showed presence of laggards and bridges but no other irregularities were detectable (Figure 9 *C*). Plant 5-9-10 had 25 percent pollen sterility and there was no determination on plant 5-9-5. Plant 5-9-6 was examined in detail, showed 50 percent pollen sterility, bridges, laggards, non-pairing at diakinesis, but no recognizable inversions.

Plant 5-9-6 was very interesting. In one anther all stages of meiosis were present, including early prophase, diakinesis, anaphase I, metaphase I, telophase I, and anaphase II. It is very unusual to note this range of division occurring in a single anther or even in a single floret. Lagging and bridges plus fragments were observed at anaphase I. At diakinesis, nine pairs were observed together with two non-paired homologues. Lagging in metaphase plate formation was noted and also micronuclei at telophase I. Irregular anaphase II division resulted in 16 chromosomes going to two poles and four to the other two poles.

Plant 5-10-6 showed 50 percent pollen sterility. Diakinesis was regular but metaphase I showed laggards, anaphase I also showed laggards with one possible bridge figure. Metaphase II and telophase II also gave evidence of laggards. Two pachytene figures showed the long arm of chromosome 1 or 2 heterozygous for a knob plus a possible deletion (Figure 9 *B*).

Plant 5-11-2 showed 10 percent sterility, had laggards at metaphase and telophase I, plus two cells with two bridges and fragments at telophase I. Plant 5-6-3 showed a figure indicating possible inversion of the long arm of chromosomes 1 (Figure 9 *A*). Plant 5-6-4 showed many figures with ring of four and eight pairs at diakinesis. However, pachytene studies failed to show translocation configurations. Plant 4-16-2 showed laggards plus bridges at anaphase II (Figure 9 *D*). One figure fave an indication of possible deletion in the long arm of chromosome 1 or 2.

Thus a series of aberrations were found in the progeny of BKQ which probably included one or more inversions and deletions. Further study of the 49-BKQ progeny would undoubtedly throw further light on the details involved.

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LYSENKO PROGRESSES BACKWARDS

LYSENKO'S new book* begins with a brief outline of the history of the species concet as developed by Linnaeus, Lamarck, Darwin, and Timiriazev. The two last named authors are mildly reproved for having entertained a theory of "one-sided, flat evolutionism," which assumes that new species arise gradually from old ones, which consorts with the "reactionary pseudo-scientific doctrine of Malthus about intraspecific struggle." This one-sidedness and flatness were done away with by Michurin and by Stalin, who invented "creative Darwinism." The latter "visualizes the development not as a flat evolution, but as a birth in the interior of the old of its opposite new quality, which undergoes a gradual quantitative accumulation of its characteristics, and, in the process of the struggle with the old quality, forms itself into a new fundamentally distinct system of characteristics with its own distinctive law of existence." The clarity of this definition of creative Darwinism is matched by the following definition of species: "A species is a special qualitatively defined status of the living forms of matter. An important characteristic of the species of plants, animals, and microorganisms lies in definite intraspecific relationships among individuals. These intraspecific relationships are qualitatively distinct from the relationships among individuals of distinct species. Hence, the qualitative distinction between the intraspecific and the interspecific relationships is one of the most important criteria for distinguishing between species and varieties." The view that varieties are incipient species is a part of the flat evolutionism. It must be

*T. D. Lysenko, *New in the Science of Biological Species (Novoe v Nauke o Biologyicheskom Vide)*. 30 pp. Selkhozgiz, Moscow, edition of 100,000 copies. Price 30 kopeks. Contains an article on "Species" written for the 2nd Edition of the "Great Soviet Encyclopedia," and a speech on "The Work of the Active Member of the Academy of Medical Sciences, U.S.S.R., O. B. Lepeshinskaia," read at a meeting of the Section of Biological Sciences of the Academy of Sciences of the U.S.S.R. in May of 1950. (1952).

replaced by the view that "species are links in the chain of living nature, or steps of the gradual historical development of the organic world." "The origin and development of new species depends upon such alterations of the metabolism in the process of the development of organisms which involve their species specificity."

If the reader is not profoundly impressed by the above philosophic foundations of "creative Darwinism" he surely can not fail to be so impressed by its experimental verifications. "In 1948 the experiments of V. K. Karapetjan disclosed that some winter sown plants of the hard 28-chromosome wheat *Triticum durum* became rather rapidly, in two-three generations, transformed into a different species, the soft 42-chromosome wheat, *Triticum vulgare.*" This splendid success has stimulated even more ambitious undertakings. "In 1949, there was organized a search of seeds of rye in the ears of wheat grown on fields in the foothills of mountains, where the plantings of winter wheat often become contaminated with rye. The source of the contamination of wheat by rye in these localities was not known to science until a few years ago. The investigators V. K. Karapetjan, M. M. Jakubziner, V. N. Gromachevsky, and also several other investigators, agronomists, and students have discovered isolated seeds of rye in the ears of hard as well as of soft species of wheat. In 1949 more than 200 such rye seeds were found. These seeds were sown at the Institute of Genetics of the Academy of Sciences of the U. S. S. R., on the experimental field of the V. I. Lenin All-Union Academy of Agriculture Sciences, and at the K. A. Timiriazev Moscow Agricultural Academy. . . . From the rye seeds developed in the ears of hard and of soft wheat there grew, with few exceptions, various but still typical rye plants. Only in a few instances the rye-like seeds gave rise to wheat plants."

The avalanche of discoveries proved hard to stop: "When the branched wheat *Triticum turgidum* was cultivated in the experimental plots of the V. I. Lenin All-Union Academy of Agricultural Sciences, and also in several other places, annually there was observed on these wheat plots contaminations by soft and hard wheats, by oats, by two-rowed and four-rowed barleys, and also by spring rye. All our observations have led us to the conclusion that the source of these contaminants is the branched wheat, *Triticum turgidum*, itself." To be sure, such contaminations were observed in the past, even as far as the first half of the nineteenth century. "But all such discoveries of one plant species in the fields of other species were, as a matter of principle, not considered by scientists as resulting from transformations of one species into another. Always there arose legitimate doubts. The possibility of the contamination being due to the often met with mechanical admixture of seeds could not be excluded. One could not be sure that the seeds sown did not contain some seeds of other species; that seeds of other species were not introduced on the field by water, wind, or by birds; that the contaminant seeds were not conserved for a long time in the soil, etc. . . . To the cases quoted above all the objections just enumerated do not apply. Indeed, scattered rye seeds found in wheat ears which grew for several generations under definite conditions could not be placed in these ears either by birds, or by men, or by any other means. These rye seeds have been produced by wheat plants and have developed in wheat ears."

Further achievements are confidently predicted: "The factual data so far obtained concerning species formation deal with the plant world only. Necessary factual data are still absent about species formation in the animal world. But one may feel certain that the development of the theory of Michurinist biology will in the near future give an opportunity to assemble factual data concerning zoological materials analogous to those concerning botanical ones." To Lysenko, the observations which he reports seem neither startling nor incredible. On the contrary, such things are just what a Michurinist biologist expects. Indeed, "when plants of a given species encounter conditions which are relatively unfavorable for a normal development of their species specificity, there occurs an enforced change, generation in the body of a given species of vestiges of another species, the specific formation of which is more suitable under new conditions of the external environment. The scattered individuals of the new species generated in the interior of the old one are better suited to the new conditions, they multiply rapidly and are capable of displacing the species in the interior of which they were generated." The presence of weeds is thus explained very simply: "Science knew for a long time that many species of weeds exist only in agronomic practice; in free nature these species are not only absent but they are even incapable of existing there. . . . Weed species are generated by some wild species as well as by cultivated species; thus this malignant pest the wild oat [*Avena barbata*] is generated by cultivated oats." "This explains why the wild progenitors of many cultivated plant species have not been found." One wonders at this point whether Lysenko ever heard about the possibility that the environment may, by means of natural selection, induce formation of adaptive genotypes from the genetic elements present in the populations of the parental species. Or is such an evolutionism too "flat" for him?

He next proceeds to incorporate the wonderful discovery of his fellow Michurinist, O. B. Lepeshinskaia, that cells arise from cell-less materials, into his theory. "Biologists who

stand on the Marxian theory of development clearly see the falsity of the postulate that plant and animal cells develop only from cells. . . . If cells arise only from cells, and even from similar cells, then how can an egg cell give rise in the developing organisms to various tissues with most different cells? Moreover, how is the egg cell itself formed? . . . It is absolutely clear to me that no theory of development is possible without acceptance of the view that cells arise from noncellular substances. As stated above, O. B. Lepeshinskaia has demonstrated experimentally that cells not only can arise but regularly do arise in any organism, and especially in the early developmental stages, from matter which has no cellular structure. This postulate and the experimental data obtained by O. B. Lepeshinskaia are basic for understanding many problems of the theory of individual organic development. No less important are the postulate and the experimental data of O. B. Lepeshinskaia for building a true theory of species formation."

"A large body of facts has been accumulated showing that rye may arise from wheat, and that different wheat species may give rise to rye. The same wheat species can generate barley. Rye can also generate wheat. Oats can generate wild oats [*Avena barbata*], etc. All depends upon the environment in which these plants develop. . . . Indeed, it is now completely demonstrated, and anyone interested can easily convince himself, that in the bodies of plant organisms of various species are generated and formed rudiments of bodies of individuals of other species. How does this happen? For example, can one imagine that a cell of the wheat plant becomes transformed into a rye cell? This I can not imagine. This is impossible. We visualize this thing as follows: In the body of a wheat plant, under the influence of proper conditions of life, there are generated granules of a rye body. But this generation does not occur by a transformation of the old into new, in this case, of wheat cells into rye cells, but by way of origination in the inner depths of the body of a given species, from a substance devoid of cellular structure, of granules of the body of another species. To start with, these granules also lack cellular structure, but they give rise later to cells and to rudiments of other species. This is what the works of O. B. Lepeshinskaia contribute toward the theory of species formation. The scientific postulates of O. B. Lepeshinskaia, together with other achievements of science, will form the basis of our developing Michurinian biology."

Lysenko's meteoric career in science has now lasted for almost a quarter of a century. It is most remarkable that during this time neither Lysenko nor any of his followers produced a single new idea, either a right or a wrong one. One might have thought that some original thinking would have occurred almost by accident. Lysenko began by rejection of all the findings of genetics, thus simply falling back to the level of knowledge which obtained in biology toward the close of the last century, which he found conveniently summarized for him in the popular writings of Timiriazev and of other Russian earlier Darwinists. But the grotesque idolatry of Timiriazev and Darwin proved also transient. With the rejection of Darwin's natural selection and of the cell theory, the level of biological knowledge reduces to somewhere back in the first half of the nineteenth century. Lysenko's belief in wheat suddenly generating rye and barley, and vice versa, is harder to date. Evolution through sudden origin of monstrosities was, of course, envisaged by Saint-Hilaire in 1830. But the "granules" which Lysenko imagines to be "generated" in some "depths of the body" sound very much like the kind of spontaneous generation which Spallanzani refuted as far back as 1775. It is impossible to tell from his writings whether Lysenko realizes all this. But it is revolting to see numerous competent biologists in the U. S. S. R. being forced to pay at least lip service to "Michurinist Biology" in their publications.

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Oh, Spinach!

SEVERAL correspondents call attention to a deplorable editorial lapse in the November-December issue of the *Journal of Heredity* page 299. *Senecio vulgaris* is described as "a spinach relative." Actually its relationship is more than remote, *Senecio* being a compositae and spinach (*Spinacia*) being a member of the Chenopodiaceae.

This blunder appears to have been occasioned by reliance on the telephone as a source of exact technical information. The Editor, who does not like the stuff, has ingested a very humble plate of the chenopod—not the composite.—R. C.