Current Research in Bioinformatics and Bioengineering
Second-Year-Student Lecture Series Presents:
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With widespread applicability, mathematical models are highly prized by biological researchers. Coupled with this demand is the necessity for more intricate models that accurately depict life from birth until death. Seemingly a morbid topic, death is a vital part of any model for a living population as organisms do tend to be mortal. Whether or not this intrigues you, I am happy to present an illustration of modeling death based on the following article:

The Shape of Things to Come:
Using Models with Physiological Structure to Predict Mortality Trajectories
Mangel M and Monsall M, Theoretical Population Biology 65 (2004) 353-359

If you are reading this, thank you for showing interest in preparing yourself for an enthralling presentation on considering such a curious abstraction as death in a more concrete setting. Keep this alongside you as you read/skin/blunder through the article and I promise it will help.

The abstract
Oh damn, I'm already confused!
Great! The article will teach you something you didn't know.
SQ1: What is the take-home message of the article?

Introduction
SQ2: How would you describe mortality?
SQ3: Is the combined approach described by the authors a good one? Hint: It's the network, stupid.
Before you despair your lack of Gompertzian knowledge, know this: the basic gist of the model is that as one ages, the likelihood of survival only gets worse as a person grows older. Consider your self and your parents.
SQ4: Is it reasonable to conclude that the older you get, the faster death approaches?
Now, the authors find evidence that death rates plateau as people get old enough. A trip to the nursing home may or may not convince you of this phenomenon, but think of someone whose fine health has led him or her to the ripe old age of eighty, several years past the average life expectancy.
SQ5: As biologists (or at least friends of biology), would it be fair to conclude that this above-average person stands a better chance of not dropping dead than his or her predecessors that died to forge the average life expectancy?

Mortality as a result of multiple physiological processes
SQ6: Wait just a minute, do you buy the fact that people die as a result of "multiple physiological processes"?

Equation one is a differential equation (key concept: happens over time) that describes the numbers in a cohort (population) as a function of mortality as determined by destiny/genetics/nature and events/outside factors/nurture. For now, the exact makeup of the processes that lead to death is considered unobservable. The point of the upcoming equations is to see what could happen to mortality as a result of these arcane processes.
SQ7: When mathematicians say "It is straightforward to solve the set of equations…" do you ever believe them?
Pictures! Do you see them? What do they mean? It would appear that having more time lags delays the anticipated time of death…interesting.
SQ8: Gompertzian models tend to imply that the older the age, the likelier one is to die. What do the pictures imply?
SQ9: This one's a gimme. What kind of structure is more conducive to longer life?
Were you reading carefully? If so, you would have seen this *striking* statement, which reads, *"First, these physiologically lagged models…capture the principle that survival beyond a certain age is plausible: that is organisms are not necessarily programmed to die."* Whoa!

Mortality as a result of growth and metabolism
SQ10: Obviously these criteria aren't fully-inclusive, but is this approach reasonable?
If I'm not mistaken, the typical cell undergoes apoptosis or some sort of programmed cell death as a part of growth and oxygen is that curious element which is both life-giving and toxic to humans. I'm going to go ahead and give this model my blessing whether or not you do.
In equation five, notice that the positive coefficient has an exponent of less than one.
SQ11: What does this imply?
In equation six, weight is multiplied by *e* raised to a negative exponent.
SQ12 (A second take on SQ11): In equation six, what happens at time gets really big? As a result, what happens to the weight?
Equation eight is a damage function that roughly describes a person's state on a progression toward an eventual death i.e. succumbing to the damage.
SQ13: Is it fair to model life as a progression toward death?
SQ14: What is the effect of growth on lifespan?
SQ15: How do antioxidants affect lifespan?

Discussion
Look at the pictures. Please re-visit your responses to SQ14 and 15 until you believe they concur.
The authors use a two-pronged approach in this model.
SQ 16: How do these methods complement each other?
The discussion isn't very long and is devoid of grunt work. Please read it and revisit SQ 1 if you wish.

Thanks for reading! I trust that you're now ready for my ten-minute jail sentence, as Jeff would say. Just think of this paper as the time spent in court and how much time was wasted on this relative to the jail sentence…your BBSI grant dollars at work.