The Use of Functional Human Tissues in Drug Development

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Summary — Drug development currently depends on animal models to provide an accurate prediction of human physiology and pathophysiology. However, as is clear from clinical trial failures during phases II and III, such in vivo models do not always predict the effects that a drug can elicit in humans. Tests with human tissues, which are obviously considered to be the closest model of human in vivo function, could fill the gap between animal-based tests and trials in patients. Despite clear advantages, logistical and ethical barriers prevent fresh human tissues from being widely used during drug development. Biopta is aiming to make human tissue testing a regular element of drug development, and works to lower the barriers surrounding the availability of tissue and practicalities of experimental work.

Key words: drug development, human tissues, organ donation, tissue donation.

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Introduction

The declining productivity of pharmaceutical R&D is forcing the industry to re-evaluate its approach to the prediction of drug safety, efficacy and pharmacokinetics. The need to better predict human efficacy is the most pressing requirement. Indeed, it is the primary reason for failure at Phase II and III clinical trials — a failure that is often attributed to an over-reliance on animal models of disease. Tests conducted by using fresh, functional human tissues have long been considered to be the closest possible model of human in vivo function, and are perfectly placed to fill the gap between cell-based or animal-based tests and trials in patients. Despite this, relatively little drug development involves the use of fresh human tissue, because of the logistical and ethical difficulties surrounding the availability of tissue and the practicalities of experimental work with it. Biopta is focusing its efforts on removing both of these barriers, with the objective of making human tissue testing a routine part of the drug development process.

A Role for Human Tissues

The first step is to improve access to human tissues for all researchers in both public and private sectors. A raft of not-for-profit tissue banks and commercial entities is now able to provide good access for many tissue types. However, a comparison of the relative volume of literature generated from human tissue research shows that it remains small compared to studies conducted in animals (around 3.7-million animals are sacrificed annually in the UK). In England and Wales, there are approximately 650,000 surgical procedures each year, but we estimate that tissue is made available from only around 1 to 2% of these procedures. The failure to make better use of valuable tissues is a tragic waste of resources. A concerted effort (by all stakeholders) to raise awareness of their potential value, can help to improve access to tissues and, in the long-term, is likely to reduce the use of animals, as well as predicting drug effects in humans more accurately.

A key step in making better use of human tissues is the emergence of a ‘human tissue research movement’, which encourages interaction between scientists in industry, universities, hospitals and biobanks. In the past two years, numerous conferences on human tissue supply, biobanking and research have been held, reflecting a growing interest. Future developments will include efforts to raise patient awareness of the value of residual surgical, transplant or post mortem tissues, which will increase the already high level of patient consent, which is not the most important barrier to tissue recovery.

However, a major challenge that remains is the negative perception and, on occasion, distrust felt by the public toward the pharmaceutical industry, in contrast to the respect and admiration given to public sector medical research. This is partly due to the secretive nature of the pharmaceutical industry, whose conduct differs from the publicly-funded laboratories, which often (rightly so) openly