

Gene expression of the house sparrow

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We know that genes are a large part of what makes one animal different from another, but what about the different parts of an animal? The heart, the liver and the brain all contain the same package of genes, but they look and function completely different. The answer lies in the fact that not all genes are used, or expressed to the same extent in different tissues. The way that gene expression works is that the build plan, DNA, is copied onto messenger-RNA, which then serves as an instruction manual for the ribosomes, the protein factories of the cell. These then produce proteins, which do the actual work in the cell. The amount of mRNA decides how many, and which proteins get produced.

In our research, we measured the messenger-RNA in different tissues of the house sparrow, a small songbird that occurs on all five continents, to see which genes are mainly used in these tissues. To know which functions those genes have, we compared these lists of genes to another songbird, the zebra finch, of which there is already a lot more information about the genes and their functions. We compared the gene expression in three types of tissue, namely the spleen, the blood and the bursa. In total we found about 8500 genes, roughly half of the total amount of genes. We made lists of the genes that were being expressed a lot in different tissues, and looked for patterns in those lists.

For example, there are only a small number of genes in the whole genome that have something to do with the transport of oxygen, but many of these genes are used a lot specifically in the blood. We therefore have reason to believe that oxygen transport is one of the things that make blood special compared to other tissues. In a similar fashion we found many heavily used genes in the spleen that had some connection to the ribosome. Whereas the link between oxygen transport and blood seems rather obvious, as this is probably the most well known function of this tissue, the link between the spleen and the ribosome does not fit in that well into our existing knowledge. As mentioned before, the ribosome is basically the protein factory of the cell, and as such, we would expect it to be used at roughly the same rate throughout different tissue types. Instead we find that it is used in the spleen much more than would be expected. There is no known correlation between the spleen and the ribosome, and this could be an interesting subject for further study in the future.