arranged in a circle, whereas the flagellum is similar with an extra central fibril (F2) in Fig. 9, and a somewhat electron opaque central mass of filling material. Further down, the flagellum has the sheath (S) shown in Fig. 9, lower. The nebenkern moves into the position in Fig. 9, between (CA) and (S, upper).

In Fig. 5, the body (CA) was previously believed to be the expanded cushion-like centriole, but we now know that it is a compound body formed as in Figs. 8 and 9, by a covering originating from certain granules (CA) nearby, which form the surround as in Fig. 12. The union between nucleus and tail in sperms of insects and probably in many phyla, is thus not dependent on the centriole, but on this centriole adjunct, which becomes very large in holometabolous insects. The centriole problem is not by any means solved in all animals, because this body is so small, but the scheme in Figs. 10 and 11 probably applies to the majority. The original spermatid (or in some cases 2nd spermatocyte) centriole divides into two as in Fig. 10, the flagellum growing out of the moiety (DC), which leaves the space (PC)—(DC) in Fig. 11, in which the mitochondria crowd, and become modified to form the tail wrapping.

At (Y), in Figs. 1–5, are Neutral Red staining granules which may be the so-called Y-granules of older workers. They have not been studied properly in raphidophorids.

Some account of *Acheta* (Gryllus) spermiogenesis has been given by Clayton, Deutsch and Jordon-Lake (1958), but their electron micrographs are scanty and below standard, and they have not fully acquainted themselves with the relevant literature. Papers on orthopteran spermiogenesis studied at the Argonne National Laboratory, Lemont, Ill., U.S.A. and based on electron microscopy carried out by T. N. Tahmisian *et al.* are extensive. These studies are published in "La Cellule", and the relevant papers are obtainable from the Argonne Laboratory on request.

The most authoritative light microscopical study on orthopteran spermiogenesis is by H. Herbert Johnson (1931). In the Gryllidae treated by him there is one acrosome. This work has been largely superseded by the investigations of Tahmisian's group using electron microscopy.

A microchemical study of insect spermiogenesis has been made by Moriber (1956) using light microscopy, and some additional facts have been recorded by Clayton *et al.* (1958).

The most recent work in this field, in which electron microscopy was used, is that of Jean André (1959) on the male germ cells of *Pieris brassicae*, the cabbage white butterfly. It will be mentioned in the discussion.

TECHNIQUE

The testis was placed in chrome-osmium fixative (F.W.A. or Champy) and small pieces (1 mm) were separated so that quick penetration was ensured. The material was left until next day, and washed overnight under a tap (the mouth of the bottle covered with butter muslin). Next day it was put in 50% ethanol for 30 minutes, 70% until evening, and left overnight in 90%. Next day it was left in two changes of good absolute alcohol and embedded in the afternoon. In some cases, it was better to leave it in absolute alcohol overnight. Subsequently most of the absolute alcohol was then poured off and some xylol added. After an hour this mixture was poured off and pure xylol added. Embedding was done by adding chips of hard wax to the xylol, and after this had melted in the oven in about one hour, pure melted wax was substituted for two hours. Sections were cut 5μ. The staining was by Heidenhain's iron alum haemotoxylin as follows: all day in iron alum, a slight wash in distilled water, then overnight in the haematoxylin. Next morning the sections which were then quite black, were