One of the most striking examples of wasted resources is the use of animals in alcohol research. Although the damaging effects of alcohol have been known for a long time, further insights can be obtained through clinical studies with alcoholics or with human tissues from biopsy samples and autopsy specimens. Nevertheless animal research continues unabated despite conflicting results. For instance, while alcohol-induced cirrhosis of the liver is a main cause of sickness and death in Western society, scientists have had great difficulty reproducing the effects in laboratory animals. Only in baboons has cirrhosis been induced[42] although even this finding has now been challenged.[43] Alcohol is also known to raise blood pressure but this is not the case in laboratory animals.[44] And while some people react violently after excessive drinking, many animal experiments have failed to show an increase in aggressive behavior.[45]

If animals are often poor models for human illness and an unreliable guide to the safety of medicines, surely it is only common sense to switch our resources to methods of more direct relevance to people? In the investigation of human illness, researchers can employ test tube experiments with human tissues to investigate disease at the cellular level and match their results with clinical and epidemiological findings so an overall picture can be obtained. On some occasions, it might be argued, animal experiments do provide a similar model of human disease. But the accuracy of animal experiments can only be judged *after* clinical research with volunteers and patients has taken place. So why waste resources on experiments which could produce conflicting results?

Test tube studies with human tissues are not only valuable in understanding human disease; they can also be used to test the effectiveness of new medicines, for instance in the development of drugs to treat AIDS.[46] The unreliability of animal models has finally persuaded the National Cancer Institute to change the way it searches for new drugs, with human cancer cells replacing mice, albeit only in preliminary tests at present.[47] Yet it was over 30 years ago,

in 1956, that Eagle and Foley showed how human tissue culture could be used to test new anticancer drugs.[48]

Test tube experiments with human cells could also be used to test the safety of medicines prior to clinical trials. While clinical trials with healthy volunteers and patients are the most reliable test of a new drug, some preliminary assessment is essential to identify the most toxic substances. And while human cell systems have their limitations, they do promise better protection against hazardous drugs. For instance, results from Britain's Lister Hospital show that human bone marrow cells can be used to detect drugs like chloramphenicol which cause deadly blood disorders. The researchers conclude that test tube methods with human tissues can give a degree of reassurance not provided by animal experiments.[49] Others have shown that human cell tests can identify thalidomide's ability to damage the unborn child.[50] And human lymphocytes are being used as part of a battery of tests to detect mutagens and carcinogens.[51]

Unfortunately, continued reliance on animal "safety" tests has delayed the full development of these systems. An International Workshop on the Application of Tissue Culture in Toxicology reported in 1980 that funds for the development of relevant tissue culture systems must be almost negligible compared with the total costs for toxicity testing.[52] It has been known for decades that human tissue culture offers great promise for the safety evaluation of chemicals[53] yet the emphasis is still overwhelmingly on animal experiments. Perhaps industry is deterred by the fear that human cell tests would be seen as *additional* rather than replacements for animal experiments.

The time has come to challenge Claude Bernard's medieval doctrine that lives can only be saved by sacrificing others, and that animal experimentation is a valid system of research. The very uncertainty of animal experiments shows that it can never be a choice between dogs and babies. The real choice lies between good science and bad science. Vivisection is bad science because it tells us about animals