

Parthenogenetic protocol

Tapan Kumar Maitra examines some of the common features of asexual reproduction in animals

REPRODUCTION by groups of cells, comparable to vegetative reproduction in plants, occurs only among the more primitive invertebrates; but among the normal sexual groups parthenogenesis is widespread and can be artificially induced in such vertebrates as the turkey and rabbit. Haploid parthenogenesis is both a form of reproduction and a means of sex determination. Fertilised eggs develop into diploid females, unfertilised parthenogenetic ones into haploid males.

The former has evolved independently six or seven times in the animal kingdom: in the Rotifera, Acarina (mites) and in four orders of insects — the Hymenoptera, Homoptera, Coleoptera and Thysanoptera. Oogenesis in these forms is essentially normal. However, because the males are haploid, spermatogenesis cannot follow a normal course of events. The first meiotic division is abortive and a reduction in chromosome number does not take place.

The second division is normal and only two instead of four spermatids are formed. This type of spermatogenesis has been shown to occur even in the rare diploid males of the wasp, *Habrobracon*, where homologous chromosomes capable of pairing in meiosis are available. In an evolutionary sense male haploidy means that every mutation is immediately exposed to the selective action of the environment. The same, of course, is true for any haploid organism. A greater degree of homozygosity and far fewer lethals are, therefore, to be expected in such populations as

compared to those of normal diploids. In this sense, the entire haploid set of chromosomes



The komodo dragon (Varanus komodoensis) can reproduce naturally by parthenogenesis.

is comparable to the X chromosome of those species, including man, which is exposed in an unprotected state in males. For example, *Drosophila* X chromosomes do not contain the frequency of lethal and deleterious genes found in autosomes. Somatic parthenogenesis produces only females from unfertilised eggs. If obligatory, the population consists only of females. If incomplete, parthenogenesis alternates with sexual reproduction in a systematic manner.

Obligate parthenogenesis is a closed genetic system, because meiosis and the recombination of genes have been abolished. Such a group of organisms can be considered a clonal line of unvarying genotype and is, consequently, at the mercy of a changing environment. Most forms exhibiting obligatory parthenogenesis are polyploid, however, and are thereby provided with a buffered genotype that can exist and reproduce in more diverse ecological situations than can their related sexual diploid forms.