Binary Cellular Analysis: Understanding the Link Between Aging and Mortality Risk

**Background**

- **Age-related diseases** account for more than 2/3 of all deaths worldwide.
- Aging processes at the cellular level is a complex web of interconnected processes, but how it leads to **exponentially increasing** disease risks is unclear.

**Project Significance and Application**

These findings provide the first mechanistic explanation for the link between aging and mortality rates of age-related diseases.

1) Explains **demographic trends/relationships** between infant and adult mortality, and the impact of factors like gender and diabetes on mortality risk.
2) Identifies important underlying biological parameters to inform **anti-aging treatments/pharmaceutical development**
3) Informs **vaccine design** through a systematic approach to evaluating immune response based on reducing lethality.
4) Informs **public health policy** through optimizing distribution and scheduling of treatments (e.g. vaccinations) across age groups.

**Two-Phase Model**

1) Linking cellular aging to loss of function at cell population level
2) Forecasting Chance of Mortality

**A Cellular Explanation of Infant and Adult Mortality**

- **Exponentially increasing** adult mortality can be traced to **exponentially declining** mitotic fraction and frequency of damage repair.
- **Infant and Adult** mortality can be traced back to the control of cell division.
  - Supported by antagonistic pleiotropy theory of William and Hamilton and the disposable soma theory of Kirkwood.
  - **Sex chromosomes** may affect lifespan through cell functionality time (Fp). Females in most species may have higher Fp due to robust X-chromosome mechanisms.
  - Suggests health conditions like diabetes significantly reduce cell functionality time (Fp), increasing mortality risk across various diseases, including COVID-19.
  - Explains how each vaccination/booster reduces the risk of COVID-19 death by roughly 33% permanently.

**References:**

Counting Cells by Age Tells Us About How, and Why, and When, We Grow, and Become Old and Ill
Luca Citi, Jessica Su, Luke Huang, James S Michaelson
medRxiv 2023.01.05.23284244; doi: https://doi.org/10.1101/2023.01.05.23284244

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