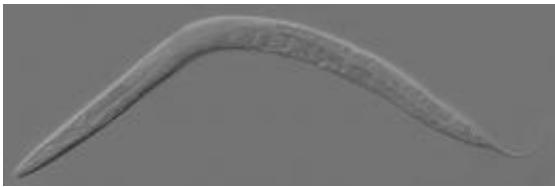


# Researchers develop mitoflash technique to predict lifespan of nematodes

February 13 2014, by Bob Yirka

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*Caenorhabditis elegans*. Image: Wikipedia.

(Phys.org) —A team of researchers in China has added fluorescence to proteins inside the muscle cells of nematodes to monitor metabolic activity in the mitochondria. In so doing, they have found a link between the frequency of mitochondrial flashes (mitoflashes) observed and the lifespan of the nematode. In their paper published in the journal *Nature*, the team describes how they discovered that adding fluorescence to mitochondrial allowed for the observation of the impact of free radicals on inner cell workings, shedding light on the aging process in general.

Mitochondria are found inside of cells—they are the parts that are responsible for respiration and energy production. They are also, many scientists believe, the part of cells responsible for aging. For that reason, a lot of research has been done to figure out why it happens. Currently, most researchers believe that it is an accumulation of [free radicals](#) inside of cells, particularly the mitochondria (which actually produce them), that drives aging, because of resulting damage to DNA. For reasons that

cannot yet be explained, mitochondria are particularly at risk because they are unable to repair the damage done to DNA the way that other cell parts can. To learn more about free radical production in mitochondria and its connection to aging, the researchers with this new effort added fluorescence to proteins inside of the [mitochondria](#) that fired when free radicals were produced.

The researchers treated several nematodes then observed them under a microscope. In so doing, they discovered that counting the number of mitoflashes that occurred when the worm was just three days old could serve as a predictor of how long the worm would live—the more flashes that occurred, the shorter the lifespan, indicating that the accumulation of free radicals tended to spell early death.

Following their first observations, the [researchers](#) added external factors (periods of starvation and heat shock) to their experiment to determine if they might cause any changes to mitoflashing frequency. Oddly, they found that doing so reduced the mitoflashing rate and subsequently increased lifespan. Exposing the worms to a certain herbicide on the other hand caused an increase in frequency and a shorter lifespan.

While it's not yet clear if the same results might be found with humans, it's likely more research will be done to find out. The team also suggests their technique might prove useful for studying other mitochondrial activity and perhaps aid in better understanding ailments that occur when something goes wrong with it.

**More information:** Mitoflash frequency in early adulthood predicts lifespan in *Caenorhabditis elegans*, *Nature* (2014) [DOI: 10.1038/nature13012](https://doi.org/10.1038/nature13012)

## **Abstract**

It has been theorized for decades that mitochondria act as the biological

clock of ageing<sup>1</sup>, but the evidence is incomplete. Here we show a strong coupling between mitochondrial function and ageing by in vivo visualization of the mitochondrial flash (mitoflash), a frequency-coded optical readout reflecting free-radical production and energy metabolism at the single-mitochondrion level<sup>2, 3</sup>. Mitoflash activity in *Caenorhabditis elegans* pharyngeal muscles peaked on adult day 3 during active reproduction and on day 9 when animals started to die off. A plethora of genetic mutations and environmental factors inversely modified the lifespan and the day-3 mitoflash frequency. Even within an isogenic population, the day-3 mitoflash frequency was negatively correlated with the lifespan of individual animals. Furthermore, enhanced activity of the glyoxylate cycle contributed to the decreased day-3 mitoflash frequency and the longevity of *daf-2* mutant animals. These results demonstrate that the day-3 mitoflash frequency is a powerful predictor of *C. elegans* lifespan across genetic, environmental and stochastic factors. They also support the notion that the rate of ageing, although adjustable in later life, has been set to a considerable degree before reproduction ceases.

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