Hepatitis: All in a day's work

Hepatitis B, non-infectious serum hepatitis, has been identified for the past two decades as an occupational risk in all medical professions. Oncology wards and hemodialysis units have been marked as high-risk areas of hepatitis B exposure, and the relative risk of infection in different medical occupations has been examined. Now, Alexander E. Denes and coworkers at the Hepatitis Laboratories Division of the U.S. Department of Health, Education and Welfare in Phoenix, Ariz., have completed the first nationwide survey to identify the risk of infection associated with particular medical specialities and to define which specialities might benefit most from a soon-to-be-developed vaccine.

A serum test for hepatitis B antibody was given to 1,192 physicians attending three American Medical Association meetings during 1975 and 1976. The results, reported in the Jan. 16 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, indicate the risk of infection for all doctors is five and a quarter times that of the general population, represented by a control group of first-time volunteer blood donors. Because hepatitis B infection is associated with exposure to blood and blood products, it is not surprising that surgeons and pathologists were found to have the highest incidence of infection, more than 25 percent in each group. Infection rates for other specialities were similar to that for all physicians. Recommendations for immunization arising from this and future studies "would focus on high-risk categories [such as surgeons and pathologists] who obviously would benefit [from immunization] early in training," co-author James B. Maynard told SCIENCE NEWS. Although no regional or geographic differences were found, 27.2 percent of urban physicians tested positive, compared to 15.6 percent of rural doctors, which "reflects the patient population," Maynard said. Only 31 percent of the antibody positive doctors recalled having the disease, suggesting that the majority of cases were either asymptomatic or so non-specific they were misdiagnosed. According to the report, the risk of hepatitis B infection rises sharply with internship and continues to climb into practice, while the risk of other forms of hepatitis remains constant. This confirms that hepatitis B, rather than other forms of hepatitis, is an occupational risk in medical professions, Maynard said.

Such results were expected by the Arizona group, Maynard said, but they may be surprising to doctors. And they may be frightening to patients who think their doctors may pass on the disease. On the contrary, Maynard said, "In general, physicians are at more risk of getting hepatitis from their patients than the patients are from the doctors." But some physicians have over-reacted to that risk, he said, noting that some pathologists have refused to perform certain autopsies and some dentists want serological screening of all patients. "The whole thing is a sensitive issue — that of the interface between physician and patient. I believe we have to look at it ethically. We're committed to patient care and if the physician is careful he can minimize the risk. It just takes a little knowledge and effective health measures." □

Pot update: Possible motor effects

Marijuana research results, like studies of potentially cancer-causing agents, continue to grow more unwieldy and confusing. But, at least for now, the type of poorly controlled studies with exaggerated results that abounded several years ago appear to have died down, replaced by somewhat more realistic, if less spectacular efforts.

Among the latest significant results is a report from the University of Trondheim, Norwegian Institute of Technology, published in the December PERCEPTUAL AND MOTOR SKILLS, and a study of possible brain effects by Robert G. Heath of Tulane University. The Norwegian researcher, Tarald O. Kvalseth, analyzed "the possible effects of marijuana on complex reaction time and motor control."

Although other studies have looked at similar effects, Kvalseth notes that such research has not only had "conflicting findings," but has ignored "motor control of accurate arm movements aimed at a target" — movements that could possibly relate to driving a car, operating machinery or any other process requiring both quick reaction and accurate arm coordination. His findings indicate that while marijuana does not seem to affect reaction or speed of movement, it can reduce the accuracy of such movements.

The researcher tested six "experienced marijuana users," all undergraduate males, 21 to 24 years old. Each subject underwent a series of tests after not smoking, smoking lightly or smoking heavily (three to four cigarettes). One experiment required the men to react to a stimulus by pressing an appropriate button; a second called for them to tap back and forth with a stylus between two parallel metal plates, as fast as possible without over- or undershooting the targets; a third involved a variation on the second experiment, using rotary arm movements rather than linear movements to hit the targets.

Kvalseth reports that marijuana:

- "Did not have a statistically significant effect on reaction time."
- "Significantly reduced" (or speeded up) the movement time between the two targets in straight-line movements but had no effect on the time of rotary actions.
- Increased error rates (as marijuana dosage increased) in hitting the targets in both linear and circular movements. Average error increased from 7 percent for linear and 8 percent for rotary with no marijuana to 25 percent for linear and 14 percent for rotary with high doses.

In his experiments on two rhesus monkeys, Heath reports what appears to be tiny but permanent changes in the brain — primarily in the form of an enlargement of the synaptic cleft regions, gaps across which nerve cells transmit signals. Heath has reported such negative changes before, but with much higher doses, where THC (marijuana's active component) was injected directly into the monkey's lungs. In this case, the monkeys were trained to smoke the equivalent of one marijuana cigarette a day, five days a week for six months. But he cautioned that it is unknown whether similar changes take place in human brains, and that the behavioral changes that may be induced by the brain change in monkeys is unknown.

Possibly casting further doubt on the new Heath findings are two studies — one at Harvard University and one at Washington University in St. Louis and the University of Kansas — that found no brain damage or shrinkage (contrary to British reports several years before) among heavy marijuana smokers (SN: 4/2/77, p. 222). The men in both studies were examined with computerized brain scans. □

IUE satellite launched

The first International Ultraviolet Explorer, a satellite designed around a telescope that will look at the sky's UV sources, which are virtually invisible from below earth's atmosphere, was successfully launched on Jan. 26. Besides NASA, the cooperative project is being sponsored by the European Space Agency and the British Science Research Council. Nearly 200 astronomers from 17 countries including the Soviet Union have already been selected to conduct experiments with IUE, which will include planetary as well as stellar targets. The satellite's telescope will cover the spectral region from 1150 to 3200 Angstroms, and is operated from the NASA Goddard Space Flight Center in Greenbelt, Md. □

Laetrile case-record review

Although animal tests to date have largely found Laetrile ineffective as a cancer drug (SN: 8/6/77, p. 92), thousands of U.S. cancer patients continue to clamor for it. Consequently, the National Cancer Institute has now announced that, within the next few months, it will attempt to

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covery in that form is inevitable and, therefore, readily foreseeable — dimensional analysis essentially short-circuits the formal process. Thus, one needn't understand the complicated physics behind Kepler's third law in order to formulate it and assert, furthermore, that it couldn't have been said in any other way.

Philosophers of science, therefore, regard the success of dimensional analysis as evidence that human reason, unassisted by experiment, can deduce the laws of nature. The modern concept, however, which derives from the Renaissance, has it that empiricism is ultimately and necessarily the arbiter of scientific truth.

One notable advocate of the contending philosophy was the late, great Sir Arthur Eddington, who in 1919 directed the experiment that originally verified Einstein's exciting prediction that light rays were bent by a gravitational field. He wrote:

"I believe that... all the laws of nature that are usually classed as fundamental can be foreseen wholly from epistemological considerations... [thus] all the fundamental laws and constants of physics can be deduced unambiguously from a priori *considerations, and are therefore subjective."*

This remarkable point of view — often called "selective subjectivism" — is as provocative today as it ever has been. And though it clearly deserves it, further elaboration here would be too great a digression. It is, instead, time now to address the *Queen Mary* problem using this marvel of human reasoning. As preparation, you shall need one regular-sized envelope.

In order to obtain the appropriate equation, follow this general recipe, which is the heart of dimensional analysis:

(1) Decide which factors in the problem are likely to influence the unknown quantity.

(2) In any combination, multiply and divide these factors so that the outcome has the same units of measurement as the unknown quantity. This "winning" combination, which may include a multiplicity of any factor, is set equal to the unknown quantity.

For step (1), I suggest you guess that the amount of displaced water is determined by the *Queen*'s bulk-mass and the density of water (since, for example, if it were floating on a denser liquid, like maple syrup, the ship would have a shallower draft).

Fine. Now proceed by trial and error to fulfill step (2). Remarkably, you will find there is only one possible combination of mass and density (which is measured as mass per volume) that has the units of volume. It is "mass divided by density," and according to dimensional analysis this quotient is equal to the unknown quantity.

With the equation now in hand, you only need to assign correct values to the factors and thereby obtain an answer for the unknown quantity. When I did this for my cousin, I recalled that the density of water is one gram per cubic centimeter (a handy number worth remembering) and, being where I was, it wasn't difficult to find out that the gigantic steamer weighs 81,237 tons, which converts to about 74 billion grams.

Doing the requisite division, you will find that the Cunard liner displaces 74 billion cubic centimeters, or about 18 million gallons — enough to fill a small lake!

You might be surprised to learn that the equation we derived so effortlessly is none-other than Archimedes' famous principle of buoyancy, which states that any floating object displaces a weight of fluid equal to its own. Discovered in the third century B.C., the idea reportedly occurred to the Greek genius one day while he sat in the bathtub.

For those of you who are now suitably impressed with dimensional analysis and anxious to "solo" on a BOTEC, I offer the following question: "About how fast will a penny dropped from the Empire State Building be falling only four seconds after its release (ignore air resistance)?" The answer will amaze you, especially when expressed in miles-per-hour. Bon BOTEC!

—Michael A. Guillen

Michael Guillen, a mathematical physicist at Cornell University, is a frequent contributor to SCIENCE NEWS.

... Laetrile

retrospectively review human case records to see whether there is any hard clinical evidence that Laetrile can help cancer patients. It there is, the NCI may then undertake a clinical trial to further document and clarify Laetrile's effects on cancer patients.

A clinical trial, of course, would be the quickest and most scientific way to determine whether Laetrile can help cancer patients or not. But the NCI is not anxious to rush into one because of the ethical question of whether it is right to give some cancer patients Laetrile only. An editorial in the Jan. 26 NEW ENGLAND JOURNAL OF MEDICINE points out that this ethical question might be solved "if all patients were fully informed and if the study were designed so that under no circumstances would a patient with a tumor known to be treatable by conventional therapy be assigned Laetrile treatment alone." □

EPA attacks organics

The first proposed regulations to reduce human exposure to organic chemicals in drinking water (SN: 12/31/77, p. 428) were issued last week by the Environmental Protection Agency. Regulations on trihalomethanes — formed when chlorine combines with decaying plant matter — would restrict their concentration to less than 100 parts per billion. Other organics would be caught with activated-carbon filtration systems. □