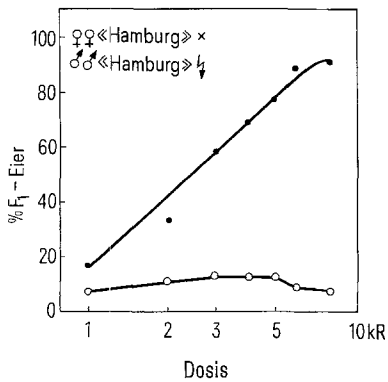

Fig. 1. Häufigkeit embryonierter (○) und nicht embryonierter Eier (●) in der normalen Kreuzung *C. pipiens* «Hamburg» ♀♀ × *C. pipiens* «Hamburg» ♂♂ nach Röntgenbestrahlung der Männchen mit Dosen zwischen 1 kR und 8 kR.

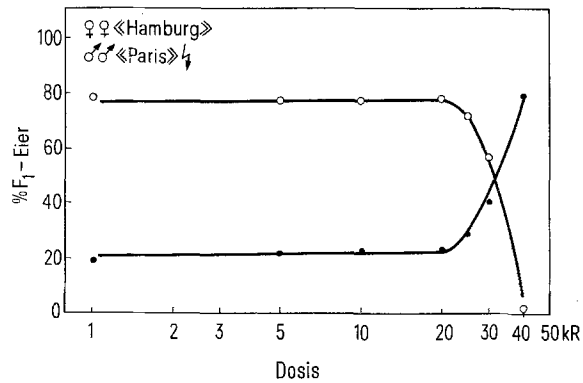

Fig. 2. Häufigkeit embryonierter (○) und nicht embryonierter Eier (●) in der inkompatiblen Kreuzung *C. pipiens* «Hamburg» ♀♀ × *C. pipiens* «Paris» ♂♂ nach Röntgenbestrahlung der Männchen mit Dosen zwischen 1 kR und 40 kR.

und es wurde geprüft, wie hoch der Anteil der nicht sichtbar embryonierten Eier, d.h. der Synkarionbildung, ist und bei welcher Dosis die Aktivierungspotenz des Spermiums verlorengeht.

Die Eier werden als embryoniert bezeichnet, wenn die Differenzierung vor dem Absterben der Embryonen über das Blastodermstadium hinaus fortgeschritten ist. Nicht embryonierte Eier sind solche, die keine sichtbaren Differenzierungsmerkmale aufweisen, was auf Fehlen des Ententwicklungsanstosses oder auf Letalität in frühen Furchungsstadien zurückgeführt werden kann.

Figur 1 zeigt, dass in der normalen Kreuzung *C. pipiens* «Hamburg» ♀♀ × *C. pipiens* «Hamburg» ♂♂ die Zahl der nicht embryonierten Eier dosisabhängig zwischen 0 kR und 8 kR von 1,5% bis 90% ansteigt. Die dosisabhängige Zunahme der nicht embryonierten Eier ist ein Mass für die Häufigkeit, mit der in ersten Furchungsstadien Letalität auftritt. Die Zahl der embryonierten Eier liegt bei allen Dosen unter 15%. Hieraus folgt, dass die dominante Letalität in der F_1 einer normalen Kreuzung durch chromosomale Störungen in den ersten Furchungsteilungen bedingt ist. In der unbestrahlten inkompatiblen Kreuzung *C. pipiens* «Hamburg» ♀♀ × *C. pipiens* «Paris» ♂♂ treten 82,3% embryonierte, 17,6% nicht embryonierte Eier und etwa 0,1% fertile, parthenogenetische Weibchen auf. Sollten sich die letalen embryonierten Eier mit Beteiligung des Spermiengenoms entwickeln, dann müsste nach Bestrahlung der Männchen die Embryonierungsrate mit steigender Dosis absinken. Wie in Figur 2 gezeigt wird, liegt die Embryonierungsrate bis 20 kR, einer Dosis, bei der in normalen Kreuzungen 100% nicht embryonierte Eier vorliegen, konstant bei 78%. Dies zeigt, dass sich alle Embryonen einer inkompatiblen Kreuzung ohne Beteiligung des Spermiums entwickeln und bestätigt frühere genetische und cytogenetische Untersuchungen, bei denen nachgewiesen wurde, dass die letalen Embryonen haploid sind und durch induzierte meiotische Parthenogenese entstehen[7,8]. Ab 20 kR findet in der inkompatiblen Kreuzung eine Reduktion der Embryonierungsrate statt, die bei 30 kR auf 57,15% und bei 40 kR auf 0% gesunken ist. Zwischen 30 kR und 40 kR zeigen einzelne Gelege noch hohe, andere bereits sehr niedrige Embryonierungsraten (Tabelle). Dies kann darauf zurückgeführt werden, dass die Spermien ab 30 kR ihre Aktivierungspotenz verlieren.

Summary. After irradiating males of the incompatible cross *C. pipiens* 'Hamburg' ♀♀ × *C. pipiens* 'Paris' ♂♂ with X-ray doses between 1 kR and 40 kR, it could be shown that in this cross the sperm has only the function of activating the egg. All the hybrid embryos develop from the haploid female pronucleus.

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Similarity in Karyotypes of *Rattus rattus* with 38 Chromosomes from India and other Parts of the World

Until the discovery of 38 chromosomes in *Rattus rattus* from S. America by Bianchi et al.[1], the diploid number of this species distributed all over the world was established to be 42. More reports on *R. rattus* with 38 chromosomes from different regions have since been published. All the specimens trapped in Australia, New Zealand and New Guinea[2], an endemic population from isles of Gigilio in South Tuscany, Italy[3], a proportion of a population from a village near Cairo, Egypt[4], in Honolulu, Hawaii[5], and in a South Brazilian population[6] have been found to possess 38 chromosomes. We report in the present communication our findings of $2n = 38$ in *R. rattus* from India and compare its karyotype with those of the same diploid number published by others.

Twelve males and as many females of *R. rattus wroughtoni* Hinton trapped in Quilon and Ettumanore, Kerala, had distinctly pale or white belly, whereas the two females of *R. rattus rufescens* procured from Majri colleiries, Nagpur, had dark belly. According to Ellerman[7], white bellied rats are wild forms of *Rattus rattus* and dark coloured ones commensals. Except one female from Nagpur, of which spleen and femoral marrow were cultured

in vitro, from the remaining individuals the slides were prepared from marrow in the field, employing ignition technique after treating as usual with colcemid, sodium citrate and acetic acid-methanol. Not less than 20 well spread metaphases were counted from each individual for determining the diploid number, which was found to be 38 in all of them. Ten selected plates were karyotyped for each sex.

The karyotypes of the specimens from Kerala and Nagpur have been found to be similar and are characterised (Figures 1 and 2) by the presence of 2 big pairs of metacentric chromosomes, 1 being the largest in the complement. Apart from these there are 7 pairs of small metacentric (m), 3 pairs of subtelocentric (st) and 6 pairs of acrocentric (t) chromosomes. Both the sex chromosomes are acrocentric, the *X* being medium-sized but not clearly distinguishable from others and *Y*, the smallest in the complement. The first 2 metacentrics are marker chromosomes, which are absent in the karyotypes having diploid number 42. In the latter, there are 4 pairs of acrocentrics more, as compared to the karyotype with 38 chromosomes. The reduction has, therefore, been achieved by Robertsonian mechanism of fusions of acrocentrics. The karyotype observed by us is exactly similar to the ones reported by others with same number of chromosomes from different regions of the world. The occurrence of such a stable kyryotype in far apart populations of *R. rattus* poses a very obvious question of their mutual relationships.

All the individuals hitherto reported from Oceanian or S. American countries are found to have only 38 chromosomes with no exceptions. But in Egypt, individuals with 38 and 42 chromosomes are found within a population of the subspecies *R. rattus rattus*. In India, we have observed that individuals from southern regions, which are described as *R. r. wroughtoni* and *R. r. rufescens*, have 38 chromosomes, whereas in the northern part of the country the widely distributed *R. rattus rufescens* has 42 chromosomes. The distinction between subspecies is made on the basis of coat colour which is so overlapping a feature that it becomes difficult to ascertain the subspecies status, particularly in the main lands with no obvious barrier between different subspecies. We have no knowledge of chromosome complement of individuals where 2 types of karyotypes are expected to meet and hybridize. However, the compatibility of hybrids between 38 and 42 chromosomes studied in laboratory by YOSIDA et al.[2] does suggest the possibility of existence of a similar situation in nature also. The coexistence of 2 types of karyotypes with 38 and 42 chromosomes within a population or in contiguous populations, indicates that neither of the karyotypes suffer from any disadvantage against the other. It is of course difficult to find out advantages, if any, of one type over the other. Family Muridae, of which *Rattus* is the most prolific genus, originated only recently in the tropics of the Old World[8]. Hence, the preponderance of $2n = 42$ in *R. rattus* throughout Asia tends to show the number as the original one. According to ELLERMAN[7], 2 most closely related species of *R. rattus* are *R. rattoides* and *R. nitidus*, occupying the same environs as *R. rattus*. A few individuals of *R. rattoides* and 1 female of *R. nitidus* studied by us have also been found to possess not only 42 chromosomes but also nearly similar karyotypes[9, 10].

Besides extensive polymorphism of certain chromosomes in *R. rattus*[11, 12] and variations in chromosome number of Robertsonian type with 38[2–6, 10] or 54 to 60 chromosomes[4], there are highly interesting reports of a unique phenomenon in which individuals in good proportion of populations possess non-Robertsonian type of numerical variations[10, 13, 14]. In the latter case, individuals with 41, 42, 43, 44, 46 or 48 chromosomes are reported. Since such a great fluctuation occurs in the chromosome complements of *R. rattus* it is apparent that its karyotype (s) is in an active process of evolving definite patterns through different pathways. The $2n = 38$ is one such stable karyotype evolved by Robertsonian mechanism which by chance, or perhaps because of certain advantageous dispersal capacity, could move to newer places and rapidly flourished where no competitor to share their niches was present as in the new world and Oceania. CAPANNA et al.[3] believe that the dispersal of these rats must have been caused by human agencies. YOSIDA et al.[5] even postulate the possible migration of these rats from Europe. How-

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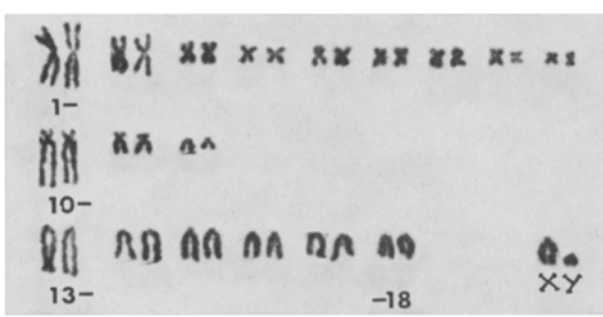

Fig. 1. The karyotype of male of *Rattus rattus wroughtoni*. ×2,000.

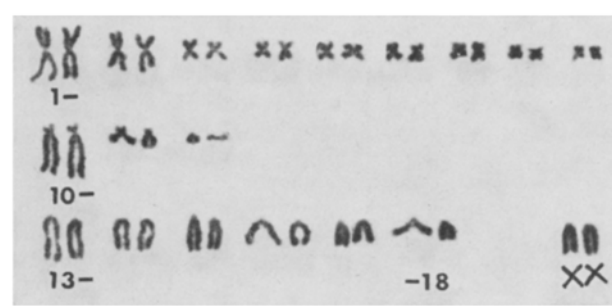

Fig. 2. The karyotype of female of *Rattus rattus rufescens* (?). ×2,000.

ever, in the light of report of such rats from Asia, the postulate of YOSIDA et al.[5] looks rather premature. Whatever may be the possible mode of their dispersal to Oceania and the New World or Europe, it appears that the presence of such rats in Asia may not be only an outcome of any migration but one of the finalities achieved in the process of karyotype evolution in the main land of its origin.

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Note added in the proof: A number of reports on $2n = 38$ *R. rattus* from different parts of the world have appeared since the acceptance of this paper[15–19]. Recently YOSIDA and SAGAI[20] have also reported a $2n = 38$ for *R. r. rufescens* trapped in India.

Zusammenfassung. Chromosomen von 12 Männchen und 12 Weibchen von *Rattus rattus wroughtoni* sowie 2 Weibchen von *Rattus rattus* wurden untersucht und es wurden überall 38 Chromosomen gefunden, verursacht durch Robertsonische Verbindung von 4 akrozentischen Paaren von *Rattus rattus* mit 42 Chromosomen.

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Control of Selectivity and Ion Fluxes in Bean Hypocotyls

Among the various processes involved in transport of ions from the xylem sap into shoot tissues, special attention was usually given to the 'filtering' of sodium out of the sap and to the consequent reduction is sodium transport into the upper parts of shoots[1–8]. However, although this phenomenon was widely described, very little is actually known of the mechanisms which control it. From the little information we have, it seems that the mechanisms which generate ion transport in bean hypocotyls are distinct and differ from those which control selectivity[9]. Rubidium, as well as most of the sodium, is transported into hypocotyl slices by means of a non-metabolic process which is unaffected by temperature changes. On the other hand, selective accumulation of sodium is temperature-dependent and is practically abolished under low temperature conditions. In most of the cases reported, the processes governing transport and selectivity were characterized by their responses to environmental conditions. In the following investigation, attempts were made to clarify what effects various plant organs have on ion uptake and ion selectivity by excised bean hypocotyls.

Bean plants (*Phaseolus vulgaris* c.v. Brittle wax) were used in the following experiments. Seeds were soaked in water, germinated, and seedlings were grown and treated as described previously[9]. Roots, cotyledons or buds were

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Effect of excision of various organs on uptake of sodium and rubidium by bean hypocotyl slices

Uptake solution Treatment	1 m*M* NaCl	1 m*M* RbCl	0.5 m*M* Na*Cl + 0.5 m*M* RbCl	0.5 m*M* Rb*Cl + 0.5 m*M* NaCl
a)				
Control	0.055 ± 0.005	0.018 ± 0.004	0.023 ± 0.004	0.008 ± 0.002
Roots excised	0.033 ± 0.004	0.018 ± 0.003	0.017 ± 0.003	0.010 ± 0.002
b)				
Control	0.057 ± 0.005	0.024 ± 0.002	0.023 ± 0.005	0.009 ± 0.003
Cotyledons excized	0.057 ± 0.005	0.016 ± 0.005	0.026 ± 0.003	0.007 ± 0.001
c)				
Control	0.049 ± 0.007	0.027 ± 0.004		
— roots	0.033 ± 0.009	0.024 ± 0.003		
— cotyledons	0.058 ± 0.005	0.019 ± 0.0005		
— buds	0.051 ± 0.007	0.019 ± 0.002		
— cotyledons and buds	0.047 ± 0.004	0.018 ± 0.003		

Data denote non-exchangeable fraction in µmol/g fresh wt. ± SD; 30° C.