

## NONCODING DNA'S VALUE

In Stephen S. Hall's interview with Ewan Birney ["Journey to the Genetic Interior"], Birney deprecates the term "junk DNA" for sequences whose function we do not know, but he is conservative on how much of nonprotein-coding DNA may be functional ("between 9 and 80 percent"). The fact that the entire genome is copied at every cell division suggests that close to 100 percent of DNA must be functional. Had any significant portion of DNA been nonfunctional in the past, evolutionary pressure to develop an editing-out mechanism to increase the cell's energy efficiency would have been tremendous.

Birney also uses the conservative term "regulation" to describe how the 98.8 percent of nonprotein-coding DNA interacts with the 1.2 percent of protein-coding segments. It is more useful to describe the entire genome as software: instructions for cells to build copies of themselves and assemble cells into life-forms. In this view, the protein-coding segments are thought of as fixed-value strings within the code.

If we could send a personal computer with Microsoft Excel and a copy of its source code back in time to Alan Turing, it seems unlikely that on comparing the screen output with the source code, Turing would conclude that fixed values such as "File," "Edit" and "View" were the essence of the software and that the other 99 percent merely "regulated" the operation of the fixed values.

MALCOLM HAMER  
*New York City*

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