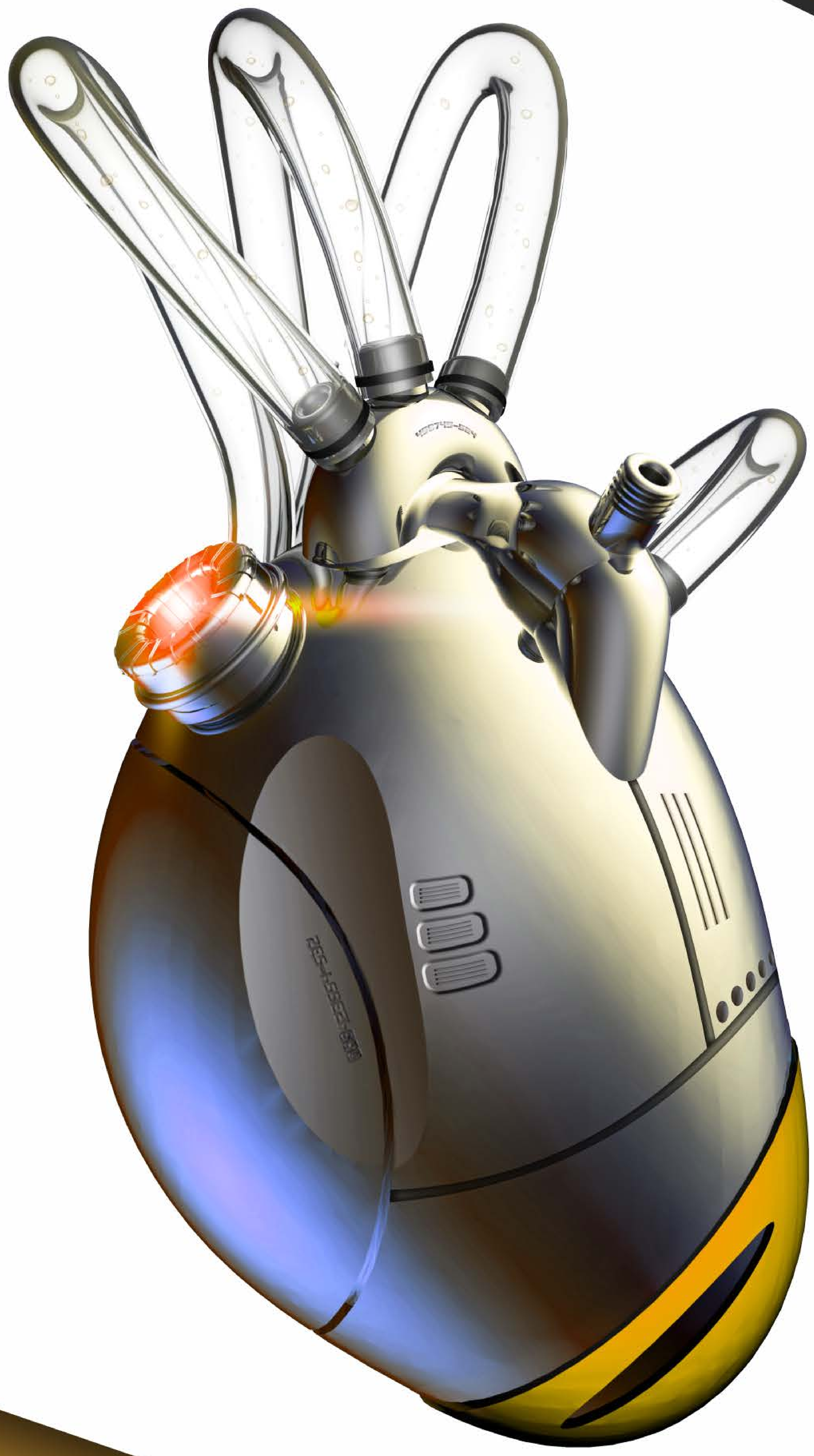
IJABE



International Journal of Advances in Biomedical Engineering

ISSN: 2822-2237
Vol:3 No:1
2024

www.ijabe.online

Volume: 3 No: 1

2024

About IJABE

IJABE is a non-profit organization
Classification of the Journal: Academic/Scholarly
Subject Category: Engineering
Frequency: Quarterly
Format: Online
ISSN: 2822-2237
Language: English
Indexed and Peer Reviewed: Yes
Publisher: Dr. Caglar Cengizler (Izmir Democracy University, IZMIR, TURKEY)
Contact: ccengizler@ijabe.online
Address: Biomedical Device Technology Program, Vocational School of Health Services, Izmir Democracy University, Izmir, Turkey

IN MEMORIAM

•

Eren TÜRKUŞAĞI

“Always in our hearts”

Received: 31/12/2024 *Accepted: 31/12/2024*

International Journal of Advances in Biomedical Engineering
Open Access Peer-reviewed Journal
ISSN: 2822-2237
www.ijabe.online
Volume:3, Number:1, Pages:(1-2)
Year:2024

Editorial: Future of Scientific Research Publishing

Founding Editor: Dr. Caglar Cengizler*

**E-mail:editorial@ijabe.online*

Future of Scientific Research Publishing

Scientific progress sometimes happens through big leaps, but more often it is the result of small, steady steps forward. For this reason, feeding collective memory with fresh information and ensuring new knowledge reaches every corner of society is vital. Until new knowledge is widely shared and firmly established, it remains fragile. Therefore, filtering research findings and delivering them to the right audience is critical for the rise of civilizations. Thanks to the global network created by publishers, the results of scientific studies can thrive, avoiding the risk of fading away. Humanity benefits from the advantages of positivism through this system of responsibilities, standing on the dedicated work of scientists. Publishing is not just about sharing information; it also protects, refines, and universalizes it. This process, which turns fragile new ideas into revolutionary breakthroughs, is itself subject to evolution and change.

As technology advances and opens up new possibilities, it is inevitable for publishing to adapt and improve. However, it is essential for anyone involved in scientific research to consider the benefits and challenges of these changes. Scientists, who build science step by step with their contributions, are also the main feedback mechanism for scientific publishing. At this point, the collective will of scientists must rise to ensure knowledge is shared fairly and objectively, preventing the formation of unfair or biased systems. This way, the opportunities offered by new technologies, which dramatically accelerate access to information, can help create a more equal future for everyone.

Any structure that wastes scientists' valuable time, energy, or even small but important pieces of knowledge, and tries to control the publishing process for the benefit of a privileged group, should be acknowledged as challenges to progress and addressed collaboratively. In today's increasingly digital world, the effort required to create, share, and protect accurate information has changed. Every new tool or method promises to save time and effort. Therefore, publishers who fail to adapt should be encouraged to catch up with these changes.

At IJABE, we invite all scientists to take an active role not just in producing knowledge, but also in ensuring it is shared freely. We call for the implementation of fair and transparent oversight mechanisms for commercial entities and the creation of independent councils, institutions, and organizations that can turn scientists' feedback into action. Knowledge, with the power to shape the future, will reach its true potential through the feedback and determination of those who create it.

Rights and permissions

Received: 22/12/2024 *Accepted: 23/12/2024*

International Journal of Advances in Biomedical Engineering
Open Access Peer-reviewed Journal
ISSN: 2822-2237
www.ijabe.online
Volume:3, Number:1, Pages:(3-10)
Year:2024

Comparative Endocrinology: Insights and Importance

İbrahim Cengizler[*1]**,**
**Corresponding Author E-mail:icengiz@cu.edu.tr*

[1]*Cukurova University, Faculty of Fisheries*
Dept. of Aquaculture
01330, Adana, Turkey

Abstract

Coordination in an organism is achieved through various chemical messengers. The term ”chemical messenger” is an expression commonly used in a general sense. This term encompasses both internal secretions and external secretions. Internal secretions function in the coordination between an organism’s organs, while external secretions play a role in coordination among individuals within a population. The main types of chemical messengers can be listed as hormones, parahormones, phytohormones, pheromones, neurohormones, and neurohumors. The word ”endocrinology” refers to chemical coordination within a living organism. Particularly in metazoan organisms, the nervous and endocrine systems ensure organ coordination. Similarities and differences exist between vertebrate and invertebrate animals and within the taxa of these groups in terms of functionality, development, and homologies. Therefore, basing endocrinological research on a comparative framework can enhance researchers’ perspectives. Identifying chemical messengers and their effects on organisms can be effectively utilized across all biological sciences.

Keywords: Chemical Messengers; Endocrinology; Comparative Analysis; Coordination Mechanisms

1. Introduction

The term *endocrinology* originates from Ancient Greek, combining *endom* (inside) and *krinein* (to separate). While its meaning has different interpretations, it generally refers to chemical coordination within a living organism. Another definition describes it as the study of the specialized secretions of ductless glands. Observing plants and animals reveals that considering only endocrine glands and their secretions is insufficient for understanding coordination [1]. Particularly in metazoan organisms, the nervous and endocrine systems play crucial roles in maintaining organ coordination.

Initially, the nervous and endocrine systems were considered independent systems, but today, it is understood that these two systems cannot be considered separately. This is because they have interconnections and shared functions. These systems jointly control many biological processes in an organism. Many endocrine gland hormones stimulate the nervous system, while the nervous system also influences endocrine glands. The activities of these glands are either stimulated or inhibited by the nervous system. Biological processes controlled solely by one system are rare [1].

Coordination in organisms is achieved through various *chemical messengers*. The term *chemical messenger* is a commonly used general term encompassing internal and external secretions. Internal secretions coordinate interactions among an organism's organs, while external secretions facilitate coordination among individuals within a population. The main types of chemical messengers include hormones, parahormones, phytohormones, pheromones, neurohormones, and neurohumors. Communication among individuals within a population first evolved in unicellular organisms, such as quorum sensing in bacteria [2]. Chemical messengers are often composed of steroids, amino acids, proteins, eicosanoids, and peptides [3].

The endocrine, nervous, and immune systems interact at multiple levels to maintain homeostasis and sustain life. At the core of the endocrine system lies the term *hormone*, derived from Latin, meaning ”stimulator.” Hormones are chemical substances synthesized in the endocrine glands of metazoan animals and transported via blood to affect specific tissues or organs [4]. Approximately 50 hormones have been identified in vertebrate animals. They are secreted from endocrine glands and differ from exocrine secretions. Major endocrine glands in vertebrates include the pituitary, adrenal glands, gonads, thyroid, parathyroid, pancreas, pineal gland, placenta, and gastrointestinal glands.

Invertebrates with simple organizational structures lack actual endocrine glands. Actual endocrine glands are present in groups such as Crustacea and Insecta. In Annelids and Mollusks, the endocrine system is not observed. Cellular communication through secretions predates neural communication phylogenetically. For example, animals such as Porifera, Placozoa, and Protists can produce various hormones. However, it is generally accurate to state that all animals with a nervous system possess a neuroendocrine control mechanism [5].

Cells in many metazoan animals communicate through direct cellular contact or

signaling mechanisms involving substances released into the extracellular space. Another mechanism for intercellular communication is the endocrine system [6]. Numerous studies have revealed structural, evolutionary, and functional similarities between the neuroendocrine systems of arthropods and vertebrates [7]. The evolution of vertebrate animals dates back approximately 500 million years. Despite this long period, the neuroendocrine system's center remains the neurosecretory cells in the brain for both groups [5]. Additionally, the early development of neuroendocrine systems in vertebrates and *Drosophila* shows remarkable similarity [8].
Not only do similarities and differences exist between vertebrate and invertebrate animals, but also within the taxa of these groups regarding functionality, development, and homologies. Therefore, basing endocrinological research on a comparative framework can broaden researchers' perspectives.
This review article aims to provide brief information on basic and comparative endocrinology, highlighting their importance.

2. The History of Endocrinology

The origins of *endocrinology* date back to ancient times. According to the humoral hypothesis, believed to have been proposed by Hippocrates, humans have four types of bodily fluids: blood, phlegm, yellow bile, and black bile. The balance of these four fluids was thought to determine an individual's health [1]. However, significant advancements in endocrinology have not occurred for many years.
The first notable experiment in endocrinology was conducted by Berthold, who demonstrated the presence of sex hormones through studies on roosters [4]. In 1855, the French researcher Claude Bernard proposed that blood is altered by the organs it passes through. In 1889, Mering and Minkowski removed the pancreas from dogs, suggesting that the pancreas influenced glucose levels in blood and urine [1].
Starling and Bayliss, who made significant contributions to the field of endocrinology, were the first to use the term *hormone* and discovered the hormone *secretin*. Through their experiments, they demonstrated for the first time that factors transported through the blood could affect other tissues and facilitate coordination [9].
Neurosecretion and neurohemal research initially focused on *Insecta*, with Kopec conducting the first studies [4]. Wolfgang Bagmann later definitively demonstrated neurosecretion and its functions in vertebrate animals [10]. In his research on frogs, Houssay was the first to show that blood from the hypothalamus flows to the pituitary gland [11].
Research on invertebrates and non-mammalian vertebrates has led to identifying many new neuropeptides, which were later found to have orthologs in mammals [4]. Investigations in the field are ongoing, continually contributing to the advancement of endocrinology.

3. Methods Used in Endocrinology

The conventional methods used in *endocrinological* studies can be categorized as cytological, histological, morphological, physiological, and ultrastructural. Among the physiological methods applied since earlier times, the extirpation method involves the removal of an endocrine gland from its host organ. This reveals the function of the gland within the organism. This method can be applied to both vertebrate and invertebrate animals. Due to the definitive nature of its results, it is considered a significant method [1].

Similarly, the transplantation method, which involves grafting a gland into a living organism, can be performed either after the removal of the original gland or as a second gland. For instance, in *Insecta*, the juvenile hormone affects larval characteristics. If the *Corpus Allatum* is transplanted excessively, the larval period is prolonged, resulting in unusually large larvae [12]. Another physiological method is the extraction method, which focuses on studying the effects of hormones rather than the gland itself. Hormones in extract form can be administered via injection or orally to observe their effects.

Cytological and histological methods are used to investigate endocrine glands' cellular and tissue characteristics. However, for functional studies, radioisotope methods may be utilized. Dissection can be employed to determine the morphological structures of glands, including their locations, sizes, and shapes within the body. These methods can be applied to both vertebrate and invertebrate animals.

In recent times, as in other scientific fields, numerous methodological advancements have emerged in endocrinology. Imaging techniques, immunohistochemical studies, high-performance liquid chromatography, and radioimmunoassay are some of the advanced methods that can be appropriately applied to endocrinological studies in both vertebrate and invertebrate animals [13].

4. The Importance of Comparative Endocrinology

The field of *endocrinology*, which examines the endocrine glands responsible for coordination within an organism and among individuals in a population, remained predominantly popular in medicine until the 1940s [14]. With advancements in zoology, comparative endocrinology saw significant progress, especially in the 1950s. It was officially recognized as a scientific discipline during the first comparative endocrinology symposium in 1954 [4].

In a study by Kobayashi, it was found that between 1961 and 1981, 25-50% of endocrinological research on invertebrates focused on *Crustacea* and *Insecta*. However, studies on *Elasmobranchs* and *Cyclostomes* were relatively scarce [14]. Comparative endocrinology explores the evolution of endocrine systems and the regulation of chemical messengers in different animal groups. It highlights the development of model systems and their interaction with the environment [15].

Insights into the environmental parameters required for normal growth, development, and reproduction, as well as the functioning of the endocrine system, provide valuable information for species conservation and ecological system management [16]. Comparative research on animals has contributed significantly to the fields of neurosecretion and neuroendocrinology [4]. Many newly identified neuropeptides were initially studied in invertebrates and lower vertebrates, and their orthologs were later discovered in mammals [4].

For example, RF-amide peptides were first isolated from the oyster species *Macrocallista nimbosa* [17]. More recently, RF-amide peptides have also been identified in mammals. Another notable example is the isolation of urotensin peptides from the caudal neurosecretion system (*urophysis*) in fish, which were found to have a homologous hormone in humans playing a crucial role in the cardiovascular system [18].

Research on invertebrates has extensively contributed to comparative endocrinology and biological sciences. The application of molecular methods in comparative and evolutionary endocrinology has been revolutionary [4]. As is well known, the endocrine system in organisms interprets environmental information and responds with the most appropriate morphological, physiological, and behavioral adaptations. However, changes caused by factors threatening vertebrates and invertebrates, such as excessive pollution and climate change, are of critical importance.

Changes in chemical messengers could serve as biomarkers, which are also significant in the study of endocrine-disrupting chemicals (EDCs). EDCs are among the most critical environmental pollutants directly affecting the sustainability of life for humans and animals. These pollutants harm individuals and negatively impact future generations [19].

5. Conclusion

The scope of *comparative endocrinology* has significantly expanded, particularly since the early 1900s. Identifying chemical messengers and their effects on organisms can be effectively applied across all biological sciences. With the growing world population, the unavoidable need to monitor and adapt to drastic environmental changes such as pollution, ecological disasters, and global warming becomes evident.

At that point, the importance of comparative endocrinology is underscored once again. However, this scientific field, which can still be considered relatively unexplored, requires advanced and innovative research to address its challenges and opportunities.

Rights and permissions

References

[1] S. Geldiay, Karşılaştırmalı endokrinoloji, Ege Üniversitesi Matbaası. 96s (1981).

[2] M. B. Miller, B. L. Bassler, Quorum sensing in bacteria, Annual Reviews in Microbiology 55 (1) (2001) 165–199.

[3] N. Neave, Hormones and behaviour: a psychological approach, Cambridge University Press, 2007.

[4] R. J. Denver, P. M. Hopkins, S. D. McCormick, C. R. Propper, L. Riddiford, S. A. Sower, J. C. Wingfield, Comparative endocrinology in the 21st century, Integrative and Comparative Biology 49 (4) (2009) 339–348.

[5] V. Hartenstein, The neuroendocrine system of invertebrates: a developmental and evolutionary perspective, Journal of endocrinology 190 (3) (2006) 555–570.

[6] H. Laufer, R. G. Downer, Endocrinology of selected invertebrate types, (No Title) (1988).

[7] D. Veelaert, L. Schoofs, A. De Loof, Peptidergic control of the corpus cardiacum-corpora allata complex of locusts, International review of cytology 182 (1998) 249–302.

[8] B. De Velasco, J. Shen, S. Go, V. Hartenstein, Embryonic development of the drosophila corpus cardiacum, a neuroendocrine gland with similarity to the vertebrate pituitary, is controlled by sine oculis and glass, Developmental biology 274 (2) (2004) 280–294.

[9] J. Henderson, Ernest starling and 'hormones': an historical commentary, Journal of endocrinology 184 (1) (2005) 5–10.

[10] M. M. Klavdieva, The history of neuropeptides iv, Frontiers in neuroendocrinology 17 (3) (1996) 247–280.

[11] B. Houssay, A. Biasotti, R. Sammartino, Functional modifications of the hypophysis after the infundibulotuberian lesions in the frog, Comptes Rendus Des Seances De La Societe De Biologie Et De Ses Filiales 120 (1935) 725–7.

[12] M. Kobayashi, Function of the corpus allatum in 'dauer-pupa'of the silkworm, bombyx mori, Nature 187 (4734) (1960) 346–347.

[13] D. O. Norris, J. A. Carr, Vertebrate endocrinology, Academic Press, 2020.

[14] H. Kobayashi, A view of comparative endocrinology and aubrey gorbman, American Zoologist 23 (3) (1983) 739–748.

[15] D. O. Norris, Comparative endocrinology: Past, present, and future, Integrative and Comparative Biology 58 (6) (2018) 1033–1042.

[16] S. D. McCormick, L. M. Romero, Conservation endocrinology, Bioscience 67 (5) (2017) 429–442.

[17] D. A. Price, M. J. Greenberg, Structure of a molluscan cardioexcitatory neuropeptide, Science 197 (4304) (1977) 670–671.

[18] J. J. Maguire, A. P. Davenport, Is urotensin-ii the new endothelin?, British Journal of Pharmacology 137 (5) (2002) 579–588.

[19] İ. Cengizler, Endokrin bozucu kimyasal (ebk)'ların balık gonadlarında endokrin sistem üzerine etkileri, Food Bulletin 1 (1) (2022) 16–20.