ALTERNATIVES

While experimenters search for the species that most closely mimics human responses, a more effective and humane approach would be to concentrate resources on methods of *direct relevance to people* such as population studies, clinical investigation of patients actually suffering from the illness, and test tube experiments with human tissues.

In human population studies, known scientifically as epidemiology, researchers monitor entire communities to discover the lifestyle, dietary and environmental origins of disease. During the 19th century, social reformers used epidemiology to influence sanitary reforms[1] and the resulting improvements in public health were chiefly responsible for the increase in life-expectancy over the following 100 years.

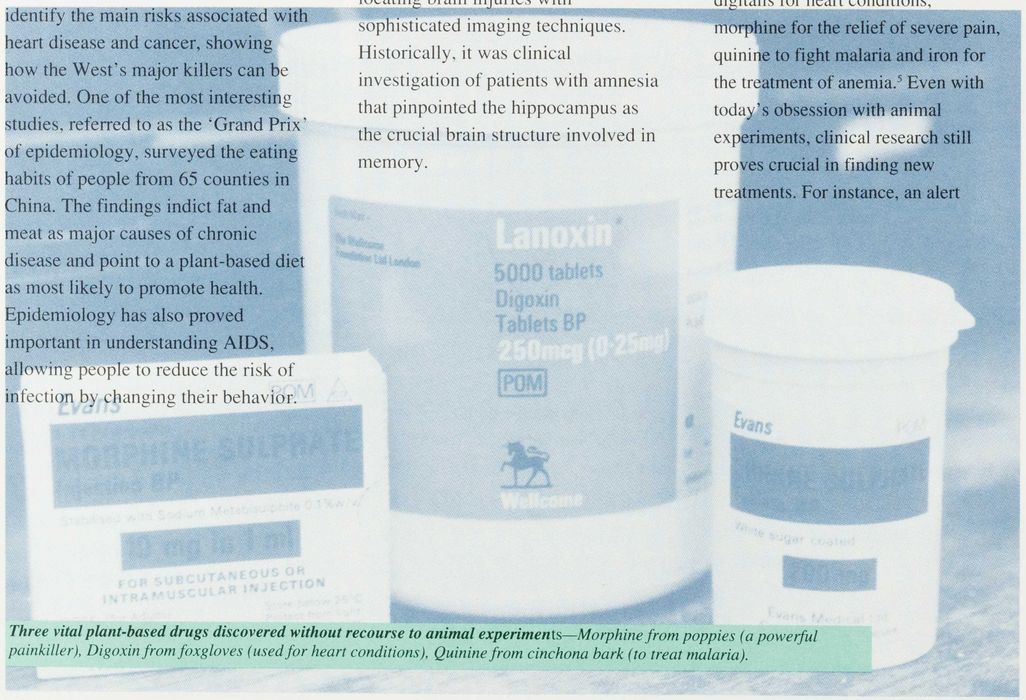
Careful detective work has enabled modern-day epidemiologists to identify the main risks associated with heart disease and cancer, showing how the West's major killers can be avoided. One of the most interesting studies, referred to as the 'Grand Prix' of epidemiology, surveyed the eating habits of people from 65 counties in China. The findings indict fat and meat as major causes of chronic disease and point to a plant-based diet as most likely to promote health. Epidemiology has also proved important in understanding AIDS, allowing people to reduce the risk of infection by changing their behavior.

Further vital information can be obtained by the direct study of actual human patients, known as clinical research. Doctors record case histories, measure blood pressure, take tissue and urine samples for analysis, and use modern scanning techniques such as positron emission tomography and magnetic resonance imaging to discover what is happening in the body. The resulting picture of disease provides a rational basis on which to devise treatment unlike experiments on animals where the same illness is likely to take a different form.

An example of clinical research is the study of brain function. Neurologists Antonio and Hanna Damasio at the University of Iowa College of Medicine observe patients with brain injuries and relate changes in their behavior to the damaged part of the brain.[2] The Damasios have studied brain lesions in 1,500 patients, often locating brain injuries with sophisticated imaging techniques. Historically, it was clinical investigation of patients with amnesia that pinpointed the hippocampus as the crucial brain structure involved in memory.

Post-mortem studies provide additional information: the link between diabetes and a damaged pancreas was discovered in this way although acceptance of the idea was delayed partly because physiologists found it difficult to reproduce the effects in animals.[3] Similar analysis of human brain tissue revealed the chemical imbalance in Parkinson's Disease allowing the logical development of drug treatment to correct the deficiency.[4]

The importance of clinical research is stressed by US physician Paul Beeson. Writing in the *American Journal of Medicine,* (vol. 67, 1979) he explains how "progress by the study of man is by no means unusual … it is more nearly the rule," and, as examples, cites hepatitis, appendicitis, rheumatic fever, typhoid fever, ulcerative colitis and hyperparathyroidism. Medicines derived from clinical research include digitalis for heart conditions, morphine for the relief of severe pain, quinine to fight malaria and iron for the treatment of anemia.[5] Even with today's obsession with animal experiments, clinical research still proves crucial in finding new treatments. For instance, an alert physician may notice that a drug prescribed for one purpose unexpectedly produces another effect which might prove beneficial. New remedies for heart disease, high blood pressure, depression, epilepsy and schizophrenia were all discovered after further clinical evaluation of existing drugs.[5]



***Three vital plant-based drugs discovered without recourse to animal experiments**—Morphine from poppies (a powerful painkiller), Digoxin from foxgloves (used for heart conditions), Quinine from cinchona bark (to treat malaria).*

Clinical investigation is also superior in the prevention and management of deliberate and accidental poisoning cases. Indeed, Dr Virginia Murray of London's National Poisons Unit believes that *one* well documented case of poisoning in a human being is equivalent to 20,000 animal experiments![6]

Medical science has a rich and productive history of researchers carrying out experiments on themselves.[7] Many preferred to do this either because there was no appropriate animal model or because they disliked or distrusted animal experiments. Examples include the development of cardiac catheterization, the introduction of nitroglycerin as a long-established treatment for angina and, most crucially of all, the discovery of anesthetics which enabled surgery to emerge from the dark ages. Perhaps the most famous case is the investigation of yellow fever. No animal was known to be susceptible and in 1900, Dr Walter Reed, head of an American military team to Cuba, proved through experiments on human volunteers that mosquitoes did indeed transmit the disease. Reed's findings were put to good use in Havana where improved sanitation and quarantine not only wiped out yellow fever but almost completely rid the area of malaria, another mosquito-borne disease.

"Any* in vitro *method using human tissue gives a degree of reassurance (in safety tests) not provided by … animal experiments."

Lister Hospital, England[11]

Much research can be carried out in the test-tube *(in vitro)* using human cells and tissues obtained from volunteers, therapeutic surgery, biopsies and post mortem specimens. Kept alive outside the body or cultured to allow continuous growth, they could save many animals in medical research, drug development, toxicity testing, and the production of vaccines and monoclonal antibodies. For instance, epilepsy research has traditionally relied on animal experiments but while there are numerous animal models of the disease, none accurately reproduces the clinical disorder and results vary depending on the model chosen. However, researchers at the National Institutes of Health in Bethesda have shown how brain tissue removed surgically during treatment for intractable epilepsy can be used to study the chemical basis of seizures in patients.[8]

VACCINE PRODUCTION

Many vaccines could be produced more safely from human rather than animal cells.
Examples include:

rabies
rubella
mumps
polio
yellow fever
smallpox
measles

Scientists at the University of Illinois College of Pharmacy have found that sufficient test tube techniques exist so that almost any useful drug effect can be detected without using living animals.[9] Such tests utilize cells, tissues and enzymes from the body and while in most cases these originate from animals, human tissues could be used to advantage.

"In recent years many animal tests for the safety of viral vaccines have been replaced by cell culture tests which are more sensitive and reliable."

***Lancet,* October 19, 1985**

In a major change of strategy, the US National Cancer Institute recently substituted many of its animal tests with cultures of human cancer cells. In April, 1990, the *Journal of NIH Research* acknowledged that traditional tests with leukemic mice were failing to identify new treatments against any of the main cancers. Yet it was over 30 years ago, in 1956, that Eagle and Foley first showed that human cancer cells could be used to test anticancer drugs. Human cells can also be used to test new treatments for AIDS.

Human cell tests also promise an alternative means of safety evaluation. The idea that a combination of *in vitro* tests can correctly predict the general toxicity of chemicals is a basic assumption behind a multi-center trial initiated during 1987 by the Scandinavian Society for Cell Toxicology. The research aims to find the best combination and while many of the cell systems derive from animals, a human-oriented approach is again preferable. For instance, in