CONCLUDING REMARKS

The phylogeny of animal species is characterised by refinement of the various organ processes and perhaps the greatest success has been achieved by the gastrointestinal tract in its morphological and functional development. This appeers true when we consider the modification of a simple alimentary tube of body length in invertebrates emerging into a large tract of great lengths in vertebrates where it becomes coiled or packed into a relatively small space of the body cavity, to accommodate the canal actually several times longer than the individual to whom it belongs. A great adaptation is also seen in the functional ability of the digestive organs to modify their activity in accordance with the demands made on the organism as a whole. Amongst the fresh water teleosteii group, the partial air breathing amphibious fishes possessing accessory lung, are well-adapted to different strenuous situations of variable temperature, salinity and oxygen content changes; and apparently a great modification of the alimentary canal has been emerged for selective adjustments, permitting survival in a hostile asphyxial situations associated with entering the terrestrial environment.

Ophicephalus punctatus, a fresh water teleost, belonging to actinopterigii, partial air-breathing 'snake-headed' amphibious fish, widely distributed in muddy environments in and around marshy lands of tropical countries with carnivorous habit, possesses short alimentary canal with a single loop and two pyloric caeca along with a sac like muscular stomach, occupying a great space in the abdominal cavity. The distinctive morphological features of this relatively simple short intestine have been characterized by numerous longitudinal folds of its luminal surface along with extensive villous projections amplifying

effectively the absorptive faculties along with specialized spiral valves. Structurally, the muscle cells are chiefly striated in oesophagus and of smooth variety in the intestine; in addition, various other types of cells and rich nerve net works and plexuses are present which may contribute to the total magnitude of the varied physiological responses and movements.

Although a comparative study of the smooth muscle pharmacology has been made extensively , it has been relatively ignored on fish smooth muscles. The physiological behaviour and pharmacological responses observed on the isolated intestine of O. punctatus disclose certain broad similarities between the vertebrate intestines along with some simple but sensitive reactions towards certain active pharmacological agents. The distinctive physiological properties of the isolated gut of this fish include spontaneous rhythmic peristaltic and segmental contractions which are easily subjected to the alteration of the pH, temperature, salinity and oxygen content of the bathing fluid. It has not been possible to denote the mechanism of such changes in contractile behaviour of isolated intestine but the majority of observations favour the view that they are both myogenic and neurogenic in origin, as the changes in the sensitivity to drug action or retardation and abolition of spontaneous contraction after cooling may not solely depend upon the inactivation of nervous elements, since cooling itself impairs the muscular tissue as well.

Like mammalian intestine, different physiological responses can be initiated by active pharmacological agents and are blocked by inhibitory agents in fish intestine also. From the present experimental set up, it is difficult to evaluate such responses of fish intestine with the mammalian intestines, as the experimental conditions in the latter are diverse and their muscles themselves are even more heterogeneous compared to the

relatively simpler structures in fish intestine. It is conceivable from the present experiments that the fish intestine is also quite specific in its pharmacological behaviour both normally and during altered physiological conditions. In one respect at least the isolated intestine of O. punctatus appears to exhibit some distinctive sensitive response towards acetylcholine and serotonin, which is appreciably pronounced and repeatedly demonstrable and reproducible with possibility of utilizing it for determination of small amounts of these substances by bioassay method. Moreover, the potentiated response of acetylcholine following physostigmine pretreatment or preincubation with calcium free media reflects either the specific receptor occupation or permeability change to particular ions within the muscle tissue.

The analysis of the effects of epinephrine on the various smooth muscles of the fish gut, particularly the stomach, swimbladder, pyloric caeca and intestine, further confirms that the response of smooth muscle of fish is also highly individualistic and specific. It is true that the activity of the gut is normally subjected to so many influences that a great caution should be exercised for interpreting specific drug activity. With the use of broad pharmacological approach on the fish gut, particularly of analysing the actions of nicotine, atropine, physostigmine, morphine, procaine, histamine, barium, serotonin and epinephrine etc., it is generally assumed that acetylcholine is the probable substance released from the postganglionic cholinergic nerves in the intestine of fish. Evidence for this conclusion was obtained by finding that atropine and epinephrine effectively inhibited the contractions of the fish intestine produced by nicotine or acetylcholine. Since procaine exerts its activity on the intrinsic nervous elements and intramural ganglia respectively of the isolated intestine (Feldberg, 1951), it appears feasible that acetylcholine is probably activated through the ganglionic release, and its liberation at the neuromuscular junctions seems to be

doubtful particularly when there was no blocking action by curare pretreatment. Although the detailed nerve supply of the fish gut has not been studied [illegible] the frequent presence of nerve plexuses inside the muscle elements supports the contention regarding the presence of intramural ganglia. Lastly, the high sensitivity of the intestine of O. punctatus towards acetylcholine and serotonin offers an advantage of utilising this for determining the minute amounts of acetylcholine or serotonin in micro ranges.

Unfortunately, the refined biophysical techniques presently available have not been exploited in studies of drug action on the fish intestine and no attempt has been made to test the applicability of information gained from experiments on fish intestine with that of mammalian intestine. But the present experimental results strongly attest the view, that owing to the simple morphology and mode of innervation, smooth muscle fish gut might offer a great advantage for investigating the mechanisms by which the drug acts. However, the comparative pharmacology of fish intestine awaits further systematic exploration.