lead to wrong conclusions regarding the definition of the plant represented by these organs.

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Polyploidy and Radiosensitivity

THE effect of polyploidy on the radiosensitivity of cells has been the object of some discussion in the past, and it may be of some practical importance in such cases as cancer therapy, for example, since tumours are often mixed diploid–polyploid populations[1,2]. For chromosomal aberration production by radiation, polyploid sensitivity equal to[3,4], greater than[3], and less than[5,6] the diploid have been reported. Each of the various experiments involved a comparison of different diploid and polyploid species, and the lack of agreement between the experiments may be due to intrinsic differences in species sensitivity, rather than to the effect of polyploidy itself.

This conclusion probably is not compromised by differences in stage and sensitivity of the haploid and diploid cells, which could result from a possible difference in the rate of development of the cells. Both kinds of cells displayed only the chromosome type of aberrations, which indicates that both were in the same stage, interphase, when irradiated. In addition, radiosensitivity in this interphase is known to be uniform for not less than one day before and one day after the time the radiation was delivered[5].

The observation that for the same dose diploid cells have only twice as many exchange aberrations per cell as the haploid cells affords geometric evidence of the limitation of space over which chromosome breaks can interact to produce an exchange. It is known that with X-rays, exchange aberrations, which result from the interaction of two independently produced breaks, increase as the square of the dose; it is believed with considerable reason that the breaks increase linearly with dose[7]. Now, per nucleus, a doubling of the number of breaks can be achieved by doubling either the dose (chromosome number constant) or the chromosome number (dose constant). In terms of concentration, doubling dose doubles the number of breaks per nucleus, and also breaks per unit volume; however, doubling chromosome number doubles only breaks per nucleus—breaks per unit volume remain the same if volume is also doubled. The ratio of diploid to haploid volumes, both cellular and nuclear, on this slide was roughly about 2·8 : 1, as estimated from the ratio of measurements made on pairs of cells in the same stage and lying side by side; total chromosome length, from metaphase measurements, was in the ratio 2 : 1. The finding that, for the same dose, a diploid cell has twice, not four times, as many aberrations as a haploid cell shows that breaks do not exchange freely over the entire volume of the nucleus but only over a very limited volume. Two breaks, to exchange, must be very close together.

Table 1. CHROMOSOME ABERRATION PRODUCTION BY 500 R. OF X-RAYS IN HAPLOID AND DIPLOID MICROSPORES WITHIN A SINGLE FLOWER BUD OF *Tradescantia*

Cell type	No. of cells	Aberrations per 100 cells					
		Exchanges			Deletions		
		Intrachange, interarm (centric rings)	Interchange* (dicentrics, etc.)	Total ± S. E.	Interstitial 'minutes'	Terminal	Total ± S. E.
Haploid (6 chromosomes)	50	22	160	182 ± 19	292	60	352 ± 26
Diploid (12 chomosomes)	25	16	344	360 ± 38	624	157	776 ± 56
Ratio of diploid to haploid aberrations per cell				2·0 : 1			2·2 : 1
aberrations per chromosome				0·99 : 1			1·1 : 1

* No. of interchanges = 1 (dicentrics) +2 (tricentrics) + 3 (quadricentrics) + . . .; for haploid cells = 1 (82) + 2 (24) +3 (10) + 4 (0) = 160; for diploid cells = 1 (240) + 2 (32) + 3 (8) + 4 (4) = 344.

The ideal situation—irradiation within a single tissue or organ of a single mixed population of normal cells and polyploid cells derived from them—was realized through a fortunate accident in a *Tradescantia* radiation experiment designed for another purpose. A single *Tradescantia paludosa* flower bud (made into a single acetocarmine slide) was found with a mixed population of haploid and diploid microspores. The bud had been irradiated four days previously (500 r. of 250-kVp. X-rays in 1 min., hvl., 1·45 mm. of copper) while the cells were in postmeiotic interphase, an extended period of uniform radiosensitivity; the bud was examined at the microspore mitotic division. About half (48 per cent) of the cells were diploids.

Chromosome aberrations were carefully counted at metaphase in 50 of the haploid (6-chromosome) and 25 of the diploid (12-chromosome) microspores, with the results given in Table 1.

The aberrations observed in both haploid and diploid cells are the customary chromosome kinds resulting from irradiation of undivided chromosomes in interphase. Per cell, the diploid cells have almost exactly twice as many aberrations as the haploid. However, *per chromosome* (since there are twice as many chromosomes per cell in the diploid) the aberration frequency is the same in the diploid and haploid cells. Thus, in the ideal situation of mixed cells in the same tissue, we can say that chromosomal radiosensitivity, or sensitivity per unit length of chromosome, is identical in haploid and diploid cells.

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