THE CURRENT STATUS OF BRAIN-PITUITARY-GONAD AXIS PHYSIOLOGY IN FISHES AND ITS MANIPULATION DURING CONTROLLED REPRODUCTION

Martin P. Schreibman[1] and Lucia Magliulo-Cepriano[2]

[1]Brooklyn College, City University of New York. [2]College of Technology at Farmingdale, State University of New York.

Recent advances in tools of investigation and their use in cytology, molecular biology, biochemistry, genetics and inmunology have presented us with new information on the reproductive physiology of fishes and introduced us to novel ways of applying this informarion to aquaculture biotechnology. Old concepts of how; the brain-pituitary-gonad axis functions and control mechanisms operate have given way to new.

For example, it is now well established that multiple forms of gonadotropin releasing hormone (GnRH) occur within a single species and that these brain releasinsg factors have different specific functions and operate at different times of the reproductive cycle and at different physiological and chronological ages. We know too that the cells that produce GnRH are themselves under the regulatory control of a battery of neurotrasmitters and amino acids. Factors such as neuropeptide Y, galamin, FMRF, amide, neurotensin, glutamate and the catecholamines may innervate the GnRH cells themselves and dictate when and how these cells are to behave. Colocalization, the occurrence of these various factors within the very cell that produce GnRH, demonstrates the intimacy of this relationship.

After many years of study, we now have confirmation that there exists two forms of beta gonadotropin (GrH), beta GTH I and beta GTH II, in the teleost pituitary gland. This finding has led to an examination of the roles of these two GTHs in the reproductive life history of the organisms studied. It appears that in most species studied GTH I is associated with early developmental stages of the reproductive systen, perhaps from birth or before during gonadogenesis. By comparison, beta GTH II makes its appearance with sexual maturation or the, onset of cyclical reproductive activity. The obvious next step, to comprehend the physiological association of the multiple forms of GnRH and GTF, has revealed interesting new findings that will affect the way aquaculturists utilize the art of hormonal manipulation in controlling reproducrive activities of farmed fishes. The discovery of families of second messengers and their variant metabolic pathways facilitates our comprehension of how multiple factors, localized within a single cell and initially seeming to control the same process, actually mediate different aspects of that process.

It is well established that signals from the environment can profoundly affect reproductive activity of all organisms. Further study of some fishes has clearly demonstrated the involvement of eyes, olfactory systen pineal gland and epidermal touch receptors in cycling the cues of vision pheromone, light (photoperiod) and Physical contact to\through GnRH producing nuclei in the brain. These signals influence GnRH cell activity and the subsequent changes jn other components of the endocrine axis.

The gonads, long a target of investigation by reproductive endocrinologists, are yielding seminal information on how they are constructed and operate. From a better comprehension of the process of vitellogenesis and its detection by epidermal mucus assays to the paracrine and autocrine regulation of gametogenesis and steroidogenesis by growth factors and humoral agents, aquaculturists will develop new approaches for manipulation of gonad development and function.

We have also isolated new pituitary hormones such as somatolactin (SL) with implications of involvement in growth development and gonad function, Insulin-like growth factors are ubiquitous and their direct involvement; in gonad activity has been recently expounded upon. The novel and mind-challenging methods of molecular biology allow us now to extract £enetic material and its products to characterize species-specific characteristics of endocrine cell activity. And new methods of detecting and quantifyin receptors are adding to our armamentarium of tools for monitoring neuroendocrine activity in the BPG axis.

The plethora of information derived in recent years of study has delivered new ideas on how to control the reproductive processes of farmed animals and has, thus, advanced significantly the practice of aquaculture around the world. We have much to learn but we are in good position to take a giant step in the application of basic research to practical issues.