particles should encourage small departments to undertake lung scans.

Nuclear medicine is expanding and changing so rapidly that it is impossible to forecast which isotopes or what equipment will be in use in 10 or 20 years. Instant imaging devices such as gamma cameras and computer processing are likely to become more widespread. There is little doubt, however, that as scanning departments are set up in more district hospitals lung scanning in some form will be among the routine investigations most commonly performed.

Glucagon and the Heart

The presence of a contaminant which caused hyperglycaemia was noticed in samples of insulin within a year or two of its discovery. But for a long time glucagon remained a curiosity, though its origin from the alpha cells of the pancreas suggested that it might have a physiological function. Subsequent research has strengthened the view that it is indeed an essential hormone. Now the development of a sensitive immunoassay capable of distinguishing pancreatic glucagon from the gastrointestinal hyperglycaemic factor, enteroglucagon, which makes up 90% of serum activity, should put the matter beyond doubt.

The two best-known actions of glucagon are the promotion of hepatic synthesis of glucose from protein and the breakdown of glycogen. Thus it may be more important than adrenaline, and it has proved valuable in the treatment of hypoglycaemia. Like adrenaline it is thought to activate the adenyl cyclase enzyme system present in all nucleated cells. In the presence of magnesium this system converts adenosine triphosphate to cyclic adenosine 3'-5' monophosphate. The latter then reacts with phosphorylase to convert glycogen to glucose-1-phosphate. Glucagon also has a number of other biochemical effects.

In 1960 A. Farah and R. Tuttle showed that glucagon increased the strength and rate of contraction of the heart in experimental preparations from several animal species. Much work since then has confirmed these findings both in the experimental animals and in man. The hormone also facilitates atrioventricular conduction.

In patients undergoing cardiac catheterization glucagon injected either directly into the pulmonary artery or intravenously produces a modest increase in heart rate and cardiac output, together with an increase in the rate of change of ventricular contraction. There may be some rise in the arterial systolic pressure and a fall in systemic vascular resistance, but left ventricular end-diastolic pressure either falls slightly or does not change. Improvement in myocardial performance is still possible in the fully digitalized heart. Though the action of glucagon varies in detail in different individuals, it begins about 1–3 minutes after injection, reaches a maximum in about 5 minutes, and lasts up to 20 minutes. It is less marked but more prolonged than the similar effects produced by catecholamines, and has the therapeutic advantage of not causing arrhythmias. There is sometimes a slight depression in serum potassium levels, and large doses tend to cause nausea.

The mechanism by which glucagon improves myocardial performance is not clear, though it would be tempting to propose an action on cardiac cyclic adenosine monophosphate. But when this has been measured the results have been conflicting. More work is needed to clarify its mode of action and its relation to other cardiovascular drugs. In the meantime there is growing evidence that this striking property of glucagon is not merely of academic interest. A substance which does not increase myocardial irritability and is still active in the presence of digitals and propranolol has obvious therapeutic possibilities. It has already been tried with some success in the treatment of resistant cardiac failure and has been suggested for use in hypotensive states following cardiac operations and myocardial infarction. A report on its administration to six patients is published in the BMJ this week (p. 663) by Drs. J. D. Eddy, E. T. O'Brien, and S. P. Singh. They describe a significant rise in blood pressure as a result of it. Glucagon might also have a place in antagonizing the myocardial depression produced by 6-blocking agents, and its effect on atioventricular conduction might be exploited in the relief of heart block. Its relatively transient action means that repeated intravenous administration will probably be required, and caution is necessary to ensure that it does not produce distressing nausea, serious falls in serum potassium, or rebound hypoglycaemia when treatment is stopped.

Cystic Fibrosis Conference

It is now over thirty years since cystic fibrosis was described, and during this time great advances in its understanding and treatment have been made, but it remains one of the major killing diseases of childhood and early adolescence. Last September the fifth international conference to be devoted to it was held in Cambridge, and speakers took the opportunity to review some of the work in progress on this not uncommon disease.

It is inherited in an autosomal recessive manner, and its incidence in the Caucasian population is about 1 in 2,000–2,500, with a lower incidence in Negro and Mongolian racial groups. Serum from affected children and also from heterozygote carriers of the disease causes disorganization and inhibition of ciliary beating in the gills of the fresh-water