3. Classification and Nomenclature.—Classification and nomenclature are closely related. The names of tumours should naturally be based on orderly subdivisions or classes and should be defined as far as possible by those names. This is a great saving to the memory, and might easily follow the method of the biological sciences: with families, genera, species and varieties. We may still adopt the principles laid down nearly a hundred years ago by Virchow and his predecessors, which has been followed with much consistency ever since. They were based on histology and embryology and received baptismal authority in Virchow’s (1855) phrase, *omnis cellula a cellula*, and to some extent with the important addition, *ejusdem naturae* (Bard, 1886).

Primary nomenclature for everyday use would be of genus-species type on a strictly binomial system (Linnaean system). A rather strict adherence to such a system is observed by botanists, zoologists, and bacteriologists, and it is undoubtedly a good system if for no other reason than its uniformity. Its application to tumours should be even more strict than in the biological sciences, for there is little else required than a cell or tissue basis for species naming, and the number of species is comparatively small. Mallory (1914) put them as about fifteen. Supplementary description and, when possible, compound description such as fibroadenoma, neurofibroma should be avoided, and the genus or species of the tumour restricted to the essential, answering in the name itself not only the question of what the tumour is (*quid sit*?), but also what sort of thing it is (*quale sit*?).

We have begun here with nomenclature before classification, and I may refer to tentative proposals which I submitted (Harvey and Hamilton, 1930) for certain names. These proposals replaced the names of carcinoma and sarcoma by the termination -blastoma, leaving that of -cytoma for the corresponding benign types; fibroblastoma was a fibrosarcoma and fibrocytoma the simple fibroma. Mallory had used the termination -blastoma only. One or two anomalies of naming deserve special reference, and I should make a plea here for the restriction of the termination -oma to tumour growth. It is a matter of regret, I think, to see terms like tuberculoma, syphiloma and amœboma coming into use. The procedure seems to me a reversion to the old and unspecific use of the word “tumor” as simple swelling, while a name like “granuloma” is really misleading; an
older name, indeed, "phlogoma," with its reminder of "phlogiston" might claim priority over granuloma. I doubt if haematoma and atheroma could be discarded, but cholesteatoma and xanthoma could easily be dispensed with. It is obvious, too, that an eponymous nomenclature would have no place in this system. Such tumour namings, at least, could only be admissible as temporary expedients; they are exemplified in the use of names such as Wilms' tumour, Grawitz's tumour and Ewing's tumour. A name, for example, such as Pick's disease is meaningless, if only that there were several Picks and several corresponding diseases. We shall see, in considering the principles of classification of disease as applied to tumours that there is no objection to the introduction of naming by cell, tissue or locality and to their elastic use, but such namings must still be on an unmixed basis. Group, variety or type subdivision may give us names or epithets of useful application such as histiocytic and lymphoblastic, even if we do not adopt the generic terms of histiocytoma and lymphoblastoma. Now I should beg of you not to dismiss this argument as mere word-spinning or exercise of pen and ink. The whole idea of the argument is insistence on precision in describing cancer, and it is not extravagant to maintain that naming should be precise. The difficulty of naming must have presented itself to every practising pathologist. You and I are identified to a large extent by our names, usually by binomials. The system I advocate, therefore, is scarcely to be regarded as only a new set of labels of an arbitrary and upsetting character. We should not say with the Blimp, "This thing is new, take it away," nor yet, "This thing is old, it must be wrong." It would be necessary, however, to recognise that any change in the naming of tumours should be gradual and be adopted by general consent, with intent to make diagnosis, and description more efficient and precise. The more nearly the naming defined the object the easier would such a change become.

Classification is another subject for discussion in the diagnosis of cancer. I still find that the principles of logical classification in pathology laid down by C. W. Cathcart in 1896 are as valid and necessary to-day as they were when issued, and nearly as often still transgressed. The principles were merely well-known canons of logic, and are set out as: (1) the constituent species must exclude each other; (2) the constituent species must be equal when added together to the genus; (3) the division must be founded on one principle or basis. It is the first and third of these rules which are ignored in many medical classifications. The classes into which cancers are subdivided, regarded as species, should be mutually exclusive and the basis of classification used within groups, genera, species, and types should be one, not manifold. The bases commonly used for classification of disease are reducible to three—locality, result and cause. It is the mixture of these bases which must be avoided if the classification is to be scientific, logical and understandable by the student or the
practitioner. In the case of cancer, with a still unknown causation, locality and result are the only two left, and are very apt to be mixed. An example, not wholly fictitious, of the small section of malignant epithelial tumours of the kidney, which includes the duct with the organ, might be: (1) adenocarcinoma, (2) hypernephroma, (3) embryoma, (4) squamous epithelioma. Here we could disentangle the classification to give a satisfying dichotomy, but as it stands it is mixed and includes as bases—cell, tissue, organ and embryology. Recent classification systems largely avoid the error. Classification of cancers, however, is a difficult matter. A use of the word “other” to gather up the unclassified tumours into the universe of genus or species is both logical and legitimate. It has been utilised in the recent Medical Research Council Classification of Diseases (1944).

4. Statistics.—The mention of statistics may conjure up a vision of irksome entries and returns, or even of forms in triplicate. It is very easy to get used to these, and they represent, as a rule, some saving of labour for somebody. They can be, and often are, constructed to save labour of writing and to require no more than a tick or stroke to give the necessary information (Harvey, 1929), e.g. married: √, single: ; male, female. Punch systems are now extensively used for records. As a mode of record I have a long-founded preference for the use of square compartments, and number entries with code indices for their interpretation. But apart from such considerations as economy of time and labour, it should be regarded as a contribution to science and a community service to furnish written detail of the main facts of a case to the pathologist engaged on the diagnosis of cancer, just as it becomes in turn the duty of the pathologist to make an appropriate statistical record of the data. Most of all, I think, should a careful record, or as careful a record as possible, be made of the sequel in a cancer case. It is the chief check on the correctness of the diagnosis and is the concern of pathologist, radiologist and surgeon alike. How often the pathologist finds that he can get no record of the outcome of a case which he considers scientifically important, or which has been subject of disagreement, or in which he is personally interested. The follow-up is perhaps a burden. It is fortunately realised now how important a datum this is, and many hospitals have established an assiduous inquiry system. I put up the plea, therefore, for submission of full essential data in all cases to the pathologist and for close attention to and record of sequelae. I should hesitate to put forward any suggestion for increasing the burden of the student, but it seems to me that it would not be out of place that he should receive some instruction in the modes of presentation of case data in statistical form, such as the use of the frequency distribution, dispersion about the mean and its measure the standard deviation, the mean and the mode, the statistical significance of a difference, and finally the method of setting out a correlation coefficient table or table of double entry. The medical man is occupied, in making a diagnosis,
in estimating a probability. It has become more and more obvious to me, in practice, that this aspect of diagnosis as a probability, the chance of occurrence, is not sufficiently realised and requires to be emphasised.

The use of the diagnostic data which he has collected will sooner or later present itself to the pathologist. It does indeed present itself to him consciously or subconsciously in all his judgments. I should say that perhaps the biggest pitfall in this utilisation is the entry of selection into the question. The use of the word "selection" has a slightly different connotation to the statistician than to others. The statistician has always to be on the look-out for selection, unconscious usually, but representing the factor which may be operative in a given deduction. Hospital statistics, autopsy statistics, experimental and laboratory statistics, radiological and surgical statistics are all highly selected and must be examined carefully on this count. To take a very crude example, it would not follow because I diagnose bronchogenic carcinoma or deal with the causation of sterility most frequently from Newcastle, basal cell carcinoma from Kansas City, U.S.A., tumours of the brain and breast from Edinburgh, that these are necessarily attached to these localities in a geographical, topographical or population sense. Selection, therefore, militates to a very great extent against the usefulness of deductions even from large data, which may not apply to any real cross section of the general population. The duty of collection and record of cancer statistical data will devolve, as a service to the community and to science, first upon the general practitioner. It is he who sees the little lumps, that are so important. Again, it should not be the attitude of the surgeon that the follow-up is not his concern even if he is satisfied that, operatively, he has done his best for his patient. Medicine, it must be contended, is as much, or even more, a science than an art. The pathologist should not complain of routine duties. Routine material is just about the best raw material for research, and especially statistical research, at least in relation to the human being. Many of the secrets of pathology are to be sought in the daily presenting specimen. We still need to have much diagnostic, microscopic light shed on questions of benign and malignant character, radioresistance, radiosensitivity, alteration of normality with age (geriatrics), etc. The daily specimen regularly poses these questions, and the answers, if obtainable, are worth a systematic statistical record. The follow-up of cases and the regular transference of the information to the pathologist will help to provide answers to many such questions. The pathologist must be incorporated, with the clinician and the radiologist, as one member of a scientific body and not left to pursue his research alone.

The practical application of methods of statistical approach to cancer and its problems merits some attention. Most of us have at one time or another tried to bring statistical proof for, say, some diagnosis or treatment. I have now for a long time advocated the
strict "alternate case" method of approach and have been variously called by colleagues or fellow-workers—inhumane, procrustean, and so on. I mean, too, by the alternate case method a strict procedure, not that of comparison with previous results, by alternative hospitals, wards or individuals, but the use of one and the same population. One of the opprobrious epithets directed to that procedure is the word "experiment"—human experimentation. I always myself use the word "trial" instead of "experiment," and I contend that trial of rival methods with some prospect of arrival at clarity is essentially both humane and scientific. At all costs one must avoid, as I have already said, the element of selection of our cases: the selection of those suitable for our special treatment, the primary sorting out of the operable from the inoperable, the separation of those cases which can be usefully treated from those that would be—in the opinion of the operator—wastefully treated. At least if, occasionally in ordinary common-sense, we must adopt such a degree of selection, it ought to be carefully sought out and placed on record. This, then, is an aspect of the statistical investigation of cancer which must be "described" to student, practitioner, specialist and general public. Prejudice has to be overcome to so-called, wrongly called, "experiment."

III. Description

1. Descriptive Method.—Description of cancer implies communication of verdict or views to another: to the pathologist by clinician and vice versa, to the student, scientific society and general public. I may take in the first instance that with which I am chiefly engaged, the description in report of the microscopic appearances of freshly operated-on material. The principles involved in such a report are:

(1) It should be understandable; it should give, if possible, at least a diagnosis and in ordinary language. At the same time I feel it is necessary to insist that there are occasions when the clinician should be content with the answer from the pathologist of "I do not know," or allow him without demur to reverse his previous conclusion. A remark made to me in correspondence by a noted radio-physicist came in substance to this—pathologists, radiologists and clinicians seem either to use the same terms for different things or different terms for the same things. That makes one realise the necessity of frequent combined conferences.* (2) It should have scientific as well as clinical value. (3) An ideal report on cancer should contain diagnosis,

* I look on the differentiated cell in tumours as finished and of no consequence for the radiologist except as possibly obstruction to his beam; I regard the real radio-sensitive and real tumour cell, for radiologist and surgeon alike as the embryonic stem cell; I should think that in this sense all tumours are radiosensitive, and that obliteration of this cell by burning or killing is the essence of radiology, and that its removal is the basis of surgical intervention. In such a view, which is not new, I believe also lies the morphological key to tumour growth and to the nebulous distinction in growth and causation between benign and malignant tumours.
differential diagnosis, contradiagnosis and negations (such as, say, absence of tuberculous or syphilitic infection), with the inclusion for scientific record even of the apparently non-significant appearances. (4) I prefer the syllogistic method of reporting, only, of course, with more than the simple major and minor premises. (5) No rubber-stamp reporting is admissible. (6) Additional remarks may be desirable: on possible degree of malignancy, radiosensitivity, complicating phenomena such as sepsis, operative clearance of the tumour area, and even the gentlest of reminders that information has not been supplied on questions such as: What was the Wassermann reaction, and what did the blood examination show? In specially interesting cases I should add, on occasion in my report, references to the literature. Most of this applies, of course, to laboratory reporting from a distance, as the best means of establishing co-operative contact with the clinicians. As far as I can see, moreover, cancer reporting in the future will require centralisation rather than decentralisation, if the benefits of the Cancer Act are to be as widely diffused as possible. There should be no difficulty about devising a centralised laboratory system which provides for frequent visitation, but outward as well as inward.

I have advocated, for reporting, a syllogistic or deductive approach to the verdict, the approach from base to apex of the diagnostic cone. It may be more artistic to approach the conclusion by steps which are plainly factual and not tendentious. We are not, however, concerned wholly with formal presentation, and there is much to be said for commencing the report with the diagnosis. I remember, for example, how a surgeon once described to me the way his patient's face lit up (the patient was a doctor) on hearing the first sentence of the report—There is "no evidence of malignancy." That, of course, was statement of conclusion. This may then be followed by relative detail, scientific record and unexplained features.

Description of cancer I have said is not merely from pathologist to clinician, but, in reverse and initially, from clinician to pathologist. It needs emphasis, too, that the data of age, sex, size, site and symptoms of tumour growth, with many others, are all of the utmost use to the pathologist if his report is to be a truly reasoned one; otherwise it is apt to be bare.

There is one method of description for which I have long had partiality and used for my own notes, but have not dared to put into official use. It appealed to me long ago and made use of what was then the Bertillon system of identification of criminals, soon to be replaced by finger print identification. In this Bertillon system the use of qualifying phrases of indefinite type was discouraged; it was not permissible to use terms like "slight," "rather," "somewhat," "fairly," "tendency towards," "suggestion of," and so on. The qualification of an adjective was by bracketting, double bracketting and treble bracketting for the diminuendo series and underlining in
the same way for the crescendo series. Thus without resort to numerical units, which will always be desirable, size in all its conceivable degrees could be set out by using one or other of the terms: small, medium, and large—((small)); (small); medium; large; large, as seven gradings. Again, three gradings of "congestion" could be set out as: (congestion); congestion; congestion.

2. Teaching and Instruction.—Teaching involves description, and in sequence it is the medical student who receives the first, the expert teaching, and the patient who receives the last, the advisory teaching. The student is the pre-practitioner, and he should be well drilled in the conception of the pre-, or primary, cancerous state. He should be made to realise that cancer diagnosis must be early and that, early cancer being curable, early diagnosis and early action are the best curatives of cancer. The general principles of treatment of cancer by surgery, radiation and chemotherapy require co-ordinated instruction, and so we come naturally to the suggestion of one more burden to the medical curriculum, the lectureship or the professorship of oncology. Perhaps that would be best dealt with as a post-graduation study. The practitioner should realise thoroughly the importance of oncscopy: ὄγκος means mass, bulk, lump, tumour, weight and, metaphorically, difficulty, trouble and dis-ease. It is the general practitioner who will inspect the little lumps, become suspicious and take curative action. With our arrival in sequence already at the practitioner we embark upon the practitioner-patient relationship and—we need not delay the topic—that of propaganda. Opinion seems steadily turning to the necessity of more propaganda directed to the understanding and detection of cancer. My own feeling is decidedly in favour of systematic, periodic examination for the earliest development of cancer and the scrutiny of all tumour-like growths; cancerophobia has been paraded as the bogey. I do not think I should go quite as far as to advocate that every woman over thirty should be taught to examine her own breast not less than every month.

The teaching of the student, who becomes in due course the resident medical officer of a hospital, must include the mode of despatch of cancer material and the type of information to be rendered to the pathologist; that that information should be as full as possible is a fairly safe generalisation. Such full information must not on any account be regarded as creating bias.

Biopsy diagnosis affects the specialist surgeon and he—as a medical student—will, or should, have been taught the importance of obtaining material to a reasonable depth, to include the growing edge as well as the more diagnostic interior lesion, from a well-selected, even if necessarily small, piece of tissue. Particular areas for microscopic examination should be marked before despatch to the laboratory. New hospital residents succeed each other. Printed rules for the despatch of material (Hay, 1945) to the pathologist should be available.
for each new resident. I do not see any such sets of rules given in any appendix in any systematic text-book of pathology that I know. An appendix on biopsy method would be valued and valuable. One other recommendation I should make: Teach your technician, not technique, but diagnosis. The labour will be repaid; it will in time ensure a valuable second opinion.

3. Inheritance.—The inheritance of cancer or a cancer tendency is a subject which is certain to be broached, and the practitioner asked for advice. It is a difficult one, but at least the advice may be reassuring. Much experimental work has been done on cancer inheritance in mice, and quite definite cancer and non-cancer strains have been produced. The method used, however, to produce the strains is of an extremely artificial kind: selection of a particular strain and a brother-sister or parent-child mating. These are calculated to produce recessive gene strains in an almost pure form. Most authorities seem inclined to regard cancerous phenomena in human beings to be dependent on recessive factors in the mendelian sense, which could only, as in mouse cancer strains, be intensified by a combination of inbreeding and selection. Some tumour conditions such as neurofibromatosis may be of the order of dominant characters, but this is probably an exception. In fact, there are few serious defects which are carried by dominant genes. In the human being no concentration of cancer susceptibility comparable to that in these special mouse populations can occur.

Many, if not most, insurance societies appear to ignore a cancer heredity, probably for a very good reason. Cancer is to a very large extent a late-in-life phenomenon, and to that extent of less importance. Possibly the insurance societies know, or at least argue, that cancer in the progeny of cancerous parents may be, in part at least, a spurious correlation due to the fact that the children come of parents with a natural expectation of long life, of living to old age, of living into a cancer age. The children in that case start with the expectation, by inheritance, of living to an old age, which should not be penalised in the insurance premium, even if it does mean ultimate death from cancer. Part of the present day supposed increase of cancer may be, and probably is, due to increased expectation of life.

Contrast now, for the sake of example, another condition, and consider it from the standpoint of gene mutation. Sufferers from xeroderma pigmentosum, one of the inherited skin conditions, usually die of cancer under the age of fifteen years, that is under the reproductive age. The condition ought, then, to disappear altogether by weeding out the carriers of the gene and, as it does not, there is argument here for an independent gene mutation. This weeding out would be complete and prompt if the gene were dominant, but very slow if recessive. Somewhat similar reasoning applies to the non-cancer condition known as erythroblastosis foetalis, with its Rh factor.

In the case of the common cancers according to Haldane (1942),
probably a number of genes are concerned in the production of susceptibility. That would make inheritance of cancer very complicated and, perhaps, quantitative rather than qualitative. From the social and economic point of view a disease which tends to kill at old age is not of the same importance as that which has an earlier age incidence.

In conclusion of this brief reference to inheritance, I may say that too little is known on the inheritance of a cancer disposition in the human being and of the relative rôles of inherited and acquired causation, of nature and nurture, to be dogmatic on the subject.

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