the photoinductive cycles were given successively. For instance, the demand for alanine and glutamate, which are the end products of glycine-pyruvate and glycine-ketoglutrate systems, increased after the completion of 3 photoinductive cycles. Similarly the requirement of aspartate, alanine and glycine, which are the end products of other 3 reaction systems, i.e. glut-oxaloacetate, glut-pyruvate and glut-glycine, showed an increase right from the beginning of 3 photoinductive cycles. However, no direct reason could be given for the increase and decrease in the activity of 5 different transaminase systems during the process of photoinduction. But it can be stated that the transaminases play an important role in the process of floral induction in biloxi soybean. Whether these biochemical changes in the leaves may be attributed mainly to the direct or indirect effect of photoinduction has to be thoroughly explored.

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External nares and olfactory perception

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Summary. Lower vertebrates have more widely separated external nares than higher forms and are thus better adapted to utilize olfactory tropotaxis, or stereolfaction, than higher vertebrates which, on account of their flexible necks, must utilize klinotaxis. Snakes and tubenosed bats break the rule on account of their specialized life styles.

There is little experimental evidence to indicate whether the olfactory system of vertebrates operates by tropotaxis, when the signal perceived by each of the paired receptor organs is compared simultaneously, or by klinotaxis, when the head is moved from side to side so both organs together can compare the concentration or other quality of an odour. Studies with dogfish[1] and man[2] suggest that tropotaxis, or stereolfaction, occurs but behavioural observations on a large number of species indicates the widespread existence of klinotaxis. Since air or water to be sampled by the olfactory system must first be drawn into the external nares, the position of these structures on the head might play a part in enhancing olfactory perception through one or other, or perhaps both, of these sampling strategies.

For an accurate assessment to be made of the direction from which an odour emanates the sampling devices, or external nares, should either be as widely separated as possible thus providing a wide base for stereolfactory triangulation, or the post-cranial skeleton should be sufficiently flexible to allow the head to be swung from side to side providing a mechanism for klinotactic comparison. With the exception of a few notable exceptions in which the external nares are positioned on lateral projections extending outwards from the side of the head, viz. hammerhead sharks (Sphyrnidae) and tubenosed bats, (Nyctimeninae and Murininae), the maximum distance separating the nares is limited by the width of the skull. This, in its turn, is a product of the ecological niche occupied by the species. Examination of the ratio of the skull width to internarial width reveals that the nostrils are relatively more widely separated in lower vertebrates than in higher forms (table 1). Exceptions to this trend are snakes and tubenosed bats, with more widely spaced nostrils than might be expected, and the aquatic reptiles with nostrils more closely positioned than the trend line would predict.

Because large animal species have, potentially at least, more widely spaced nares than smaller species, consideration of the absolute separation must be restricted to species of more or less uniform size and in this analysis includes only those species with a maximum adult weight not exceeding 200 g (238 g in the case of snakes). The data shown in table 2 indicate that higher vertebrates have more closely set nostrils than lower vertebrates and once again the snakes and tubenosed bats stand apart from the trend.

Consideration of the data in the tables indicates that the position of the external nares might be related to factors

Table 1. Ratio of skull width to internarial width for a sample of 165 genera of vertebrates

	Number of specimens	Ratio	±SE
Elasmobranchs	12	1.8	0.21
Teleosts	21	2.4	0.44
Urodeles	9	2.8	0.22
Anurans	12	3.7	0.37
Snakes	18	2.0	0.20
Lizards	39	4.0	1.29
Turtles	3	7.6	-
Crocodiles	3	9.3	-
Birds	14	4.2	0.70
Tree shrews, Insectivores, Marsupials	16	5.1	0.69
Rodents	8	6.0	0.41
Tube nosed fruit bats	4	1.7	0.17
Tube nosed insectivorous bats	6	2.1	0.21

All measurements were made on spirit preserved museum specimens with the exception of 4 bird and 5 marsupial genera which were made on live specimens. All specimens were adult. The skull width is the maximum width of the head measured immediately anterior to the ears and the internarial width is the minimum separation between the inner edges of the external nares.

other than inspiration only. The lower vertebrates, which are 'stiff-necked' and incapable of swinging the head from side to side have more widely separated nares, both relatively and absolutely when compared with other small vertebrates, than the higher forms which have a flexible post-cranial skeleton. This would appear to be an adaptation for tropotactic olfactory perception. Higher vertebrates are already adapted in such a way that klinotaxis is readily accomplished. The question then arises, why do snakes and tubenosed bats - both flexible necked types - resemble the lower vertebrates in so far as they have widely spaced nostrils? The answer lies in their specialized life styles. Prior to striking, snakes gain information about the precise location of their prey by vision, infra-red detection and by sampling the air with the bifid tongue. The precise role of the olfactory system, rather than the accessory olfactory organ of Jacobson to which the tongue carries scented particles, is not known but presumably a lateral head shaking would make the final attack less successful. Widely spaced nostrils give the snake the best chances for olfactory information to come through stereolfaction. Tubenosed fruit bats locate ripe fruit from among unripe fruit by olfaction[3], and since detection and selection has to be made while on the wing it seems likely that tropotaxis is beneficial inasmuch as it does not necessitate physical movement of the head which would likely interfere with flight stability.

Table 2. Absolute internarial separation (in mm) for a sample of 133 genera of small vertebrates

	Number of specimens	Separation (mm)	±SE
Teleosts	20	10.3	4.2
Urodeles	9	4.2	2.2
Anurans	12	4.6	1.5
Snakes	18	7.1	2.8
Lizards	30	4.1	2.5
Birds	12	4.0	1.5
Tree shrews, Insectivores, Marsupials	14	2.9	1.0
Rodents	8	3.0	1.4
Tube nosed fruit bats	4	12.1	1.5
Tube nosed insectivorous bats	6	4.6	0.6

See legend to table 1.

Further support for the contention that lower vertebrates have to rely upon stereolfaction comes from many species of fish themselves. Tubular nares, which effectively increase the base for triangulation, are found in a number of species including the bichir *Polypterus bichir*, catfish *Nemacheilus barbatula* and the eel *Anguilla anguilla*. In other species the small vertical flap of tissue standing between the incurrent and exhalent nares, called the pavilion, serves to catch and direct downwards water from the faster moving layers not immediately in contact with the body. In this manner the 2 streams of sampled water come from as widely separated sources as possible.

Although the data expressed in this paper are morphometric and not behavioural, there seems no other reasonable interpretation explaining the position of the external nares of vertebrates.

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Mitosis in the haemocytes of *Sarcophaga ruficornis* (Diptera)[1]

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Summary. Among the haemocytes of *Sarcophaga ruficornis*, only the prohaemocytes divide. Injection of phytohaemagglutinin-P induces 100% prohaemocytes to undergo mitosis but does not induce mitosis in other cells. Mitotic stages other than the prophase are apparently very short lived.

It is generally believed that among the different kinds of haemocytes found in insects, the prohaemocytes alone divide and the other types of cells are derived from the differentiation of these stem cells[2]. However, the question is by no means settled. For instance, Arnold[3] has reported the division of plasmatocytes and spheroidocytes in *Ephestia kuhniella;* Arnold and Sohi[4] noted the division of granular haemocytes in *Malacosoma disstria;* and Nittono[5] observed the division of spherule cells in *Bombyx mori.*

In smears of haemolymph drawn from the different stages in the life history of *Sarcophaga ruficornis*, we have observed mitotic figures only in the phohaemocytes, and also noted that the maximum percentage of dividing cells (about 20% of prohaemocytes) occurs in the freshly moulted 3rd instar larva. Mitotic figures were not observed in any other type of cells although closely adhering pairs of cells of various kinds and binucleate cells, giving a false impression of division, were occasionally encountered.

The possibility existed that the number of cells actually dividing, other than the prohaemocytes, in the circulating haemolymph is so small that they are missed in the examinations. Therefore, we used a mitotic stimulator, phytohaemagglutinin-P, to induce their division. 0.05 ml of a 2% aqueous solution of phytohaemagglutinin-P was injected per larva into the freshly moulted 3rd instar larval stage, and haemolymph was drawn out 4, 8, 22 and 26 h after the injection for preparing smears. It was noted that the percentage of prohaemocytes undergoing mitosis suddenly increased within 4 h after the injection of the mitotic stimulator from 20% to about 84% and 22 h after the injection all the circulating prohaemocytes were in one stage or the other of mitosis. Until 26 h after the injection, all the prohaemocytes were in dividing stages. None of the other types of cells were, however, seen undergoing mitosis in any preparation even after the treatment with the mitotic stimulator. This shows that haemocytes other than the prohaemocytes in *S. ruficornis*, viz. plasmatocytes, granular haemocytes and spherule cells, do not have the competence to undergo mitosis. The table gives the percentage of prohaemocytes showing mitosis after different intervals after the injection of the mitotic stimulator, and the stages in which they were observed.