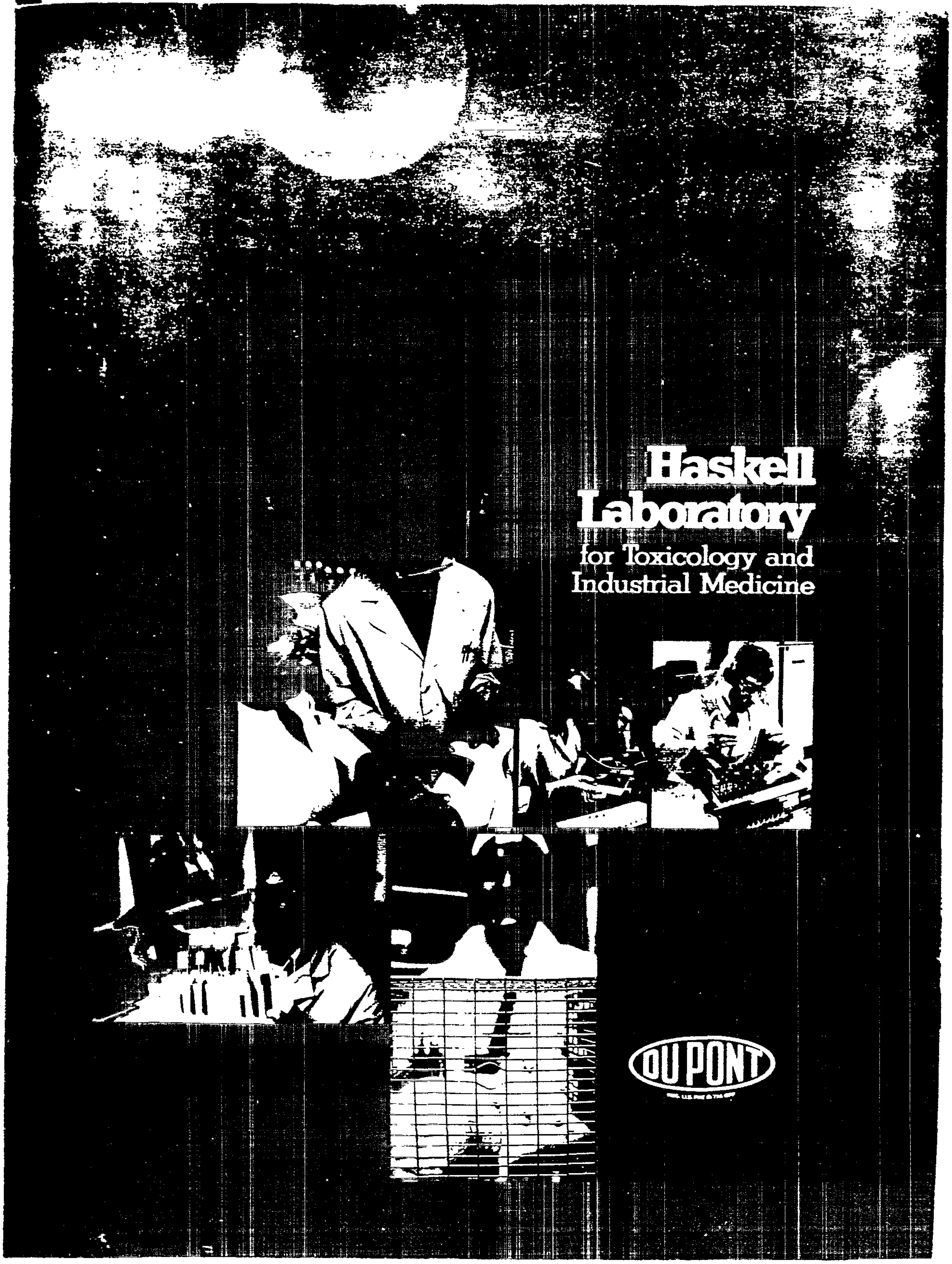


Haskell Laboratory
for Toxicology and Industrial Medicine

DU PONT

Haskell's Mission: Identifying the Risks

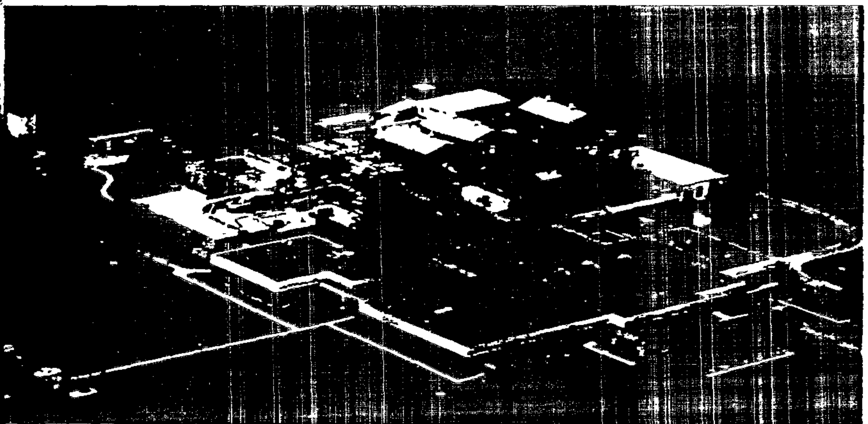
Society today is acutely aware that many natural and man-made substances within the environment carry some risk to health and safety. The Haskell Laboratory for Toxicology and Industrial Medicine—one of industry's first major test centers for toxicology—was established in 1935 as part of the Du Pont Company's program to protect its employees, its customers and the public from such hazards.

The Du Pont Company is committed to selling only products that can be manufactured, transported, consumed and disposed of without harm to workers, consumers or the environment. The company is managed with the conviction that all injuries are preventable and that all identified risks to health can be contained. This does *not* mean that all risk can be eliminated—most endeavors contain a degree of risk. It *does* mean that risk can be controlled.

The chemical industry has made possible many products widely used in contemporary society. Man-made fibers, finishes, plastics, agricultural chemicals and pharmaceuticals are all created by this industry. Basic chemicals also are essential ingredients in the productive processes of other major industries. However, many of these chemicals are flammable, corrosive or toxic, and Du Pont recognizes its responsibility to insure that risks associated with its products are controlled.

Haskell Laboratory is an essential element in implementing this philosophy. Its primary job is to determine the toxic properties of chemical compounds and the precautions

Analysis of blood, urine and tissue keeps Haskell's pathology section busy. Here Dr. William Krauss, pathology manager, studies tissues to see whether test compounds have caused abnormalities.



Haskell Laboratory operates in 105,000 square feet of space and with a staff of about 225. An addition presently under construction will add another 45,000 square feet.

Haskell employees shown on front cover, starting at top and moving clockwise, are: Walter Konieczki (left) and Bobby Moore, clinical chemists; Alice Erwin, biologist; James Russell, biologist; Terry Greer, technician; and Wallace Bessicks, technician.

Central Research & Development Department
E. I. du Pont de Nemours and Co., Inc.
Wilmington, Delaware 19898

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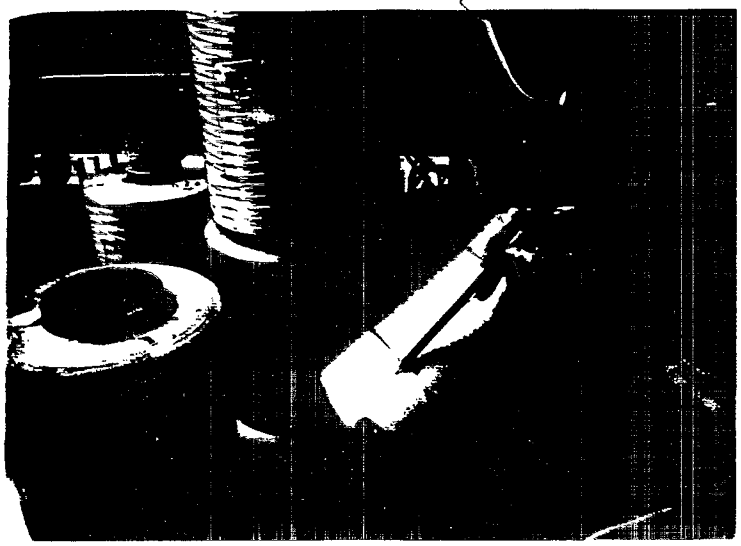

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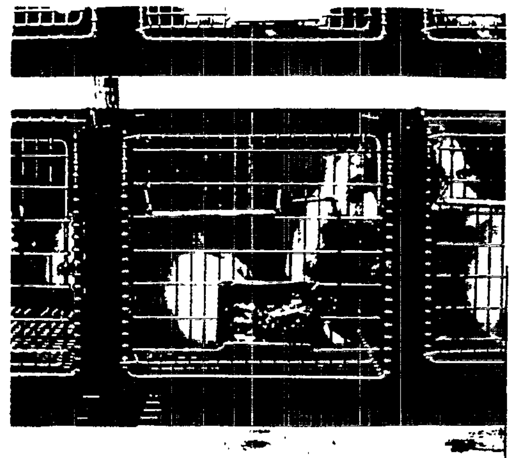
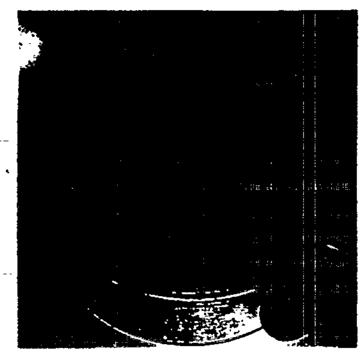


Animal testing constitutes a major portion of Haskell's work. White laboratory rats are most commonly used, and the best possible animal care is provided.

that are required to use them safely. What effects might the compound have if it is inhaled, swallowed, absorbed through the skin or splashed into the eye? Are there dangers if it combines with other substances? Could its disposal be harmful to the environment? Could an unintended use have dangerous side effects? These are the kinds of questions posed to Haskell's staff every day.

Answers are sought through batteries of laboratory tests. Haskell determines the degree of toxicity and the acceptable exposure levels at which the compound can be manufactured and used, utilizing laboratory animals in studies that can consume a few days or several years. Many of its long-term tests are for carcinogenicity (whether the substance causes cancer), and considerable attention is being devoted to development of short-term tests or assays that might help identify carcinogenic compounds.

The findings of Haskell's studies, whether on new compounds or existing compounds used in Du Pont products or processes, have a number of uses. They are an



Research leading to improvements in the testing process is an ongoing activity at Haskell. This dish is used in a short-term assay to identify possible carcinogens.

important and sometimes decisive factor in whether to produce the compound at all. They are useful in the design or modification of industrial processes to achieve an acceptable level of safety. Many of the studies are required to comply with government laws or regulations.

Haskell does not work in a vacuum. Its scientists and managers are in constant contact with Du Pont's manufacturing groups and top management. It is part of a companywide safety and health program that includes the monitoring of employee health on both an individual and group basis and the review of plant procedures by trained safety and health auditors. Laboratory personnel work with company engineers on plant design and with lawyers on product labeling. Organizationally, Haskell is part of the Central Research and Development Department, which reports directly to Du Pont's Executive Committee.

An increasing emphasis on long-term studies and governmental requirements has necessitated larger staff and facilities. To keep up with such needs, the laboratory was enlarged by 40 percent in 1967 and by 70 percent in 1976. An addition which will increase the laboratory by another 40 percent is presently under construction, and is due to be completed by mid-1981. Whereas nine employees worked at Haskell in 1935, the lab has 226 employees today.

"A New Idea in American Industry"

"We will run up against difficulties. For instance, the operating department will want to know 'why the laboratory doesn't produce something.' The sales department will want to know 'why the laboratory works up data that might make our customers believe our products are unsafe.' But we are embarked on our campaign with determination and it is only a question of time before the world recognizes that a very constructive thing has been done."

Lammot du Pont at the dedication of Haskell Laboratory, 1935

The decision to build a laboratory for toxicology and industrial medicine was in its time, as a newspaper account then described it, "a new idea in American industry." It was not, however, the first Du Pont Company action to make the workplace as safe as possible.

Du Pont was founded in 1802 to manufacture explosives. The hazard in producing black powder was self-evident, and the company invoked stringent safety procedures. Employee safety became a keystone of company policy. Health problems also were an early concern, and Du Pont was among the first American companies to provide a formalized program of medical surveillance for employees.

The hazards became both more numerous and more complex when Du Pont was transformed from a maker of explosives to a diversified chemical manufacturing company in the years following World War I. Workers exposed to carbon disulfide when manufacturing cellophane and rayon were showing toxic effects. Those making tetraethyl lead, the gasoline antiknock additive, faced the danger of lead poisoning. It was discovered in the early 1930's that beta-naphthylamine, an intermediate used in the making of coal tar dyes, was related to an unusually high incidence of employee bladder tumors.

This is a scene from the original Haskell Laboratory dedicated in 1935. Katherine Panta is shown.

In response to these problems, Du Pont initiated extensive engineering and process improvements. It examined and treated affected employees, and it developed closed production systems that reduced exposure below the level that could be measured by the instruments of the time. Equally important, the company launched a program to prevent such incidents from happening in the future and, at the recommendation of Medical Director George Gehrmann, constructed a laboratory of industrial toxicology to research such questions.

The facility was opened in 1935 on the site of Du Pont's Experimental Station near Wilmington, Delaware. It was named for Harry G. Haskell, Sr., who as Director of the High Explosives Department has been credited with creating the company's Medical Division. Eighteen years later the laboratory moved to the present 386-acre site on the Maryland-Delaware border near Newark, Delaware.

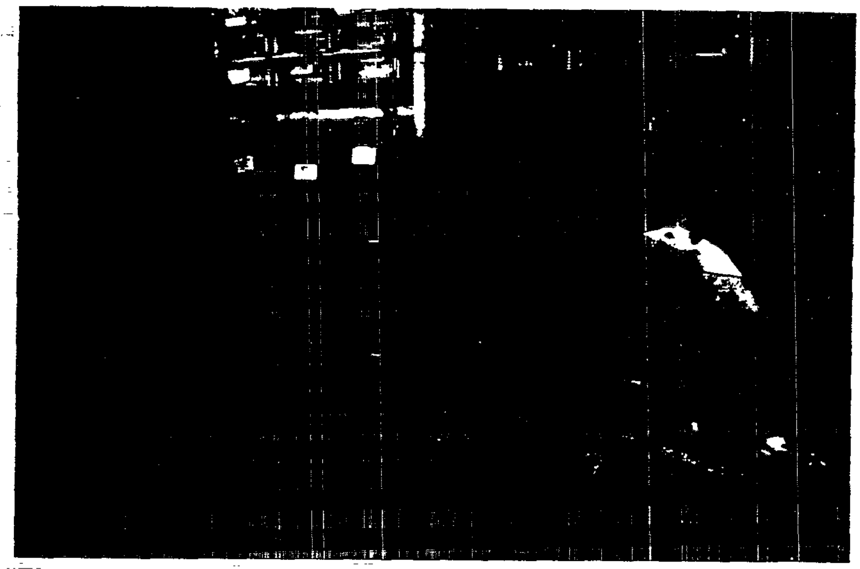
Seeking the Acceptable Exposure Level

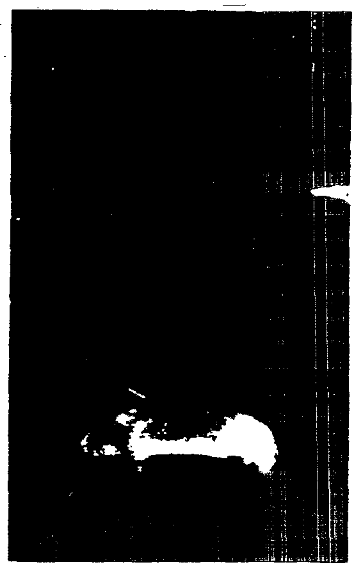
Toxicology is the study of adverse effects of chemicals on various types of biological systems, including man. "All things are poisons . . ." said the 16th century scientist Paracelsus. "Only the dose decides that a thing is not poisonous."

The point is still valid and is essential to an understanding of industrial medicine. Everything is potentially toxic — it is the *dose* which determines effect. By limiting the amount and frequency of exposure, it is possible to identify a level of dosage at which a hazardous substance has no significant adverse effects.

Haskell's task is to find that acceptable exposure level. The classic procedure is to expose laboratory animals to test compounds; identify clinical signs that may be produced, find the dose-effect relationship, and project the findings to human situations.

As awareness about human biochemistry increases, and as the tools of measurement become more sophisticated— measurement in parts per *billion* is now common—the demand grows for a greater number and diversity of tests. There is also a corresponding increase in the time, complexity and cost involved in toxicological studies.





Acute tests, in which the exposure to a chemical is of short duration, are distinguishable from chronic tests, where exposure to generally lower concentrations of a chemical occurs over a long period of time. Tests are divided not only between acute and chronic but also by the manner in which a compound is administered: by inhalation,

Top: The regular examination and weighing of animals is an important part of the testing process. Here, Charles Hall, a technician, uses an automatic weighing system which stores cumulative data in a computer.

Left: Selection of animals for testing is based partly on their similarity to humans—for instance, the guinea pig's immune response system makes it suitable for skin allergy tests. Technician Lynn Silber is shown.

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Haskell information analysts search the open literature via computer on-line data bases. Using this terminal, [illegible] retrieves bibliographies of published toxicity data.

ingestion, skin absorption or eye contact. Test animals are selected according to their similarity to man. For example, a rat's digestive process and respiratory system are generally similar to that of a human. Obviously, there are differences between animals and humans; nonetheless, the results of animal testing have proved to be highly useful in the study of health hazards in man.

Attention to detail is vital in this kind of operation. The environment must be rigidly controlled to rule out extraneous factors; thus, laboratory air is filtered to prevent microorganisms from conveying diseases which would bias test results. Because animals must be known to be free of disease, they are quarantined upon arrival. Thereafter, they are cared for by an expert staff headed by a veterinarian, fed a balanced diet and housed in environmentally controlled living quarters.

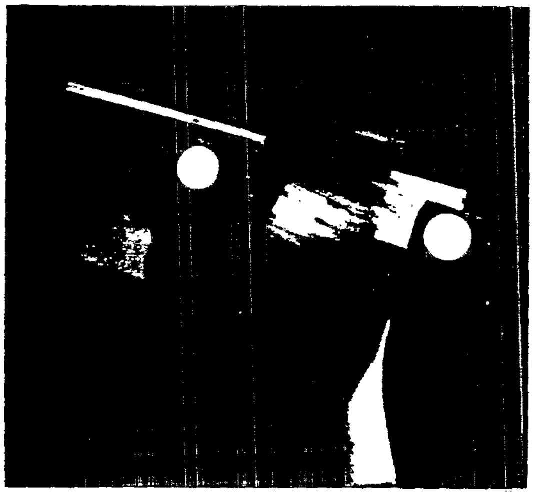
Because they often work with hazardous chemicals, all laboratory employees strictly observe safe handling precautions. A Quality Assurance Committee monitors laboratory procedures to guarantee the accuracy of test results and interpretations.

The First Step

The first step in testing is not in the laboratory but in the library. Haskell's information specialists compile all available information about a compound. A variety of data bases linked to the laboratory via computer terminal provides abstracts and bibliographic references to published papers, many of which exist in Haskell's library. The library offers some 5,000 titles, as well as subscriptions to approximately 300 foreign and domestic journals.

The result of this research is a report describing the substance—its physical properties and whatever is known of its acute and chronic toxicity, including carcinogenicity, and its effects on wildlife and humans. The report will also incorporate information on the compound's teratogenicity (its ability to cause malformation in fetuses) and mutagenicity (its ability to induce basic alterations in genetic material).

In some cases the report provides enough information to make the required decision. When it does not, it is helpful in deciding which tests need to be conducted.



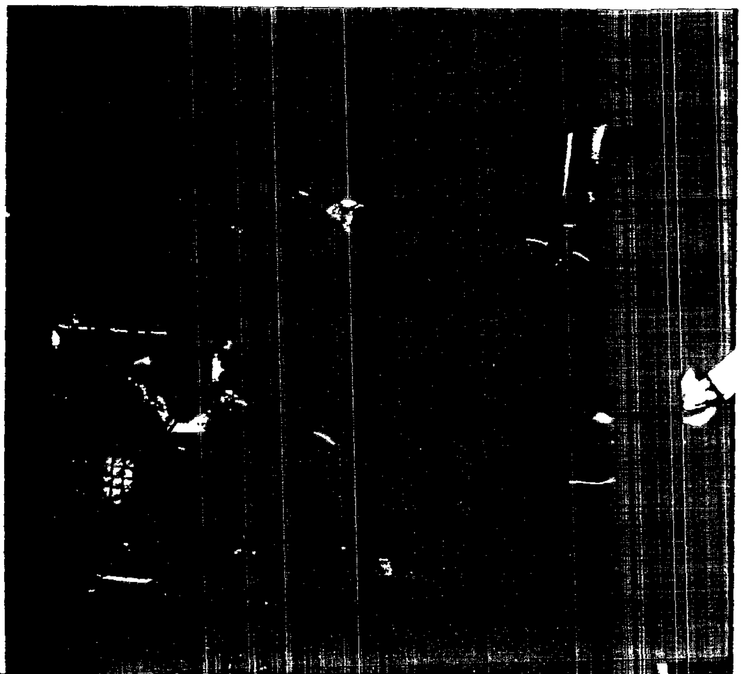
Quality preparation of test materials is essential in gathering accurate data. These tissues are being sliced as part of the preparation process which precedes examination by pathologists.

Establishing a Baseline

Short-term or acute studies, the first step in the testing process, are used to obtain information on inherent toxicity and to establish a baseline for further work. One initial study establishes the LD50 or LC50, the dose or concentration level calculated to be fatal to one-half the animal population tested.

While the nature of the chemical and its application determine the exact procedure, a basic test protocol exists. Oral, inhalation, and dermal ocular studies may be conducted, with observation both during and after the exposure period.

[illegible] from 6 to 10 rats to a test compound [illegible] a technician.

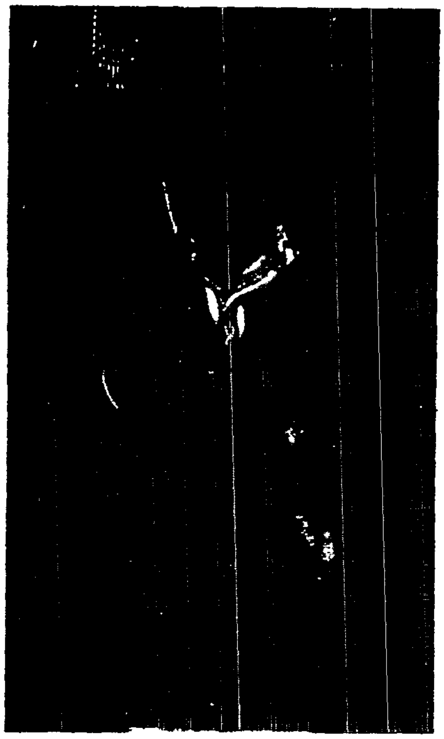


An oral study is undertaken by exposing groups of white laboratory rats to multiple dose levels. After the lethal dose level is established, the surviving rats are observed for two weeks for clinical signs.

If the substance tested is a gas, dust, vapor, fume or mist, an inhalation study is undertaken. In this instance groups of rats are exposed to the substance for a single four-hour period at different exposure levels.

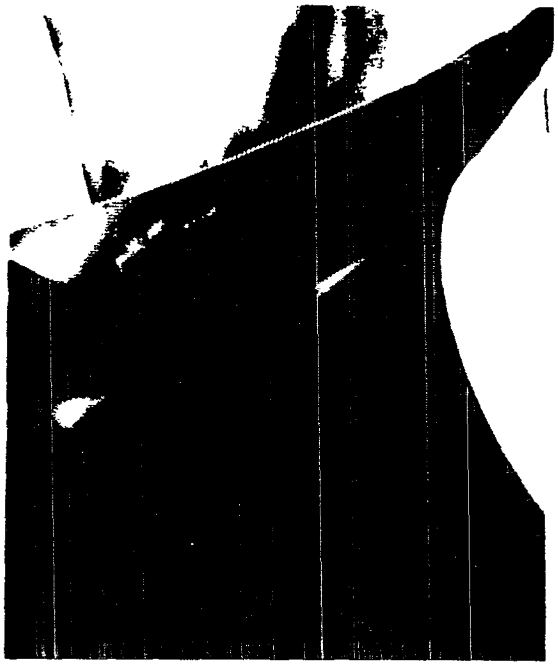
Since a substantial percentage of adverse effects from chemicals in plant situations involve the skin, acute dermal studies may also be

Acute oral studies generally involve direct dosing while in a long-term test the compound is often added to the animal's food. Connie Hincke, a technician, doses a rat as part of an oral LD50



Left: In order to ascertain whether a chemical causes skin irritation, rabbits are treated with compounds and then examined for erythema (redness) and edema (swelling). Here a chemist [illegible] evaluates the dermal toxicity of a new compound while Charles Honey, an assistant, holds the rabbit.

Human patch tests are sometimes conducted where a product may come in frequent contact with the skin. Such testing is done only after extensive animal studies have proved the material to be safe for skin contact.



conducted. Skin irritation tests are of relatively brief duration, lasting from 24 hours to three days, and generally coincide with acute oral and inhalation studies. Hair is clipped off the backs of rabbits or guinea pigs and a test compound is applied directly to the skin to gauge the resulting irritation.

Haskell also tests for allergic sensitization, and when animal tests allow the setting of safe levels, volunteers are used to test compounds where substantial skin contact is likely—as in hosiery or fibers used for carpet. These volunteers wear patches on the arm or leg, and regular checks are made to determine whether skin irritation results.

A compound which can be spilled onto the skin can also come into contact with the eye. Thus, eye tests generally are conducted on rabbits while skin tests are under way. Such tests include a measure of the difference an eye wash can make if applied soon after exposure, simulating the time a worker needs to reach an eye wash station in a plant.

The next step in the testing process is subacute studies to determine whether the material produces cumulative effects and what organ or organs are primarily involved. Typically, rats are exposed to one-fifth the LD50 or LC50 for 10 exposures over a two-week period. Some animals are sacrificed and the tissues examined by pathologists at that point while others undergo a 14-day recovery period to see if effects of the exposure are reversible.

Based on the acute and subacute studies, the material may be classified on a scale ranging from extremely toxic to relatively harmless.

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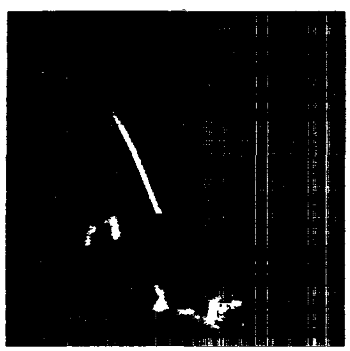
Short-Term Assays

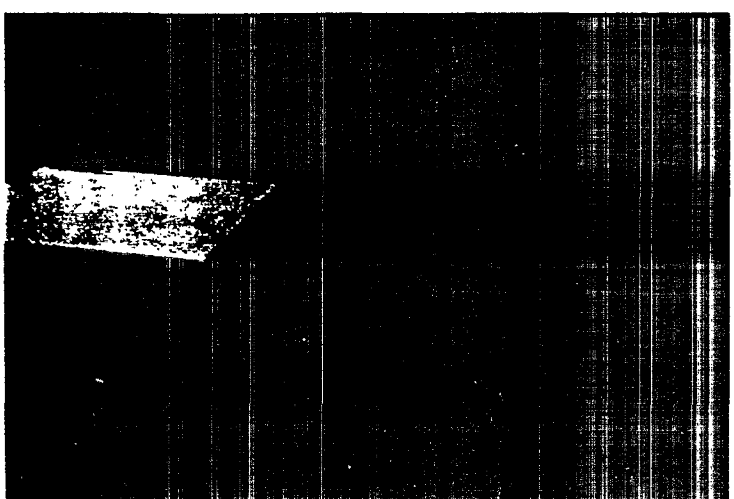
Long-term animal tests, traditionally employed to determine whether a chemical can cause chronic toxicity and cancer, cost substantial sums of money—sometimes in excess of three-quarters of a million dollars per compound—and take several years to complete. Test facilities and the supply of suitable test animals are limited, and toxicologists and pathologists are in short supply. As large numbers of compounds have been called into question, scientists have sought to develop short-term assays or "screens" to provide a relatively prompt and inexpensive indication of possible carcinogens.

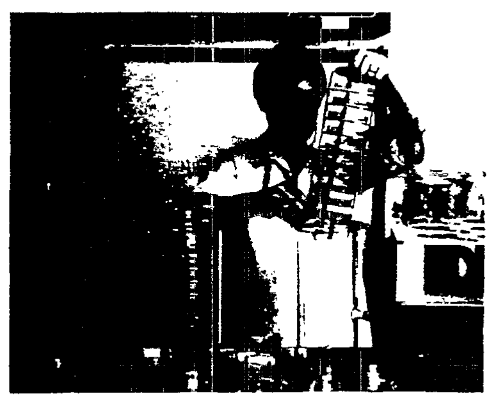
Such assays measure the ability of compounds to cause mutations, chromosomal damage or transformation of normal cultured cells to cells that can cause tumors.

Haskell was one of the first industrial toxicological laboratories to use a salmonella/liver microsome test developed by Dr. Bruce N. Ames, professor of biochemistry at the University of California. The Ames test measures a chemical's ability to induce mutations in specific strains of bacteria. Because a high proportion of known carcinogens cause mutations in the Ames test, a compound that is mutagenic in this test is a candidate for more specific tests for carcinogenicity. Other assays that measure mutagenesis, transformation or DNA damage in cultured mammalian cells are being evaluated for possible routine use at Haskell.

In this fast-changing field, no test has been sufficiently validated to constitute a reliable determinant of carcinogenesis. However, short-term assays have shown their value in helping set priorities for long-term animal tests.







Above: In a modification of the standard Ames assay, gases such as halcalkanes are tested for mutagenic activity. Bacteria are exposed to a test gas, incubated for 48 hours and then examined for mutations. Here biologist James Russell is placing petri dishes containing bacteria into sealed chambers.

Top left: Haskell is investigating a two-stage test for tumor initiation and promotion. Two weeks after a compound is applied to the mouse's back, a promoter chemical is applied to accelerate a reaction that might otherwise occur only after a much longer period of time.

Left: Biologist Maryjane Grant is weighing a chemical that will be used in the Chinese hamster ovary (CHO) test. The CHO test is one of several mutagenicity screens used by Haskell.

An Adequate Margin of Safety

Acute toxicity is relatively easy to recognize. Much more difficult to identify are effects from relatively low concentrations—parts per million or even parts per billion—accumulated over a prolonged period of time. To simulate these conditions, Haskell conducts studies using white rats or other laboratory animals and lasting either 90 days or a lifetime, usually about two years.

As in short-term studies, compounds may be administered to the animals orally, dermally or by inhalation, and the effect upon a control group is compared with the effect upon several groups representing different dose levels. The test may involve as many as 120 rats per sex per level for a two-year study. Blood and urine samples are analyzed at intervals during the study, and in a two-year test some animals will be sacrificed and examined at one year to determine the onset of tumors or other effects and to provide a reference point on tumor development.

The objective in these long-term tests is to find an exposure level which when extrapolated to humans will produce no ill effects. Haskell can then advise the concerned industrial department and others that exposures limited to that level—along with engineering controls and medical surveillance—should provide an adequate margin of safety for workers or customers.

Sometimes Haskell recommends that a material not be used at all, as when it tested a brominated biphenyl the company had found effective in protecting synthetic fibers against fire. As a result of toxicological data developed in a chronic oral study at Haskell, Du Pont decided to drop the compound.

Teratology and Reproduction

A chemical or drug with no known adverse effect upon those coming into direct contact with it at a particular concentration may still adversely affect developing fetuses or future generations. Thus, Haskell conducts teratogenic (and sometimes reproduction) studies if women of childbearing potential are likely to be exposed to a chemical.

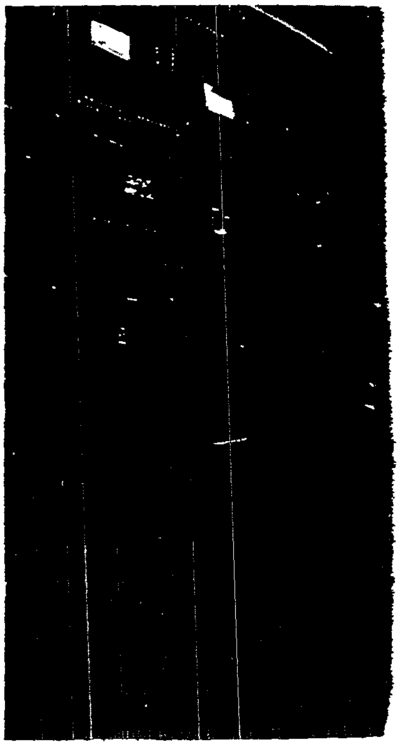
In teratogenic studies, pregnant rats are exposed to test compounds for a period during gestation, and fetuses are examined for skeletal and other abnormalities.

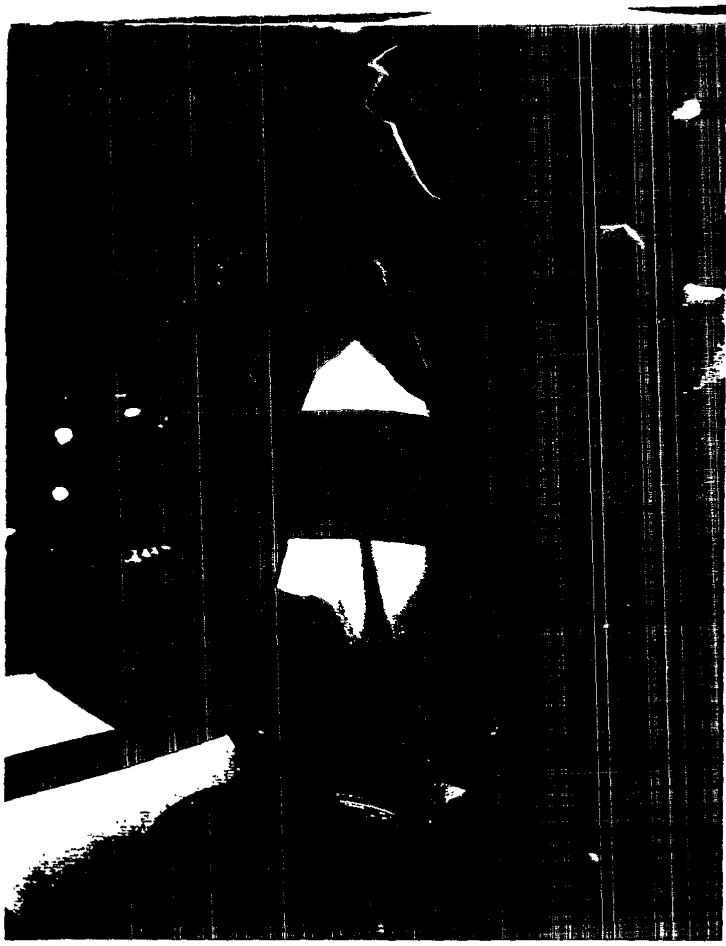
In reproduction studies, rats are exposed to the test substance and then mated in an effort to determine whether any effects are transmitted from one generation to another. Six-litter, three-generation reproduction studies may be conducted alone or as part of a two-year testing program.

Carcinogenicity

Until fairly recently, it was thought that only a few substances caused cancer in

Long-term inhalation studies normally last about two years. If the test material is extremely toxic or a suspected carcinogen, technicians such as Terry Greer wear protective clothing with a self-contained air system to transfer cages from the test chambers to the animal holding area.





A [illegible] test is undertaken to determine whether a substance [illegible] [illegible] [illegible]

humans—a textbook published in the early 1950's mentioned only three unadulterated agents. We now know the list is much longer, although chemicals that are carcinogenic may have other serious toxic effects as well and may have already been tightly controlled as toxic substances.

One reason for the difficulty in recognizing human carcinogens is that 20 years or more may pass between exposure to a carcinogen and the appearance of cancer. Further complicating the problem is the lack of an exact correlation between animal and human carcinogens.

If there is reason to control a chemical which poses a carcinogenic risk, actions are taken ranging from increased safety measures to abandoning production altogether. A large proportion of Haskell's two-year tests are undertaken to determine whether a substance is carcinogenic and to establish a no-detectable effect exposure level. This permits the establishment of an acceptable level of exposure in the workplace or assures safe use of the product.

For like other toxic effects, carcinogenesis is related to dose, and exposure can be limited to acceptable levels.

Seeking Abnormalities

Instruments today are capable of measuring very small amounts of a material. For example, a chemical particle on the head of a pin which is invisible even when magnified one thousand times can be detected by a high-pressure liquid chromatograph. This instrument can measure concentrations as low as one-half part per billion. One result of this ever-increasing ability to identify materials at very low levels and of scientists' growing knowledge has been the discovery of contaminants of which man was previously unaware.

Using these and other instruments Haskell scientists conduct analyses at regular intervals during the testing process to establish baselines and seek abnormalities that may result from compounds administered in the studies. As in all areas, everything hinges on the accuracy of the data, and extra care is taken in laboratory procedures to assure that the results are accurate and complete.

Biochemistry

Blood and urine analyses and metabolic studies are among the services performed by Haskell's biochemists to determine what happens when a chemical gets into the body. They want to know such things as how much of the chemical is absorbed, how it is eliminated and whether it is chemically altered. In addition to its toxicological work, the biochemistry group also offers an analytical service for the laboratory and particularly for its industrial hygienists. For example, a plant physician may want help in establishing biological monitoring programs for workers exposed to a solvent; or a manufacturing department may want to establish the efficiency of absorbent materials used in worker respiratory masks.

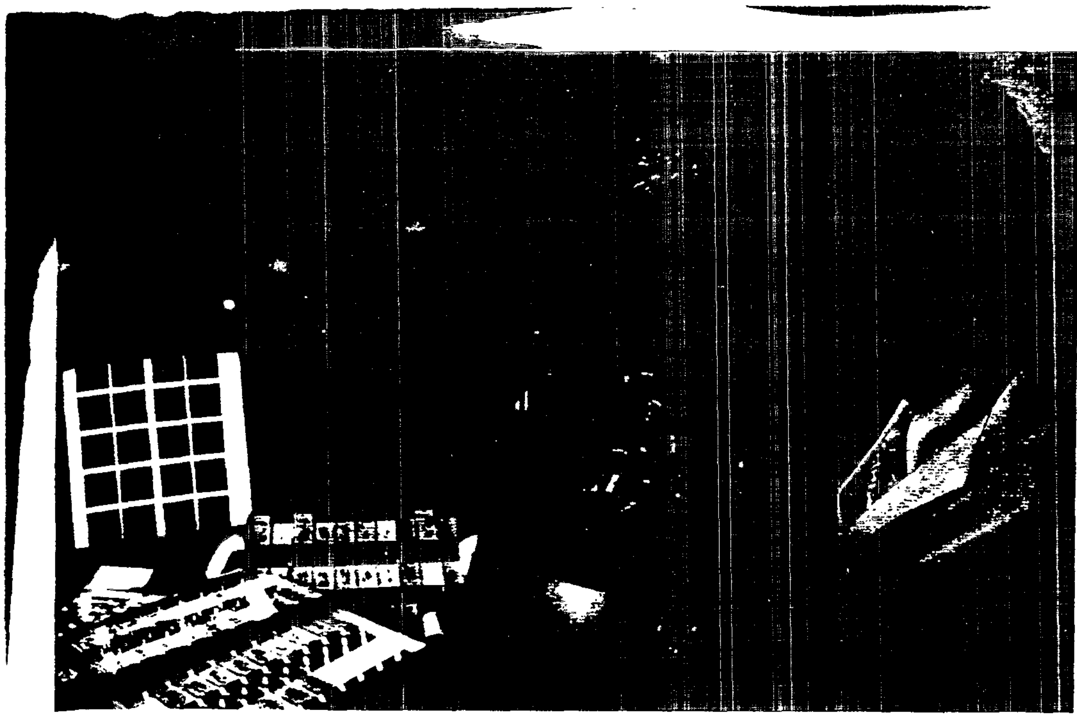
This analytical manifold allows Haskell scientists to generate known atmospheric concentrations of organic vapors by controlling air flow, temperature and pressure. Norman Henry is the chemist.

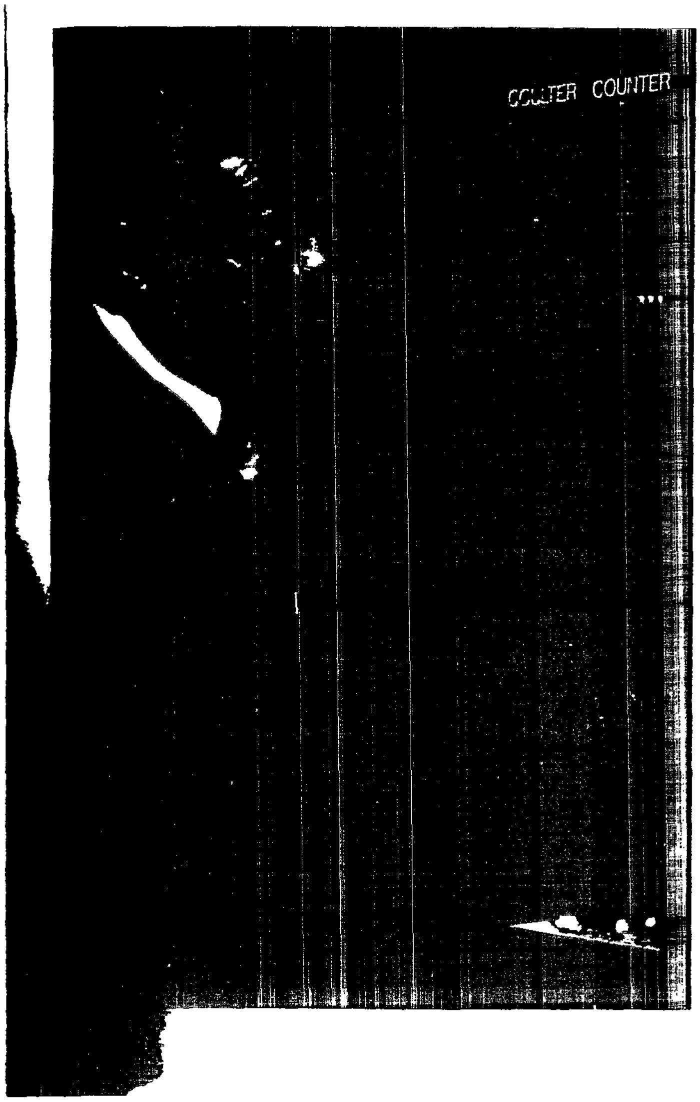
Pathology

The last step in the testing process is taken by pathologists who perform autopsies on sacrificed animals, then examine the tissues microscopically. Approximately 20,000 tissues can be generated in the course of a long-term study—more than 30 tissue samples from each of 640 animals—and the experienced eye of highly trained pathologists is needed to detect abnormalities. If tumors appear with a greater than normal frequency or within a shorter than usual time span, the determination of whether this is the result of the test material or of some unrelated factor is often difficult.

Statistics

Assisting throughout the testing and evaluation process are Haskell biostatisticians. They provide advice on such questions as the number of animals required for a statistically valid study, the dose level that will achieve a sufficient level of safety or the significance of abnormal findings by the pathologist. In short, whenever numbers are involved, the statistician is also involved.





Top) In order to determine possible detrimental effects of the test compounds, the tissues from experimental animals exposed to a chemical are subjected to microscopic examination. Dr K. P. Lee, staff pathologist, examines a kidney tissue from exposed rats.

Top right. Computer systems are used to collect and analyze test data. Research toxicologist Dr. Craig Wood examines the results of a recent toxicological study.

(Left) Blood counts of animals are conducted on an automatic blood cell counting apparatus to check for toxic effects of test chemicals. Here clinical chemist Walter Koniecki places a sample of diluted blood into the counter.

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DU 039666

New Frontiers of Knowledge or Concern

Increasingly, Haskell Laboratory is called upon to perform tests that extend beyond traditional acute and chronic toxicological studies. Some of these tests have been undertaken for years; others represent new frontiers of knowledge. For example

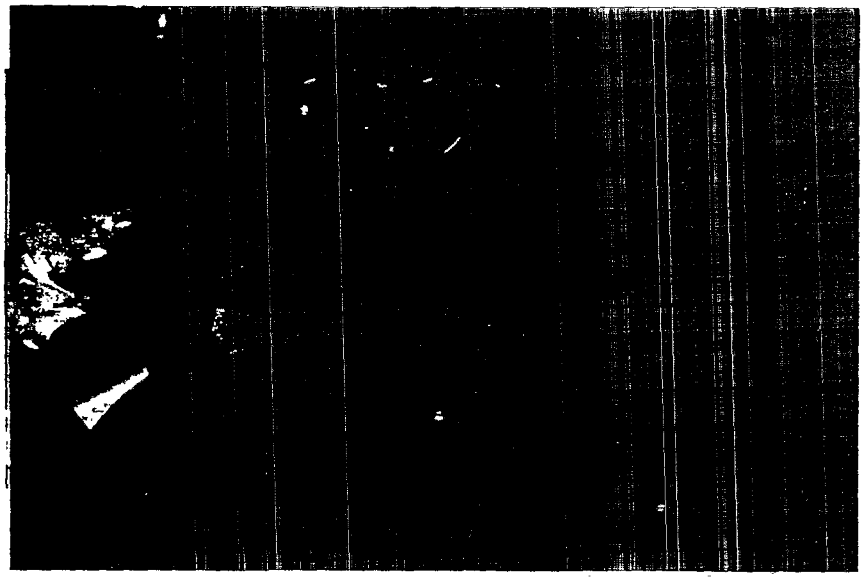
- Combustion/pyrolysis studies may be conducted to determine the harmful effects of gases generated when a substance burns.
- Chickens may be used to evaluate delayed neurotoxicity.
- Potentiation studies may be undertaken to gauge the effect of combining one compound with another.
- Pharmacokinetic studies may be employed to learn even more about the effects of chemicals present in the body over a period of time.

Genetic Toxicology

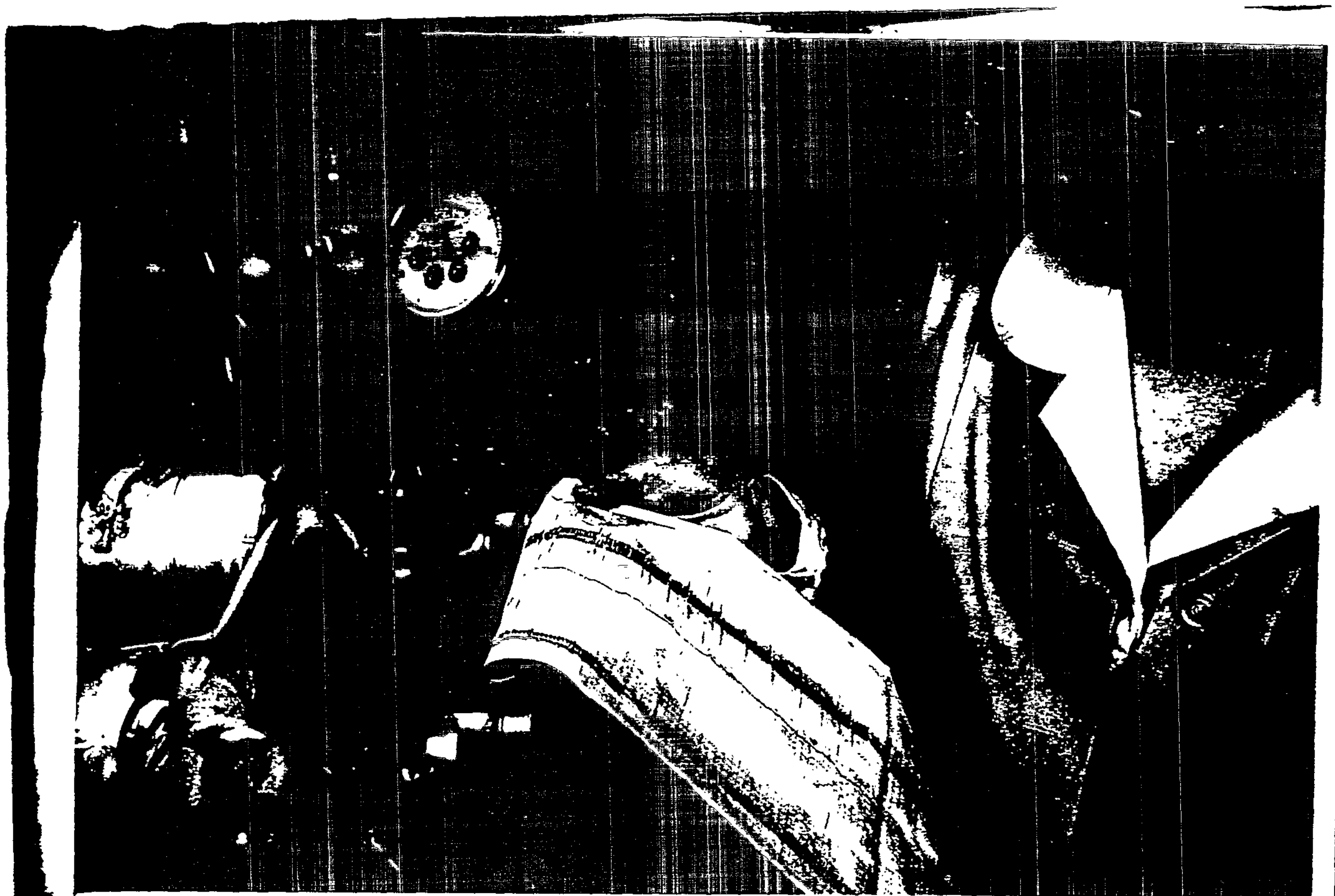
Genetic toxicology studies are also expanding. In addition to the Ames assay and Chinese hamster ovary test, described previously, Haskell is establishing and evaluating new tests to measure the mutagenic and carcinogenic potential of compounds. One such test is the sister-chromatid exchange assay. In this assay toxicologists observe the exchange of genetic material in dividing chromosomes. The test provides another indication of genetic damage and it can be performed with mammalian cells in culture (<u>in vitro</u>) or in live animals (<u>in vivo</u>).

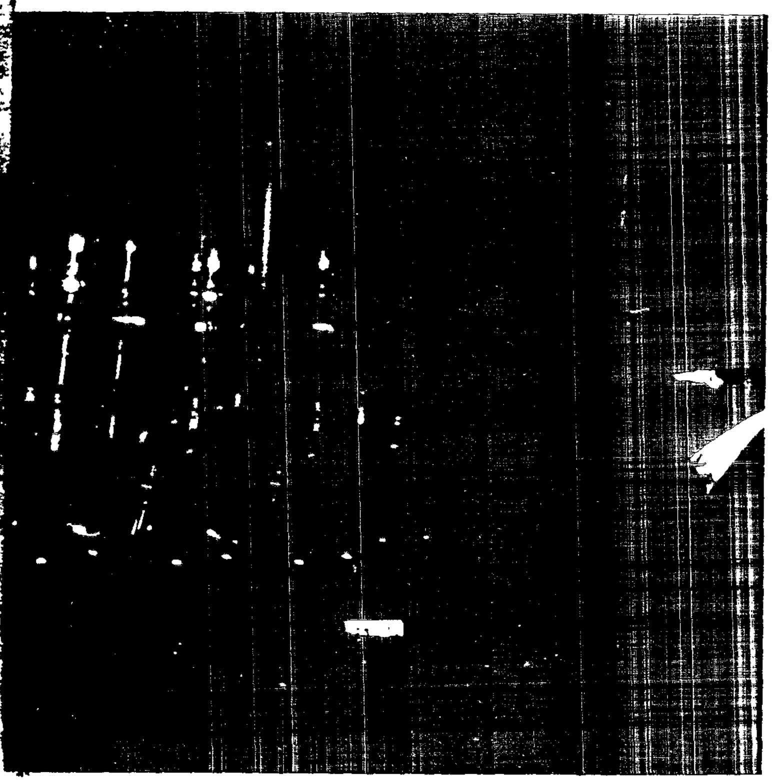
In another genetic toxicology test, rat liver cells are used to determine whether a chemical interacts with DNA by measuring DNA repair. This test is very important because freshly isolated liver cells metabolize chemicals in a way very similar to <u>in vivo</u> metabolism.

The results of these kinds of tests supply the toxicologists with valuable information to set priorities for higher level testing. There is a need, however, to develop additional assays designed to identify potential mutagens and carcinogens. Since different chemicals have different properties and are metabolized differently, no single assay will provide all the necessary information. Haskell's goal is to set up a series of assays that will allow scientists to evaluate the genetic hazards of chemicals on a case-by-case basis



Here biologist Paul Grube is conducting a modified range finding study on bluegill sunfish which will give an indication as to the toxicity of the test chemical. This will be followed by a more definitive study to determine the LC50—the concentration which is lethal to 50% of a test population during a specified time period





Respiratory sensitization tests are conducted on guinea pigs to determine if chemicals may cause asthma-like allergic reactions. The respiration rate of the animals is recorded with a plethysmograph and then examined. Here physiologist Linda M[illegible]n studies the rates of two guinea pigs.

Biodegradation studies are now being conducted at Haskell to ascertain the effect Du Pont products may have on the environment as they decompose. Here technician Jeffrey Feine inspects flasks of an oxidation unit.

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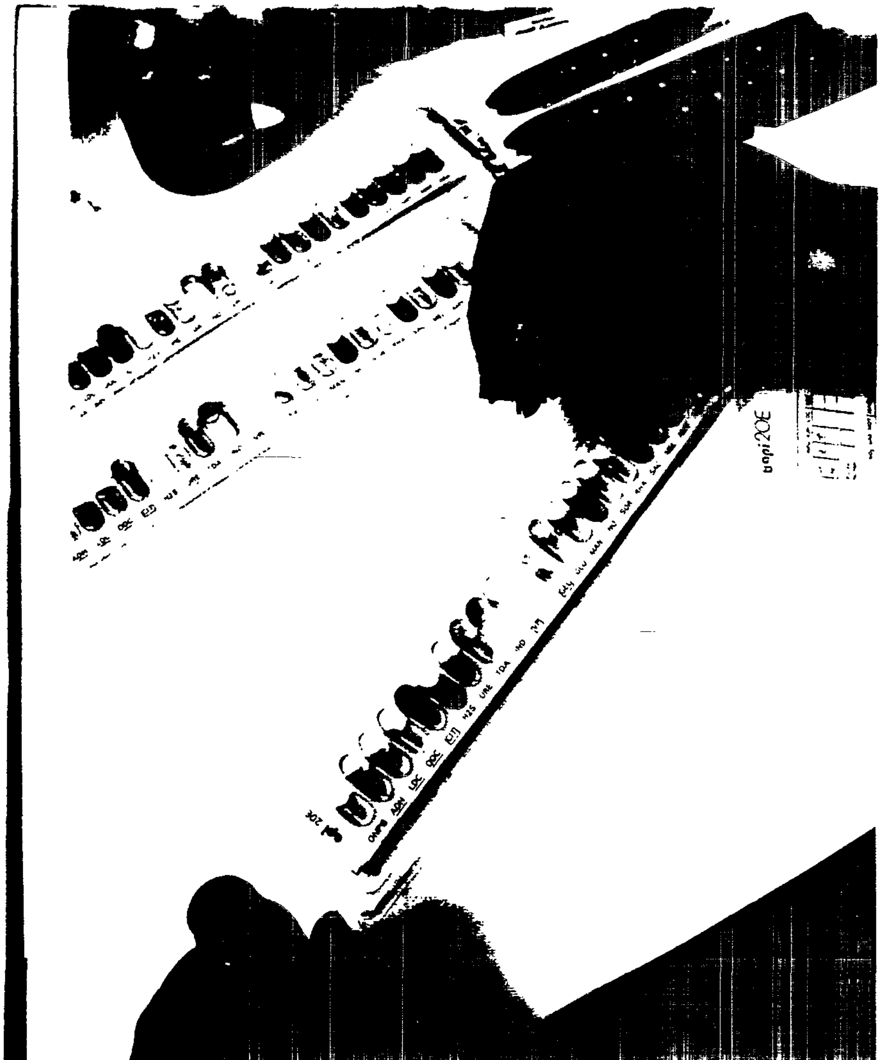


Aquatic Toxicology

A chemical is to be barged up a river What are the potential hazards of a spill? A plant environmental coordinator needs help in preparing a demonstration project for the Environmental Protection Agency Haskell supplies the answers and the help. Any company impact on the aquatic environment is likely to appear on the agenda of Haskell's aquatic toxicologists, who offer consulting services and conduct and oversee tests on everything from complex plant effluent to compounds that are candidates for marketing

Again, a general pattern is followed. The most basic study involves acute static toxicity, in which fish are exposed to test compounds in standing water to determine a lethal concentration. Dynamic acute studies utilize constantly renewed exposure solutions in flowing water, which is more relevant to the real environment and assures more meaningful results. The use of invertebrates such as daphnia (water fleas) in chronic studies provides subtle information on reproduction and growth as well as lethality in relatively short periods of time.

Haskell's aquatic section also tests the ability of fish to absorb and store a compound dissolved in water—agrichemicals or heavy metals for instance The purpose is to determine whether eating such fish could prove dangerous to humans or animals. In addition, spill situations can be simulated by using a cyclically flowing system which generates pulses of a chemical in water

Microbiology

One of the major new areas of emphasis for Haskell microbiology is the microbial biodegradation of non-pesticide organic chemicals Tests will provide estimates of the rates at which natural mixtures of soil and water can break down a compound into simpler molecules. Microbial degradation studies will also be used to determine if harmful chemicals are produced as a result of the decomposition process. If this occurs, waste treatment methods may have to be altered.

Occasionally, it will be necessary to examine specific environmental effects of test compounds, such as how the carbon, nitrogen or sulfur cycles in the soil and water would be affected by contact with a compound.

These studies will allow Du Pont to plan more efficiently and economically for the transport and storage of chemicals and the disposal of wastes generated in their synthesis.

DUP 0949315

DU 039669

Part of a Companywide Effort

Almost everything Haskell does is for use outside its walls The laboratory is part of a companywide effort to provide safe products and an acceptable working environment. and it interacts frequently with individuals and institutions outside Du Pont.

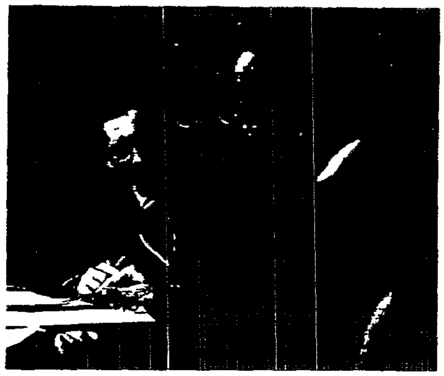
Within Du Pont

An important part of the Haskell team is the corps of industrial hygienists who visit plant sites to advise on equipment and procedures which will assure worker safety.

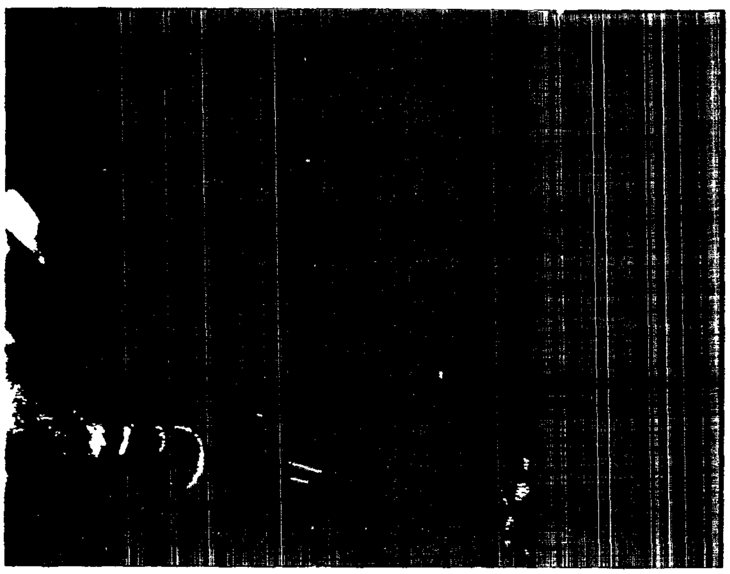
While such contact most often is initiated by Du Pont's plants and industrial departments. the process also works the other way around. as when laboratory personnel have a finding they want to share with the company's manufacturing units. This is in keeping with Du Pont's policy of releasing any information that would enable others—either inside or outside the company—to act with greater safety

A basic goal when working with highly toxic materials is to isolate the worker from the chemical. Haskell's industrial hygienists may recommend that a new plant be designed to contain the material within pipes. tanks or other vessels. or even within a sealed-off and automated "building within a building" where access is allowed only for maintenance and then through air locks.

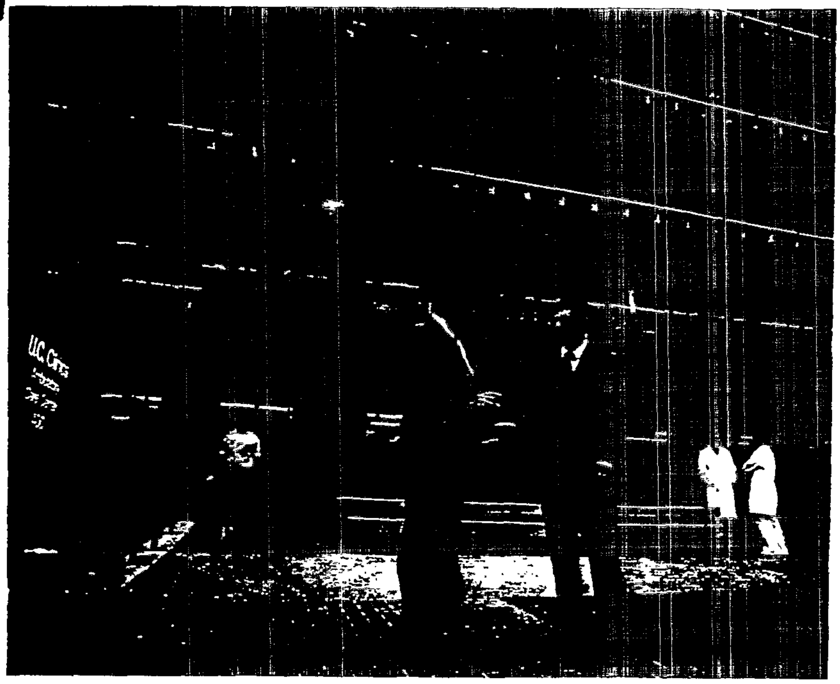
Haskell's industrial hygienists measure and monitor exposure levels at plant locations. Sometimes changes are needed in existing facilities, such as an improved ventilation system. Dikes may be needed around storage tanks, or improved seals and gaskets. Depending upon the operation involved. employees may have to change their work clothing daily. use butyl or neoprene gloves and overshoes to preclude skin contact. or wear a Du Pont-designed "Chem Proof Air Suit."



Dr Charles Reinhardt (left), director of Haskell Laboratory spends a substantial proportion of his time meeting with representatives of Du Pont's manufacturing departments He's shown here with Dr John Daly Jr of the Petrochemicals Department



A portable quantitative face-fit test system is used by plants to make sure respirators fit properly It is also used in respiration research projects Here industrial hygienists Joseph Loschiavo (right) and Dr Orrin Skretvedt demonstrate how the system works



Contact with scientists on campus is an important part of Haskell's work. Here assistant director Dr. Blaine McKusick, right, visits Dr. Charles Hine, clinical professor of toxicology and occupational medicine at the University of California School of Medicine in San Francisco.

Students from the Delaware Summer Science Workshop hear research biologist Dr. Frank [illegible] explain the monitoring system for a portion of Haskell's aquatic area. Acquainting interested persons with its activities is part of Haskell's program of community involvement.

To further ensure that levels of chemicals found in the workplace are safe for employees, Du Pont's Acceptable Exposure Limits Committee develops guidelines for permissible exposures based on human experience and/or animal toxicity studies. The AEL Committee consists of toxicologists, industrial hygienists, occupational physicians and information specialists. This group establishes AEL's (acceptable exposure limits) for materials produced or used within Du Pont and involving sufficient volume and/or potential worker exposure.

Responsibility for medical surveillance of employees rests with Du Pont's Medical Division. It examines employee histories for adverse impacts on health and analyzes blood and urine at frequent intervals. If anything unusual is found, more testing is done and the employees' work practices are carefully reviewed. Instances of employee cancer are recorded in a cancer registry established in 1956 to provide the data for epidemiological studies. Depending upon the circumstances, notice of Du Pont's experience will go to affected employees, customers, government agencies, other producers and the media.

Du Pont's top management is intimately involved in safety and health matters. The Environmental Quality Committee reports directly to the Executive Committee and coordinates activity in this area. Day-to-day contact is maintained through a liaison committee composed of departmental management representatives and Haskell coordinators.

Outside Du Pont

Haskell scientists and managers are in frequent contact with commercial toxicology laboratories, with which Haskell sometimes contracts to supplement its own work. Likewise, they are in close touch with government agencies like the Environmental Protection Agency, the Occupational Safety and Health Administration and the National Institute for Occupational Safety and Health, which recommend and administer the myriad laws and regulations on public and worker safety and health. There are also regular contacts with the academic and scientific communities, in a two-way sharing of information.

Another important association is with CIIT, the Chemical Industry Institute of Toxicology, which Du Pont and other companies created and support to undertake toxicity studies and non-proprietary research on widely used chemicals. Among the chemicals CIIT selected for early testing were chlorine, ethylene and toluene, the latter frequently used in solvents and paints and as an intermediate in many chemical processes.

Finally, Haskell provides emergency information on product formulation and/or toxicity, as well as recommendations on safe handling and antidotes, to physicians, poison control centers, hospitals and other chemical companies.

DUP 0949317

DU 039671

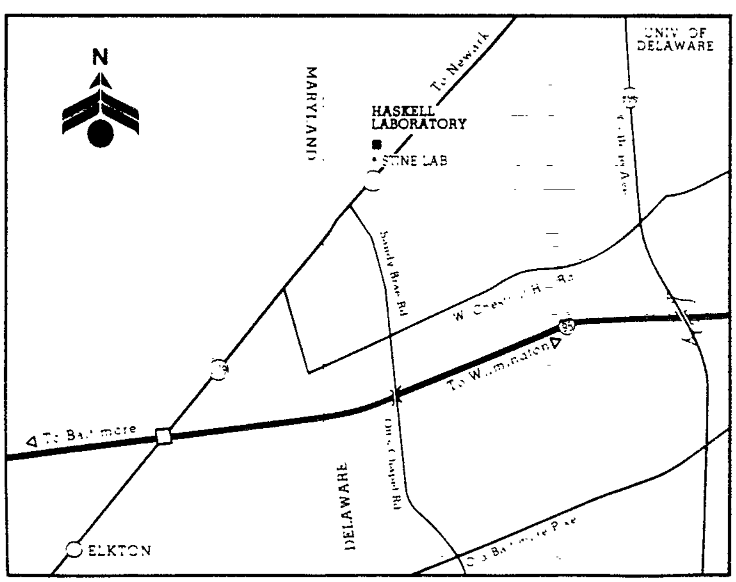
Some Haskell Facts

The Haskell staff numbers around 225, more than 20 percent of whom have doctorate degrees. Almost half the staff have a bachelor's degree or higher, and there are four medical doctors and seven veterinarians, several of whom also have Ph.D. degrees. Molecular biology and microbiology, acquatic toxicology, chemistry and biochemistry, biostatistics and pathology are among the disciplines represented. Since 1935, over 200 articles written by Haskell scientists have been published in the scientific literature and over 10,000 reports have been issued.

Each year the laboratory tests approximately 700 chemical substances for potential hazards. In 1979, approximately 1200 tests were conducted. Haskell's animal population numbers about 10,000, 95 percent of them rodents.

Haskell is located on Elkton Road (Delaware Route 2; Maryland Route 279) just off Interstate 95 between Elkton, Maryland, and Newark, Delaware, just a few minutes from the University of Delaware campus.

Above: Two new wings presently under construction are scheduled to be completed by mid-1981



Credits
Booklet design is by Lyons Studios, Wilmington, Delaware. Photography is by Keith Meyers with the following exceptions: the San Francisco picture on page 17 is by Christopher Springmann of Black Star; pictures of Dr. Reinhardt on page 16 and of the blood analysis on the front cover (top left) are by Dennis Brack of Black Star; and pictures on extreme right side of cover and on page 3 are from Du Pont photo files.