Animal Concern Factsheet 6 -
Alternatives to Live Animal Research

IN VITRO METHODS

Cell, tissue and organ culture enables researchers to study a wide array of body components under carefully controlled conditions outside the body.

Cell culture - individual cell types are grown in special nutrients, which allow the cells to be maintained artificially. Any chemical or drug can be directly added to the medium.

Tissue culture - fragments of tissue (lung, heart, liver etc.) taken at an autopsy or operation are kept in nutrients.

Organ culture - A whole organ with a full range of cell and tissue types can be kept for a short time in special nutrients.

(A) Applications: These procedures can be used as successful alternatives to the outdated LD5O test and other toxicology testing.

Alternatives to the Draize Eye Test are numerous and the EEC have listed some as useful alternatives. The tests include IET (the Isolated Eye Test), NRU (Neutral Red Uptake), NRR (Neutral Red Release), Total Cellular Protein, Tetrahymena Motility Assay, SIRC Cytotoxic Test, EYTEM (TM), Dual Dye Staining Procedure, Chromium-51 Release Assay, Agarose Diffusion Method (ADM), Pollen Tube Test, MTT Assay, and the Chorio-allantoic Membrane Assay.

All these are undergoing analysis to find out if the results are more accurate than the Draize Test.

In vitro techniques are being used for the production of vaccines, cancer analysis and the search for treatments of many diseases.

(B) Advantages: In-vitro methods enable individual cell types, tissue types or whole organs to be studied separate from the potentially confounding influences of other body systems. The amount of test substance required for a result is much smaller as it does not first go through the rest of the body system. These cultures are much more sensitive as a result. As human cells are used, results are more relevant to humans.

An interesting fact about cell culture is that it shows the drug which caused the Thalidomide tragedy would cause side effects in humans. Something animal experiments failed to do.

COMPUTER AND MATHEMATICAL MODELLING

The potential of a new drug or chemical can be tested by computer. Toxicity can be measured as a factor of the presence or absence of certain reactive fragments in the test chemical. By computer animated reconstruction of the physical-chemical properties of a substance its reaction to the introduction of a toxic agent can be simulated.

Application: This system is already used by some pharmaceutical companies to limit the number of drugs tested on animals (for every animal- tested drug which makes it onto the

number of drugs tested on animals (for every animal- tested drug which makes it onto the market it is believed that 7-8,000 go by the wayside).

(B) Advantages: Such techniques can also be used in physiology and pharmacology to greatly reduce the number of animals killed. The costs of producing new drugs would be reduced as potentially lethal ones can be weeded out straight away.

PHYSICAL - CHEMICAL METHODS

Physical and chemical methods include liquid chromatography and mass spectrophotometry. These assess the potency of a chemical without using animals or cell and tissue cultures. The presence and amount of a particular chemical can be quickly assessed.

(A) Applications: Assays for vitamins, potency of drugs and pregnancy testing.

(B) Advantages: Again the cost of producing an effective drug will be reduced

DRUG DESIGN

For every new drug on the market as many as 8,000 have failed animal tests. This hit-and-miss technology, where many substances are tested in the hope that one will eventually work, is a great waste of time, money and most importantly, animals.

Alternative methods of drug design will hopefully eradicate the need for this wasteful practice. Drugs interact in a lock and key manner, drug design plays upon this. A computer can produce a 3-D image of the virus, bacteria or rogue protein. A new drug would be designed to interact with the known structure of the protein.

(A) Application: All drug design would be aided with this technology
(B) Advantages: An advantage of this system would be that, as the whole structure of the new drug has been designed, adverse side effects would be controlled.

GENETIC ENGINEERING OF PROTEINS

Many genetic disorders are due to either the complete lack of a particular protein or the presence of a malfunctioning one, as in the case of diabetes. Diabetic sufferers are treated with insulin purified from pancreatic extracts.

With many genetic conditions the protein responsible is either not known or not easy to purify. In these cases the gene for the protein is cloned (the actual DNA sequence is extracted) and the sequence is put into another organism, usually a yeast or a bacteria. The organism can then be manipulated to make vast quantities of the protein. Human insulin is now produced in this manner, as is factor-8 which haemophilia-sufferers lack. As the protein has been genetically engineered there is no risk of cross-infection, as in the case of haemophilia sufferers and AIDS.

(A) Application: All genetic conditions can be treated in this way. The gene responsible for Duchenne Muscular Dystrophy has been cloned and the protein is at present undergoing purification. Hopefully a treatment will soon be on the market.

(B) Advantages: A genetically engineered protein should be identical to the normal protein in humans and as such there should be no side effects.

YEAST, BACTERIA AND LESS SENTIENT ANIMALS

Toxicity testing and tetratogenic (birth defect) testing can be carried out on yeast (and other fungi), bacteria and invertebrate organisms like Drosophila, Ceanorhadbitis and Trypanosomes.

Many toxicity tests are already carried out on bacteria as in the Ames' test which exposes salmonella bacteria to substances suspected of causing cancer. The test is highly sensitive and costs around 20 times less than animal tests.

(A) Application: All cancer testing could firstly go through an Ames' test before going on to a cell or tissue culture test.

(B) Advantages: Again the costs of producing a new drug would decrease and these procedures could be used to test for potential carcinogens without using hundreds of animals and massive quantities of the chemical.

HUMAN STUDIES

(A) Applications

(1) Autopsy - Autopsies have been carried out on humans for many years. Observations from autopsies have lead to important discoveries like the cause of diabetes and Alzheimers disease. A drawback of autopsies is that you only see the final stages of the disease.

(2) Biopsy - Diagnostic needle biopsies and endoscopic biopsies can be carried out at any time. They therefore make up for the drawbacks of autopsies.

(3) Clinical Observation - Informed guesswork by clinical observers has always been a major factor in the understanding and possible treatments for a disease. A good clinician will often uncover facts that an animal model will not show.

(4) Epidemiolociv - Epidemiology is the study of a disease accounting for the population as a whole. These studies have indicated that 80% of cancers are preventable and they showed the link between smoking and cancer.

(B) Advantages

As you are studying humans directly there is far less chance of a severe drug disaster occurring.