DISCUSSION
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The present work deals with the study of male germ cell cycles in *Aulacophora femoraiis*, *Aulacophora indica*, *Aspidomorpha andrecors* and *Oocassida circumtata* species of Chrysomellidae (Coleoptera).

TESTIS

A number of previous workers have observed the organisation of various insect testis. David M. Philips (1970) found that most species of insects possess paired testis but the butterflies and moths possess only one. In some of the insects the testis can be easily identified due to their bright-red, green, yellow or brown colour. The testis are covered by epithelium, which is generally pigmented. It is this testicular epithelium which encloses a number of follicles. Imms, A.D. (1948), Wigglesworth (1953) and Ross (1964) reported that the shape and number of the follicles vary widely from one insect group to another. Baccetti and Bairati (1964), Cantacuzene (1968) noted that the follicles contain many cysts and each of which consists of a clone of germinal cells. Baccetti and Bairati (1964), Hoage and Kessel (1968) observed that the gonial and meiotic divisions are synchronous within the cyst. During the study of spermatogenesis in beetles, leaf-hoppers, butterflies and moths, David M. Philips
(1970) observed that insects have spherical testicular follicles. These follicles contain the cysts which are arranged in order of increasing maturity i.e., from the periphery to the centre of the testis. His observations further revealed that the cyst containing spermatogonia, spermatocyte or young spermatids are generally more or less spherical or polyhedral in shape. Such cysts are generally systematically arranged with respect to the stages of development of the germ cells. The number of these cells in a cyst appear to be constant because the number of spermatids per cyst is characteristic for a species.

As far as the number of testis present in the four species of chrysomellids under study vary remarkably. Aulacophora femoralis and Aulacophora indica possess only one testis where as Aspidomorpha andreorsci and Oocassida circumtata possess two. The colour of the testis in Aulacophora femoralis is yellowish, in Aulacophora indica orange-yellow, in Aspidomorpha andreorsci white and in Oocassida circumtata it is slightly pinkish.

In all the species the testis has been found surrounded by a fibrous-sheath. In the case of Aulacophora indica the sheath is comparatively thick where as in Aspidomorpha andreorsci it is thin. The primordial germ cells are situated close to the fibrous-sheath and stain deeply with haemotoxylin. These cells
show active dividing stages.

The spermatogonial cells, primary and secondary spermatocyte cells, spermatids and sperms have been found in groups within the testicular lumen. Mostly the central part of the cavity has been found to be filled with spermatids, developing and mature sperm bundles as compared to the other groups of cells.

**SPERMATOGONIAL CELLS**

Nillo Virkki (1964) reported that the divisions of the spermatogonial cells could not be seen in the species. *Aprea portoricensis*, Blake, *Syphraea quintalli*, Bechyne and *Disonycha nigrita*, Jacoby of sub-family Alticinae (coleoptera). However, in *Brachyphora lateralis* only a few spermatogonial metaphase could be observed. Similarly, the mitotic divisions have been seen by some workers like Tiwari, C.K. (1985), Milind Dange (1991), Vyas, S. (1994), Yadav, J.S. and Vyas, S. (1996). During the present investigations, in all these species, some spermatogonial cells show active mitotic stages.

The cell size is largest in *Aulacophora femoralis* measuring approximately 12.0μ in *Aulacophora indica* 10.0μ, in *Ogassida circumtata* 10.0μ and smallest in *Aspidomorpha andrecorsi* 7.0μ in diameter. These cells remain separated from each other and
exhibit no cytoplasmic connections between them. However, Noelle Richard Mercier (1979) reported that, broad cytoplasmic bridges are found between these cells connecting each other. Andre and Rouiller (1957) found that a granular substance comes out from the nuclear pores, which they named 'clouds'. Keeping in view the above findings of Andre and his coworker (1957), it may be mentioned here that the 'clouds' of granular substance could not be traced in all the four species. However, the nucleoplasm is more granular as compared to the cytoplasm of spermatogonial cells. Favard - Serrano (1968), Klag (1977) and Roussel (1978) reported the presence of only one nucleolus in the nucleus of the spermatogonial cells in most of the insects, but Noelle Richard Mercier (1979) found two nucleoli in the larval testis of Doryphora and Leptinotarsa decemlineata. Herbault (1972) reported the fragmentation of nucleolus in these cells, which enables the synthetic secretion of RNA and protein.

In the species under study, only one distinct nucleolus has been observed in the nucleus of the cells. In Aulacophora femoralis it is largest in size and measures 2.0μ, in Oocassida circumtata 2.0μ, in Aulacophora indica 1.0μ and smallest in Aspidomorpha andrecorsi 1.0μ in diameter. It is remarkable to note here that in Aulacophora femoralis one or two clear vacuoles
are found within the nucleolus of the cells while *Aulacophora indica* has only one. However, in *Aspidomorpha andrecorsi* and in *Ooassida circumtata* such vacuoles could not be traced and may be absent. Further, in *Aulacophora femoralis, Aulacophora indica* and *Ooassida circumtata* a clear unstained perinucleolar ring has been found surrounding the nucleolus. The nucleolur vacuole as well as the perinucleolar ring remain unstained throughout the process.

**PRIMARY SPERMATOCYTE CELLS**

In all the four species under investigation, the primary spermatocyte cells are abundant in the testis and remain packed together, therefore their cell boundaries fail to keep their regular rounded shape. Their cell membrane and the nuclear membrane are distinct. The nucleoplasm is granular while cytoplasm is almost clear in appearance. A well-stained nucleolus is clearly distinct in the nucleus of these cells. *Aulacophora femoralis* contains one or two nucleolar vacuoles in the nucleolus, while *Aulacophora indica* has only one vacuole. However, in *Aspidomorpha andrecorsi* and *Ooassida circumtata* the nucleolus is devoid of such vacuoles. It is remarkable to mention here that an unstained perinucleolar ring is present around the nucleolus in *Aulacophora femoralis, Aulacophora indica* and *Ooassida circumtata*, but in *Aspidomorpha andrecorsi* it could not be traced.
Noelle Richard Mercier (1979) while studying the larval testis of *Doryphora* and *Leptinotarsa decemlineata*, Say reported that during leptotene the nucleus is spherical and nuclear membrane does not show any modifications. Its nucleolus maintains its identity up to the end of prophase stage. However, during zygotene and pachytene it is seen close to the nuclear membrane.

During present study in all the species at leptotene stage the nucleolus becomes eccentric and shifts close to the inner margin of nuclear membrane. In *Aulacophora femoralis* and *Aulacophora indica*, at this stage, the nucleolus contains one or two unstained vacuoles, but in *Aspidomorpha andrecorsi* and *Oocassida circumtata* these are probably absent. The perinucleolar unstained ring around the nucleolus has been found in *Aulacophora femoralis*, *Aulacophora indica* and *Oocassida circumtata*, but is absent in *Aspidomorpha andrecorsi*. Noelle Richard Mercier (1979) reported that in the larval testis of *Doryphora* and *Leptinotarsa decemlineata* the two nucleoli which are identical up to the leptotene stage become divided and align themselves along the axis of the nucleus.

Present investigations reveal that the behaviour of the nucleolus at zygotene stage is interesting. The nucleolus remains attached to the inner border of the nuclear membrane in all the species. The size of the nucleolus in *Aulacophora femoralis*
increases in comparison to that of leptotene stage, but in *Aspidomorpha andreocorsi* and *Oocassida circumtata* its size remains almost the same. It is remarkable to note here that the vacuoles within the nucleolus, in the case of *Aulacophora femoralis* and *Aulacophora indica* enlarges, whereas in *Aspidomorpha andreocorsi* and *Oocassida circumtata* the vacuole is absent in the zygotene nucleus. During zygotene the size of the nucleolar vacuole increases more. It is possible that the enlargement of the vacuole probably helps in the extrusion of nucleolar fragments by pushing them out during forthcoming stages. As far as perinucleolar ring is concerned it is present in *Aulacophora femoralis*, *Aulacophora indica* and *Oocassida circumtata* and absent in *Aspidomorpha andreocorsi*.

During pachytene stage, Schafer and Handerson (1907) in *Dytiscus* reported the formation of 'bouquet'. Nillo Virkki (1964) in *Apraea portoricensis* Blake also observed the ends of chromosomal threads tend to associate together forming rosette-like structure in pachytene stage. However, Marja Sourti (1971) was unable to find the bouquets in *Dytiscus*, *Ilybius* species and *Platambus maculatus*.

In the present study in *Aulacophora femoralis* and the
nucleolus shifts to one side, at the base of the 'loops' and a typical 'bouquet' is formed in *Oocassida circumtata*.

Further, in diplotene and diakinesis, Schafer and Henderson (1907) in *Dytiscus* found abundance of ring bivalents. Hayden (1925) in *Phaneus* reported that the diplotene stage of primary spermatocyte cell is quite diffused. Nillo Virkki (1964) also stated a considerably diffused diplotene stage in *Disonycha nignita*, Jacoby. He found sporadic ring bivalents in *Polygramma flavitarsis*, Guerin, but could not observe these rings in *Calligrapha fulvipes* stalk. Further, in *Diabrotica baltacta* Leconte, bivalents were seen in diakinesis, but there were no rings. J.S.Yadav (1976) found that in *Diapromorpha tureica* the regular diplotene and diakinesis have been replaced by a diffused stage and the rings are totally absent.

In the present investigation it has been found that in *Aulacophora femoralis* and *Oocassida circumtata* during diplotene, the chromosome loops become shorter. At certain points the crossing over and Chiasma have also been observed in some of these cells. However, in *Aulacophora indica* and *Aspidomorpha andrecorsi*, the chromosomes condense to a very great extent. During Diakinesis, only in *Aulacophora femoralis*. Some of chromosomes form 'rings', where as in others, these look -like 'rod' and dot-shaped. The chromosomes of *Aspidomorpha*
andrecorsi are very small and appear as 'dots' during diakinesis. In Aulacophora indica and Oacassida circumtata the rings could not be observed, but chromosomes appear as 'rods' and 'dots.'


SECONDARY SPERMATOCYTE CELLS

The primary spermatocyte cells, after the first meiotic division form the cells known as secondary spermatocytes. These cells are smaller in size as compared to primary spermatocytes. It has been noticed that the primary spermatocyte cells are found in groups and packed together. The cells in a group are of the same age and all start dividing at one time, with the result, the newly formed secondary spermatocyte cells are also of the same age and are found in groups.

The size of the secondary spermatocyte cells in Aulacophora femoralis is largest measuring 7.0μ to 8.0μ in
**Aspidomorpha andrecorsi**, it is smallest measuring 4.0μ to 5.0μ in diameter. In *Aulacophora femoralis* and *Aspidomorpha andrecorsi* the nucleolus appears as a densely stained body and the nucleolar vacuole is absent within it. However, in *Aulacophora indica* and *Oocassida circumtata* a clear nucleolar vacuole is visible, inside the nucleolus. An unstained perinucleolar ring around the nucleolus is seen up to the prophase stage in *Aulacophora femoralis*, *Aulacophora indica* and *Oocassida circumtata*, but it appears to be absent in *Aspidomorpha andrecorsi*. All the secondary spermatocyte cells of one group have been found exhibiting prophase, metaphase, anaphase and telophase stages in *Aulacophora femoralis*, *Aspidomorpha andrecorsi*, *Oocassida circumtata*. This confirms the Synchronous division of these cells showing only one stage of division in all the cells. This phenomenon is absent in *Aulacophora indica*. The behaviour of nucleolar vacuoles and perinucleolar rings have been reported for the first time. The perinucleolar ring the nucleolar vacuole which are formed during the resting as well as the other active dividing stages of the gonial, primary and secondary spermatocyte cells show a peculiar, variable behaviour of their disappearance and reappearance during spermatogenesis. This feature has not been marked by any of the previous workers. It is remarkable to note here that these structures remain unstained, throughout. One of the reasons of their unstained nature may be that, there is no
chromatin material just below them and these unstained zones might be extending to some depth. This probably keeps the nucleous and the inner vacuole separate from its surroundings. It is difficult to understand and speculate the role of these structures during spermatogenesis. However, it is presumed that these may help during the extrusion of the nucleolar fragments.

SPERMIOHISTOGENESIS

SPERMATIDS

The present investigation reveals that the formation of spermatids follow the same general trend as in other coleopterans as reported by previous authors, Robert H. Bowen (1924) in Chelymorpha (Cassidinae) found that, at the close of second spermatocyte division the nucleus is quickly reformed. The chromatin material becomes scattered in the form of a delicate network over the inner surface of the nuclear membrane. In early spermatids the chromatin gradually condense on the inner surface of the nuclear membrane. David M. Phillip (1970) concluded that the structural reorganisation of the chromatin during nuclear condensation does not follow the same course in all insect species. He found that in early spermatids the chromatin is generally in a very diffused form but in mature insect sperm the chromatin is dense and devoid of visible structures. However, it has been shown in Spur-throated grass hoppers, the chromatin is uniform through
out the nucleus during spermiogenesis, but in Cerasa (treehopper) it is non-uniform and in Scudaria (Bush Katydid) the anterior end of the nucleus has less condensed chromatin as compared to the posterior end of it.

George Gassner III, Dinnah Childress and Donna J.Klemetson (1975) in Anthonomus grandis observed that in spermatids the nuclear contents appear in two general forms i.e., compact aggregates of chromatin strands, and dispersed strands of chromatin. During early stages, the compact aggregated chromatin strands appears to be associated with the inner part of the nuclear membrane, while the dispersed strands is distributed through out the interior of the nucleus.

Tiwari C.K. (1985) in Aspidomorpha miliaris, Chirida binduta, Corynodes peregrinus, Aulacophora intermedia, and Lema coromendeliana reported that, on the inner surface of the nuclear membrane, the chromatin material aggregates within the spermatid nucleus and stains deeply. Thus a clear unstained nuclear vesicle appears inside the nucleus and remain conspicuous for some period. Similar observations were made by Khatoon, S. (1986).

During the present investigation in Aulacophora femoralis, Aulacophora indica, Aspidomorpha andrecorsi and Oocassida circumtata it has been found that the newly formed spermatids are round, having deeply stained and condensed chromatin material within the nucleus. However, in its later stages the chromatin
material aggregates at the inner margin of the nuclear membrane. Due to this condensation of the chromatin material at one side, a clear nuclear vesicle is seen within the nucleus in all the species.

**GOLGI BODIES AND ACROSOME:**

The golgi bodies and the formation of acrosome has been carefully studied by many authors such as Bowen (1920, 24, 24b), Pollister (1930), Johnson (1931), Vishwanath (1951, 57, 1965), Kaye (1962), Werner (1965, 1966) David M. Philip (1966, 1670) George Gassner -III, Dinnah Childress and Donna. J. Klemetson (1975) including many other workers studying insect spermiogenesis.

In a review by David M. Philip (1970), Bowen (1920), Pollister (1930) and Johnson (1931) concluded that acrosome is a product of golgi-bodies and is spherical in shape. It was termed as 'pro-acrosome' granule. This granule becomes intimately associated with the nucleus. The golgi-bodies subsequently migrate into the caudal cytoplasm where as the 'pro-acrosomal' granule gradually changes in shape and in subsequent development attains its final form very late in spermiogenesis.

During the studies of spermiogenesis in *Chelymorpha*, Robert. H. Bowen (1924) found that the acrobast is more or less disc-shaped and the golgi material forms a well-stained rim. The acrosome appears as a small vesicle attached to the acrobast and is in contact with the nuclear membrane. A darkly stained, minute
acrosomal granule appears at the point of their contact.

Vishwanath (1951) gave a very comprehensive account of golgi bodies and acrosome formation in *Aulacophora foevicolis* and *Coccinella septumpunctata*. He observed that in *Aulacophora foevicolis* golgi bodies appear as deeply stained granules of varying sizes in the early spermatids. Such golgi-granules unite and fuse to form a single large vesicle with a chromophilic rim and a chromophobic interior. He termed this as 'acroblast'. Soon the acroblast loses the staining capacity, with the result the complete structure appears to be colourless. This is the 'acrosomal vesicle'. Later, a deeply stained acrosomal granule appears on the border of the acrosomal vesicle. During subsequent development the acrosomal vesicle and acrosomal granule get separated from each other. The vesicle moves backward into the tail to be sloughed off and the granule moves in front of the nucleus, so as to form acrosome. Due to its elongation it becomes needle shaped with its broad base and narrow pointed anterior end. In *Coccinella septumpunctata* the acrosomal granule appears within the vesicle and grow in size while the acrosomal vesicle shrinks. Thus the acrosome fillsup the whole space in the vesicle. Later, the large acrosomal granule migrates to the anterior end of the nucleus and forms the acrosome as in the case of *Aulacophora foevicolis*. Now the acroblast shift towards the sperm tail, it degenerates and is ultimately sloughed off. Nath (1957a) , after studying the four
species of tiger beetles (Coccinella nitida, C. erudita, C. albina and C. vigintiguttata) concluded that in early spermatids, the golgi-bodies are in the form of 'spheroids' which fuse to form the acroblast, subsequently the acroblast comes in contact with nuclear membrane of the spermatid and at the point of its contact the acrosomal sheath probably disappears, with the result the acroblast assumes 'U' - Shape. Simultenously the acroblast deposits a dark prominent acrosomal granule on the nuclear surface. Now the acroblast appears as a vacuole. Immediately after the secretion of the acrosome, the acroblast moves back appearing as a spherical homogenous body. In the advanced stages of spermatids, the acroblast moves inside the spermatid tail and breakup into a number of granules which are ultimately sloughed off. The acrosomal granule grows into a small cone-like acrosome at the tip of the sperm nucleus. Vishwanath, Gupta, B.L. Swadesh Mehta (1957a) in Cicindela reported their observations which are almost similar to that of Nath (1957a) on tiger beetles. In this case the acroblast which is formed by the fusion of golgi-bodies, show the characteristic pale sphere, surrounded by an incomplete thick and darkly stained sheath.

The electron microscope studies of many insects made by Kaye (1962) and Phillips (1966) reveals that the proacrosome granule is situated on the concave face of the golgi-complex, between its inner most cisternae and the spermatid nucleus. The
acrosome in other beetles is unlike the tiger beetle *Cicindela* (Werner 1965). Here the structure and development of acrosome is dissimilar and the acrosome is 'U-shaped', covering the tapering end of the nucleus. Remarkably, in *Bollweevils* the developing acroblast remains as a flattened ellipsoid until it is positioned on the apex of the nucleus as noted by Werner (1966).

The electron microscopic studies made George Gassner III, Dinnah childress and Donna. J. Klemetson (1975) in *bollweevil Anthonomous grandis*, reveals that in immature sperm a spherical acroblast situated at the apex is derived from golgi-bodies. During the elongation of the sperm nucleus, the acroblast forms a cone-shaped acrosome and acrosomal cap covers a septum, this surrounds the acrosomal space. On further elongation the acrosome is filled with an opaque material and the shape of acrosome becomes like a rod.

Tiwari C.K. (1985) reported that in *Aspidomorpha miliaris*, *chirida binduta*, *Corynodes peregrinus*, *Aulacophora intermedia* and *Lema coromendeliana* the role of golgi-bodies in acrosome formation is almost similar to the observations made by earlier authors such Nath (1951, 1957a) in *Aulacophora foeviolis*, *Cicindela septumpunctata*, *C.erudita*, *C.albina*, *C.nitida* and *C.vigintiguttata* and Nath. Gupta, B.L., Swadesh Metha (1957a) in *Cicindela* and some other authors. He found that in *Corynodes peregrinus* and *Lema coromendeliana*, the acrosomal granule appears as a deeply
stained body within acroblast, situated near the nuclear membrane, but in Aspidomorpha miliaris, Chirida binduta and Aulacophora intermedia it appeared as a deeply stained granule without acroblast. He further reported that the acroblast has been found in contact with nuclear membrane at a point. The acroblast sheath probably disappears at this point of contact with the result, it assumes the form of a "horse-shoe" shaped vesicle. This has a deeply stained rim but its interior remains unstained. 

During the present study the role of golgi in the formation of acroosome is more or less similar as reported by Kaye (1962), Phillips (1966), Nath (1951, 1957a). It may be mentioned here that the acroosome appears as a deeply stained granule situated near the nuclear membrane. However, the acroblast could be seen in Aulacophora femoralis and Oecassida circumtata only. They acrosomal granule gradually grows at the anterior tip of the elongating sperm nucleus.

**CENTRIOLE**

Robert. H. Bowen (1924) in Cicindela sexguttata reported that as the nucleus elongates, the centriole, with its attached axial filament begins to move forward pushing or carrying ahead of it-the acrosome. Later, the centriole becomes double, lying side by side and to one centriole tail filament is attached. Vishwanath (1951) found that in Aulacophora foevicolis, Coccinella
septumpunctata and Plocaederus obesus, a single centriole is situated at the base of sperm formation. However, it reappears in late spermatid, at the base of nucleus. Goldsmith(1919) and Viswanath (1957a) in the tiger beetle Cicindela observed a most outstanding feature of spermiohistogenesis. They noted the migration of the centriole to the anterior tip of the nucleus just behind the acrosome and the nuclear vesicle. Werner (1964), Fried Lander (1969), Wahrmann (1966) and Smith (1969) reported that the young spermatids contain two centrioles, one of which serves as a basal body while the other is oriented at the right angle to the first. David M. Phillips (1970) reported that the centriole disappears during spermiogenesis.

During the present investigations in Aulacophora femoralis and Oocassida circumtata two centrioles have been found as small deeply stained granules on the nuclear membrane which is similar to the findings of Werner (1964), Fried Lander and Wahrmann (1966), Smith (1969). In Aulacophora indica only one centriole has been found near the nuclear membrane but in Aspidomorpha andrecorsi the centriole could not be traced. In Aulacophora femoralis, Aulacophora indica and Oocassida Circumtata the flagellum has been found attached to the centriole a well-stained granule.
SPERM - FORMATION

Robert H. Bowen (1924) in Cicindela sexguttata has given a good account of his observations regarding the behaviour of the spermatid till the formation of mature sperm. It is interesting to note the manner in which the condensation of the chromatin material of the nucleus occurs during this phase. Several vesicles have been observed within the nucleus during spermiogenesis. According to his opinion, these vesicles collectively are comparable to the nuclear vesicle in Chelymorpha. In advanced stages these scattered vesicles tend to collect and fuse together with the result a single vesicle is formed. In Cicindela during nuclear elongation an intermediate stage looks like a 'trypanosome'. In Chelymorpha, he found that the elongated head always possess a clear definite thread which runs along the entire length of the nucleus. At this stage the nucleus becomes much flattened. Vishwanath, Gupta, B.L. and Swadesh Mehta (1957a) reported that in Cicindela the centriole is having two granules in the spermatids which are lost for a short period in spermiogenesis. During this period, a heavily stained chromatin plate appears at the base of the flattened head. Similar condition has also been reported by Bowen (1924) in Cicindela sexguttata and Chelymorpha.

David M. Phillips (1970) reported that in insects a spherical vesicle appears in association with the basal body from which the
flagellar tubule arises. The vesicle as well as the flagellar tubule elongates and ultimately comes in contact with the cell-membrane and fuses with it. Tiwari.C.K. (1985) reported that the elongating nucleus contains a few vacuoles within it, but at later stages their identity is lost. In Corynodes peregrinus during elongation of the sperm nucleus, he found 'trypanosome' like form, which confirms the observations of Robert.H.Bowen (1924) in Cicindela.

During the present study of Aulacophara femoralis, Aulacophora indica, Aspidomorpha andrecorsi and Oocassida circumtata the nucleus of spermatid gradually elongates and becomes oval, fusiform and lastly filamentous. In the species Aulacophora femoralis, Aulacophora indica and Oocassida circumtata the acrosome and centriole have been found to be situated at the anterior and posterior ends respectively. In Aspidomorpha andrecosi acrosome and the centriole could not be differentiated.

The posterior end of the elongating nucleus is broad in Aulacophora femoralis and Oocassida circumtata, but in Aulacophora indica and Aspidomorpha andrecorsi it remains pointed. The chromatin material appear as deeply stained granules within which some vacuoles are seen. In Aulacophora femoralis it contains one to four vacuoles. In Aulacophora indica two or three vacuoles, in Aspidomorpha andrecorsi it has only one vacuole which
appears elongated in the central cavity. Here the chromatin material aggregates at the lateral margin of the elongating nucleus. During further elongation it has been found that such vacuoles are lost. In *Aulacophora femoralis* and *Oocassida circumtata* the elongated sperm nucleus contains within itself a single tube-like vacuole, which is gradually lost due to further condensation of the nucleus. Only in *Aspidomorpha andrecorsi* the 'trypanosome' like forms have been observed during sperm elongation. It may be mentioned here that during condensation, the nucleus assumes the form of a plate-like structure. The two lateral marins of this plate roll inward in such a way, so as to unite and fuse together, with the result, the flattened nucleus now contains an elongated narrow cavity within itself. The broad basal end of the nucleus also takes part in this rolling behaviour with the result, the cytoplasmic tail attached at this end, also encloses an elongated space within it and the tail remains as a tubular structure. Due to further condensation and elongation of the nuclear material the hollow space within it is totally lost and it becomes filamentous and stains deeply. Finally a single mature sperm after going through the phenomenon of spermiogistogensis has a deeply-stained nucleus with acrosome.