Volwiler Lecture: Dr. Joan Steitz Uncovers an Extra Step in the Central Dogma

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Dr. Steitz first immersed herself in the scientific world during a time when much of society still believed that women belonged at home, rather than in the laboratory. This fact about her past makes her success in the sciences even more remarkable, for she has had to work especially hard in order to overcome gender stereotypes and become a prominent member of the scientific community. She has worked with numerous renowned scientists, including James D. Watson, Francis Crick, and Thomas R. Cech, but she has gained an international reputation for her own research on RNA.

Dr. Steitz began her research on bacterial and bacteriophage RNA. In 1975, Dr. Steitz published the results of her research on how ribosomes, cellular organelles that manufacture proteins, find the start site on a strand of messenger RNA (mRNA) (Woodbury, 2006). More specifically, she revealed her discovery that complementary base pairing is used for this identification. Not long after this discovery, however, she turned her attention to RNA within eukaryotic cells.

As she discussed in her lecture, Dr. Steitz was particularly interested in the reason why only ten percent of the RNA synthesized in the nucleus is used to synthesize proteins. She gained some important insight into this question upon her discovery of the snRNP (pronounced snurp), a small length of RNA that forms a complex with various proteins. Interestingly, this discovery was based on analyses of blood samples from patients with Lupus who were found to make antibodies against snRNPs. Dr. Steitz and her research team proposed that snRNPs are involved in splicing newly transcribed RNA (pre-mRNA). Splicing involves removing the introns, or the non-coding regions, of a strand of RNA. This provides an explanation for the RNA mystery; a significant portion of transcribed RNA is taken out by snRNPs and is therefore not used to synthesize proteins. Furthermore, Dr. Steitz’s discovery of another kind of snRNP demonstrated that introns are not purely “junk”, as was once thought. Although they do not code for proteins, introns can serve a purpose; in the nucleolus, for example, they code for the RNA found in small nucleolar RNPs (snoRNPs). These molecules chemically modify ribosomal RNA, and are thus essential to its function.

Dr. Steitz’s remarkable findings suggest that the splicing of RNA must be included in the Central Dogma if it is to be a complete description of the flow of genetic information from genes to gene expression. Moreover, her studies show the importance for continued research on RNA in order to elucidate its many functions within the cell. This will clearly be necessary if we are to one day understand how genes and gene expression determine who and what we are. Thanks to Dr. Joan Steitz, and other researchers around the world, RNA is no longer considered simply an intermediate between DNA and proteins; rather, it is believed to have a very complex and critical role within the cell. One might even say that, like Dr. Joan Steitz, RNA has become a superstar in the scientific community.

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References  