from the etiologic agents or factors responsible for a number of spontaneous mouse leukemias as well.

It is interesting that C3H/P mice—a strain in which no antibody has so far been found in uninoculated animals—frequently developed CF and HI antibody to the S.E. polyoma virus following inoculation with the C3H leukemia described by Schoolman, Schwartz, and Szanto (*12*); of seven groups of mice receiving tumor extracts and tumor filtrates, at three passage levels, all pooled sera were positive, as were pooled sera of two of three groups inoculated with brain extracts of mice carrying the transplantable tumor. However, of the pooled sera of five groups inoculated with brain filtrates, none of which developed leukemia, only one had antibody. Whether the apparent presence of S.E. polyoma virus in this leukemia bears any relationship to the reported transmissibility of the leukemia by filtrates, as described by Schoolman *et al.*, or represents fortuitous contamination remains to be determined.

Sera from 162 human beings were tested for CF antibody; a 1 : 8 serum dilution was tested against 2 units of S.E. polyoma antigen. The persons tested included 25 healthy adults, 65 healthy children from 1 to 4 years of age, and 72 persons, mostly adults, with solid tumors or leukemia. All tests were completely negative. This absence of reactions indicates that the S.E. polyoma virus does not share common CF antigens with prevalent human viruses such as the adenoviruses, the Coxsackie, ECHO, and polioviruses, the herpes simplex virus, the salivary gland virus, and the human myxoviruses, to which CF antibodies are commonly present in human sera. It also suggests that the polyoma virus does not share CF antigens with hypothetical viruses responsible for the tumors in the patients studied.

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Fertility in Two Haploids of Solanum tuberosum

Haploid plants ($2n = 24$) of several selections of the common potato, *Solanum tuberosum* L. ($2n = 48$), have been obtained (*1*). These plants were found among seedling progenies of interspecific matings designed to make detection of parthenogenetic individuals relatively easy. Haploids of this species represent tools of potential value for future potato investigations in both applied and theoretical areas of research. The realization of such potentialities is dependent initially upon a reasonable level of fertility in the haploid individuals.

This is a preliminary report (*2*) on the fertility of two haploids of *S. tuberosum*. Fertility has been measured in two ways: (i) by the percentage of good pollen as determined from mature anthers squashed and stained in acetocarmine and (ii) by the results of crosses with other tuber-bearing species.

One haploid, US-W1, from the commercial variety Katahdin, is highly pollen-fertile. From 60 to 75 percent of the pollen grains are plump and stain with acetocarmine (Fig. 1). A limited number of attempts to self-pollinate this individual have not produced any fruit. This may be due to self-incompatibility, which is known to be the usual situation in 24-chromosome, tuber-bearing species of *Solanum* (*3*). However, a larger number of self-pollinations must be attempted before self-incompatibility can be definitely established for the US-W1 haploid.

Pollen from this plant was used in matings with four 24-chromosome, tuber-bearing *Solanum* species [*S. kurtzianum*, P.I. 175434 (formerly *S. macolae*); *S. neohawkesii*, P.I. 210044; *S. phureja*, P.I. 195191, and P.I. 195198 (formerly *S. kesselbrenneri* and *S. rybinii*, respectively); and *S. simplicifolium*, P.I. 218224] (*4*). All these matings resulted in the formation of fruits, each of which contained many viable seeds. This haploid has also been successfully crossed to a selection of *S. tuberosum*.

Meiosis was fairly regular in the US-W1 haploid plant. Twelve bivalents were present at first metaphase in over two-thirds of the microsporocytes examined. A similar regularity in meiosis was observed by Ivanovskaja (*5*) in a haploid of *S. tuberosum* variety Aurora.

Another haploid, US-W3, from breeding selection Minn. 15-2-10-1-2, is only slightly pollen-fertile. The majority of the pollen grains are small, shrunken, and only 5 to 15 percent stain with acetocarmine (Fig. 1). This haploid has failed as a staminate parent in the few crosses attempted to date. The high degree of male sterility was not surprising in view of the cytological findings. Less than 10 percent of the microsporocytes contained 12 bivalents at first metaphase. Univalents were frequent, and the majority of the tetrads contained micronuclei. Multivalents, especially quadrivalents, as well as chromatid bridges, were also present. When this haploid failed to function as a pollen parent, it was used as a pistillate parent. As a female, it was easily hybridized with *S. phureja*, P.I. 225682 (formerly *S. rybinii*), a cultivated 24-chromosome species from South America. Several fruits were obtained, and each fruit contained a large number of seed. Therefore, even though the US-W3 haploid is only slightly pollen-fertile, it is highly functional as a female parent.

The finding of fertility in haploids of the common potato makes their use as future research material appear extremely promising. Genetic studies at the diploid level should now be possible with such materials. The success of this approach would overcome many of the problems inherent in genetic studies at

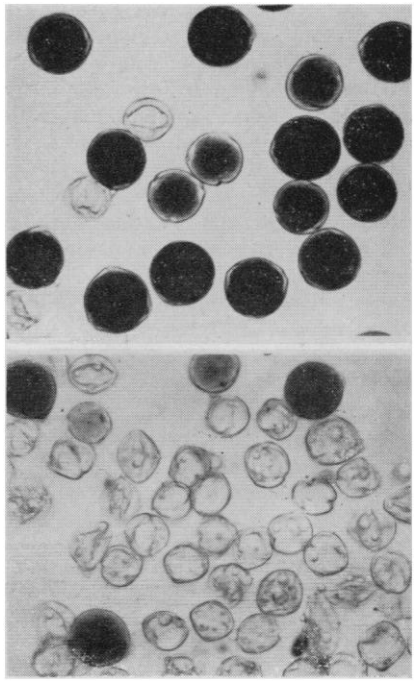

Fig. 1. Pollen grains of US-W1 (top) and US-W3 (bottom).

the tetraploid level. The haploids would seem to provide an excellent opportunity for effecting gene transfer from the numerous cultivated and wild diploid ($2n = 24$) *Solanum* species. They also represent promising material for studies on the nature of ploidy in *S. tuberosum* and chromosome differentiation within the tuber-bearing solanums.

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Phosphorescence Spectra and Analyses of Some Indole Derivatives

Abstract. Phosphorescence spectra of solutions frozen and at low temperatures (77°K) possess more characteristic structure and detail than fluorescence spectra. They contain no background due to scattering of the exciting radiation. Thus greater analytical specificity and sensitivity are obtained. Some indole derivatives indistinguishable by spectrofluorimetry are easily differentiated by spectrophosphorimetry.

The substitution (*1*) of two monochromators for the customary light filters in fluorimetry, one for selecting the wavelengths of light for excitation, the other for the analysis of the resulting fluorescence, has made fluorimetry a rather general method of analysis of high sensitivity. The modification in technique was appealed to in the beginning especially for analyses of indole derivatives, which are of importance in the study of the central nervous system. In this report (*2*) we discuss characteristics of the closely allied spectra of phosphorescence (*3*) and their applicability for analyses, again with reference to indole derivatives.

The apparatus employed for fluorescence may serve for phosphorescence also, but the sample instead of being mobile as in a fluid solution must be rigid as in a glass or a crystal. Both fluorescence and phosphorescence spectra are emitted simultaneously, partially superimposed on each other. The time intervals in which the intensities of the two types of radiation diminish to half their values differ by orders of magnitudes, a characteristic which may be utilized to separate them. Indeed, a rotating phosphoroscope (*3*) between the two monochromators disposed at right angles as in fluorimetry was adequate for isolating the phosphorescence with half-life of the order of 1 second.

The phosphoroscope consisted of a rotating vertical cylindrical drum having two vertical slits 180 deg apart. On the axis was the solution in a fused silica tube within a fused silica Dewar flask. The retardation was the time required for a slit facing the first monochromator to make one quarter turn and face the second. At a rotation of 3000 rev/min the phosphorescence registered arose 5 msec after its excitation. A consequence was the elimination of the principal back-ground present in fluorescence which arises from the radiation of the light source scattered by the first monochromator.

The intensity of fluorescence increased with reduction in temperature and after solidification of the solution phosphorescence appeared at the expense of fluorescence. When some indoles had been dissolved only in water and frozen, the phosphorescence at 77°K was extremely feeble, but the addition of almost any solute such as an electrolyte increased the intensity (*4*). It appears that imperfection in the ice lattice favors trapping of excited states or electrons, forming what may be regarded as momentary color centers, in the same way as, under x-irradiation, color centers in crystals are favored by lattice imperfections introduced by impurities or mechanical strain (*5*). Variation of luminescence with solvent was also investigated. Some nonaqueous solutions yielded higher intensities than did aqueous solutions. Solvents were chosen that formed transparent glasses at the low temperature in order to reduce scattering and thereby achieve more intense luminescence.

Figure 1 shows recordings (*6*) of the phosphorescence spectra of the following substances (*7*) in transparent glasses of methanol and ethanol in ratio of 9 : 1. Indole (curve I) and tryptophan (curve II) exhibit different patterns. However, the fluorescence spectra of these substances at room temperature consist of virtually the same bell-shaped form with the same single maximum (*1*) at 360 mμ. 5-Hydroxytryptamine (serotonin) (curve III) shows still a different pattern. At room temperature only one maximum appeared at 330 mμ. At the low temperatures, indications of structure are evident in flourescence but they are not so distinct as they are in phosphorescence.

Reserpine (not shown here) had an entirely different shape for its phosphorescent spectrum, a tall mound with two minor peaks at 450 and 470 mμ. Indoleacetic acid and tryptamine, also indistinguishable from indole and tryptophan at room temperature, could be differentiated from them and from each other by means of their phosphorescence spectra, which resembled the spectrum of tryptophan rather closely. Greater differences in relative maxima were shown by indoleacetic acid than by tryptamine.

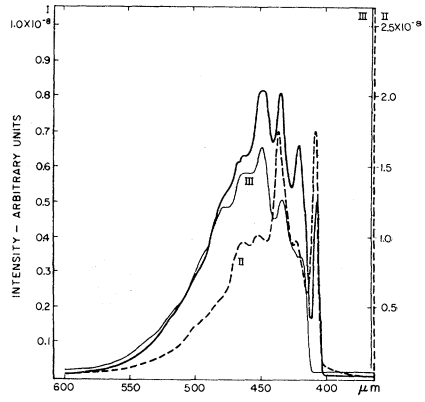

Fig. 1. Phosphorescence spectra of indole derivatives in alcohols at 77°K. I, Indole (2.5 mg/ml); II, tryptophan (0.5 mg/ml); III, 5-hydroxytryptamine (serotonin) creatinine sulfate (0.1 mg/ml) in glasses of methanol and ethanol, 9:1 by volume. Ordinates are in amperes.

In activation spectra different wavelengths produced phosphorescence spectra of different shapes as well as intensities. Such behavior furnishes highly specific criteria for identification.

We defer discussion of sensitivity to some later date. With our present equipment the sensitivity by phosphorescence was about 10 times as great as by fluorescence in the submicrogram region. The limitation appears as background due to the phosphorescence of solvents and of fused silica of containers. However, the phosphorescence contained no background due to scattered exciting radiation, which is chiefly limiting in the sensitivity of measurements by fluorescence.

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