used here as surface contaminants. It was not found possible, however, to prepare H_2SO_4 aerosols that were as monodisperse as those prepared from DOP. Consequently, when these aerosols were grown over the master solutions, the resulting aerosols became too polydisperse to exhibit reasonably distinct orders in the Higher Order Tyndall Spectra. This increase in polydispersity on growth may be attributed to the Kelvin effect; i.e., the growth of the smaller droplets in the initially moderately polydisperse pure H_2SO_4 aerosol is inhibited with respect to the growth of the larger droplets, thus broadening the range of the size distribution. Reasonable results in growth or shrinkage experiments using the light scattering technique may therefore only be obtained when the initial aerosol is very monodisperse as in the case of DOP. The increase in polydispersity on growth has been discussed theoretically in detail elsewhere (*6*).

Quite similar results to those obtained in the case of sulfuric acid were obtained when attempts were made to grow glycerol aerosols over glycerol-water solutions.

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Evidence for X-Ray Induced Recessive Lethal Mutations in Yeast[1]

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The difference in radiosensitivity of haploid and diploid yeast cells, as shown by earlier investigations (*1–3*), indicates that the site of the radiation-induced damage is in the nucleus. This difference in sensitivity of the two ploidies has been accounted for quantitatively (*3*) by assuming that the damage to the cells is principally in the form of recessive lethal mutations, the haploid cell being killed by one such mutation while the diploid cell would be killed only when an allelic pair of such mutations has been induced. On the basis of these assumptions, one would expect many of the diploid cells which survive a dose of x-rays to carry one or more recessive lethal mutations in heterozygous state. These cells should exhibit an inheritable increase in radiosensitivity because of the increased probability of producing an allelic pair of recessive lethal mutations with a second dose of x-rays. This postulate has been verified experimentally by Tobias and Stepka (*4*).

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TABLE 1

Number of Asci Showing Different Fractional Germinations from Control and Irradiated Diploid Cells

Fraction of the spores germinating per ascus	Control	2500 r	7500 r
4/4	11	2	4
3/4	0	0	2
2/4	1	4	4
1/4	0	0	0
0/4	0	1	6
Total no. of asci dissected	12	7	16
% viable spores	96	57	47

The present experiment was undertaken in an attempt to exhibit by another procedure the presence of x-ray-induced recessive lethal mutations in irradiated yeast. This was carried out by demonstrating a reduction in the percentage of germination of spores produced by diploid cells previously exposed to a small dose of x-rays. Sporulation of a diploid cell carrying recessive lethal mutations would bring about segregation of these mutations to the nuclei of the 4 haploid ascospores. Those spores receiving recessive lethal mutations would fail to germinate, and would thus provide a direct means of detecting this form of radiation-induced damage.

Cells of a diploid culture of *Saccharomyces cerevisiae* were grown on presporulation medium (*5*) for 72 hr, at which time a large loopful of cells was removed from the slant and suspended in sterile water. Half the suspension was placed directly on a gypsum slant, the other half was irradiated and then placed on another gypsum slant. This procedure was carried out for 2 doses of x-rays, 2500 r and 7500 r, both of which kill relatively few of the diploid cells; the lower dose kills only 3% of the cells whereas the higher dose kills about 10% of the cells. After 48 hr, a number of 4-spore linear asci were present in the cells which were sampled from both control and irradiated diploid slants, the frequency of sporulation being unaltered by the low doses of x-rays. A number of these asci, selected at random, were dissected using the procedure described by Lindegren (*5*), and the individual haploid spores were placed on separate drops of yeast extract-dextrose agar medium. The slide on which the spores were inoculated was placed on a Van Tieghem cell and incubated at 30° C. The number of spores germinating from each ascus was observed after 72 hr incubation. The results of this experiment are presented in Table 1.

The data presented in Table 1 clearly indicate that exposure of yeast cells to x-rays results in the induction of recessive lethal mutations. In nearly every case,

asci produced by the unirradiated diploid cells contained 4 viable spores. Asci arising from the irradiated diploid cells, however, showed a statistically significant reduction in the percentage of viable spores which they contained ($P < 0.001$). The majority of the asci having reduced percentage germination contained either 2/4 or 4/4 inviable spores. This is indicative of segregation of lethal gene or chromosomal mutations. These mutations most likely are recessive since, at the doses used, the diploid cell that carried them would still have been viable for vegetative reproduction.

Although this experiment demonstrates the presence of x-ray induced recessive lethal mutations in yeast, it still does not prove that this is the only form of lethal damage induced. Extension of the radiobiological data on haploid and diploid yeast to triploid and tetraploid yeast cells (*6, 7*) indicates that some other form of lethal damage is also induced by the x-rays. This damage has been proposed to be in the form of dominant lethal mutations.

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Secondary Galls and Other Plant Growth-Modifying Effects Induced by Translocated α-Methoxyphenylacetic Acid

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Several well-known growth-modifying compounds that induce cell proliferation (gall formation) such as 2,4-dichlorophenoxyacetic acid, 2,4,5-trichlorophenoxyacetic acid, and naphthoxyacetic acid are composed of a ring nucleus and the acetic acid side chain, these two parts being associated through oxygen thus forming an ether linkage (*1, 2*). Alpha-methoxyphenylacetic acid (MOPA), prepared by Reeve and Christoffel (*3*), has an ether linkage associated with a carbon of the acetic acid side chain rather than with a carbon of the ring nucleus. In the present investigation α-methoxyphenylacetic acid and several related compounds[2] were studied to determine their effects on cell proliferation and other growth responses.

In preliminary screening tests MOPA greatly modified vegetative growth of cucumber, snap bean, and sunflower plants. It also caused primary cell proliferation (gall formation in the treated portion of the stem) and secondary cell proliferation in the stems of bean plants, the secondary galls being formed some distance from the primary ones. These and other growth responses were therefore studied in detail by applying MOPA to several kinds of crop plants.

A lanolin-Tween 20 mixture of the compound was prepared by dissolving 25 mg of MOPA in 0.5 g of Tween 20 and thoroughly mixing with 2 g of melted lanolin. Approximately 12 mg of the mixture was applied to the stem of each plant by means of a narrow glass rod. Various dosage levels were obtained by diluting aliquots of the original 1% mixture with the required amounts of the lanolin-Tween 20 carrier. The paste was placed as a band approximately 3 mm wide around the stem midway between the first and the second node of bean and between the second and the third node of tomato and on the upper portion of the hypocotyl of sunflower and cucumber plants. Approximately the same amount of paste was applied as a strip about 1 cm wide and extending across the upper surface of the first leaf of barley and corn plants. All plants were grown in a greenhouse and treated at an early stage in their development.

The initial response by tomato and bean plants was a moderate and temporary stem curvature. In addition, primary leaf petioles of bean plants curled temporarily downward, the sides of the leaves folding upward at the midrib and thus exposing the under surfaces.

Later responses of cucumber, sunflower, and bean plants included suppression of terminal growth accompanied by increased growth of axillary shoots. The compound delayed flowering and production of fruit by bean plants. The terminal growth of tomatoes was not suppressed, but development of axillary shoots was stimulated. Axillary shoots of treated tomato plants grew in length 59 times as much as did those of comparable untreated ones. No delay in flowering resulted from application of the chemical. Response of tomato leaves was marked, varying from a reduction in the size of leaflets to a reduction in their number. MOPA had a similar effect on the development of bean leaves and in addition some 4- and 5-lobed leaves developed.

Growth of corn and barley plants was not apparently affected by MOPA applied at various concentrations including 1, 0.5, 0.25, 0.13, 0.06, and 0.03%. In contrast, growth of the bean and tomato plants was affected by MOPA at all these concentrations, the least effect occurring at the lowest dosage level.

So that the growth-modifying effects of MOPA could be compared with those of phenylacetic acid, each compound was applied at 4 concentration levels (1, 0.5, 0.25, and 0.1%) to the first internodes of some bean plants and to the second internodes of

[1] Principal Physiologist and Biological Science Aid, respectively.

[2] Samples obtained from W. Reeve, University of Maryland, through the Chemical-Biological Coordination Center, National Research Council.