7B1-1. Cultures fed *P. aurelia* have in general fewer nuclei per vitellarium and more nuclei per gastric gland than parallel cultures fed *P. bursaria* or *Eudorina elegans*. Differences between parallel cultures fed different diets are not always significant but are always consistent in direction. The reduction in number of vitellarium nuclei can be detected after as little as 2 days, or about two generations, after feeding *Eudorina;* an increase in gastric-gland nuclei was not detectable after 3 days but was significant at 6 days (about six generations). Similar results have been obtained with *Asplanchna brightwelli* from Indiana, but the samples were too small to allow definite conclusions.

These variations in nuclear number occur between two organs in an individual, and among organs in different individuals all descended by diploid parthenogenesis from a single female. Such individuals are believed, on the basis of cytological evidence, to constitute a clone. The variations seem far too great to be explained by mutation or by any recombination which might occur during the mitosis-like maturation divisions of the parthenogenetic eggs. The parthenogenetic female embryos of *Asplanchna* undergo their entire embryonic development within the uterus of their mother; mitosis ceases early in development, and the embryo is born with a fixed number of nuclei. Environmental effects, such as diet, which have at least partial control over nuclear number, must thus act indirectly through the mother. Possibly dietary changes may first affect the vitellarium and subsequently the egg whose cytoplasm is derived largely from the vitellarium during oogenesis. Differences between organs in the same individual or between different individuals in the same culture container are not readily explained by environmental effects, and may reflect imperfections in the mechanism or mechanisms which control mitosis during embryogenesis. They could also indicate variations in the proportion of embryonic cells which are set aside to form the primordia of these organs. Possibly information about the mechanism of eutely will be more easily obtained from studies on organs in which the mechanism shows some variability, especially when that variability can be partially controlled by the experimenter, than from studies on other organs where the mechanism operates almost perfectly.

We have also looked for interclonal differences that might be utilized in studying the genic control of nuclear number. No significant differences have been found between the Indiana and Tennessee stocks of *A. brightwelli*, which can be crossed. These stocks usually have slightly larger numbers of nuclei in both the vitellarium and gastric glands than do the Pennsylvania stocks. Unfortunately, we have been unable to attempt to mate these stocks, because of difficulties in obtaining miotic females in large numbers from clones 7B1 or 7B1-1. *Asplanchna girodi*, which cannot be crossed with *A. brightwelli*, has a mean of about 34 nuclei per vitellarium and may not differ significantly from the other species. It has, however, about 32 nuclei in each gastric gland (too many to count accurately with our method); in this respect it clearly differs from all our *A. brightwelli* stocks.

We do not intend to imply that our findings on the gastric glands and vitellaria of *Asplanchna* cast doubt on the existence on eutely as a general phenomenon in the rotifers. Nachtwey (*5*) found a somewhat lesser degree of variability in these same organs in *Asplanchna priodonta*. However, in *Epiphanes senta* Van Cleave (*6*) and Shull (*7*) found that 100 and 92.5 percent respectively of all gastric glands had six nuclei and 99.7 and 92.5 percent of all vitellaria had eight nuclei. We have also looked at certain other organs in *Asplanchna* which typically have one or a few nuclei and have found the nuclear numbers in these organs to be quite constant.

C. W. BIRKY, JR.
BONNIE FIELD*

Department of Zoology,
University of California,
Berkeley

References and Notes

1. L. Hyman, *The Invertebrates*: vol. 3, *Acanthocephala, Aschelminthes, and Entoprocta* (McGraw-Hill, New York, 1951).
2. C. W. Birky, Jr., *J. Exp. Zool.* **155**, 273 (1964).
3. J. J. Gilbert, *ibid.* **153**, 113 (1963).
4. Identification by J. J. Gilbert.
5. R. Nachtwey, *Zeit. wiss. Zool.* **126**, 239 (1925).
6. H. J. Van Cleave, *Biol. Bull.* **42**, 85 (1922).
7. A. F. Shull, *J. Morphol.* **30**, 455 (1918).
8. Supported by USPHS grant GM 12183. We thank Nancy Gilbert for technical assistance.
* Present address: 728 Luring Drive, Glendale 6, California.

1 November 1965

Auxin Effects on the Mobility of Kinetin in the Plant

Abstract. *Kinetin (6-furfurylaminopurine) is generally considered to be relatively immobile within plants. Kinetin labeled with ^{14}C was applied to the stumps of decapitated bean plants, with or without simultaneous application of indoleacetic acid. Significantly greater amounts of kinetin moved downwards in the stem in the presence of added indoleacetic acid than in its absence.*

Kinetin (6-furfurylaminopurine) is generally considered to be relatively immobile within plants (*1*). In experiments on hormone-directed transport, it was found that when indoleacetic acid (IAA) was applied to the internodes of decapitated pea plants it induced the movement of ^{32}P from the base of the stem toward the point of application (*2*). Kinetin alone had no effect upon the movement of ^{32}P in this system, but when it was applied in combination with IAA kinetin enhanced the IAA-induced movement (*3*). Since kinetin affects the level of ^{14}C-IAA in the stems of decapitated bean plants (*4*), we have investigated whether IAA, in turn, affects the movement of ^{14}C-labeled kinetin.

Young seedlings of French bean (*Phaseolus vulgaris*), grown in pots in a heated greenhouse for 3 to 4 weeks, were decapitated just below the third node so that the primary leaves and one fully expanded trifoliate leaf and the internode above it were left on each plant. Immediately after decapitation, 0.5 μc of kinetin-^{14}C (6-furfurylaminopurine-8-^{14}C) in 0.01 ml of 80 percent aqueous ethanol was applied to the side of the decapitated stump after scraping away a small area of epidermis. Equal amounts of lanolin

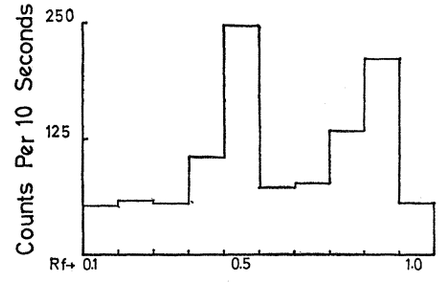

Fig. 1. Chromatogram of extract of internodes of decapitated bean plants to which kinetin-8-^{14}C and IAA were applied. There has been some metabolism of the kinetin-^{14}C but the fraction occurring at R_F 0.7 to 1.0 appears to be unmodified kinetin.

paste containing 0.1 percent kinetin were immediately applied to the tops of the decapitated internodes of ten plants by means of gelatin capsules (1 ml), and a mixture of kinetin and IAA each at 0.1 percent was similarly applied to a further ten plants. After 24 hours, 5-cm internode pieces from the stump were harvested from each plant, and were each divided into 1-cm pieces, the uppermost piece from each plant being discarded. The corresponding remaining pieces (that is, from the same part of the stem) from separate plants were pooled in groups of five and extracted with 80 percent methanol. Prior experiments had indicated that when the extracts were chromatographed in paper with a mixture of *n*-butanol, acetic acid, and water (4 : 1 : 1) as solvent, there were two main peaks of radioactivity, which occurred in the region R_F 0.7 to 1.0 (Fig. 1) corresponding to the zone at which authentic kinetin runs in this solvent system. The extracts from the experimental plants were therefore chromatographed in this way and the zone R_F 0.7 to 1.0 was then cut out and placed in tubes to each of which was added 5 ml of scintillation liquid EN 220 (dioxane based) and 0.5 ml of water at *p*H 5.0. After storage in the dark overnight to reduce chemiluminescence and to allow equilibration, the radioactivity was determined with a scintillation counter (Fig. 2).

The 1-cm sections of stem, immediately below the point of application, contained greater activity with kinetin than with kinetin plus IAA. Nevertheless, at a distance of 3 to 4 cm below the point of application there was much greater activity in the plants treated with kinetin and IAA than with kinetin alone.

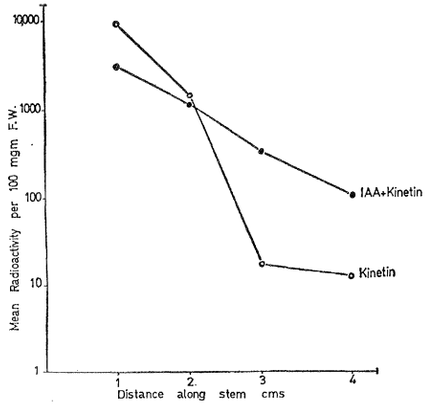

Fig. 2. Effect of IAA on movement of kinetin-^{14}C in internodes of decapitated bean plants. Kinetin-^{14}C at 0.1 percent in lanolin was applied at the stump of both series of plants and IAA (0.1 percent) was also applied to one series. Abscissa indicates distance from point of decapitation to the top of the stem section in question.

The reduced radioactivity in the top 1-cm sections of the plants to which IAA had been applied may have been due to partial inhibition of kinetin uptake by IAA, or to increased movement away from the site of application. Similar results have been obtained in several experiments in which significantly greater amounts of kinetin moved down the stems of plants to which IAA had been applied. Thus, although kinetin alone appears relatively immobile in the plant, its basipetal movement seems greatly increased in the presence of added IAA. In this respect, the properties of kinetin resemble those of benzyladenine, the basipetal movement of which is enhanced by IAA (*5*), although the benzyladenine is much more mobile in the plant than kinetin when applied alone.

A. K. Seth
C. R. Davies
P. F. Wareing

Department of Botany,
University College of Wales,
Aberystwyth, Great Britain

References and Notes

1. K. V. Thimann, *Ann. Rev. Plant Physiol.* **14**, 1 (1963).
2. C. R. Davies and P. F. Wareing, *Planta* **65**, 139 (1965).
3. A. K. Seth and P. F. Wareing, *Life Sci.* **3**, 1483 (1964).
4. C. R. Davies, A. K. Seth, P. F. Wareing, *Science* **151**, 468 (1966).
5. D. J. Osborne and M. K. Black, *Nature* **201**, 97 (1964). See also J. E. Fox, J. S. Weis, D. J. Osborne, C. C. McCready, *Nature* **206**, 678 (1965).
6. Supported by a grant from the U.K. Agricultural Research Council.

6 December 1965

Swimming Speed of a Pacific Bottlenose Porpoise

Abstract. *Four kinds of speed runs showed a Pacific bottlenose porpoise* (Tursiops gilli) *to have a top speed of 29.9 kilometers per hour (16.1 knots) for 7.5 seconds and a top speed of 21.9 kilometers per hour (11.8 knots) for 50 seconds. These results compare closely with highest predictions based upon rigid body drag calculations, the same power output per unit body weight as for athletes, and a propulsive efficiency of 85 percent.*

Many observations of the speed of porpoises have been made from shipboard (*1*), and analysis indicates unusually high power output or unusually low drag (*2*), or both. Some of these observations indicate various types of assisted locomotion (*3*), where the animal obtains thrust from ship waves. Such field observations are always difficult to interpret in terms of exact speeds, so tests with calibrated instrumentation under controlled conditions are needed.

In 1960, speed tests were conducted on a Pacific striped porpoise (*Lagenorhynchus obliquidens*) in a 97-m tank (*4*). Top speed was only 27.9 km/hr (15.0 knots), which indicates nothing unusual in performance.

On 24 March 1964 a Pacific bottlenose porpoise (*Tursiops gilli*) was captured in Hawaiian waters. This animal (Fig. 1), an approximately 3-year-old male named Keiki, was trained by conditioned-response techniques to swim at high speed in open water and to return upon command (*5*). He weighed 89 kg and was 191 cm long.

Four types of speed runs were conducted from August to December 1964, two in an enclosed lagoon racecourse and two with a speedboat in the ocean. The lagoon runs took place in 3 m of sea water in the 300- by 35-m lagoon at Coconut Island, in Kaneohe Bay, Oahu, Hawaii. The speedboat runs were conducted off Oahu, near Rabbit Island, and in Kaneohe Bay.

Lagoon runs were made by stationing Keiki inside a 9.3- by 9.3- by 3.1-m chain link pen which rested on the bottom of the lagoon. With one side of the pen open, Keiki was stationed under his trainer's hand at the back of the pen. When the hand was lifted, Keiki accelerated toward the entrance. As his snout passed over it, a timer was started and simultaneously an audible "start signal" was projected underwater to the animal. The porpoise raced the entire length of the 61-m course underwater, crossing a submerged finish line. If the run was of acceptable speed, as indicated on a timer at the finish line, a police whistle was blown and a reward of three fish was given. If the run was unusually fast, six fish were given simultaneously. An underwater recall signal returned the animal for another run. If the animal appeared tired, which would usually be indicated by an increased rate