

## Chemical Aspects of Stimuli

by H. KLEEREKOPER

Texas A & M University, Department of Biology, College of Science, College Station (Texas 77843, USA).

The initiative to dedicate an issue of *Experientia* to the role of the chemical senses in the reproductive behaviour of fishes is in itself evidence for the scientific interest in the many facets of this biologically important and fascinating problem.

Although even from a strictly descriptive point of view the part played by the chemical senses in that behaviour has become known only superficially, there remains no doubt as to the importance of their involvement in a number of behaviour patterns related to reproduction in these animals, from orientation in migration to social behaviour and parental care. It may be expected that continuing research in this area will reveal the dependence of many more behavioural functions in reproduction on chemical communication which is potentially one of the most versatile biological mechanisms for the transfer of precise and unequivocal information so essential in many phases of reproduction. The many fascinating results of modern physiological investigations of behaviour related to reproduction in insects and, to a lesser extent, in mammals are strongly suggestive as to what similar efforts may yield with respect to that behaviour in fishes.

The information available on the role of the chemical senses in the behaviour of fish generally is largely descriptive in that inquiries into the chemical identity of the substances involved are almost entirely non-existent. The few attempts described in the literature, including my own, which have yielded some information on chemical characteristics, have dealt with olfactory stimuli related to orientation (food localization) and alarm substances.

Having been invited by you to prepare for this issue of *Experientia* a short review of the present status of our knowledge on the chemical aspects of stimuli involved in reproductive behaviour in fish, I ex-

haustively searched the literature on information that may be even remotely related to the problem at hand. I cannot remember any other of the many literature searches carried out by me over the years that was as totally negative as the one in question. I have occasionally emphasized the urgent need for an intensive and highly sophisticated chemo-analytical approach to the problem of odour identity of the waters of spawning grounds and migratory pathways and was well aware of the great void in meaningful knowledge on this aspect which is extraordinarily complex and whose solution is technically difficult and expensive. However, it is far less obvious why, apparently, so few efforts have been made to ascertain the chemical nature, not to speak of the identity, of substances involved in less complex chemical communication such as is likely to be involved in sexual discrimination. It seems reasonable to speculate that, in many cases, we may be dealing with fairly simple steroids whose identification should not present too great problems.

Allow me to, once more, express the opinion that advances in knowledge on the fundamental processes in chemical communication in general and, in the context of the present issue of your journal, on that related to reproductive behaviour in fishes will be dependent on precise information on the chemistry of the substances involved. The analogy with the great advances in physiology of reproductive behaviour in insects, following biochemical identification of many pheromones, is obvious. However, the analytical problems are bound to be considerable and complex in most cases and would call for the application of the advanced techniques not generally accessible to the general and behavioural biologist. Collaborative efforts with organic and biochemists would be required in serious investigations of this type.

## Conclusion

by M. DOMINIQUE CRAPON DE CAPRONA

Abteilung Mittelstaedt, Max-Planck-Institut für Verhaltensphysiologie, D-8131 Seewiesen, (Germany).

The previous articles, demonstrating the importance of chemoreception in many aspects of fish reproduction, can be summarized in the following way.

When breeding is limited to certain periods of the year, chemoreception promotes spawning synchrony by bringing together many individuals of a given species. This is accomplished either through migration to spawning grounds, or by an increase of the repro-

ductive activity and receptiveness of the individuals. This assures a greater variety of prospective partners, consequently an efficient spreading and mixing of the gene 'capital' of a population (and possibly even sexual selection).