infra-red astronomy in the past few years. The latest surprise, announced in the most recent number of *Astrophysical Journal Letters* (149, L1; 1967), is the discovery by D. E. Kleinmann and F. J. Low of a new source of infra-red radiation in the Orion nebula. This has been detected at a wavelength of 22 microns and covers an area of sky 30 secs of arc in diameter. Using the observed flux and angular diameter, the brightness temperature of the source is only 70° K (about the temperature at which nitrogen liquefies). But at all wavelengths, it probably emits at least one hundred thousand times as much radiation as the Sun. Looking at 5 microns in another "window" where the Earth's atmosphere is sufficiently transparent to observe the sky, Kleinmann and Low failed to detect the source, thus confirming its low temperature. Nearby, however, is another source of infra-red radiation known as Decklin's star after its discoverer. The latter, with a higher temperature (about 600° K), emits powerfully at 5 microns but is not detected at 22 microns by Kleinmann and Low. The relation, if any, between these sources is an exciting puzzle for the theorists.

If the 22 micron source were in front of the Orion nebula, it would be seen in optical wavelengths as a black cloud superimposed on the bright background. Since no such black region exists, it is behind or inside the nebula. So far, two theories have been advanced to account for this peculiar object. One, championed by A. G. W. Cameron and W. K. Hartmann, is that the radiation comes from the gravitational contraction of a proto-cluster of stars which are still forming from dust and gas. On this view, it is far behind the Orion nebula, and the fact that it is in the same direction as the nebula, another important star formation region, is a coincidence. Another point of view put forward by M. Harwit and K. Davidson is that it is a single very luminous star in the midst of the Orion nebula which is cocooned in the dust cloud from which it was formed. The "cocoon-star" would be surrounded by a sphere of hydrogen ionized by the star's radiation and contained within the cocoon. This gives hope of distinguishing between the two theories by radio observations of the bremstrahlung emission from the ionized hydrogen region.

Transport of Secretory Protein

from our Cell Biology Correspondent

OVER the past decade the beautiful work of Palade and his collaborators has revealed the essential features of the secretory cycle in pancreatic exocrine cells. The cycle can be divided into four steps: (1) the synthesis of enzymes and zymogens on ribosomes attached to the endoplasmic reticulum; (2) transfer of the protein to the cisternae of this reticulum; (3) intracellular transport of the protein to the Golgi complex where it is packed in zymogen granules; and (4) discharge of the zymogen granules into the glandular lumina. The third of these steps is least understood. Caro and Palade (1964) showed with autoradiography that, within 10 min of synthesis, the protein reaches the condensing vacuoles of the Golgi complex where it is concentrated, but because of the low resolution of autoradiography they were unable to answer the vital question: does the protein migrate to the Golgi complex through the cytoplasmic matrix or is it transported there in membrane bound vesicles? Data obtained in the early days of cell fractionation suggested the former route, but, as Jamieson and Palade (*J. Cell Biol.*, **34**, 577 and 597; 1967) have now shown, the secretory protein is in fact transported from the cisternae of the endoplasmic reticulum to the Golgi complex in vesicles.

To establish this they overcame the difficulties which make it impossible to give a short pulse of labelled amino-acid to the pancreas *in vivo*. Instead, they incubated slices of guinea-pig pancreas in a medium containing ^{14}C leucine for 3 min and then chased the label by incubating in cold medium. The tissue slices were homogenized either immediately after labelling or at intervals during the chase and fractionated by gradient centrifugation. In this way they determined the kinetics of labelling of the rough microsomes (derived from the ER), the smooth microsomes (derived from the periphery of the Golgi complex), and the condensing vacuoles and zymogen granules.

Immediately after giving the pulse the labelled protein is in the rough microsomes, but during a 7 min chase it is transferred to the smooth microsomes and it then accumulates in the zymogen granules, reaching a maximum concentration after 37 to 57 min. Furthermore, the labelled protein is in the lumen of the microsomes not associated with the bounding membrane and throughout the whole experiment the specific radioactivity of the post microsomal proteins—proteins of the cytoplasmic matrix *in vivo*—remains constant. Clearly, newly synthesized secretory protein is never released into the cell sap but is always kept within membrane bound spaces as it is moved about the cell. On this basis Jamieson and Palade propose a scheme for the intracellular transport of secretory protein that is applicable not only to exocrine pancreas cells but all gland cells specialized for the synthesis, concentration, temporary storage and eventual export of protein.

They envisage that as secretory protein is synthesized it passes immediately across the membrane of the endoplasmic reticulum into the lumina of the cisternae —Sabatini, Tashiro and Palade (*J. Mol. Biol.*, **19**, 503; 1966) suggested how this might occur. Once sequestered within the cisternae the protein can be moved to the transitional zone where the endoplasmic reticulum and Golgi complex meet. Small vesicles then shuttle backward and forward, transporting accumulated protein from the reticulum to the condensing vacuoles of the Golgi complex—there is morphological evidence which suggests this—and in the condensing vacuoles it is concentrated, perhaps by ion pumps; the condensing vacuoles thus become secretory granules. Thus from the very initiation of its synthesis the secretory protein is segregated and directly channelled into a secretory granule.

Denatured States of DNA

from our Molecular Biology Correspondent

A FRACTIONATION technique of great potential, which has so far received surprisingly little attention, is partition between aqueous polymer two-phase systems.