Modularization of Zebrafish Senescence Gene - Protein under Cytoscape

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Abstract: The research of zebrafish senescence gene under Cytoscape is based on the discovery of the “secret” of senescence in the process of human research on zebrafish, and zebrafish has become the first model animal for human research on gene function. The high similarity of the two genes enables it to further reveal human senescence through the research model of zebrafish senescence, thus providing help for the study of the laws and mechanisms of human growth, senescence, disease and repair. The modularization research of protein is a better way to form this research model. According to relevant literature, zebrafish senescence gene has a relationship with protein interaction, such as protein-protein interaction network (PPI network). Obviously, PPI network is the key of zebrafish senescence gene.

1. Introduction

With the advent of an aging society, the study of senescence has become the focus of the main biological and medical science research in this era. It is no longer a mysterious topic for human beings to explore the senescence mechanism. Since four thousand years ago, Qin Shihuang began to make pills to pursue immortality. The ancients were limited their cognitive ability to obtain anti-senescence by taking “pills” internally. Although human beings have been studying anti-senescence methods for thousands of years, it is less than 100 years since the methods that can really slow down human senescence appeared. With the discovery and analysis of genes and pathways controlling the senescence process, more and more anti-senescence methods have emerged. The first systematic study on genes related to longevity was conducted on Cryptorhabditis elegans, but now it has been conducted on zebrafish [1].

Now, human beings have obtained the secret of human senescence to a large extent through the senescence model of zebrafish. Although the life span of zebrafish is relatively short, it is similar to the process of human senescence. It has a short life cycle and is also suitable for biological research and experiments. The most important thing is that zebrafish can express the meaning of cell physiology better by relatively static molecules, making zebrafish the best choice to reveal human senescence. In the process of studying related diseases and repair, we can also obtain unknown mechanisms and make satisfactory models.

2. Importance of Zebrafish Senescence Model for Human Study of Gene Function

Humans use zebrafish senescence model to study gene function, mainly by using its molecular mechanism, such as the residence and movement of different proteins in muscle, and the energy exchange formed by the interaction between proteins. Recently, the senescence of zebrafish nervous system has shown that it has a relationship with PPI network. Although there is no ready evidence to show the zebrafish senescence genome, experiments can show that everything related to senescence traits needs to involve a complex interaction between molecules. The research on zebrafish shows that the process of human senescence is no exception, so the research on zebrafish senescence is of great value for the scientific research on senescence. It also shows that the process

of human senescence will inevitably involve the consumption of energy and the weakening of the interaction between molecules, thus promoting the extensive development of basic zebrafish biology and related protein interaction experimental technology with the spirit of development and gene research.

Zebrafish is a very small vertebrate. Its most obvious characteristics, as well as its advantage of high similarity with human beings, have provided positive help for us to study human anti-senescence today. The existing research shows that: first, most zebrafish genomes have been sequenced by humans, and experiments have proved that zebrafish and humans have the characteristics of direct homologues of human genes [2]. Second, zebrafish has the whole complex genetic process of mammalian development, and also generates a relatively complete nervous system to support its activities. Third, due to the influence of the development of the nervous system, the brain area reflex of zebrafish is similar to all the main brain areas of human beings and can be mapped, which also endows these zebrafish with more advanced cognitive functions and social behaviors to a certain extent.

The above points further establish the importance of zebrafish senescence model for human to study gene function. In addition, the zebrafish senescence model experiment uses the method of in vivo imaging to observe the way to obtain and lose function, and the role of different proteins in zebrafish senescence model experiment is observed by cloning technology, which further supports the role of protein in zebrafish gene, so as to further support the role of senescence.

3. Protein Correlation Analysis of Zebrafish Senescence Gene

As in previous studies on zebrafish, senescence is not the focus, and zebrafish senescence models were considered to be less valuable. However, with the progress of science and technology, it has been shown that zebrafish has a latent senescence pathway, which further explains that zebrafish has the same senescence process as other vertebrate species. It shows many symptoms similar to human. For example, there are typical senescence markers, and the reduced expression ofβ-galactosidase, and the senescence phenotype is similar to the known age-related degenerative pathology in humans, such as osteoarthritis and synovitis. Studies have shown that zebrafish senescence genes are related to the movement of protein modularity. However, due to the complexity of zebrafish itself and the multi effect nature of causing senescence, it is difficult to characterize zebrafish senescence status with specific quantitative characteristics. This is also the difficulty of many studies on zebrafish senescence genes. However, many scientists have found more and more clearly that the driving factors of many zebrafish senescence are related to the modular movement of protein, which also proves the importance of protein in the anti-senescence process in human senescence research, and that protein is the most abundant and functional macromolecular organic substance in cell components [3]. Senescence is a process of limiting the proliferation of damaged cells under various pressures, which is related to the increase of age. The accumulation of senescent cells in zebrafish tissues leads to organ degeneration and other age-related diseases similar to those in humans. French scientists have proved that the gradual consumption of protein in zebrafish will promote the proliferation of cells into an irreversible senescence process.

3.1 The Tissue Itself Cannot Produce Protein

In the research on the function of zebrafish protein, a certain amount of protein is obtained from zebrafish food. After being decomposed into amino acids by enzymes in the body, human proteins are synthesized according to certain procedures to meet the needs of zebrafish’s brain, organs and skin. In the whole process, the protein is not produced by the tissue itself, but the product after a certain procedure, so it is more significant to study the modular movement of protein.

In addition, for zebrafish, various hormones that regulate metabolism, various enzymes that catalyze the chemical reaction of protein in the survival process and antibodies that can enhance human defense function are all related to proteins or their derivatives. Protein is not only the basic material of human body, but also participates in various physiological activities. Food digestion,

oxygen transportation, heart beating, muscle contraction, etc. are all related to the biological functions of various proteins.

3.2 Proteins Are the Materials That Make Up Tissues and Provide Them with the Ability to Grow, Renew and Repair Tissues

Protein is an important component of organism. These proteins in zebrafish are in a dynamic balance of continuous decomposition, reconstruction and repair. About 3% of protein is involved in updating every day. Even if the body does not take protein at all, the body still carries out protein decomposition and synthesis. Therefore, a certain amount of protein must be taken from the diet every day to maintain the nitrogen balance of the body.

3.3 The Combination of Function and Nutrition of Protein

After supplementing zebrafish with protein, it can activate the internal related enzyme system, promote the permeability of the intermediate metabolic membrane, or affect the synthesis of specific proteins by controlling DNA transcription or translation, and finally produce specific effects or play its physiological role. Different proteins have different molecular sizes, and they can be realized through interaction. Therefore, scientists are also looking for methods for molecular interaction diagrams of zebrafish senescence proteins.

3.4 Zebrafish and Human Have 9 Senescence Characteristics

The articles published on Nature Communications by scientists from the Federal Institute of Technology of Zurich and the JenAge Federation of Germany believed that they included genomic instability, telomere shortening, epigenetic changes, loss of protein homeostasis, nutrient sensing disorder, mitochondrial dysfunction, cell senescence, stem cell depletion, and changes in information exchange between cells. These 9 senescence characteristics are an important challenge that zebrafish and human need to face together. By analyzing and studying the correlation, we can respond to their contribution to senescence, and ultimately find the significance of drug targets to improve human health.

4. Relevant Achievements in the Modular Study of Zebrafish Senescence Gene Protein

4.1 Zebrafish Has Been Identified as an Important Resource for Human Function and Disease Research

According to Dr. Derek Stemple of Wellcome Trust Sanger Institute published in *Nature*, 70% of proteins encoding human genes are related to zebrafish genes, and 84% of known human diseases are corresponding to zebrafish genes. And the research team has developed a high-quality annotated zebrafish genome sequence for comparison with the human reference genome. The zebrafish large genome has been sequenced to this high standard. The completed zebrafish genome will become a powerful research foundation to promote the development of human genes. Zebrafish is very similar to humans in biology, sharing most of the same genes with humans, making it an important model to understand how genes play a role between proteins. In terms of gene function, how to play its role, especially in the study of protein's participation in genetics and senescence variation, is not easy for other organisms to do. It can be said that the study of zebrafish has led to biological progress, including disease, and is promoting the understanding of tissue, muscle and organ development and senescence. Zebrafish has been used to verify the cause-and-effect gene of muscular dystrophy. What is unique to zebrafish is that compared with human genome, more than 100 genomes of zebrafish can be found in human pseudogenes in research.

4.2 The Molecular Mechanism of Zebrafish Senescence Rarely Involves Intermolecular Interaction

Some studies have found a series of differentially expressed genes or proteins among different groups of samples through RNA seq, expression profile chip or proteome analysis. Then, the STRING database was searched for possible potential interactions between coded proteins, and

constructed a protein interaction PPI network to express them. The purpose is to describe the relationship between these genes or proteins. In fact, this is a protein modularization, such as physical contact, targeted regulation, etc., and finally explain the role in the organism to realize the protein molecular regulation network through protein interaction network. The STRING database was used to collect the information of thousands of zebrafish proteins and hundreds of millions of protein interactions. It shows that these protein interactions include both direct physical interaction and co-expression correlation [4].

4.3 Protein-Protein Interaction (PPI) Network is Very Useful

The research and identification of zebrafish reference genome sequence and more than 10000 protein coding genes showed that zebrafish genome sequence can be used as a research model for senescence. In addition, there is extensive characterization between the molecular and cellular physiology of its good proteins, and the role of proteins is an important part of the potential mechanism of zebrafish senescence, disease and repair. However, when the molecular mechanisms of zebrafish senescence rarely occur, protein-protein interaction (PPI) network is very desirable. From the perspective of research process, zebrafish, a model of biological senescence mechanism, has proved that there are hundreds of proteins related to senescence. Currently, research shows that 88 proteins are characterized by more than 700 interactions. This includes not only accurately predicted PPI, but also those molecular interactions obtained from literature collection and experiments. The interaction of these molecules is modularized. After the modularization, 11 central genes are found to analyze and predict the senescence process, making the PPI network of protein-protein interaction of zebrafish become a necessary hypothesis and basis to help study the senescence process of zebrafish.

5. Conclusion

Zebrafish has become a hot creature in vertebrate gene function research. More and more research on human genetic diseases and senescence has been carried out, but at present, domestic research has not yet drawn a zebrafish senescence gene map, which still needs to be further promoted, but existing research shows that zebrafish senescence genes are related to the modular movement of proteins.

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