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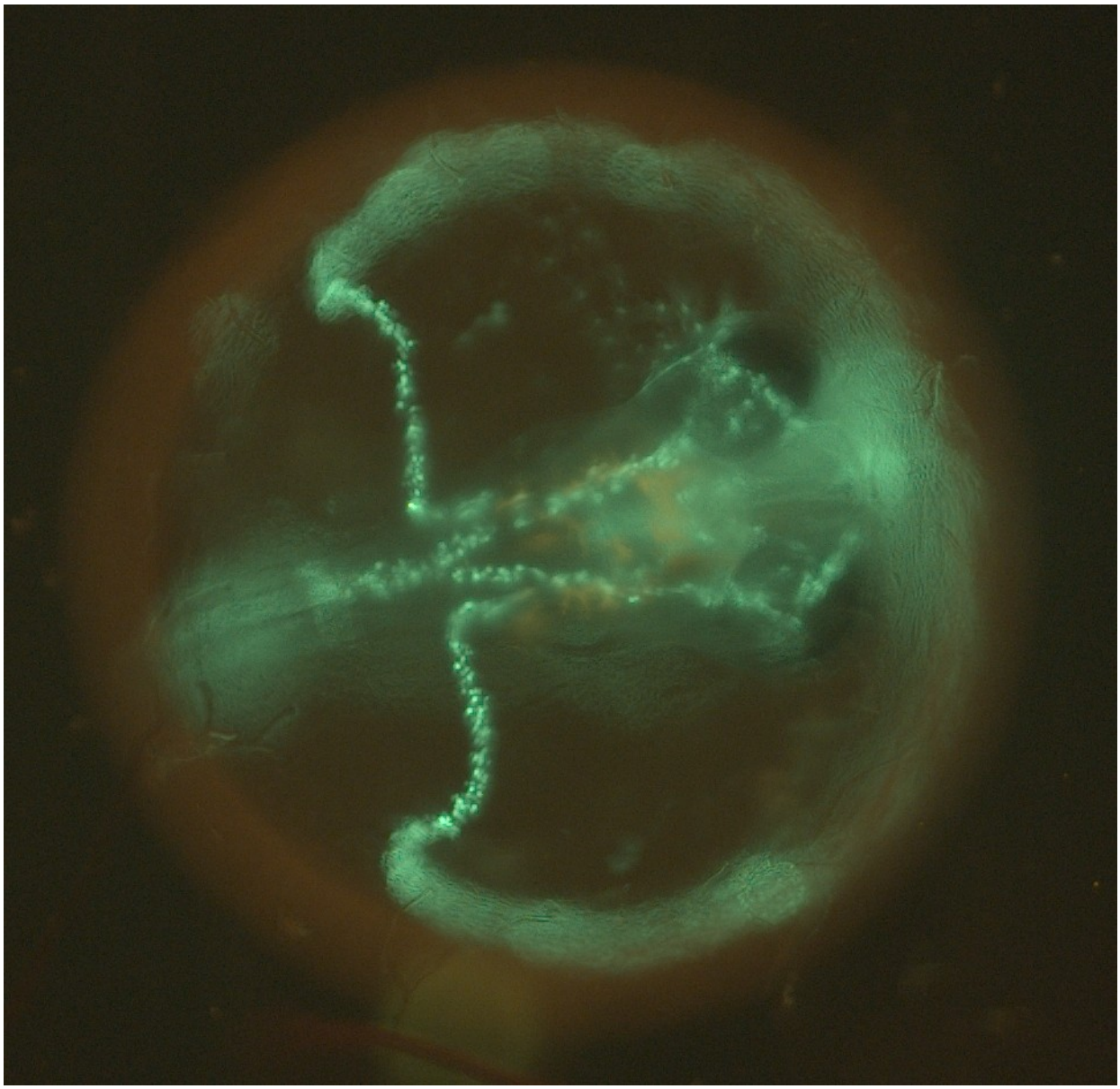
https://www.gesundheitsindustrie-bw.de/en/article/press-release/allegedly-useless-parts-of-the-human-genome-fulfil-regulatory-tasks

Allegedly Useless Parts of the Human Genome Fulfil Regulatory Tasks

The international ENCODE project aims to assemble an encyclopedia of all functional DNA elements in the human genome. The Heidelberg scientists were able to confirm in a showcase with the model organism Medaka fish that surprisingly many of the analysed elements in the non-protein-coding part of the DNA can actually regulate gene activity in a very specific way.



In a four day old Medaka embryo, blood cells are specifically labelled by the green fluorescent protein as a reporter under the control of a DNA element (enhancer) that was identified by the ENCODE project.

A surprisingly large part of allegedly useless DNA in the human genome turns out to be responsible for regulating gene activity. This is now shown in a study by the international ENCODE project under participation of biologists from Heidelberg University's Centre for Organismal Studies (COS). ENCODE aims to assemble an encyclopedia of all functional DNA elements in the human genome. The Heidelberg scientists were able to confirm in a showcase with the model organism Medaka fish that surprisingly many of the analysed elements in the non-protein-coding part of the DNA can actually regulate gene activity in a very specific way. The results of the ENCODE study are now published in the journal "Nature", among others.

The human genome contains roughly 20.000 genes, which are the blueprint for all proteins making up the human body - from muscles via liver and eye to nerve cells and their messenger molecules. However, genes coding for proteins constitute only about 3 percent of the human genome. The functions of the remaining 97 percent have long remained unclear. "So far, we have had a limited understanding of the mode of gene regulation, e.g. why a gene is activated at a specific point in time in a specific organ. This could only be studied in single cases and with substantial effort", explains Joachim Wittbrodt, head of the Department for

Animal Physiology and Developmental Biology at the Centre for Organismal Studies Heidelberg.

The ENCODE project aims at characterising the entire human hereditary information in more detail in order to identify functions for the large, non-protein-coding part of the human genome and to place it in context with the regulation of gene activity. One prerequisite was the development of novel methods for large-scale experimental approaches as well as for data handling and analysis. Using biochemical and bioinformatics approaches, it was possible to identify "candidates" of DNA elements that co-determine when and where in the human body a gene is active. The team of Joachim Wittbrodt contributed significantly to the experimental validation of these so-called enhancers.

The Heidelberg scientists have prepared the putative enhancers in a way that they could be used to drive the expression of a reporter in the Medaka fish embryo. The reporter is easily identified in Medaka due to its bright green glow. Thus, the scientists could show that a large part of the analysed DNA elements is actually able to specifically regulate gene activity. "Our validation is of special importance since it was not done in an experimentally isolated system, but in the developing Medaka embryo", says Dr. Stephanie Schneider of the Centre for Organismal Studies.

The "Encyclopedia of DNA Elements" (ENCODE) project - conducted by 80 research groups across the globe - was financed through grants from the National Human Genome Research Institute in the USA. All data that was generated, collected and analysed within the ENCODE project is publicly available and serves as a valuable resource for future research projects.

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