instrument, partly because the focusing system makes it possible to operate on a very small field, and also because of the important feature that the contrast need not be linked to resolution. They work, however, with the electrons transmitted by the sample, rather than the secondary emission. A central technical problem was to devise a source capable of producing very high intensity in a small spot. The electron gun design was based on the metal tip field emission source, which gives about a million times the brightness of a conventional hot filament, and can be focused to give a spot of about 5 Å. Many other formidable technical problems and their conquest are described by Crewe and Wall, though from their description it seems that at least in a manipulative sense their instrument is simpler to align and use than a conventional electron microscope.

The results show great promise. A picture of a T4 bacteriophage shows a high degree of detail in the tail sheath; in rods of tobacco mosaic virus, stacked protein disks are resolved with great clarity; and in single molecules of the protein ferritin, the subunits and the ferric cores can be clearly discerned.

A further facility that the instrument offers is measurement of the energies of the transmitted electrons. The energy loss on passing through a specimen is a function of the material, and the measurement of energy loss distribution should thus open up analytical applications, as well as the possibility of increasing the contrast by choosing the most favourable energy band for detection.

Electron microscopists will no doubt be waiting anxiously to see whether the promise of high contrast at the best resolution is fulfilled; in a new review also just published (*Quart. Rev. Biophys.*, **3**, 137; 1970), Crewe has already reported the probable detection of single chemical substituents, containing clusters of heavy atoms, in DNA, so that the strategy evolved by Beer and his colleagues of sequencing nucleic acids with the electron microscope may soon be realized.

ENDOCRINOLOGY

Hormones in Cells

from a Correspondent

An eminent collection of people with an interest in hormones met in Bristol from April 5 to 11 to discuss subcellular organization and function in endocrine tissues. Professor Marilyn Farquhar (University of California School of Medicine, San Francisco) described how in the adenohypophysis excess hormone-containing granules are incorporated into lysosomes. Future research may well centre around control systems determining intracellular recirculation of granules to the Golgi apparatus and the direction of granule transport in cells.

Professor I. Geschwind (University of California, Davis) indicated that a possible site of action of calcium during its mediation of the secretory process was on the intracellular microtubular system evolved to direct granules to specific sites on plasma membranes for secretion. Later, Dr E. K. Matthews (University of Cambridge) suggested that calcium induced secretion by reducing the intracellular viscosity and the energy barrier arising from the surface charge on the granule and the inner face of the plasma membrane, thereby permitting fusion of the granule and cell membranes.

Professor W. W. Douglas (Yale University Medical School, New Haven) provoked much discussion with morphological evidence which apparently indicated that the neurohypophyseal hormones are secreted by exocytosis. This would involve the inward budding of the plasma membrane, subsequently transported centripetally as microvesicles. There were doubts as to whether this rarely observed process of a two-way axonal or cellular transport system of hormone storage and microvesicles could be the physiologically significant route for granule secretion. The alternative between the existence of an "extragranular hormone pool" and exocytosis as mechanisms for hormone release was discussed by Dr R. P. Gould (Middlesex Hospital Medical School, London), who suggested that the site of fusion of the granule and cell membrane could become an area of increased permeability permitting the outward movement of high molecular substances.

Drs F. S. LaBella, S. Shin and S. R. Vivian (University of Manitoba, Winnipeg) reported the existence of six neurophysins, but the consensus of opinion on present evidence settled the number at three. During a session on neuroendocrine organization detailed comparisons were made between neurosecretory systems in invertebrates and vertebrates. It seems that comparative research determining possible carrier proteins for neurohypophyseal hormones in vertebrates may prove rewarding and of significance in understanding the vertebrate system.

Professor Dorothy Hodgkin (University of Oxford) described the most recent model of the structure of insulin. She also commented on correlations between species amino-acid differences in the insulin molecule which are located on the "exposed" surface of the molecule with differences in the hexagonal laminated structure of the insulin granule. She agreed with Professor H. Heller (University of Bristol) that the molecular configuration of protein and peptide hormones and their carriers may well have a direct effect on the morphology of the hormone granules, thus providing a "bridge" between molecular and ultrastructure.

In a session devoted to catecholamines Dr J. Häggendal (University of Göteborg, Sweden) presented some new information about the uptake of exogenous noradrenaline chiefly by newly formed amine storage granules. Dr A. Pletscher (Hoffmann-LaRoche Co., Basle) had evidence for the storage of biogenic amines *in vivo* as high molecular weight aggregates of ATP, produced by stacking together molecules of the nucleotide. Professor J. P. Green (Mount Sinai School of Medicine, New York) considered the reactive sites on the histamine (the amino-acid group of the side chain and pyridine-like ring nitrogen) and 5-hydroxytryptamine (primary amino group of the side chain and specific electrons of the indole ring) which would form linkages for binding in granules.

NUCLEIC ACIDS

Precursors and Products

from our Cell Biology Correspondent

Messenger RNA molecules undoubtedly exist in the cytoplasm of eukaryotic cells, but precisely how they