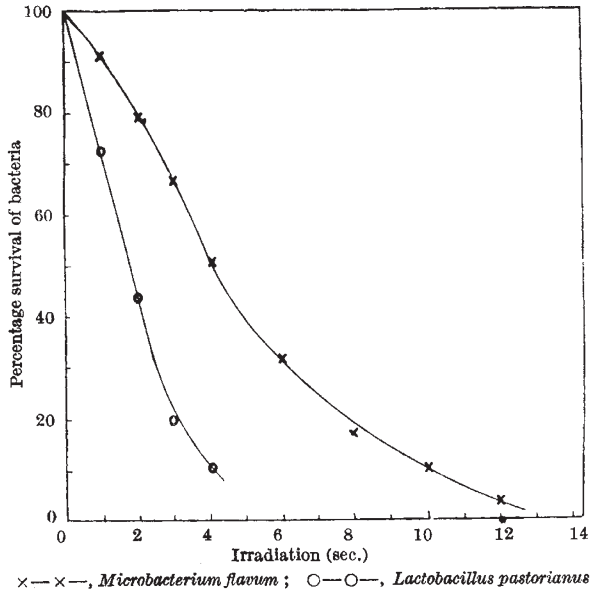
Susceptibility of Catalase-negative Bacteria to Ultra-violet Irradiation

In the tribe Lactobacteriacea there are two closely related genera—*Lactobacillus*, which are catalase-negative, and *Microbacterium*, which are catalase-positive. Representative members of these genera were selected, namely, *Lactobacillus pastorianus* (ATC 8291) as the catalase-negative bacteria and *Microbacterium flavum* (ATC 10340) as the catalase-positive bacteria. Both species form distinct colonies and have an optimum temperature near 30° C. The bacteria were reared on Difco's stock culture broth media and buffered with calcium carbonate, and incubated for seven to nine days at 30° C. *L. pastorianus* was diluted 1–10,000 and *M. flavum* 1–50,000 with physiological salt solution, and 1 ml. of the solution placed in the centre of a sterile Petri plate. The aliquot was exposed to ultra-violet radiation from a 40-watt tube, model HUVM-30 (American Sterilizer Co., Erie, Pa.), with about 90 per cent of the radiation at 2537 A. The distance from the tube to the bacteria was 43 cm. and time of exposure was at various intervals from 1 to 14 sec. Thirty plates were run for each time of irradiation, and average results are presented in the accompanying graph. Immediately after irradiation, 15–20 ml. of tomato agar was added to the plate and agitated to distribute the bacteria uniformly around the plate. The plates are incubated for seven days at 30° C. and the colonies counted. Controls were those bacteria which were not exposed to ultra-violet radiation.

The catalase-positive bacteria, *M. flavum*, is more resistant to ultra-violet radiation than the catalase-negative, *L. pastorianus*. Note in the graph that, after 4 sec. exposure to ultra-violet light, 50 per cent of *M. flavum* survive while only 10 per cent of *L. pastorianus* are viable.

Even after 1 sec. exposure there is a 20 per cent difference in survival, with *L. pastorianus* being more susceptible. These results would indicate that catalase does afford some protection from death by irradiation by decomposing the harmful peroxides which are produced, for the chief difference between the species is the presence or absence of catalase. The negative rate of change of the slope of the curve for *M. flavum* in the graph indicates that an enzymatic reaction of the second order is influencing the survival-rate.



×—×—, *Microbacterium flavum*; ○—○—, *Lactobacillus pastorianus*

Survival-rates of catalase-negative *Lactobacillus pastorianus* and the catalase-positive *Microbacterium flavum* for similar periods of irradiation

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Mitochondrial Distribution in Saccharomyces

Genetical experiments by Ephrussi and co-workers[1] have adequately demonstrated the existence of extra-chromosomal factors determining the cytochrome oxidase and succino-dehydrogenase activities of yeast clones analysed by them. A particulate nature was ascribed to these factors, and their identity with the mitochondria was suggested in view of the well-known association of the enzymes concerned with these bodies; however, no direct observations on the behaviour of the mitochondria during cell divisions were reported.

In spite of their very small size, the mitochondria of actively dividing yeast constitute the most prominently visible entities of the cytoplasm and are, moreover, not obscured by any other cytoplasmic inclusions. They are recognized by their extraordinarily uniform diameters, their ability to react with the 'Nadi' reagent and with tetrazolium, and by their staining with janus green *B*. Phase-contrast microscopy reveals them with unusual clarity in the living cell, making their behaviour and distribution in budding cells amenable to direct analysis. Table 1 indicates the frequencies of mitochondria in single haploid cells, of monosporic derivation, observed in the microscope field at random. The mitochondrial counts were made under bright contrast with Kohler method illumination and a yellow-green filter. All levels within the cell were carefully focused in succession to ensure a precise count.

The variation in frequency from 1 to 18 per haploid cell bore no relation to the differences in sizes of cells normally occurring in any actively proliferating culture. Thus, for example, small single

Table 1

No. of mitochondria per cell	No. of cells counted	Percentage of cells
1	22	3·8
2	40	6·9
3	42	7·3
4	80	13·9
5	36	6·3
6	154	26·8
7	26	4·5
8	78	13·5
9	10	1·8
10	26	4·5
11	6	1·0
12	16	2·8
13	2	0·3
14	28	4·9
15	4	0·7
16	4	0·7
17	0	0
18	2	0·3
	576	100