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Nanolaser spectroscopy of Normal and Genetically Defective Mitochondria: New Biostatistical Tool for Studying Disease PAUL GOURLEY, JUDY HENDRICKS, Sandia National Labs, ROBERT NAVIAUX, MICHAEL YAFFE, UC San Diego — We report an analysis of wild and mutant strains of mitochondria from yeast cells using nanolaser spectroscopy to measure cytochrome density and its statistical variation in the population. The first strain 110 was derived from wild-type strain 104 (Saccharomyces cerevisiae) by removal of its mitochondrial DNA (mtDNA), resulting in loss of all mtDNA-encoded proteins and RNAs, and loss of the pigmented, heme-containing cytochromes a and b that can be detected in the laser spectra. Histograms of laser wavelengths produced by wild-type mitochondria produced peaked distributions, while mutant mitochondria exhibit asymmetric, highly skewed distributions. Surprisingly, all of these distributions exhibit extended tails and can be self-consistently fit with log-normal distribution functions. In striking contrast, the mitochondrial diameters (measured separately by microscopy) exhibit normal Gaussian distributions. These results indicate that the nanolaser spectra are useful for quantifying cytochrome content in mitochondria and may have important implications for quantifying defects in mitochondria that manifest human disease.

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