and with PROP $0{\cdot}480 \pm 0{\cdot}146$. Both these values are significantly different from zero, and support the conclusion[1] that there is a positive association between increasing number of foods disliked and increasing taste sensitivity.

The sample included 39 husband–wife pairs. The members of these pairs are not closely related genetically and there is no significant correlation between their scores for quinine or PROP in spite of the fact that they have shared a common environment for varying lengths of time. A significant positive correlation was observed between the scores on the food questionnaire of husbands and wives. On Part *A* of the questionnaire the correlation coefficient was found to be 0·482 (significant for $N=39$ at the 0·01 level). The 16 pairs of monozygotic twins in the sample were all married and had lived apart for varying lengths of time. Their scores on Part *A* of the food-preference form were found to be highly correlated (0·70, significant for $N=16$ at the 0·01 level). The scores on Part *A* of the questionnaire for 10 pairs of dizygotic twins, 8 pairs of whom lived apart, showed an insignificant correlation of 0·18.

Both males and females showed a positive correlation between preference for mild-tasting foods and relatively sensitive perception of the taste of quinine and PROP. The males showed a somewhat higher correlation than the females, but the difference was not statistically significant.

Taste sensitivity for PROP is closely associated with that for phenylthiourea (PTC)[3], which in turn is associated with that for a variety of thiourea and thioamide compounds[4]. Taste thresholds for all these compounds appear to be largely determined by the same pair of genes. The relative proportion of the two genes varies in different populations and the system provides one of the classic examples of polymorphism. The equilibrium between the genes must be of great antiquity as the polymorphism has been identified among apes[5]. The factors which maintain the balance are not clear. Many thiourea and thioamide compounds have anti-thyroid properties and some of them occur naturally in vegetables, particularly in members of the cabbage family[6]. It has been suggested that the existence of the PTC–PROP tasting genes in human populations is associated with the ability to taste these toxic products in food[7].

The flavour of the majority of foods is the result of a medley of tastes and odours, and it may at first seem surprising that the choice of certain foods is correlated with taste sensitivity to a single compound such as PROP. However, sensitivity to PROP has been shown to be correlated with taste sensitivity to a wide variety of other compounds, including those tasting bitter, salty, sour and sweet[3]. The association between taste and odour sensitivities, if any, has received little investigation.

Repeated determinations of the taste threshold of an individual have shown that under controlled conditions the thresholds for PROP and quinine are relatively stable characteristics[3]. However, a number of factors are known to effect thresholds for these compounds. For example, there is a gradual decline in sensitivity with increasing age[8]. Heavy smoking habits are associated with relative taste insensitivity[9] and duodenal ulcer is associated with increased sensitivity to PROP[10]. Increased sensitivities in the four taste modalities, salt, sweet, sour and bitter, have been reported for patients suffering from cystic fibrosis[11] and adrenal insufficiency[12]. In some women, taste sensitivity for PROP and quinine fluctuates with the phases of the menstrual cycle[13].

Our investigation has revealed social influences on food preference as well as demonstrating the importance of perceptive factors. A correlation in food preference between husband and wife was apparent in spite of the absence of correlation between their taste thresholds. We may note, in passing, that for our 39 husband–wife pairs the correlation between PROP threshold and food preference score was 0·495 for husbands but only 0·335 for wives. This is not a statistically significant difference, though one may surmise jestingly that the woman who stirs the pot moulds her preferences to cater for the tastes of her husband rather than for her own.

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[See also p. 930 of this issue of *Nature*.]

OBITUARIES

Dr. F. J. Richards, F.R.S.

WITH the death, after prolonged illness, of Dr. F. J. Richards on January 2, 1965, Britain has lost an outstanding plant physiologist, and his colleagues a much-valued friend. He was educated at Burton-on-Trent Grammar School and then entered the University of Birmingham, where he read botany and biochemistry, graduating with honours in 1924. Two years later, after a period of research on fungal respiration at Birmingham, he joined the staff of the Institute of Plant Physiology of the Imperial College of Science and Technology, London, under the directorship of Prof. V. H. Blackman. Located at Rothamsted from this time, he began his close collaboration with the late Prof. F. G. Gregory in the field of mineral nutrition of plants. With his extraordinary thoroughness, Richards examined the syndromes of deficiency in the barley plant (especially of phosphorus and potassium) in all its aspects: growth analysis, rates of respiration and photosynthesis, water content, carbohydrate and nitrogen metabolism, the effects of other cations, in particular the partial replacement of the essential role of potassium by rubidium, etc. These investigations established his international reputation and continued, in collaboration with his students, until his death. More recently, the discovery that the amide putrescine is accumulated under potassium deficiency conditions has led to further important metabolic and enzymatic investigations.

In 1930, still in connexion with his Birmingham interests, and with the assistance of his wife, Richards followed up R. H. Yapp's investigations on the rates of accretion in the salt marshes of the Dovey Estuary. In the analysis of the data, he used the then new statistical techniques devised by R. A. Fisher, and became one of the first to introduce such methods into ecological problems. His interest in statistics led him to devise a method for the graphic representation of the results of factorial

experiments, which enables the immediate visual appreciation of their main effects and their interactions.

Richards's considerable mathematical ability found another outlet in the investigation of phyllotaxis. What was initially a hobby developed into a serious investigation. Taking into account the radial as well as the tangential spacing of leaf primordia at the apex, he was able to derive a function describing phyllotaxis uniquely in terms of a single index which grades smoothly from one order of phyllotaxis to the next and is applicable to all systems. A simple transformation allows the index to be applied to a conical surface when the apical angle is known (equivalent phyllotaxis index). Application of these techniques to data derived from serial sections of growing points enabled detailed analysis to be made of rates of growth of the various parts of the apex, its changing shape at different developmental stages of the plant, etc. These developments have placed the quantitative measurement of phyllotaxis on a completely new basis and represent the greatest advance in this field for many years. Quite recently, Richards developed a flexible, generalized growth function of great utility which is suitable for a considerable diversity of data.

In 1958, when the late Prof. F. G. Gregory retired from the chair of plant physiology and the directorship of the Institute of Plant Physiology, the Institute was dissolved, and Richards took over the research group located at Rothamsted as director of the new Agricultural Research Council Unit of Plant Morphogenesis and Nutrition formed for this purpose, which was later moved to Wye College.

Richards was one of the most modest of men and of a rather shy disposition; thus it was a particular pleasure to his friends when his achievements were recognized by his election to the Royal Society in 1954. He had a delightful, gentle sense of humour which enlivened many a tea-time discussion in the laboratory. In spite of his usual reticence, he could be very firm in any controversial matter where scientific principle was concerned. With his acutely critical mind he would at once see the essential core of any problem, and a friendly discussion between him and F. G. Gregory, who was as usual bubbling with ideas, was an intellectual joy to witness.

Richards served as executive editor of *Plant and Soil* and also on the editorial board of the *Journal of Experimental Botany*. Although he never held a teaching post, his influence on younger research workers was very considerable. In his unhurried, quiet, helpful and completely unselfish manner he would stimulate their enthusiasm as well as their critical faculties and bring out the best in all who had contact with him, and many a scientific paper which did not carry his name or even an acknowledgment was the better for his meticulous attention.

The interest in natural history in his parental home found its reflexion in Richards's scientific hobbies. He built his own reflector telescope, made a collection of most of the commoner macro-lepidoptera; a keen photographer, he specialized in stereo-photography, and above all, he enjoyed his mathematical interests: number theory, the Fibonacci series and numerous geometric and algebraic variations he derived therefrom. During his holidays in Wales, Dartmoor and elsewhere, he pursued his archaeological interests, visiting prehistoric sites and collecting artefacts. With his keen eye he even discovered and made a collection of palaeolithic flint tools on the classical fields of Rothamsted. All these hobbies were followed with the same meticulous thoroughness as was displayed in his work, and his students and colleagues were privileged indeed to share in them. When he died at the early age of sixty-three there can have been few people whose retirement would have held greater promise of useful and enjoyable activity.

He will be remembered with the greatest affection by his many friends, students and colleagues, and his wife and two daughters who survive have our sincerest sympathy in their loss.

W. W. SCHWABE

Dr. R. F. A. Dean

WHEN Dr. Rex Dean died on December 2, 1964, Britain lost an exceptional character.

After he left school, Dean went straight into the Bank of England and worked there for ten years. Here he found time for his artistic interests and revelled in the art galleries and musical opportunities of London. One of his characteristics was a desire for knowledge. Books were good, but better still was the chance of talking to an expert. He was not interested in money, and his restless ambition and enthusiasm found no satisfaction in a banking career. Comparatively late in life, therefore, he began to study medicine at St. Thomas's Hospital, where he qualified in the shortest possible time and took up a house appointment at Addenbrooke's Hospital, Cambridge, in 1943. By this time he was an accomplished pianist with a profound knowledge of the great musical masters past and present. He was also a painter of no mean skill.

Dean at once began to show his devotion to clinical medicine. He loved to examine all his patients himself, never took anything for granted and always saw that everything possible was done for their present and future welfare. He joined the Department of Medicine (later the Department of Experimental Medicine), Cambridge, in 1944 and thus started a career in medical research which he was to pursue for the rest of his life.

Dean went to Germany in 1946 with the Medical Research Council team that set out to investigate the effects of undernutrition on the German population. Here he took an active part in all the studies that were being made, and we quickly began to value his ability, not only as a clinician but also as an administrator. As an investigator he was at first almost a beginner, but he quickly grasped the essentials of organizing a controlled experiment involving a large number of people, and he was a tower of strength throughout the three years we were in Wuppertal. Dean worked very hard, and from the very beginning set high standards for himself and those working under him. His relaxations were painting and music. He delighted in the Bechstein grand piano which was in the '*Herrenzimmer*' of the old German house where we lived, and he often went on playing long after everyone else had gone to bed.

The first investigation of which Dean took sole charge was one designed to find out if plant proteins could substitute effectively for milk proteins in the diet of infants and young children. It was possible to do this under controlled conditions in Wuppertal at that time, for the City and even the orphanages were desperately short of milk. He first tried soy bean proteins and at once ran into difficulties over the trypsin inhibitor associated with them, and made numerous journeys to visit experts, manufacturers and others who might help him and at the same time kept the nutritional work going and, even more important, the German staff at the orphanage and the public health authorities solidly behind him. The results of this investigation were published as a *Medical Research Council Special Report*, and on the basis of this work Dean was awarded the Ph.D. (Cambridge) degree.

Dean's success with this investigation made him anxious to apply the results on a large scale where they were clearly needed and likely to be so for some time. His chance came when he was invited by the Medical Research Council to set up a Unit for the study of infantile malnutrition at Kampala. From this he never looked back and, in spite of great difficulties and misunderstandings at times, he gradually built up an organization centred on the small research hospital and laboratories which he himself designed. The money for this was provided, largely through his own persuasive efforts, by the Uganda Government, the World Health Organization and the International Children's Centre in Paris, but he was always supported by the Medical Research Council. Here