spring (February–April), and local during late spring and summer (May–July), as observed in 1948.

As regards the host-range of the teleutosporic stage, inoculations have been made only within the genus *Gladiolus*. *Gladiolus byzantinus*, *G. communis*, *G. illyricus*, *G. imbrincatus*, *G. segetum*, *G. tristis*, and *G. undulatus* proved to be congenial to this rust. Some plants, however, or some sources of plants, of *G. communis*, *G. illyricus* and *G. segetum*, have reactions which ranged from the hypersensitive type to moderate resistance (reaction 2+). On the other hand, *Gladiolus brenchleyensis* (only one plant gave reaction 4), *G. hybridus* (all varieties except Heinrich Klauzleuter, of which some plants gave reaction 0 to 2), *G. palustris*, *G. primulinus* and *G. psittacinus*, were immune to this rust.

The above results show that *Puccinia Gladioli* Cast. is an Opsisuredinea, with the gametophytic stage on different species of *Valerianella* and the teleutosporic phase on species of *Gladiolus*. *Aecidium Valerianellæ* Biv. cannot be mistaken by *Aecidium Fedia-olitoriæ* Bals and DeNot, which occur on *Valerianella olitoria*, and which Tranzchel (1935) proved to belong to the cycle of *Puccinia cynodontis* Desm., a rust on *Cynodon Dactylon*.

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Chemical State of Radioactive Phosphorus (^{32}P)

NUCLEAR reactions initiated by heavy nucleons involve the transfer of considerable energy from the incident particle to the target nucleus. The amount of energy carried off by the recoiling nucleus is generally sufficient to break chemical bonds, or in irradiated crystalline substances to move the atom to a new site in the lattice. Little information is available about the chemical form in which these recoil atoms come to rest, but useful surveys of previous work have been given by Libby[1], and by Edwards and Davies[2]. A study of the literature shows that the knowledge of chemical behaviour following high-energy particle bombardments is especially lacking, the well-known Szilard–Chalmers effect having been mainly studied with slow neutrons.

I have recently investigated the chemical form in which phosphorus-32 is produced by the fast-neutron reaction on sulphur-32. Pure dry sodium sulphide and thiourea samples enclosed in an argon atmosphere were irradiated in the low-energy pile at the Atomic Energy Research Establishment, Harwell. Each sample was then opened in an inert atmosphere and treated with air-free water. The radioactivity of the phosphorus-32 was used as a tracer to determine the behaviour of the newly formed phosphorus atoms. Chemical analysis using carriers for active phosphine, active elementary phosphorus and active phosphate demonstrated that nearly all the phosphorus-32 was now present in a form which was carried down with the magnesium ammonium phosphate precipitate. The results indicate that a recoiling phosphorus atom loses one or more electrons and is thus in an oxidized state. In a solid medium this ion is trapped within the lattice as a positive ion, and when released by dissolving the crystal in water it is at once hydrolysed to one of the various oxyphosphorus ions by a mech anism such as, for example,

$$P^+ + 2H_2O \rightarrow H_2PO_2^- + 2H^+.$$

Investigations have also been made into the behaviour of phosphorus-32 formed from sulphur-32 by the irradiation of carbon disulphide and of elementary sulphur, both of which are insoluble in water. In carbon disulphide, about half the active phosphorus behaves as if it were in the elemental form. It is possible that the remainder enters into chemical combination with the target substance, and the formation of phosphorus sulphides seems likely. Sulphur, which after irradiation has to be brought into solution in, say, carbon disulphide before it can be effectively treated with the air-free water, also gives a good yield of elemental phosphorus-32. This may be explained by the release of trapped phosphorus ions by the organic solvent, allowing them to be discharged before they can become hydrolysed.

Govaerts has reported[3] that more than half the phosphorus-32 produced in neutron-irradiated carbon disulphide can be collected on a positively charged electrode, but no chemical evidence for the existence of a negative ion has so far been obtained.

Further work is in progress, and it is hoped that a full account will be published later.

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[1] Libby, W. F., *J. Amer. Chem. Soc.*, **69**, 2523 (1947).
[2] Edwards, R. R., and Davies, T. H., *Nucleonics*, **2**, No. 6, 44 (1948).
[3] Govaerts, J., *J. Chim. Phys.*, **36**, 130 (1939).

An Inert Gas Compound

IN clathrate compounds, one molecular component forms an enclosing structure trapping the second component, for which it need have little attraction. From a consideration of their properties it was suggested[1] that such a compound of an inert gas and quinol might be formed by crystallization of a solution containing quinol and saturated with the inert gas at high pressure. Experiments have now been carried out to test this.

0·7 gm. quinol and 60 c.c. benzene were contained in a stainless steel pressure-vessel. Air was removed by pumping, and there were several further pumpings after admission of argon. The pressure of argon, which was spectroscopically pure, was then raised to 20 atmospheres. The temperature of the solution, initially at 30° C., was raised to 87·5° C., and the vessel was allowed to cool at an average rate of 1° C. per 3 hours to 19·2° C.

Since most crystals of quinol give off a certain amount of gas when dissolved in water, the product was examined as follows. It was placed in a bulb connected to a high-vacuum system; the bulb was also connected to a small water reservoir. The water was first degassed, and then frozen to liquid oxygen temperature. The quinol crystals were degassed for half an hour, the ice was allowed to melt and the resulting water transferred to the bulb containing the crystals. There was a large evolution of gas, and when a small quantity of this was examined in a discharge tube, it gave a discharge identical with that obtained from the cylinder argon.