- Pamukcu, A. M., Göksoy, S. K. & Price, J. M. (1967). *Cancer Res.* **27**, 917.
- Pamukcu, A. M., Olson, C. & Price, J. M. (1966). *Cancer Res.* **26**, 1745.
- Widdop, B. (1967). Ph.D. Thesis: University of Wales, Bangor.

Phenolic Metabolism in Potato Tuber Tissue after Infection with *Phytophthora infestans*

By J. FRIEND, S. B. REYNOLDS and M. A. AVEYARD.
(Department of Botany, University of Hull, Hull HU6 7RX, U.K.)

Phenolic compounds accumulate in potato tissue after inoculation with *Phytophthora infestans*. Chlorogenic acid, scopolein (Hughes & Swain, 1960) and a lignin-like polymer (Friend & Knee, 1969) have been found in infected susceptible tubers (var. Majestic), whereas suspended tissue cultures of R₁-resistant potatoes (var. Orion) accumulate salicylic acid, vanillic acid and *p*-hydroxybenzoic acid after inoculation with an incompatible race of the fungus (Robertson *et al.* 1968).

We compared the changes in phenolic compounds and of phenylalanine ammonia-lyase activity of tubers of susceptible and resistant varieties after inoculation with a sporangial suspension of *P. infestans*. There was a large increase in chlorogenic acid concentration in both inoculated and control discs of Orion (resistant) compared with similarly treated Majestic (susceptible) tubers. Phenylalanine ammonia-lyase activity also increased more rapidly in Orion than in Majestic tubers, and this higher activity was maintained. There was a greater accumulation of a lignin-like polymer in both sets of inoculated tubers; the increase in Orion was more than in Majestic tubers.

The changes in lignification in relation to the spread of the fungus across the surface of tuber slices from a central inoculation site were also examined. In Majestic tubers the infected zone was 50 mm in diameter after 140 h, but in Orion tubers it did not extend beyond 15 mm, a distance reached in 40 h. In Orion tubers maximum lignification was after 70 h near the centre of the infected area, whereas in Majestic tubers lignification was spread over a wider area and the highest values were obtained in the outer portion of the infected area after 140 h. The values of phenylalanine ammonia-lyase activity followed a similar pattern.

Lignification may well be involved in the restriction of the spread of the fungus in Orion tubers; similar suggestions have been made for other host-parasite combinations (Hijwegen, 1963) and the extent of lignification could be controlled by the activity of phenylalanine ammonia-lyase. Lignin could act as a barrier by modifying the galactan-

containing polymers in the cell wall so that they can no longer be hydrolysed by the *P. infestans* galactanase (Knee & Friend, 1970).

This work was supported by the Agricultural Research Council and a Science Research Council Studentship to S. B. R.

- Friend, J. & Knee, M. (1969). *J. exp. Bot.* **20**, 763.
- Hijwegen, T. (1963). *Tijdschr. PlZiekt.* **68**, 314.
- Hughes, J. C. & Swain, T. (1960). *Phytopathology*, **50**, 398.
- Knee, M. & Friend, J. (1970). *J. gen. Microbiol.* **60**, 23.
- Robertson, N. F., Friend, J., Aveyard, M. A., Brown, J., Huffee, M. & Homans, A. L. (1968). *J. gen. Microbiol.* **54**, 261.

The Effect of γ -Irradiation on the Amino Acid Content of Proteins

By M. T. NADEEM CHAUDHRY and R. A. EVANS,
(Department of Biochemistry and Soil Science,
University College of North Wales, Bangor, Caerns., U.K.)

The technology of γ -irradiation has been developed and applied to foods to prevent loss by insect depredation and by bacterial and fungal attack. The hazards of radiation have led to intensive research applied to the task of showing that irradiated foods are safe to eat. Far less effort has gone into a study of the effect of radiation on the nutrients contained in the foods. There is evidence that radiation can cause change or destruction of free amino acids. Amino acids in proteins are also susceptible, but reports vary as to the nature and extent of the damage. The discrepancies in the literature may result from variations in the conditions of irradiation, such as temperature, oxygen partial pressure, water content, dose and dose rate.

We have investigated the amino acid content of accelerated-freeze-dried egg (Affined Foods Ltd., High Wycombe, Bucks., U.K.) and two batches of wheat gluten (BDH Chemicals Ltd., Poole, Dorset, U.K.). The moisture contents were 1.6, 6 and 10% respectively. These were distributed into cellophane-polythene laminate bags, sealed under 96% N₂, and irradiated at room temperature at dose rates of approx. 1.5 Mrd/h in the Spent Fuel Rod Assembly, Atomic Energy Research Establishment, Harwell, Berks, U.K., for total doses of 0.0, 0.5, 2.5 and 5.0 Mrd, and, for the second batch of gluten, 10 Mrd. After irradiation and transport to our laboratory, the samples were stored at -20°C until analysed by hydrolysis and ion-exchange chromatography. In egg the only amino acids significantly damaged were methionine and tryptophan. In gluten tryptophan in both batches, and threonine in batch 1 and methionine in batch 2 were significantly diminished. An apparent effect on aspartic acid, serine, glutamic acid, glycine, leucine, tyrosine