cites his own work in opposing the theories of Drs. Kornetsky and Cochin. The Boston researchers hold that the persistent effects they have observed may be due to some kind of immune mechanism. Dr. Goldstein feels that the drug interferes with enzyme action and does not provoke any kind of immunity.

In direct contradiction to the others, he says his own results indicate that there is no persistent effect. His animals, brought to a state of tolerence or addiction and then cut off from the drug, return to normal at a rate similar to that at which they developed tolerance. On subsequent administration of opiates they respond as do undosed animals.

Dr. Goldstein suggested a model for the action of some narcotics. A certain enzyme acts on a given amount of precursor substance in the body to produce a certain product necessary to the organism. The drug inhibits the action of the enzyme, thus reducing the amount of the free product and causing euphoria and other symptoms.

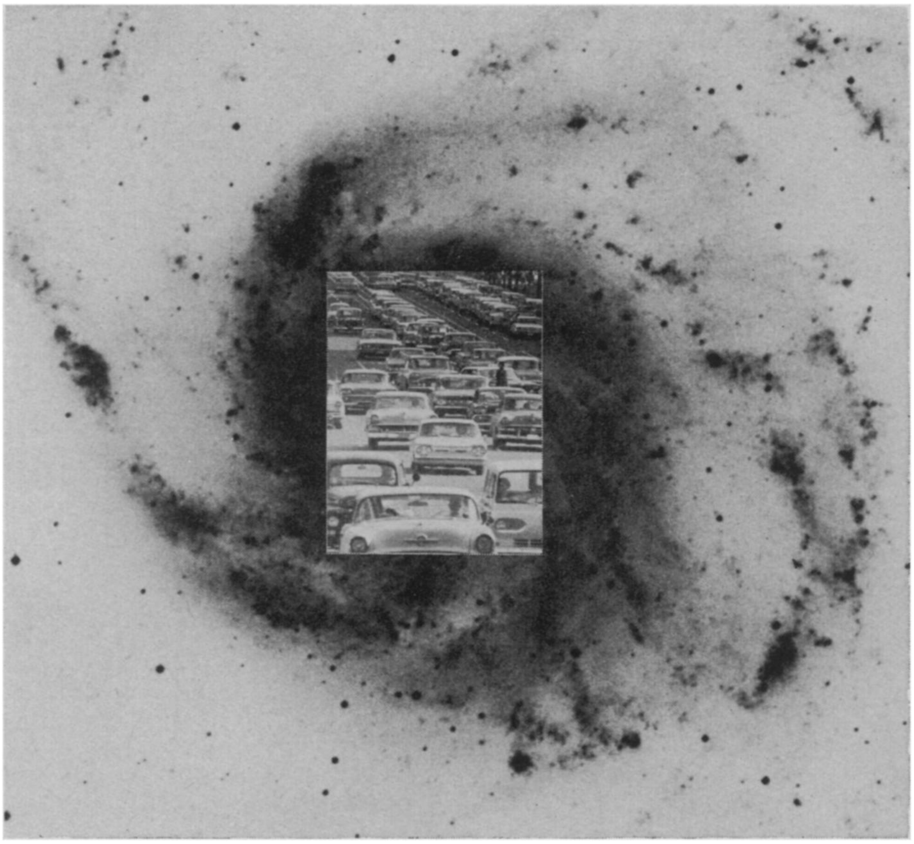
The production of enzymes generally is regulated by the amount of their product that is present in the system. If the product is reduced, the production of enzyme will be stepped up to compensate. Thus, the product returns to former levels in the presence of the drug.

In order to achieve reduction of the enzyme's product and consequent euphoria, the user therefore has to increase the drug dose to inhibit the extra enzyme production. The whole cycle starts again. Now if withdrawal is attempted there is initially a tremendous overproduction of enzyme, uninhibited by drug. This in turn results in overproduction of a product which causes withdrawal symptoms.

Finally, according to the model, the production of enzyme falls off to normal and the drug experience is forgotten, at least biochemically. The model also could serve to explain hangovers.

FLUID DYNAMICS

Galaxies, earth mantle and cars



Orderly arms of a galaxy and distempers of traffic obey similar physical laws.

Systems as seemingly diverse as spiral galaxies, the earth's upper mantle and the driver in his car actually have something in common—the way they behave can be described, at least partially, using the established laws of fluid dynamics.

A session of invited papers at the American Physical Society meeting last week was devoted to these unusual fluid systems.

The structures of hundreds of millions of spiral galaxies, of which the Milky Way is a typical example, can be pictured as giant natural laboratories of plasma physics, with each star behaving in a manner corresponding to a single electron or proton in the plasma of a terrestrial laboratory.

Dr. C. C. Lin and his collaborators at Massachusetts Institute of Technology, especially Dr. Frank H. Shu, believe such stellar systems can develop density waves through the collective behavior of the stars, very much like the waves known in laboratory plasmas.

These density waves—alternate condensation and rarefaction of star concentrations—are not observable by themselves, but can be traced by plotting the positions of brilliant young stars that have little to do with the structure of the spiral, which is maintained by the older stars. These young stars, each more than 10,000 times brighter than the sun, are distributed along the spiral arms.

The density waves travel around the Milky Way galaxy once every 450 million years, Dr. Lin has calculated, whereas the stars in the solar vicinity would have a galactic year of 200 million years.

For the earth's mantle, one of the implications of a fluid behavior is the possibility of a Rayleigh instability: The lower mantle will become hot due to the heat released by radioactive elements. The heated rocks expand and move upward, resulting in a thermally driven flow of a cellular type.

Dr. Daniel L. Turcotte of Cornell University, Ithaca, N.Y., has developed a theory that the core of each such cell has a circulating fluid flow, all at the same temperature; thermal gradients are restricted to the boundaries of the cell.

He suggests that the ascending flow in a cell is associated with the oceanic ridges. The rising hot mantle material results in volcanic activity, shallow earthquakes and high heat flow.

The mantle material then spreads away from the ridges, resulting in the observed sea floor spreading. Dr. Turcotte reports that calculated values of the heat flux to the ocean floors are in good agreement with observations.

The descending flow is associated with the oceanic trenches adjacent to continents, and seismic observations on these zones of deep earthquake activity support this interpretation, Dr. Turcotte says.

The volcanic activity and high heat flows associated with the trenches, he notes, can be explained by frictional heating by the descending oceanic crust.

Fluid dynamics may also be creating a science of vehicular traffic.

Vehicular traffic flow resembles a fluid and is "amenable to sophisticated mathematical attack," reports Dr. Robert Herman, head of the theoretical physics department of General Motors Corporation's Research Laboratories in Warren, Mich.

One approach used by traffic theoreticians describes the flow of traffic on the basis of the behavior of individual units—the driver and his car. When one motorist tries to drive along a highway behind another car in a stable manner, the motion of his car appears to obey a simple law.

Dr. Herman and his co-workers have derived a mathematical relation that describes this car-following phenomenon. It explains, for instance, why drivers seem to follow another car too closely—a driver, instead of responding to the distance between his car and the one ahead, attempts to keep at a minimum the difference in speed between his car and the leading automobile.

This follow-the-leader theory is helpful in examining the stability and flow characteristics of a line of vehicles under conditions of no passing. If a driver suddenly changes speed—slowing down because of an insect sting, for instance—this change can be easily absorbed by the next few drivers if they react quickly enough to the stimulus, and the situation will again be stable.

However, if the reaction time of the nearest following drivers is even slightly delayed, the change in the motion of the lead car may lead to a wavelike transfer of instability, a fluctuation propagated along the traffic line that can result in one or more tail-end collisions.

CANCER THEORY

Starve the tumor, not the cell

Research done at the Chicago Medical School may be helping to point the way toward a new route of attack on certain cancerous tumors.

Drs. Melvin Greenblatt and Philippe Shubik, reporting at the annual meeting of the Federation of American Societies for Experimental Biology, say their animal experiments demonstrate for the first time that transplanted tumors release a chemical into the host's bloodstream that causes the host to produce blood vessels to supply the tumor. Existence of such a substance has been suggested before but not demonstrated.

If such a factor can be identified in human cancers, and if it can be suppressed without harm to the patient, it might be possible to prevent the vascularization of tumors. Since tumors above a certain small size require a blood supply to live, they might by this method be starved to death.

Current approaches to cancer treatment often try to exploit the small differences between cancerous and normal cells. Cancer cells are more susceptible than normal to certain toxic substances, for instance.

The development of an effective weapon against the tumor, rather than against the cells of which it is composed, might be applicable to a far wider range of cancers. And there is no known reason why short-term suppression of the body's process of blood-vessel building should be too harmful to the patient.

Any human benefits of the new work are still far off, however, primarily because the blood-vessel attractant hasn't been found in humans yet, nor has it been characterized.

The experiment reported involves inserting plastic windows in the cheek pouches of hamsters. Malignant melanomas then are transplanted under the windows. Those tumors in contact with the hamster's tissues develop a blood supply system as is usually observed in such transplants. A blood supply develops even when tumor and hamster tissue are separated by a porous membrane.

This membrane allows passage of proteins and other substances, but no direct tissue-to-tissue contact. A cellophane membrane which allows the passage of small molecules but not large molecules like proteins prevents development of blood vessels.

From this it is theorized that a substance, christened angiogenin, is released by the live tumor and stimulates the proliferation of blood vessels around and into the tumor. Angiogenin is assumed from the membrane tests to be a substance of medium to large molecular size.