observed within the first 24 h of life were very much higher than in the rat or rabbit and exceeded 100 µg/100 ml. Furthermore, the subsequent fall in plasma levels is much less precipitous than in the other two species studied.

Plasma adrenocorticosteroids circulating immediately after birth could originate from either the maternal or foetal adrenal. Evidence for the first possibility exists, in that the placenta is permeable to corticosterone in the rat, since labelled corticosterone injected into the mother enters the foetal circulation[12].

Glycogen deposition in the foetal rat liver is impaired more when maternal adrenalectomy is combined with foetal decapitation than after foetal decapitation alone[13]. This argues for the ability of maternal corticosteroids to cross the placenta.

On the other hand, evidence in favour of foetal adrenal secretion comes from the ability of the foetal rat to maintain normal carbohydrate metabolism after maternal adrenalectomy, provided its own adrenal glands are intact, although this does not necessarily prove foetal secretion under normal conditions.

In the newborn rat the present results indicate the half-life decline of plasma corticosterone levels during the first 8 h of life to be 3.44 h. Such a half-life suggests that immediately after birth, the rat is secreting corticosterone into the circulating pool rather than simply clearing the corticosterone which had previously crossed the placenta from the mother. This argument would also seem to hold for the rabbit and especially for the guinea-pig in view of the data we have reported here[14].

Résumé. On a mesuré le taux de cortisol et de corticostérone dans le plasma du jeune rat, du lapin et du rat d'Amérique aussitôt après la mise bas et jusqu'à 14 jours après. Dans toutes ces espèces, la concentration de l'adrénocorticostéroide principal était élevée les premiers jours et diminuait regulièrement par la suite.

K.W. Malinowska, R.N. Hardy and P.W. Nathanielsz

Physiological Laboratory, Cambridge CB2 3EG (England), 18 May 1972.

[1] J. M. Bassett and G. D. Thorburn, J. Endocr. *44*, 285 (1969).
[2] R. B. Paisey and P. W. Nathanielsz, J. Endocr. *50*, 701 (1971).
[3] P. W. Nathanielsz, R. S. Comline, M. Silver and R. B. Paisey, J. Reprod. Fertil. Suppl. No. *16*, 39 (1972).
[4] M. Thornton, E. R. Hughes, V. C. Kelley and R. S. Ely, Am. J. Physiol. *202*, 392 (1962).
[5] R. K. Sarin, G. M. Connell and J. A. Linfoot, Analyt. Biochem. *41*, 265 (1971).
[6] K. W. Malinowska, R. N. Hardy and P. W. Nathanielsz, J. Endocr. (1972), in press.
[7] P. G. Holt and I. T. Oliver, Biochem. J. *108*, 339 (1968).
[8] K. Milkovic and S. Milkovic, Endocrinology *73*, 535 (1963).
[9] G. C. Haltmeyer, V. G. Denenberg, J. Thatcher and M. X. Zarrow, Nature, Lond. *212*, 1371 (1966).
[10] S. Leeman, Fedn. Proc. *22*, 165 (1963).
[11] A. Bartova, Gen. comp. Endocr. *10*, 235 (1968).
[12] M. X. Zarrow, J. E. Philpot and V. G. Denenberg, Nature, Lond. *226*, 1058 (1970).
[13] R. Jacquot, J. Physiol., Paris *51*, 655 (1959).
[14] Acknowledgments. We are grateful to Mr. D. Clarke for his excellent care of the experimental animals, and to the Agricultural Research Council for financial support.

Origin of the Synaptonemal Complex

Chromosomes are attached to the nuclear membrane (NM), in particular to the annuli[1,2]. At the beginning of meiosis, the synaptonemal complexes (SC) were also found to be attached to the nuclear membrane[3,4]. During the pairing process, the DNA fibres are disposed along these structures.

The unknown origin of the SC prompted us to investigate this structure in amphibian and mammal meiotic phases. A new technique permitted a comparative study of the very same cell by both light microscope (LM) and electron microscope (EM). Our findings suggest that the SC may result from NM invagination. Its structure would correspond to a folded double membrane with the lateral elements formed by the inner membrane and the central element by the apposition of the outer NM. In this case, the cavity, corresponding to the SC, would appear as a pore at the surface of the nucleus. The starting point of the glove-finger-like invagination would be an annulus to which homologous chromosomes are attached (Figure A–C).

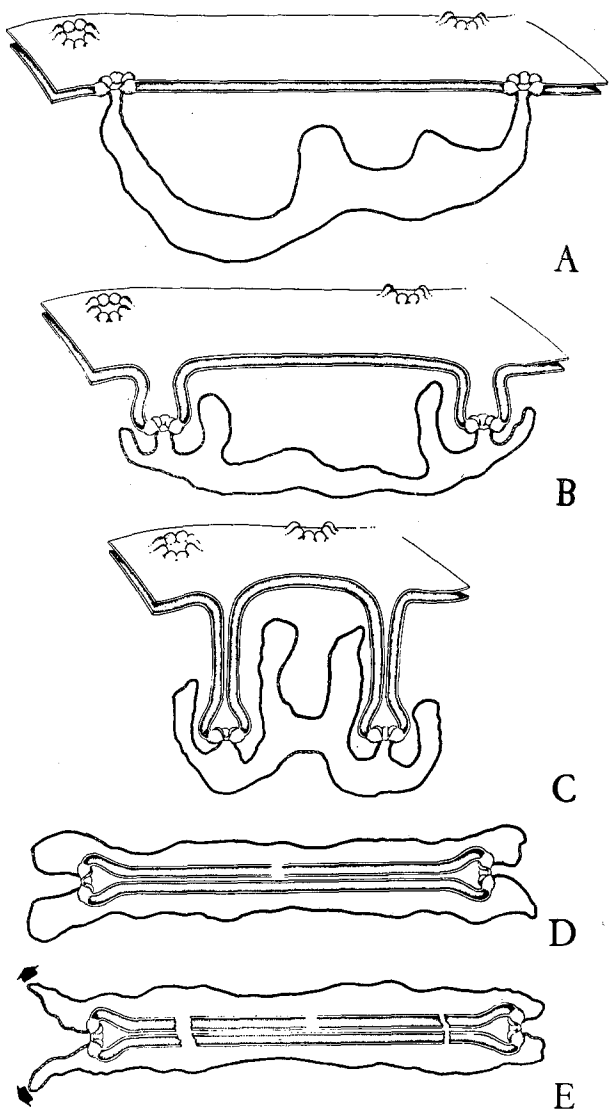
Small fragments of frog and mouse testis were treated with distilled water for 15 min, fixed in 50% glacial acetic acid for 15 min, maintained 1–3 days in cold Carnoy, and transferred to 50% acetic acid for 15 min. Each fragment was squashed or squeezed on a 1% parlodion coated slide. Scotch-tape with a 3 mm² opening enclosing the preselected phase contrast field was placed over the slide. By removing the tape, the parlodion was transferred to a grid previously immersed in a solution of petroleum ether containing scotch-tape glue, and rapidly air-dried. The grids were stained in 2% uranyl acetate for 30 min, air-dried and examined in a Siemens UM at 60 kV and an Elmiskop I at 80 kV.

Due to the hypotonic and Carnoy treatment, the chromosomes became hypertrophied, and some of the structures, normally visualized only at the EM, could then be detected at the LM level. Enlargement of chromosome fibres in ethanol and hemoglobin solution has been previously reported[5].

We found faceted, annulated structures of 6,000 Å in the mouse, and 12,000 Å in the tetraploid frog *Odontophrynus americanus*[6], showing points of higher density at the periphery, from where the chromatin fibres irradiate. These structures are often found in zygotene nuclei, highly distended by the smear or squash process, each homologue pair showing such a ring at both ends. In the frog they seem to be polarized and to coincide with the region, from where the chromosomes spread in a bouquet configuration.

[1] E. J. Dupraw, Proc. natn. Acad. sci. USA *53*, 161 (1965).
[2] D. E. Comings and T. A. Okada, Expl. Cell Res. *62*, 293 (1970).
[3] M. J. Moses, J. Biophys. biochem. Cytol. *2*, 215 (1956).
[4] D. W. Fawcett, J. Biophys. biochem. Cytol. *2*, 403 (1956).
[5] A. J. Solari, Expl. Cell Res. *67*, 161 (1971).
[6] M. L. Beçak, W. Beçak and M. N. Rabello, Chromosoma *22*, 192 (1967).

At the LM the mouse material prepared in the same way and stained in Giemsa, pH 7.0, showed that: 1. Zygotene homologues present a paired, condensed and highly stained heterochromatic end (telomere), while the euchromatic portion is very thin, long, lampbrush-like and weakly stained. 2. Both ends of each pachytene bivalent terminate at different sites of the NM. The fact that mouse chromosomes are acrocentric with an heterochromatic centromere, facilitates this observation[7,8]. 3. Non-homologue centromeric heterochromatin frequently ends at very close sites of the NM[9], but have independent annuli as seen at the EM. 4. The hydrolized nuclei (N HCl at 60°C, 10 min) show that the homologues of each pachytene bivalent run parallel and coil around a thin axis of low density in direction of the NM. The bivalents terminate radially at the border of a cylinder whose diameter is at the resolution limit of the LM and corresponds to the annuli visualized at the EM. 5. Membrane invaginations are often found at regions where heterochromatin blocks are attached.



Hypothetical origin of the synaptonemal complex (SC). The invagination of the nuclear membranes start at the annuli to which chromosome fibres are attached (A, B), resulting in SC. (C). After disaggregation of the nuclear membranes both SC of each bivalent constitute an unit (D) which is further fragmented when the homologues separate (E).

The chemical constitution of the annuli and of the SC is apparently similar. Negatively charged gold particles attach to amphibians oocyte annuli more profusely than the positive charged ones[10]. Our results showed that a weak trypsin solution attacks preferentially the annulated structures in the NM. This evidence suggests that the annuli[1] are constituted by basic proteins. On the other hand, the SC, including the lateral elements, the central element and the L-C fibres, is DNAse-resistant but digested by trypsin, thus indicating also a basic protein constitution[11,12].

The annuli present a variable diameter of about 1,000 Å[13,14]. On the other hand, the width of the SC of about 1,200 Å[15] corresponds to the width of a double NM (that would be about 450 Å, including the perinuclear space[14]), folded and with a small interval at the zone of apposition.

In our preparations both hypertrophied annuli and SC show an average width of 6,000 Å in mice, reaching 12,000 Å in frogs. In spite of the large distension suffered by the material due to the method we used, there is still aggreement between the dimensions of both structures.

Optical and electronic aspects of the association between chromosomes and annuli may suggest that the membrane in the invagination process carries at its penetrating end the bound portion of the filaments. During this motion, the filaments would turn in an approximately 360° direction, and would be mechanically apposed to the glove-finger-like invagination. Since the filaments, attached to the same site of the NM, are apparently homologues (bouquet), during invagination they would be the ones to be apposed concentrically to the sheat at the periphery (Figure A–C).

Instead of the zip-fastener-like hypothesis, to explain chromosome pairing, we suggest that pairing may occur through invagination of the NM, forming the SC. Once apposed around the complexes, there would be a much easier pairing of homologue regions at the molecular level.

With the disaggregation of the NM both complexes of each bivalent would constitute a unit which, by closing, would complete the pairing of the homologues (Figure D). Further, with the separation of the homologues, the SC

[7] R. WETTSTEIN and J. R. SOTELO, J. Microsc. *6*, 557 (1967).
[8] D. WOOLAM, J. MILLEN and E. FORD, Nature, Lond. *213*, 298 (1967).
[9] T. C. HSU and J. E. K. COOPER, M. L. MACE and B. R. BRINKLEY, Chromosoma *34*, 73 (1971).
[10] C. M. FELDHERR, J. Cell Biol. *20*, 188 (1964).
[11] M. J. MOSES and J. R. COLEMAN, in *The Role of Chromosomes in Development* (Ed. M. LOCKE; Academic Press, New York 1964).
[12] D. E. COMINGS and T. A. OKADA, Chromosoma *30*, 269 (1970).
[13] E. VIVIER, J. Microsc. *6*, 371 (1967).
[14] B. J. STEVENS and J. ANDRÉ, in *Handbook of Molecular Cytology* (Ed. A. LIMA DE FARIA; North Holland Publisher Co., Amsterdam 1967).
[15] E. J. DUPRAW, *Cell and Molecular Biology* (Academic Press, New York 1968).
[16] Supported by the Brazilian CNPq, FAPESP and FEDIB. The authors acknowledge A. BRUNNER JR. for the electron microscope facilities; SYLVIA M. CARNEIRO and J. A. T. BILOTTA for technical assistance.

would disrupt, with fragments still attached to the ends of the chromosomes (Figure E). These fragments could be used to reconstruct the NM at the end of cell division[16].

Résumé. La microscopie életronique des noyaux méiotiques de l'amphibien tétraploïde *O. americanus* et de la souris a permis d'émettre l'hypothese suivant laquelle le complexe synaptonémique résulte de l'invagination de la membrane nucléaire, le synapsis étant la conséquence de ce mécanisme.

Maria Luiza Beçak and W. Beçak

Serviço de Genética, Instituto Butantan, Caixa Postal 65, São Paulo (Brazil),
24 April 1972.

Karyological Description of Three Species of the Genus *Passer*

Inspite of the growing number of karyologically studied species, comparative studies of bird species, both close to each other and from different populations, carried out so far are still insufficient.

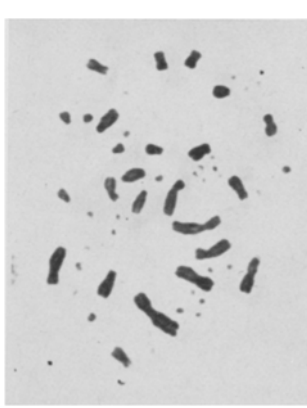
This paper describes the karyotypes of West Siberian and Middle Asian representatives of 3 species of sparrows: *Passer d. domesticus* (3 nestlings, 2 adult males and 1 adult female, vicinities of Novosibirsk), *P. d. griseogularis* (8 nestlings and 2 adult males, Dushanbé, Tajikistan); *P. hispaniolensis* (7 nestlings, Dushanbé; 1 adult female, Gheok-Tepe, Turkmenia); and *P. montanus* (1 nestling, 2 adult males and 3 females, vicinities of Novosibirsk; 1 adult male and female, Dushanbé).

Chromosome preparations were obtained by direct method from bone marrow cells of preliminarily colchicinized nestlings and adult birds, according to conventional cytogenetical technique[1], and stained in Giemsa. For each species about 25–30 metaphases were analyzed.

Domestic sparrow, Passer domesticus. $2n=76$. On comparison of karyograms of 2 subspecies of the domestic sparrow, no differences were found[2]. In the chromosome complement of this species, 12 chromosome pairs are clearly identifiable (Figure 1). The first submetacentric chromosome is remarkable for its size. Two next chromosomes (submetacentric and subtelocentric, respectively) are equal in size but shorter than the first chromosome. The 4th chromosome represented by a pair of metacentrics on metaphase plates in males is single in females. This allows us to identify it as *Z*-chromosome. Next to them in the karyotype are 4 submetacentrics-metacentrics of decreasing size. The next 2 chromosome pairs, of about the same size, are acrocentrics. The small acrocentric chromosomes NN11–12 can be well detected on metaphases and may be designated as transitional to the group of microchromosomes. The *W*-chromosome in chromosome sets of females can be determined rather distinctly. It is a submetacentric, the 12th or 13th by size.

The willow sparrow, P. hispaniolensis. $2n=76$, as in the preceding species. In the individuals studied, from different areas, the chromosome complements do not differ. The chromosomes of this species are like those in

[1] C. E. Ford and J. L. Hamerton, Stain. Tech. *31*, 247 (1956).
[2] S. I. Radjabli and E. N. Panov, Problems of Evolution (Novosibirsk) *2*, 255 (1972).



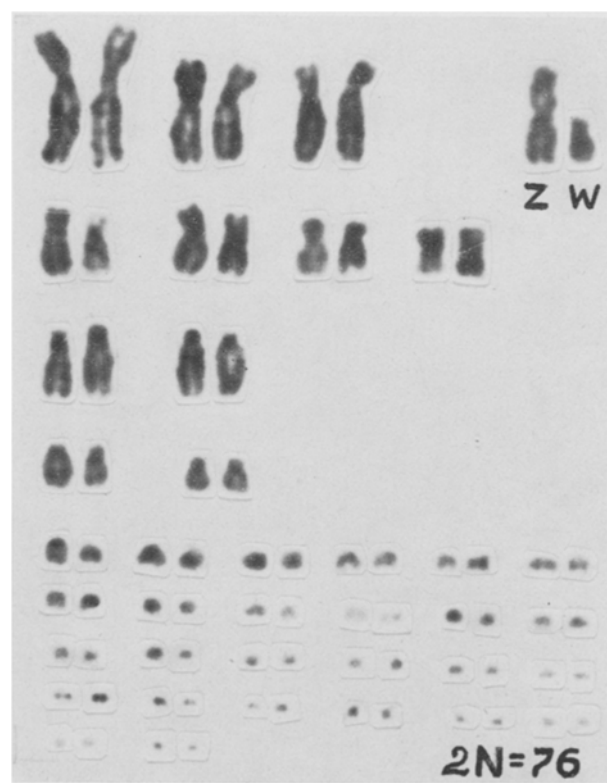


Fig. 1. Karyotype of female *Passer domesticus*.