

Scientists have detected unusual behavior of the PIWIL2 gene 'helpers'

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A team of scientists from the Institute of Bioorganic Chemistry RAS have discovered new information on how the PIWIL2 human gene expresses itself. This breakthrough discovery could result in a diagnostic marker for determining testicular germ cell tumors. The research findings suggest the interchangeability of the PIWIL2 "helpers"—the promoter of this gene is also able to act as an enhancer of the expression of another gene. The work, published in the PLoS ONE journal, expands the background knowledge in this field.

Generally occurring between the ages of 20 to 40 years, testicular cancer is a "youth" tumor that constitutes about 2 percent of all tumors in men. The study of the expression of the PIWIL2 gene could help determine a diagnostic marker for one of the two types of testicular [germ cell tumors](#)

Regulating gene expression is a complex and multi-layered process that involves many participants: promoters, enhancers, [transcription factors](#), chromatin modification and spatial organization of the nucleus. The work of each link and its interaction with the others has to be properly coordinated for the gene to function properly. Thus, promoters (DNA nucleotide sequences that recognize RNA polymerase) initialize the transcription process. Enhancers (DNA regions associated with transcription factors) attract polymerase to the promoter. Finally, chemical modification and the much-needed chromatin spatial organization create all the necessary conditions for the [transcription process](#). The violation of any stage could stop the expression process,

which could potentially cause serious diseases.

Recent research on the regulation of transcription indicates that in some cases, the individual components in the expression process can switch roles: enhancers begin to function as promoters, and vice versa.

"From the test performed on the PIWIL2 human gene, our group was able to provide ample evidence to this hypothesis," explains Yulia Skvortsova, junior research associate at the Russian Academy of Sciences, and main author of the article. "The protein product of the PIWIL2 gene is one of the key participants of the piRNA / PIWI systems that is responsible for controlling the expression of genetic elements during spermatogenesis."

The researchers advanced their hypothesis, and were able to experimentally prove that the alternative promoter of this gene, located in exon 7 (the DNA region responsible for protein coding), may also be an enhancer for the PHYHIP gene at a distance of 60 kilobase pairs. "Summarizing the data collected in these studies, we concluded that switching the enhancer / promoter functions may affect both the RNA and protein expression of several [genes](#), which significantly expands our understanding of the fundamental process of the regulation of [gene expression](#)," concludes Sophia Kondratieva, graduate student at the Laboratory of Human Genes Structure and Functions of the IBCh RAS, one of the authors of the article.

The work done by Yulia, Sophia and their colleagues expands our understanding of the role played by the PIWIL2 gene. The protein product of this gene has the potential to be used as a [diagnostic marker](#) for the determination of one of the two types of testicular germ cell tumors, offering a different approach to the treatment and prognosis of patients.

More information: Yulia V. Skvortsova et al. Intragenic Locus in Human PIWIL2 Gene Shares Promoter and Enhancer Functions, *PLOS ONE* (2016). [DOI: 10.1371/journal.pone.0156454](https://doi.org/10.1371/journal.pone.0156454)

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