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Medicine advancing with study of the human genome

According to Hensin Tsao, M.D., Ph.D., the human genome is everything seen, heard, touched or tasted. It's 76,000 raised hands inside Giants Stadium, the sheet music to a beautiful melody, and/or the Steinway Piano converting those notes into song.

Hensin Tsao, M.D.

Friday morning, Dr. Tsao treated attendees at his focus session presentation "The Human Genome" to just such a melody before sharing the latest advances in mapping the human genome in terms of content and evolution, as well as what medicine is learning from it.

"What we have been listening to this morning — while everyone has been getting seated and eating their breakfast — is a musical interpretation of a DNA molecule," he said.

The study of the human genome is a polymer science focusing on more than 3 billion nucleotide bases — structural units of RNA, DNA, and several cofactors including CoA, FAD, FMN, NAD, and NADP — as well as a host of other factors that make up the whole of the hereditary information encoded in the DNA. For some viruses, hereditary information is coded to the RNA.

"The study of the genome has been called 'the most beautiful experiment in biology,'" Dr. Tsao said, explaining that the mechanism of DNA replication would look like "little bubbles forming" were it visible to the naked eye.

"The entire essence of this process happens at the replication fork, which is created and opened up by helicase," he said. "This is started by an RNA primer ... and if you look at the difference in continuity, one side of the strand shows a continuous synthesis, while the other does not. Eventually though, everything is drawn together before the Delta telomere comes along and finishes the job."

In studying DNA polymerase, an enzyme assisting in the replication process, scientists discovered the polymerase chain reaction (PCR), which replicates DNA exponentially without using a living organism. PCR can be used to perform a wide array of genetic manipulations in laboratories — mapping the genome, discerning the heredity of diseases, etc.

"With PCR, we can amplify a specific region of interest," Dr. Tsao said. "Your DNA telomerase cannot survive this, and were we to amplify the DNA linearly, it would take far too long."

In all, Dr. Tsao said that scientists have only touched the surface of what can be gleaned from the genetic code, but the future is bright.

"The effort is there to transfer medicine to a much more molecular state, and we are making progress," he said.

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