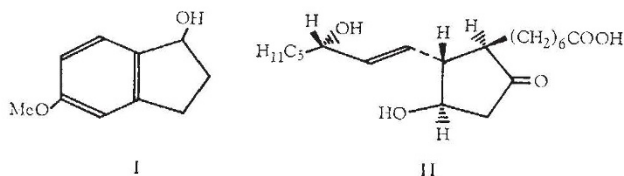


mercially viable synthetic route for the production of prostaglandins.

During the past three years, chemical syntheses have been described by research groups at McGill and Harvard Universities and at the Upjohn Co. Now Merck, Sharp and Dohme enter the field with a high yielding, stereoselective pathway which differs fundamentally from previous syntheses (*J. Chem. Soc., D*, 1258; 1970). Wender's route retains the five-membered ring of the starting material, 6-methoxy-3-indanol, (I), through twenty-nine individual steps, which introduce the heptanoic acid side chain first and then elaborate the benzene ring to give the eight-carbon residue. The final product, prostaglandin E<sub>1</sub> (II), is racemic in form and has properties identical with the naturally occurring, laevorotatory enantiomer with just half of its biological activity.



## ANIMAL BEHAVIOUR

### Discriminating Sticklebacks

from our Marine Vertebrate Correspondent

DISCRIMINATION by females during courtship is an important factor preventing hybridization between two closely related species of stickleback according to the results of a recent study. Sticklebacks are widely distributed in fresh water and in the shallow sea in the North Temperate zone, from western Europe across the Eurasian landmass and through North America, where the greatest profusion of species is found. Two species, which are widely distributed in fresh water, are the three-spined stickleback (*Gasterosteus aculeatus*) and *Pygosteus pungitius*, the ten-spined stickleback, and because both are nest builders, exhibiting strong territorial behaviour, and sexual dimorphism, they are ideally suited for behavioural study in the laboratory.

A recent study on the reproductive isolation in the two species by Kenneth J. Wilz (*Copeia* (3), 587; 1970) has taken previous observations a step further. Wilz's object was to determine what, if any, ethological isolating mechanism underlies the lack of hybridization between these two species. Within much of their ranges they can be found in the same waters, the only obvious difference being that *Pygosteus* lives in densely weeded areas and builds its nest in vegetation, while *Gasterosteus* is most common in open water and nests on the bottom. Yet hybrids are not seen in nature although they are often frequent between other closely related sympatric fishes.

The courtship activity of the two species is well known. Male *Gasterosteus* have a striking red belly, throat, and greenish eye, and "dance" during courtship, mostly in a horizontal direction with frequent sorties towards the nest. Male *Pygosteus*, however, are a velvet black with whitish pelvic spines, and display to the female with the head down, making fewer dashes towards the nest. The problem to be solved was whether the males discriminated between

females of the two species during courtship, or whether the females selected conspecific males. Wilz found that males of both species make little selection, provided the female is gravid and confined close to the nest. Male *Gasterosteus* showed a slight preference (measured in "dancing units" released) for the conspecific female, but *Pygosteus* males actually scored more (41.0 dancing units) for the other species than for females of their own kind (38.4 dancing units). It seems that male discrimination of the "right" female is not a major factor in the genetic isolation of the two species.

Further experiments were designed to determine the extent of the females' selection of males of the same species. By presenting gravid females to sexually active males of the other species, Wilz discovered that although the males go through their courtship activities undeterred the response of the females is very tentative. Assessed as a time interval before the female approached the nest he found that only two out of thirty-five *Gasterosteus* females responded positively to male *Pygosteus*, but a rather higher proportion of female *Pygosteus* responded to males of the other species, and two eventually spawned.

It seems that female discrimination early in courtship behaviour is the major block to interbreeding between the two species. The suggestion is that the difference in male coloration and in the form of the "dance" are the basic factors.

It is interesting that both sexes of *Pygosteus* seem to be less selective than *Gasterosteus*, but as Wilz points out *Pygosteus* regularly holds territories in dense submerged vegetation and thus is only likely to encounter its own species. *Gasterosteus*, on the other hand, lives in more open water, only seeking shelter in marginal vegetation in winter and in flood conditions, and the females school, and leave the school to mate. Such habits make good discrimination for males of the same species a necessity. The effectiveness of these and the ethological barriers between the species is shown by the absence of naturally occurring hybrids.

## ARCHAEOLOGY

### Origins of Farming

from a Correspondent

EXAMINATION of plant remains found in northern Syria has supported the theory that some early human communities settled in permanent villages before agriculture was fully underway. The origins of farming in the Old World have recently been studied more intensively than most problems of prehistoric archaeology, and the latest finds follow a series of American, British, Dutch and French field projects as well as excavations conducted by the Near Eastern nations themselves. Plant remains and animal bones now amply document the subsistence of the early village farmers, who were the world's first peasants.

For many years animal bones have given an insight into the meat diet of the Palaeolithic hunters who preceded these first Neolithic farmers. The principal domestic animals of the early Neolithic in the Near East were the sheep and goat (with cattle in Anatolia). Specialized hunting of these species, implying a close relationship between man and animals in the late