THE LIVER GROUP

CHAIRMAN'S REPORT
IN RESPECT OF THE ACCOUNTS
FOR THE YEAR ENDING 31 DECEMBER 2004

We are pleased to report on another year's research, pursuing our aim to improve the treatment of liver disease through understanding and harnessing the natural biology of liver cells.

Last year this report highlighted our developments of the key component of a bio-artificial liver – the compact collection of living cells, the hepatocytes, the factory cells of the liver, growing in a tiny spherical capsule. This system, which we developed, provides important advances over previous approaches to providing the living cell component of an artificial liver. This year I would like to highlight the essential, parallel work we are pursuing – providing an environment in which those cells can grow, and then be applied to treat a patient with liver disease. This takes us into the field of bio-reactors.

We are using two types of bio-reactors. In the first, we need to be able to culture the spherical alginate beads in which a few hepatocytes have been seeded, to allow their number to increase up to the hundreds of billions that will be needed for treatment. We have utilised the 'zero-gravity' bioreactors, which by slowly rotating a chamber containing cells simulates the weightlessness of outer space, and significantly alters the stresses on cells and the ability of nutrient molecules to move in and out of the capsules containing the growing cells. We find that the growth rate and the cell density (the number of cell per bead) increase much more rapidly than in conventional culture conditions, and are now developing techniques to use this in practice.

The second bioreactor stage requires the design of the chamber in which cells will be when blood plasma from a sick patient is passed over them. Here we have started a collaboration with a group of bioengineers in France, who have extensive experience with 'fluidised-bed' reactors, and we are entering an exciting phase that combines mathematical modelling with practical design of bioreactors; we have completed the work in small prototypes and are moving to bioreactors of the size that could be applied in man.

Meanwhile the clinical workers in the unit have been applying the current 'state-of-the-art' artificial liver in sick patients at the Royal Free Hospital. This is a non-biological machine that absorbs out toxins but does not have a cell component, and thus cannot replicate the function of the liver in the way that the bio-artificial liver we work towards will. The machine has provided some help to patients, and by using it we provide the current 'best' to certain sick patients, but it also makes us very aware just how far short the current machine is from the functioning bio-artificial liver machine that we need in this field. As the list of our activities shows we are making steady progress to that major aim. Our wide-ranging laboratory programme involves not only the work already referred to above, but also genetic modification of our cultured hepatocytes to stimulate them to provide the fullest possible spectrum of normal liver function.

As always we are immensely grateful to our supporters. The funds provided from the Liver Group are all devoted to our aim of improving the treatment of liver disease.

Humphrey Hodgson *FRCP, F Med Sci.*
Chairman