Interestingly, the recent discovery that coelacanths are live-bearers was anticipated from the fossil record by nearly fifty years. D. M. S. Watson (*Proc. zool. Soc., London*, 453; 1927) reported the discovery of two small speciments of *Holophagus* (as *Undina*) within the body cavity of a larger specimen of this Jurassic fossil. It is pleasant that after this lapse of time Watson's observation on the fossil coelacanth has been confirmed by examination of the only living survivor of the group. □

The meiotic process

from a Correspondent

A Royal Society meeting for discussion on The Meiotic Process was held in London on December 10 and 11, 1975.

THE meeting explored fully the biological roles of meiosis: the halving of chromosome number in the formation of gametes and the synapsis and subsequent genetic recombination between homologous chromosomes. Opening the meeting, C. D. Darlington (University of Oxford) set the tone by pointing out that the chromosomes do not follow the laws of heredity, they make the laws. Almost every subsequent paper was concerned with one or other aspect of the movement, crossing over or disjunction of chromosomes in the two cell divisions which make up meiosis. The dominant theme was the study by electron microscopy of the synaptonemal complex (SC), an organelle of remarkably uniform dimensions and appearance in a wide range of eukaryotes, which mediates the pairing of homologues at the pachytene stage of meiosis.

Reconstructions of pachytene nuclei from serial sections show that the SCs extend along the whole length of the paired chromosomes (bivalents) and are usually attached at either end to the nuclear membrane. One of the major problems is to explain why bivalents do not become interlocked. S. W. Rasmussen (Carlsberg Laboratory, Copenhagen) showed that at an early stage in pairing in the silk worm, *Bombyx*, interlocking can in fact occur, but is in some way eliminated at a later stage. In this organism there is no crossing over or chiasmata formation in females and a progressive modification of the structure of the SC ensures that the chromosomes are held together until metaphase. D. von Wettstein (Carlsberg Laboratory, Copenhagen) showed that in normal meiosis, where crossing over occurs, the SC is discarded after pachytene and can accumulate as polycomplex material dissociated from the chromosomes. A small part of the SC remains associated with the homologues at diplotene, probably at the points of crossing over. The importance of the recent discovery of nodules or nodes was emphasised by D. L. Lindsley (University of California, San Diego). These are discrete, densely stained bodies of unknown composition lying within or just outside the SC. Carpenter has obtained very suggestive evidence from *Drosophila* that the nodules in some way mediate or are associated with cross overs. Although a wealth of morphological information is available about the SC, so far almost no chemical work has been done. The major component is protein, probably with associated RNA, but it is completely unknown whether DNA enters the SC very occasionally at sites of crossing over, or at many sites, only a few of which generate cross overs.

Other approaches to the problem of pairing have been made with wheat and other cereals by R. Riley, R. B. Flavell and G. A. Dover (Plant Breeding Institute and Department of Genetics, Cambridge). In a wide range of cytological and physiological studies, the importance of the 5B and 5D chromosomes in controlling homologous and homoeologous pairing has been established. It has been shown by temperature shift experiments and by colchicine treatment that events occur before the premeiotic S phase which are essential for normal chromosome pairing. The favoured hypothesis is that homologous chromosomes are pre-aligned at this stage and that a colchicine-sensitive fibrillar protein is involved. M. P. Maguire (University of Texas, Austin) also presented visible evidence for pre-aligned chromosomes in maize. M. D. Bennett (Plant Breeding Institute, Cambridge) showed that there is a linear relationship between DNA content and the duration of meiosis, which is independent of chromosome number. However, increases in ploidy within a species broke this rule and decreased the time of meiosis.

The importance of mutants in probing meiosis was best shown by the detailed studies of D. L. Lindsley and L. Sandler with *Drosphila*. A very large number of mutants are known which may specifically affect synapsis, crossing over or disjunction at the first or second division. Some are being exploited in further studies of the cross over 'nodule'. Many meiotic mutants also exist in yeast, and P. B. Moens (York University, Ontario) described two which are blocked in premeiotic DNA synthesis, but which nevertheless continue to proceed through meiosis and form recombinants. One of the highlights of the meeting was the film by B. Nicklas (Duke University, North Carolina). He showed that by physically reorienting bivalents of grasshopper meiotic cells, the direction of movement of the chromosomes of metaphase I was determined by the direction in which the kinetochore (centromere) is pointing. Using the method of Telzer *et al.*, he has demonstrated *in vitro* that this may be related to the spontaneous association of tubulin with the kinetochores.

R. Holliday (National Institute for Medical Research, Mill Hill) discussed the likely mechanism of reciprocal and non-reciprocal recombination at the molecular level in relation to the processes of pairing and the formation of chiasmata. Cross overs between naked DNA molecules must be stabilised to form the chiasmata which hold the bivalents together, whereas non-reciprocal events may be transient. In an attempt to explain the ubiquitous phenomenon of interference between cross overs, he suggested that the SC may contain a limiting amount of a DNA-binding protein which is essential for their stabilisation. A major problem in our understanding of meiosis is the lack of biochemical information. The only systematic study has been made by H. Stern and Y. Hotta (University of California, San Diego) using *Lilium* and *Trillium*. In a review of the advances that have been made, Stern described the properties of the minor fractions of DNA synthesised at zygotene, which may be involved in pairing, and in pachytene, which may be due to repair synthesis during recombination. The latter is absent in the achiasmatic hybrid Black Beauty. Proteins which are synthesised at meiotic prophase and may play an essential role in recombination are a DNA-binding lipoprotein and an endonuclease.

Finally, D. Lewis (University College London) presented in one of the discussion periods an intriguing, although somewhat unrepeatable experiment. He described how in late Summer during the war, a V-1 flying bomb exploded at the John Innes Horticultural Institute, resulting two weeks later in out of season induction of meiosis and blossom in apple and particularly plum trees. It soon became apparent that the denudation of leaves was the main effect of the explosion. The result of this experiment, previously kept secret, indicated that the maturation of meiocytes may be under the control of inhibitors, produced in this case by the leaves of the trees. This was certainly one of the most exciting experiments presented, and if published, the Materials and Methods should provide particularly interesting reading. □