With regard to birth palsy, I have seen excellent results with muscular relaxation for the paralysed limbs. Relaxation seems to give increased confidence, with consequent improvement in gait, and also to make the best use of the injured muscle.

In cases of tennis leg and tennis elbow, relaxation is an important part of the treatment.

According to the late W. Trethowan, 85 per cent of cases of spinal curvature are due to functional nervous disorder and are not indicative of any organic disease. This condition usually denotes that a larger call is being made on the child than its general physique will stand. It is often found during adolescence and may be associated with enlarged tonsils, adenoids, constipation or over-pressure in study.

Attention to the general health usually results in the disappearance of the defect. Early cases of spinal curvature respond better to a midday rest in the recumbent position than to exercises. It is useless to try to heal the muscles by working them. Muscular relaxation practised under expert guidance is of untold value; it not only rests the patient but also is definitely curative in effect.

An elementary school teacher of great experience told me that children suffered less when the Blitz was at its height, because they were in the shelters early and went to sleep. During later raids they no longer went to the shelters regularly but played in the streets and went to bed late. When the sirens sounded they were got out of bed, with resulting greater fatigue and emotional disturbance. In one day raid in 1943 there were bombs and machine-gunning in the streets which caused an increased amount of tension at the time and delayed progress in relaxation therapy at some of our speech centres. On the morning after the winter raids of 1943 it was interesting to notice that the children relaxed voluntarily for a much longer time than usual.

The evacuation of school-children has shown that far more children suffer from enuresis than was generally supposed. Some cases are the result of neglect in training, but the majority are attributable to nervous causes. Some children develop this habit on being evacuated to the country, but in many cases it stops if the child settles down happily. If the enuresis is of long standing and the child is unhappy, it may be necessary for the case to be sent to a special hostel, though it is doubtful whether this segregation is satisfactory in all cases. A nervous, sensitive child may develop a sense of shame difficult to eradicate even after the enuresis has been cured.

Stammerers suffering from enuresis have been cured of this habit through relaxation, and cases have been known where the enuresis has ceased after one week's attendance at a centre.

In the case of writer's cramp, there is, in addition to the physical condition, a psychological factor. These cases are helped greatly by relaxation.

Dr. Grantly Dick Read says that pain in child-birth could be largely eliminated if mothers were trained to relax from the fourth to fifth month of pregnancy for a few minutes each day. So much pain in normal child-birth is due to a misapplication of the sense messages of fear to the brain, which leads to a tension of the fibres.

Conclusion

Relaxation in some form has been known throughout the ages. Even animals and plants relax for specific periods.

Primitive races still instinctively use it, and ancient

racers of the East have never ceased to practise it, perhaps because their civilization is of longer duration than ours and was arrived at more slowly.

There is nothing new in the art of relaxation, and its complete story has yet to be told. It is not the panacea for all ills, but it can alleviate physical, nervous and emotional conditions.

The inner peace and tranquillity that may be developed by means of relaxation may pervade a man's life; so that we can still say with the Psalmist: "Commune with your own heart upon your bed, and be still".

SYNTHESIS OF NEW SPECIES OF WHEATS*

By DR. ANTON ZHEBRACK

Timiryasev Agricultural Academy, U.S.S.R.

AS generally known, the species of wheats existing in natural conditions are classified into three chromosome groups of 14, 28, and 42, according to the number of chromosomes in their somatic cells. The most widespread species represented by a great number of varieties of races, biotypes and agricultural sorts is the bread wheat *Triticum vulgare*. This species is the most polymorphic and is represented by spring as well as winter sorts of wheats. The record frost-resisting agricultural sorts are found only among *Triticum vulgare*, which belongs to the group with the highest number of chromosomes.

The fact that a number of very valuable agricultural and biotypical qualities has developed in the process of evolution among the highest chromosome species of wheats *T. vulgare*, supports the chromosome theory that the high chromosome species are undergoing evolution and adapting themselves to various conditions of environment more rapidly than the species with a low number of chromosomes. Hence the problem of introducing wheats into new areas might best be solved by increasing the number of chromosomes. The above, as well as a number of purely theoretical considerations, led us to take up the question of obtaining high chromosome forms of such an important cereal as wheat. However, as most species of wheats are already polyploids, no more valuable and more fertile types can be obtained by an increase in the number of chromosomes in pure wheats, as this would probably lead to highly sterile forms.

We therefore began our effort to obtain high chromosome forms of wheats by doubling the number of chromosomes of interspecific hybrids and not that of pure species.

We selected two species of wheats for hybridization, namely, *Tr. monococcum* and *Tr. timopheevi*. Both these species are immune from a number of fungal parasites and insects and, what is most important, they have isolated chromosome complexes producing, when crossed with other species, absolutely or highly sterile hybrids. By increasing the number of chromosomes of such highly sterile hybrids we restore fertility and obtain amphidiploid types with higher numbers of chromosomes than those of the parental species of wheats.

* A report on this work was made by Dr. Anton R. Zhebrak in 1940 at the December session of the Timiryasev Agricultural Academy, in 1942 at the November session of the Academy of Science of the U.S.S.R. in Tashkent, and was repeated at the session of the Timiryasev Academy in March 1943.

We began our research into methods of obtaining amphidiploids of wheats in 1936. At first, in order to increase the number of chromosomes, we used various agents—chemicals, temperature, X-ray treatment, etc.—which had been employed by numerous scientific workers prior to us. Unfortunately these agents did not lead to the desired results. Only in 1938, after the publication of the work of Blakeslee and Avery on obtaining polyploid forms among plants by colchicine treatment, did we succeed in obtaining the first amphidiploid types of wheat. At that time we had obtained hybrid seeds of the following combinations: *T. durum* Desf. $\times$ *T. monococcum* L., *T. polonicum* L. $\times$ *T. durum* Desf., *T. durum* Desf. $\times$ *T. Timopheevi* Zhuk., *T. persicum* Vav. $\times$ *T. Timopheevi* Zhuk.

In the spring of 1938 we treated hybrid seeds of the above-mentioned combinations with a 0.1 per cent colchicine solution and obtained amphidiploid spikes from the following hybrids: *T. durum* Desf. $\times$ *T. monococcum* L., *T. durum* Desf. $\times$ *T. Timopheevi* Zhuk., *T. polonicum* L. $\times$ *T. durum* Desf.

The amphidiploid spikes *T. durum* $\times$ *T. monococcum* and *T. durum* $\times$ *T. Timopheevi* were of normal fertility and widely differed from the sterile amphihaploid spikes. We found forty-two chromosomes in the somatic cells of the amphidiploids *T. durum* $\times$ *T. monococcum* and fifty-six chromosomes in the amphidiploid *T. durum* $\times$ *T. Timopheevi*.

The spikes of *T. polonicum* $\times$ *T. durum* hybrids which had been subjected to treatment with colchicine solution in the seed stage contained various numbers of grains: 7–10 and 25–30. Next year (1939) the plants obtained from ears of various fertility were investigated. It was discovered that the ears with low fertility contained amphidiploid grains giving 56-chromosome plants, while spikes with a high fertility gave plants with twenty-eight chromosomes. Thus on the basis of these investigations we ascertained that in the highly sterile *T. durum* $\times$ *T. monococcum* and *T. durum* $\times$ *T. Timopheevi* hybrids the doubling of the number of chromosomes led to the restoration of normal fertility while the increase of the number of chromosomes of normally fertile hybrids of the first generation of *T. polonicum* $\times$ *T. durum* produced polyploid plants of low fertility. We are continuing experiments with them, however.

The amphidiploids *T. durum* $\times$ *T. monococcum* have forty-two chromosomes in their somatic cells and occupy an intermediate position between *T. durum* and *T. monococcum*. We consider this amphidiploid a new species of wheat and have named it *Triticum Edwardi* Zheb. The characteristic peculiarities of this species are the intense greenness of the sprouts and the adult plant, the erectness of the stems and their high tillering, the lack of pubescence (hairlessness) of its glumes. The glumes are triangular with blunt crenature. Spikelets are arranged along the stem in a straight line. The side of the ear is wider than the front. The kernel is large and somewhat asymmetrical.

We have classified the amphidiploid *T. durum* $\times$ *T. Timopheevi* ($2n=56$) as new species, *Triticum soveticum* Zheb. In 1939–40 we obtained such 56-chromosome types by crossing *T. Timopheevi* with numerous sorts of nineteen varieties of *T. durum*, six varieties of *T. turgidum*, three varieties of *T. persicum*, three varieties of *T. polonicum* and one variety of *T. orientale*.

Thus 56-chromosome amphidiploid types have been

obtained from crossing *T. Timopheevi* with thirty-two varieties belonging to five 28-chromosome species. As there is no great difference in external morphological characteristics and all the above-mentioned amphidiploid types may be easily crossed among themselves and contain the same number of chromosomes, we have classified them as a single botanical species *T. soveticum* Zheb. The amphidiploids of different varieties of *T. durum* $\times$ *T. Timopheevi* will form the respective varieties of the new species *T. soveticum* ssp. *durum* Zheb., and similarly for other crosses. Thus the species *T. soveticum* Zheb. obtained experimentally is represented by five sub-species and thirty-two varieties. The number of varieties can be increased by mutational changes, as well as by taking advantage of the variability of the hybrid by crossing different sub-species of *T. soveticum* between themselves. We effected such crossing in 1942.

The most characteristic and general attributes of all sub-species of *Triticum soveticum* Zheb. are the following: dark green pubescent shoots, erect bush and dark green colour of the stem and entire plant. The leaves are pubescent. At the base of the leaf the plant has a ligule and auricle. It possesses high tillering capacity. The spike stem does not break easily. The glumes of the spikelets are pubescent. The colouring of the spikes varies: white, red, black and intermediate shades. The grain is red, glassy, large and long—8–12 mm. The absolute weight of a thousand grains is about 100 grams. This species varies widely in all combinations. It has 56 chromosomes.

The amphidiploids of *T. Timopheevi* with different species of 28-chromosome wheats occupy the intermediate position between *T. Timopheevi* and these species. But as they differ widely from the original species in many characteristics, their number of chromosomes and their ability to cross, we place them in the new species, *T. soveticum*, but in designating the sub-species retain the name of the original 28-chromosome species with which the crossing with *T. Timopheevi* was performed. The peculiarities of the varieties of the 28-chromosome wheats in *T. soveticum* are not always apparent owing to the prevalence of a number of morphological characteristics of *T. Timopheevi*.

The new properties of the amphidiploid types of wheats are: (1) the exceedingly large absolute weight of the kernel, which greatly exceeds that of the parent species (1,000 selected kernels of various combinations weigh between 100 and 110 gm.; the weight of a thousand average grains is about 80 gm.); (2) the amphidiploid species have a longer vegetative period than their parents; (3) various amphidiploid combinations such as sub-species *durum*, *turgidum*, *orientale* have acquired the ability to survive the winter in Moscow.

A new type as regards the number of their chromosomes are the amphidiploids *T. vulgare* $\times$ *T. Timopheevi* and reciprocal crossings. Such amphidiploids are obtained from the following varieties of *T. vulgare*: *lutescens*, *multurum graecum*, *alborubrum*, *albidum* and *erythrospermum*. These varieties include spring as well as winter forms. The amphidiploids resulting from crossing with the winter sorts of *T. vulgare* are spring wheats with late ripening. The fertility of these amphidiploids is not high, usually one or two kernels per spikelet. They have seventy chromosomes and belong to the decaploid group. The amphidiploids vary greatly in their morphological characteristics and the length of their vegeta-

tive period. We have classified them as a separate species called *Triticum Borisovi* Zheb. The basic peculiarities of this type are the dark green colour of the shoots, the pubescence of the shoots and leaves and the glumes of the spikelets. The stem of the spike is only slightly brittle. The grains are tightly wrapped into flower paleæ. The number of chromosomes is seventy.

We have also obtained 70-chromosome amphidiploids from crossing *T. durum* $\times$ *T. vulgare*. Their fertility is not high but they differ in their morphological characteristics. In some combinations the kernel is good. A more complete account of these amphidiploids will follow later upon completion of more extensive research.

Both the 70-chromosome amphidiploid types have a common peculiarity: their lower fertility as compared with the 42- and 56-chromosome types.

In conclusion, I wish again to stress that colchicine is exceedingly effective as a factor in increasing the number of chromosomes. This is shown by the facts outlined in our work, from which it may be seen that, in a brief period, we succeeded in obtaining more than ninety amphidiploid types of wheat belonging to the three chromosome groups 42, 56 and 70, which may be considered as new botanical species. To the best of our knowledge these amphidiploid types of wheat have been obtained for the first time, and amphidiploids in general, in such large quantities, also for the first time.

OBITUARIES

Dr. J. K. Roberts, F.R.S.

It is difficult for the colleagues and friends in the Laboratory of Colloid Science, and others who have been intimately connected with John Keith Roberts, to realize that he has departed from us. He died on April 25, aged forty-seven.

I first met 'J. K.' when he was working in the Cavendish Laboratory. At that time, under the genial guidance of Lord Rutherford, the main interest in the Cavendish lay in the problems of nuclear structure. To 'J. K.', however, the nucleus had no attraction; he was both by training and inclination steeped in the classical tradition of physics based upon thermodynamics. He was at the time engaged upon the problem of the extent to which thermal energy is exchanged when gas molecules hit and leave a solid surface. He found that the values for the accommodation coefficient were coming out unexpectedly higher than anticipated from Baule's calculations. In my Department we were searching for different methods by which layers of gas adsorbed at metal surfaces could be detected and examined, and it seemed possible that the high values for the accommodation coefficient which Roberts found were due to the presence of a chemisorbed layer of gas on the tungsten wire which he was using. If this proved to be the case, the accommodation coefficient might serve as a useful tool for exploring surfaces.

Roberts welcomed with enthusiasm the suggestion of moving from the Cavendish to next door, and taking up this field of inquiry. He devoted the next ten years of his life to this problem. In this investigation he was strikingly successful. Roberts not only showed how one could trace and follow the building up of adsorbed monolayers on tungsten wires by means of the accommodation coefficient of neon as

an indicator, but also later developed methods for actually measuring the heat of adsorption of gases on thin wires by making the wire one arm of a Wheatstone bridge. A series of papers both experimental and theoretical testify to the great skill, painstaking accuracy, and attention to detail which characterized all his work. Methods had to be worked out for circulating pure neon over scrupulously clean wires and for the admission of gases at minute but regulated pressures. The apparatus was essentially simple, but the elimination of contamination in the system indicates the extraordinary cleanliness which he achieved. Many important discoveries were made, and what had hitherto been matters of opinion experimentally tested. Thus it was found that when the tungsten wire was clean, chemisorption of several elementary gases occurred without appreciable energies of activation, that a slow process of activated diffusion could take place into the wire, and that gases could be quantitatively displaced from the surface. When diatomic gases were chemisorbed as atoms, holes were left in the surface which play an important part when chemical reactions take place in the adsorbed phase. He showed that there could be a transition from immobile to mobile monolayers, and revealed how the influence of mutual interaction between the adsorbed particles could be traced both in the form of the adsorption isotherm and in the thermal behaviour on adsorption.

Apart from this field of inquiry, which he made particularly his own, Roberts took a great interest in many other problems, especially in the mechanism of melting of a crystalline solid and in the origin of the elasticity in rubber. He was always ready to give his advice and criticism to those commencing research. Here, for Roberts, no trouble was too great, no time too long. Many have gained from the lasting impression he made by his directness and simplicity of approach in experimental attack, his insistence upon rigour in argument and soundness in thermodynamic treatment. His lectures were clear and attractive, and his book on thermodynamics has already gone into the third edition. Little can be said at present about his activities in the War, but he took a post in a naval research establishment that was difficult administratively, and involved research and development along important and novel lines. Here he was an unqualified success.

In the laboratory Roberts was always cheerful and ready to deal with all the vexatious details which arise—this in spite of his health, which was never good. At times a leg gave him much trouble, but no one ever heard a word of complaint. He took much pleasure in the fact that his work was appreciated, both at home and abroad. He had been elected to the fellowship of the Royal Society and quite recently made a fellow of Christ's College, and was looking forward to his return to Cambridge, where his heart lay.

ERIC K. RIDEAL.

WE regret to announce the following deaths:

Dr. J. A. Campbell, of the research staff of the National Institute of Medical Research, on April 20, aged sixty.

Lieut.-Colonel Stanley Casson, reader in classical archaeology in the University of Oxford, aged fifty-four.

Mr. H. B. Walters, O.B.E., keeper of Greek and Roman antiquities in the British Museum during 1925–32, on April 24, aged seventy-seven.