with the glass rod (7), which is dipped in one normal solution of the reagent before insertion.

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A NEW METHOD OF OBTAINING MOSAIC "VIRUS"[1]

IN connection with certain studies on the nature of the causal agent of the mosaic disease it became desirable to secure "virus" with less mixture of foreign substances than could be obtained by filtration of plant extracts through Pasteur or similar filters. It is quite evident that the causal agent of mosaic is carried in the sap of the vascular system of infected plants. By submitting the root system (or the end of a cut stem) to a pressure[2] of about one hundred pounds, it was found that the contents of the vascular bundles could be forced out of the plants and collected with capillary pipettes or medicine droppers. This was accomplished by placing the washed-out roots of the plants in a metal container attached to the city water supply, the stem of the plant extending through a split rubber stopper inserted in a "packing box," similar to that used around valve stems. With a little experience no difficulty was found in making this connection water tight around the plant stem. A succulent mosaic plant with hydathodes readily yields considerable quantities of the liquid water containing the infectious principle, though apparently the "virus" was not as concentrated as when secured from crushed tissue. By cutting the leaf or petioles so as to expose the ends of the bundles the liquid may be secured in a more concentrated form from plants with or without hydathodes. Modifications of the above apparatus and method will be evident to the experimenter to suit the particular needs in hand. It is important to use rapidly growing succulent plants for the best results.

A comparative microscope study of the liquid exuded from healthy and mosaiced plants did not lead to any conclusive results as to the presence of an organism. On slides stained with carbol-fuchsin bodies closely resembling very small bacteria were abundant, but apparently similar bodies occurred in the exudate from healthy plants.

Virus obtained in this way probably closely approximates the virus transmitted by sucking insects, and the method may, therefore, be useful for cross-inoculation studies. This material is also useful in other ways, as, for instance, in attempts at culturing the mosaic agent. The sap as it comes out of the vascular system is usually sterile. It may also prove interesting in studies with other plant diseases, particularly where vascular parasites are concerned.

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[1] Published with the permission of the director of the Wisconsin Agricultural Experiment Station.

[2] This principle was first described by De Bary in studying exudation of liquid water from plants.

SPECIAL ARTICLES

CHROMOSOMAL CHIMERAS IN THE JIMSON WEED

THE production of so-called bud sports is not a rare phenomenon in plants. In general, they may be classified either as sectorial chimeras in which a branch or other portion of the plant shows morphological differences from the rest of the individual, or as periclinal chimeras in which an internal tissue of one type is surrounded by tissue of a different type. The cause of these chimeras has been carefully studied in relatively few cases. Their origin has generally been assumed to be due to somatic mutations in the genes effecting the visible changes. Evidence has been accumulating during the last few years' study of the Jimson Weed (*Datura Stramonium*) that in this species chimeras are brought about by changes in the somatic number of chromosomes, and at least three types of sectorial chromosomal chimeras have been established: (a) those in which one of the sets shows a deficiency of a single chromosome and hence can be represented by the formula $(2n-1)$; (b) those in which the aberrant branch has an extra chromosome, the formula of which would be $(2n+1)$; and (c) those in which one branch has 4n chromosomes or double the number of the normal 2n branch.

(a) *Chimeras with chromosome deficiencies.* In the summer of 1922, two plants from different lines were found each with a branch which showed certain slight deviations from normal. The pollen from both these abnormal branches had considerably more than 50% of abortive grains. Counts of chromosomes in their dividing pollen mother-cells demonstrated a deficiency of one of the largest chromosomes which has been shown to be the extra chromosome present in our $(2n+1)$ mutant known as Rolled. Offspring from these $(2n-1)$ branches failed to show individuals of the parental type, a fact which indicates that gametes deficient for the Rolled chromosome are rarely if ever capable of functioning. In the summer of 1923, a single individual was found with a branch similar in appearance and in the degree of pollen abortion to the two chimeras already mentioned, but the failure of grafts to set prevented a count of its chromosomes. Counts of chromosomes in pollen mother-cells reveal the cytological condition in the subepidermal tissue only and it is possible that these sectorial chimeras were at the same time periclinal chimeras with an epidermal tissue having

a different chromosomal number. That this may have been the case is suggested by the fact that we have found a single plant which was markedly abnormal throughout and distinct from the (2n — 1) branches previously investigated, but which was found also to lack one of the same Rolled chromosomes.

(b) *Chimeras with chromosome excess.* A plant otherwise normal, has been found with one branch bearing leaves and capsules which resembled the (2n + 1) Globe mutant. Chromosome counts have not yet been secured; but offspring from the normal branches were normal, while offspring from the abnormal branch showed the proportion of Globe seedlings expected from Globe parents. The evidence is clear, therefore, that the subepidermal tissue of the abnormal branch of this chimera was (2n + 1) with the extra chromosome in the Globe set. That the epidermal tissue was possibly of a different chromosomal constitution is suggested by the fact that neither the leaves nor capsules on the abnormal branch were fully typical for Globe characters.

(c) *Chimeras with doubled chromosome number.* Several cases have been found chiefly after treatment with cold, in which a single branch on an otherwise normal 2n plant has shown resemblances to a tetraploid. Growth and bud formation in these cases has been poor, but these abnormal branches have been shown to be 4n in generative tissue by the sizes of their pollen grains as well as by the tetraploid offspring which they have produced as contrasted with the 2n offspring produced by the normal branches.

Other and possibly more complicated chimeras which may have a basis in differences in chromosome number are under investigation. The evidence already obtained, however, is sufficient to indicate that chromosomal aberrations may be an important cause in the production of bud sports.

Figures and a more detailed description of the chromosomal chimeras mentioned in the present paper will appear shortly in the *Journal of Heredity.*

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UNIQUE DIETARY NEEDS FOR LACTATION[1]

INVESTIGATION of the dependence of specific bodily functions upon specific nutritive elements is possible because the maintenance of life and, indeed, approximately normal growth are independent of some of those functions. Animals may be reared and will continue to live indefinitely despite disorder, for instance, of the osseous system. It is a matter of practical knowledge centuries old that reproduction may be normal in animals and the function of lactation subnormal or held in abeyance. It has been possible for us to show that active, normal sized and normal appearing rats may be reared by dietary régimes which sterilize them. It has, furthermore, been possible to show that this "dietary" sterility is due to the absence of minute quantities of a specific so-called vitamine substance X, the stability, solubilities and other characteristics of which have now been studied.[2] The commonest dietary régime employed by us in such studies consisted of a well-known mixture of "pure" or isolated foodstuffs (casein 18, cornstarch 54, lard 15, salts 4)[3] together with an abundance of the growth vitamines A and B in the form of butter and yeast. The butter constitutes 9 per cent. of the ration, but the yeast must be fed daily separately in a dose of from 400 to 600 milligrams.

Work with this basal ration of pure food and an abundance of the vitamines at present known should enable us to detect whether or not the function of lactation has other and special dietary dependencies. It is clear that hitherto one could not have amassed the requisite data for such study, since animals do not usually reproduce upon such synthetic mixtures. The detection of the vitamine substance X makes it possible to convey minute but adequate amounts of this substance to animals upon the classic pure food régime and to secure at will reproduction on the régime and to study lactation upon it. Other studies, moreover, have shown that at least one of the foods involved in the pure ration itself, namely, milk fat, possesses seasonally a sufficient contamination with vitamine X to enable animals reared upon this régime to have their first litters. This fact has unfortunately led certain workers to deny the existence of a vitamine which determines reproduction. We have designated this phenomenon "first litter fertility," for upon the same régime the same animals are subsequently sterile. It is due, we believe, to a low amount of dietary vitamine X augmented by

[1] Aided by grants from the National Research Council (Committee for Research on Problems of Sex) and the United States Department of Agriculture (Dairy Division).

[2] Evans and Bishop, SCIENCE, Vol. 56, p. 650, Dec. 8, 1922; *Jour. of Metabolic Research,* Vol. 3, No. 2, Feb., 1923; and Evans and Bishop and Evans and Burr, Proc. Amer. Assoc. Anat., *Anatomical Record,* Vol. 27, No. 4, April, 1924.

[3] Salts. The salt mixture employed was identical with that used by E. V. McCollum and consisted of

NaCl	0.173
$MgSO_4$ (anhyd)	0.266
$NaH_2PO_4 + H_2O$	0.347
$CaH_4(PO_4)_2 + H_2O$	0.540
Fe citrate	0.118
Ca lactate	1.300
K_2HPO_4	0.954