in some instances a supply of medicines to allow the patient to treat any minor intercurrent illness may be provided privately at relatively little cost. All these precautions should ensure minimal inconvenience while on holiday abroad, and avoid additional expenses owing to inadequate medical insurance cover.

The medico-legal information in this article was supplied by the Medical Defence Union and their solicitors through reports from lawyers in each country concerned, and I am grateful for their help and comments. The facts relating to medical insurance were obtained from several sources, including Airworld Insurance Brokers, Automobile Association, British Insurance Association, British United Provident Association, General Accident, Medical Insurance Agency, P. & O. Lines, Royal Exchange Assurance, and Yorkshire Insurance Agency, and I gratefully acknowledge their help and comments. The British Medical Association, Department of Health and Social Security, and Home Office provided information and general opinions.

Finally, I wish to thank Mr. J. D. Cronin, Chief Pharmacist, for information, and Professor R. Kilpatrick, Professor D. S. Munro, and Dr. A. J. Smith in this department for their criticism of the manuscript.

[1] British doctors and any other individual are not entitled to take narcotics —for example, morphine—abroad. It is unlawful under Section 10 of the Dangerous Drugs Act 1965 to import or export substances in Part I of the Schedule to this Act (excluding preparations in Part II—for example, kaolin and morphine mixture, *B.P.C.*) except under licence granted by the Home Secretary. In practice import/export licences are generally issued only for commercial transactions. It is unlikely that other countries would approve temporary import since they abide by the International Narcotics Conventions. Moreover, it must be appreciated that medical practitioners do not have an international authority to possess these drugs; under national laws each country authorizes such posession only by medical practitioners entitled to practise medicine in that country. A doctor registered by the General Medical Council is generally authorized within the United Kingdom to possess any of the drugs in Part I of the Schedule to the above-mentioned Act. The Channel Islands and the Isle of Man have separate legislation in respect of the drugs. The degree of control, if any, over drugs not subject to the International Narcotics Conventions varies from country to country. So far as the United Kingdom is concerned, the *import* of amphetamines and other substances controlled under the Drugs (Prevention of Misuse) Act 1964 is also prohibited under Section 5 of that Act except under licence granted by the Home Secretary. The possession of amphetamine and amphetamine-like substances by patients travelling abroad may infringe similar legislation in countries visited, and though their doctor may provide a letter or other document indicating that they have been prescribed for a particular medical reason, such letters have no legal authority.

Other substances, such as antibiotics, may be restricted in individual countries, but a common-sense attitude is adopted if these are in reasonable quantities for personal use of the individual.

Radium Vita Emanator—an Unusual Potential Radiation Hazard

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Thirty years or more ago the drinking of weak radioactive solutions was recommended for a multitude of unrelated disorders (Fig. 1). The benefits claimed by the vendors of such solutions were greatly exaggerated, and at the same time we now have a more acute appreciation of the potential hazards of the ingestion of radioactive substances. It was doubtful if the radioactive content of these wares was always as high as was advertised, but even so one cannot but speculate about the effect on the radium body-burden of sipping daily "half a wine-glass full of Radium Water—Good for Children and Adults." We were recently given the opportunity of examining a device for the home manufacture of radon water. The apparatus was discovered by a member of the public in a trunk underneath her mother's bed after her death from "Paget's disease." It had probably been there for at least 20 years. Her father had died previously from "cancer of the liver"; for several years it had been his practice to drink at least one glass of water from the device daily. In this instance we were able to show that its radioactive output was indeed as high as was claimed by the manufacturers, and it became of interest to consider the radioactive hazards in the light of present-day standards of radiological safety.

The Radium Vita Emanator (Fig. 2) was on sale to the public in the 1930s. It contained a radium source with arrangements for collecting the evolved radon in solution, and the makers claimed, and recommended as the optimum dosage, a daily output of 10 μCi (expressed in the more imposing style of "10,000 millimicrocuries"). The main features of its internal construction are shown in Fig. 3. The lower chamber is an enclosed reservoir of about 160-ml. capacity, which normally remains filled with water. A radium source in the form of small pellets is contained in a metal cage attached to the roof of the reservoir. To use the apparatus the upper chamber is first filled with fresh water. When the valve is opened this water displaces the contents of the lower chamber through the spout into a drinking-glass. The displaced water contains in solution the radon evolved since the last time of use. The valve is closed after use, preventing the further escape of radon from the lower reservoir.

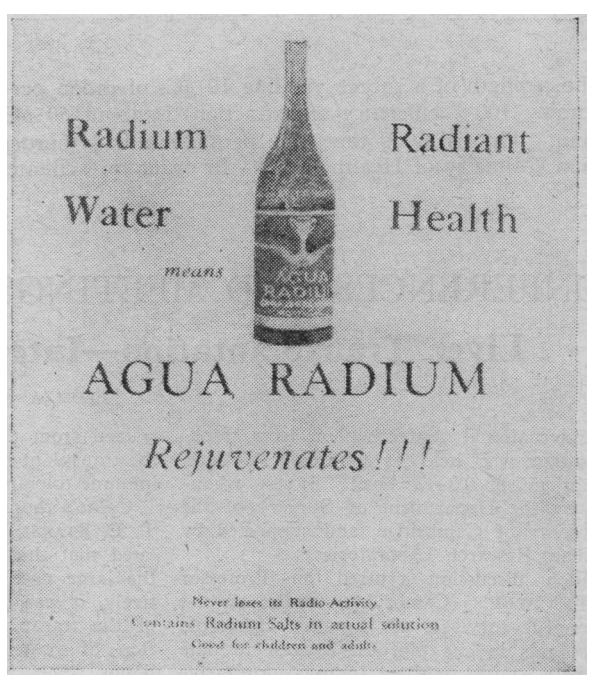

FIG. 1.—One of the many varieties of "radium water" on sale to the public in the 1920s and 1930s. It was proudly claimed by the vendors that "its radioactivity is due not only to the emanation of Radium but also to the presence of salts of dissolved Radium." Among many other recommendations it was stated that "if mixed with milk it makes it more digestive for all children and invalids."

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A study of radon ingestion by Hursh, Morken, Davis, and Lovaas (1965) shows that the organ receiving the highest dose is the stomach. The calculations of Hems (1966) indicate that a daily intake of 10 μCi as recommended by the Radium Vita firm would result in an annual *x*-ray equivalent dose to the dividing cells of the gastric epithelium of 800 rem. In comparison, the recommendations of the International Commission on Radiological Protection (1959) permit a maximum of 0·5 rem/year for the general population, or 1·5 rem/year for a small group of individuals.

FIG. 2.

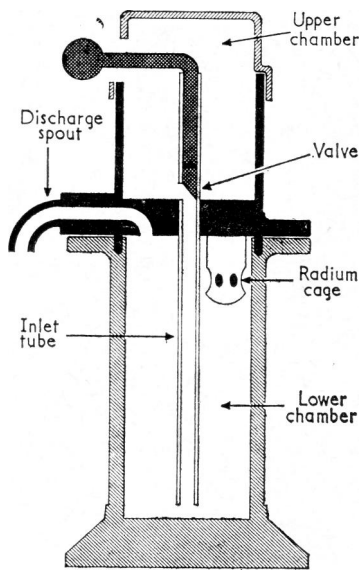

FIG. 3

FIG. 2.—The Radium Vita Emanator. FIG. 3.—Sectional diagram of the Radium Vita Emanator. The top chamber can be filled with water after taking off the loosely fitted cover. This water runs into the lower chamber when the valve is opened, displacing any water that is already present in the lower chamber. The fresh water is allowed to stand in the lower chamber in contact with the radium cage, where it dissolves radon evolved from the radium pellets.

The strength of a source yielding 10 μCi of radon per day (assuming 100% efficiency of extraction) is about 60 μCi of radium. This is 1,000 times the permissible body-burden of radium (Ministry of Health, 1964). In order to facilitate the evolution of radon the radium source of the Emanator is necessarily in a finely dispersed state, so that the risk of release of radium salt into the solution seems appreciable. The escape in this way of as little as 0·1% of the radium present would constitute a serious hazard by present-day standards.

On examination of the device that came into our hands the lower reservoir was found filled with water. The valve was fixed in the closed position by corrosion, indicating that the apparatus had not been used for some considerable time. The measured activity of the radium source was 90 μCi. The radon content of the water was 23 μCi, which is only one-quarter of the equilibrium amount, but possibly some radon may have been lost to the atmosphere during dismantling of the apparatus. The source pellets appeared as if coated by lime from hard water, which also may have prevented free evolution of radon.

In addition to radon, the water removed from the device contained 1 μCi of long-lived activity, identified by gamma-spectroscopy as radium, and the dried-off casing of the lower reservoir showed a long-lived activity of 2·3 μCi. It thus appeared that over 3 μCi. had become detached from the main source and might well have been ingested had the apparatus remained in use. This is 50 times the permissible body-burden of radium.

The firm that manufactured this apparatus (Radium Vita Limited) was formed in 1933 and dissolved in 1954. But as it is possible that similar devices are still in existence, this note has been written in order to draw attention to the potential hazards of long-term ingestion of radon solution and, more seriously, of radium salts, and to recommend that any examples found should be entrusted to a competent organization for safe disposal.

We are grateful to Mrs. M. Chilson for allowing us to examine the Radium Vita Emanator, to Miss Walker for her help with the illustrations, and to Mr. E. Lawrence, the Radiochemical Centre, Amersham, for his advice.

REFERENCES

Hems, G. (1966). *International Journal of Air and Water Pollution*, **10**, 769.
Hursh, J. B., Morken, D. A., Davis, T. P., and Lovaas, A. (1965). *Health Physics*, **11**, 465.
International Commission on Radiological Protection (1959). *Report on Permissible Dose for Internal Radiation: Recommendations of Committee II*, p. 20. London, Pergamon Press.
Ministry of Health (1964). *Code of Practice for the Protection of Persons against Ionising Radiations Arising from Medical and Dental Use*, p. 96. London, H.M.S.O.

CONFERENCES AND MEETINGS

Liver Transplantation—International Conference at Cambridge

[FROM A SPECIAL CORRESPONDENT]

An international conference on liver transplantation was held at Churchill College, Cambridge, on 10–12 April. It was organized by the Department of Surgery of the University of Cambridge, and supported by Beecham Research Laboratories.

Much discussion centred on Professor R. Y. CALNE'S (Cambridge) studies on the prolonged survival of hepatic orthotopic transplants in the pig, the longest to date being 14 months without immunosuppressive therapy. Rejection appeared to be a mild process, and transplantation of the liver along with either skin, kidney, or heart led to longer survival of these organs. Similar protection was produced by a fraction extracted from the liver. He suggested that the transplant led to the induction of specific immune tolerance.

Calne's thesis was questioned by Professor T. E. STARZL (Denver, U.S.A.), who postulated that this protection was a function of the large dose of antigen given. Alternatively, it was due to the synthetic functions of the transplanted liver, with the production of protein substances specific to the donor liver which altered the immune response of the recipient. In man group-specific complement and certain globulins of the donor phenotype became identifiable in the recipient's blood after hepatic transplantation.

Extracorporeal Perfusion

Dr. W. V. MCDERMOTT (Boston, U.S.A.) had also found that following the treatment of patients with acute hepatic coma by an isolated pig's liver perfusion, a form of extracorporeal xenograft, porcine albumin and globulins appeared in the blood of treated patients. Nevertheless, Professor H. GARNIER (Paris) had observed typical rejection in the pig, while Dr. J. TERBLANCHE (Cape Town) had found more rejection in Cape Town pigs than he had previously observed at Bristol.

Professor Starzl also reported that in the dog rejection of the liver was also less definite than that of the kidney. In some animals