SPOTLIGHT ON DR. DANIEL STARR

Nuclei don't use Google Maps
So how do they get to where they need to go?

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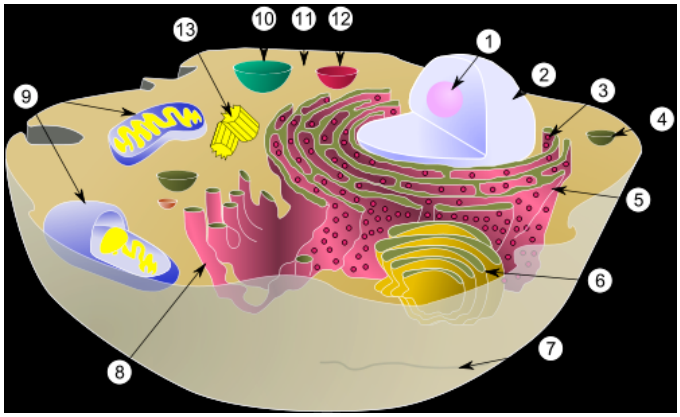

When I hear scientists throw out terms like nucleus, cell membrane, and endoplasmic reticulum, a general image pops into my head that looks something like this:

Everything is brightly colored, and all the parts are nicely distributed throughout the cell in cartoony fashion. I'm sure it's a remnant of a diagram I studied long ago in my intro to biology class in high school, but none-the-less, it has served me well ever since. Or so I thought.

You see, based on this diagram, I had unwittingly formed the theory that as long as everything was in there somewhere—nucleus: check—cell wall: check—DNA: check—then it was all good. But that that is simply not the case.

It is, for example, often *imperative* that the nucleus be positioned to a specific location within the cell. And it has to move around to other exact positions during various stages of development. Then, once it gets to where it is going, it needs to stay there. I mean, I know a good number of *people* who can't even get to where they need to go, and that's with the help of a GPS! Clearly there must be some sophisticated mechanism at work within the cell that coordinates this process, and Dr. Daniel Starr, UC Davis professor of Molecular and Cellular Biology, is en route to discovering exactly what that is.

Working with the model organism *Caenorhabditis elegans*, a small transparent roundworm, Dr. Starr applies forward genetics—generating random mutations throughout the organism, isolating the mutant individuals with nuclei in the wrong place, and then sequencing that altered genome in order to detect the exact location of the mutation—in order to understand what specific genes play a role in orchestrating the nuclear movement.

And since mispositioned nuclei are linked to human diseases such as such as muscular dystrophy, ataxia, progeria, lissencephaly, and cancer, there are potentially a tremendous number of very impactful ways in which Dr. Starr's research could be applied to a very broad spectrum of fields.

But if what everyone wants ultimately to do is cure human diseases, why study a worm? Interestingly, many of the fundamental cellular processes that Dr. Starr is studying in *C. elegans* are conserved all the way up to humans. So by looking at that very basic and well-understood organism, he can identify and comprehend exactly how the nuclear positioning is happening, and then apply that knowledge to a more complex organism.

So far Dr. Starr is making very good progress. He has recently identified several proteins, known as KASH-SUN proteins, that play key roles in nuclear positioning. In additional studies on *C. elegans*, removing a cell's ability to make these proteins leads to the nuclear mispositioning that can cause the aforementioned diseases.

Dr. Starr thinks that the possibility of applying any of this research towards curing human subjects is still a distant goal, but he is expanding the research to encompass more complex organisms like mice.

And, as for me, I will return home tonight grateful that my nuclei all arrived safely at their intended destinations (as far as I know, at least), and quite curious about what Dr. Starr will uncover next. I'm sure it is going to be big.