



Cornell University  
Graduate School

## Cornell University Three Minute Thesis (3MT) Competition

### Robert Swanda, Biomedical & Biological Sciences: “Why the Quality, Not the Quantity, of Your Protein Matters”

[Clock Ticking]

>> Narrator: Cornell University 2019 Three Minute Thesis finalist. Robert Swanda, Biomedical & Biological Sciences: “Why the Quality, Not the Quantity, of Your Protein Matters.”

>> Swanda: Proteins are one of three macromolecules that your body needs, in combination with fats and carbohydrates, to help maintain adequate health and nutrition. Proteins are used in every biochemical reaction within our bodies, to help maintain metabolism, produce hormones, and for intracellular transportation. But unlike fats and carbohydrates, proteins are broken down into 20 unique pieces, or amino acids, which can then be used to build even more proteins through a process called translation, which is simply the makings of a brand-new protein. Your DNA provides the blueprints for building proteins. But it's the factory workers of translation that piece together individual amino acids like a puzzle, until a fully functional protein is made. Now, researchers have learned a lot about this process of translation, through the complete removal of all 20 amino acids. And, while this method shuts down protein production, they've used it to identify different processing steps involved in building a protein, as well as define unique proteins that are produced during adverse conditions, such as during diabetes, neural degeneration and cancer. But, what happens if just one of these 20 amino acids is missing? If the protein building machinery is trying to fit together a puzzle, but it notices that one of the pieces is gone? I hypothesize that deprivation of each of the individual amino acids would have a unique role in what proteins could be produced, and have downstream effects on human metabolism. So, I employed a variety of biochemical and genetic approaches to understand what is happening at the cellular level when just one of these amino acids is gone. Now, under conditions where amino acids are abundant, the protein building machinery will produce typical, functional proteins. But, I've found that it's during these times of individual amino acid depletion, such as only missing cysteine, or only missing methionine, that the protein building machinery binds out of frame, at a place it's not supposed to, activating stress response pathways, leading to more rapid cell death. It's not a complete loss of these amino acids, but single amino acid depletion's that are slowing down metabolism, that delay hormone production, and that impair intracellular transportation. My research has demonstrated how each of the individual amino acids has a unique footprint in global protein production, and how we could use amino acids as potential therapeutics for a variety of metabolic disorders. But, more importantly, I'm demonstrating how critical it is to ensure that individuals are consuming all of these building blocks to

avoid turning on stress related pathways. So, the next time you're eating a meal, remember it's the quality, not the quantity of your protein that matters. Thank you.

[Applause]