with environmental carcinogens; furthermore, the skin has been universally used as a test system for tumour induction in laboratory animals. Nevertheless, many clinical and experimental aspects of skin carcinogenesis are still obscure.

The incidence of squamous cancer of the skin in man is difficult to determine. Many lesions are curable and deaths are correspondingly few. On the other hand, death rates are the only reliable figures available on a world-wide basis and, despite their obvious limitations, they provide valuable information. Striking variations are seen which appear to reflect aetiological factors. In particular, they indicate that the groups mainly at risk are pale-skinned Caucasians who are exposed to large amounts of sunlight in countries such as Australia, New Zealand and South Africa. The operation of additional ethnic factors is suggested by the pronounced susceptibility of Celtic immigrants to these countries; a high incidence of skin cancers is also found in the indigenous population of Ireland. Heavily-pigmented races are apparently insensitive to the tumour inducing effects of intense sunlight, and skin cancers in these individuals have a different aetiology (v.i.). Other environmental causes of squamous cancer of the skin include polycyclic hydrocarbons (e.g. occurring in coal tar, creosote and mineral oils), arsenic and irradiation. Most of the tumours induced by these agents are characterized by long latent periods (> 20 years) though the skin cancers following irradiation usually appear after a considerably shorter time interval, sometimes approaching that for tumours developing in individuals with xeroderma pigmentosa. Mineral oils continue to provide a carcinogenic hazard in some industrial processes; a recent example is provided by workers in the jute industry where prolonged exposure to mineral oils has been associated with an increased incidence of squamous cancers and premalignant skin changes. The carcinogenicity of such mineral oils has been confirmed by skin painting experiments in mice, showing that the oil under test acts both as a complete carcinogen and as a co-carcinogen promoting the effects of a small initiating dose of DMBA. Skin cancers associated with chronic trauma—sinuses, ulcers and scars—are rare in the United Kingdom but these antecedent lesions are very common in pigmented races who are not susceptible to sunlight; the Ugandan Africans provide a striking example.

The role of host factors in the development of skin cancers has been investigated, particularly in relation to immune competence. Studies on skin carcinogenesis with polycyclic hydrocarbons in neonatally thymectomized mice have shown that immune deficiency may potentiate certain aspects of the growth of skin tumours; several of the experimental findings are, however, still open to dispute. The basis for regression of carcinogen induced skin papillomata is, for instance, uncertain and it seems likely that both immunological and non-immunological factors may be involved. There is a little evidence that chronic immune suppression in man may predispose to the development of squamous carcinomata of the skin. Information on immunological changes in patients with established squamous carcinomata of the skin is scanty but it seems probable that specifically cytotoxic lymphocytes may be demonstrated from such patients in vitro.

CANCER OF THE GASTRO-INTESTINAL TRACT; ENVIRONMENTAL FACTORS IN ALimentary CANCER. C. R. Gillis. Department of Epidemiology and Preventive Medicine, University of Glasgow.

The variation in the incidence and prevalence of alimentary cancer throughout the world is such that it must be considered primarily as a disease of the environment. Scotland has some of the highest mortality rates for cancer of the oesophagus, intestine and rectum when compared with Europe, North America and Japan. With the sole exception of cancer of the oesophagus, Scotland has considerably higher mortality for cancer of the stomach, large intestine, colon and rectum for both sexes when compared to the rest of the United Kingdom. A review of the literature suggests a variety of environmental factors, such as diet, social conditions, atmospheric pollution and occupation, which might be implicated in the aetiology of alimentary cancer. So far, analysis of standardized incidence data for the 5 Scottish Hospital Regions indicates that the pattern of the various cancers of the alimentary tract shows little consistent geographical variation. However, cancer of the colon and rectum appeared to be signifi-
cantly commoner in the Eastern and North Eastern Regions in women only.

In view of the possible importance of the role of C.E.A. in relation to cancer of the colon, the incidence of this cancer was examined with relation to parity. Preliminary results suggest that parous and non-parous women exhibit a different pattern of mortality for cancer of the colon and rectum with regard to age.

Studies have been carried out of the accuracy of cancer registration and mortality data and have indicated the degree of validity of the regional differences mentioned with regard to site of the disease and place of occurrence.

Recently there has been a suggestion that oesophageal warts predispose to several forms of alimentary cancer in cattle, particularly where they consume bracken. A scheme for the investigation of this hypothesis with regard to alimentary cancer in humans is being carried out in Ayrshire, by searching for clusters, by time, space, occupation and soil content. A review of the literature confirms the importance of these factors and also supports the possibility of a virus aetiology.

Apart from the tentative results discussed, these investigations have underlined the need for a proper national cancer intelligence system based on a scheme for record linkage, and it is suggested that local Cancer Registration Bureaux might act as epidemiological reference centres for cancer control, especially in the emergent oncolgical centres. This will be exemplified from the activities of the West of Scotland Oncological Organization.

OESOPHAGEAL AND STOMACH CANCER IN CATTLE; A CANDIDATE VIRAL AND CARCINOGEN MODEL SYSTEM AND ITS POSSIBLE RELEVANCE TO MAN. W. F. H. JARRETT. University of Glasgow.

Several areas of high incidence of oesophageal and stomach cancer in cattle have been found in the last few years; these are in Kenya, Turkey and Brazil. We have now found a very high incidence of the disease in West and North Scotland. In Turkey and Brazil bracken fern has been incriminated as the source of carcinogen. The latter is a radiomimetic poison which can cause outbreaks of acute and frequently lethal disease in cattle. Experimentally, cattle have to be fed bracken for over a year before tumours arise. In Turkey the disease is commonest in animals between 12 and 20 years of age, which are constantly exposed to dried bracken as bedding. The active molecule is transmissible via the milk.

There is a reported high human incidence of gastric cancer in West Wales and West Ireland, but at the moment comparable figures are not available for Western Scotland. We have recently studied 32 cattle cases, all from areas where bracken occurs on the grazing; we have found no cases in other areas. There was a constant association with papillomata caused by the papova group virus. All of the cases studied in detail had coincident viral papillomata. The carcinoma sites were identical with the common papilloma sites. Cases were found in which there was direct transformation to malignancy occurring at the base of virus-containing papillomata. The age range was from 2 to 13 years. Studies to date have indicated that the malignancy occurs in farms which have previously experienced outbreaks of acute bracken poisoning. In the area studied most cases of acute bracken poisoning are associated with a short exposure to eating bracken in the early part of July. Half of the carcinoma cases became clinically evident in the months of February to April. It is possible that this represents the latent period. It is possibly also true that continued long exposure to the carcinogen is not required. It is thought possible that transformation to malignancy is taking place in virus-containing cells; these may or may not be in papillomata. There is also a high incidence of transitional carcinoma of the bladder in these areas. We are attempting to elucidate the causal relationships by combined infection of virus and exposure to purified carcinogen and to bracken in food. An attempt is being made by molecular hybridization to demonstrate viral genome in the malignant cells and in other non-transformed cells of the alimentary canal.

We have found that the method of keeping cattle in these areas is that one or 2 milk cows are allowed to graze with the larger numbers of the more common beef animals. This is a relatively unusual situation and means that milk is being ingested locally which will certainly contain carcinogen. An investigation is in progress to study any possible relationship with alimentary carcinoma in the human.