Speir (S. F.)

THE USE OF

THE MICROSCOPE

IN THE

DIFFERENTIAL DIAGNOSIS

—OF—

MORBID GROWTHS,

With a New Method for Determining the Diagnosis, Prognosis and Treatment of

TUMORS AND CANCERS.

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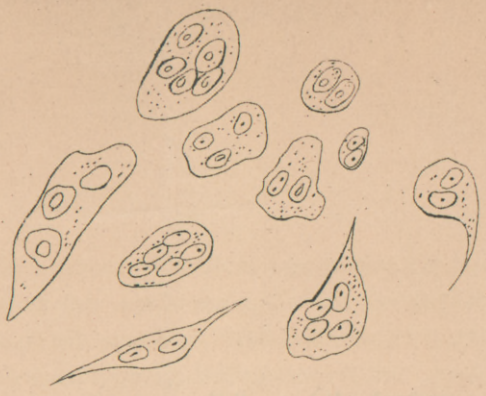

Examples of "compound Cancer cells"

Examples of "Simple Cancer cells" as they are usually represented

Examples of "Simple Cancer cells as described in this paper

Mr. President, Gentlemen, Fellows of the Academy:

THE subject to which I am permitted to invite your attention is—

The Use of the Microscope in the Differential Diagnosis of Morbid Growths; the Characters and Causes of Cancer, with a New Method for Determining the Diagnosis, Prognosis and Treatment of Tumors and Cancers.

IN these days of microscopy, when almost every physician resorts more or less to the use of the microscope as a means of diagnosis, and the pathological resources of the profession are so great that a comprehensive knowledge of morbid growths seems to be within the reach of all, is it not strange that some absolute and definite characteristic has not been attributed to the cells of that growth (cancer) which, before the application of the microscope, had puzzled all observers, and which even now seems to baffle the efforts of practical men to perceive of what real benefit the application of the microscope has been in solving the question of the malignity of morbid growths?

Most surgeons or physicians have little need of the

aid of a microscope to determine a cancer when it is fully developed. The naked eye, and the history of the case, are sufficient to decide the question at once; and the recognition of the "mother cell," or "compound cancer cell," is only looked for to corroborate the preconceived opinion.

That the "compound cancer cell," or poly-nucleated cell, is characteristic of cancer there can be no doubt, but that it is to be found in all cancers is certainly not true: it belongs to a certain stage of development of most cancers. In other stages of growth it is not found, and in its stead we find, as a constant element, a different form of cell, which to me has been sufficient to aid very positively in the diagnosis of cancer by the use of the microscope, as well as to determine the degree of malignity of a given tumor, in its early stage of development.

During the past ten years, my opportunities for pathological observation, and the microscopical study of morbid growths have been considerable, and I feel that it is my duty as well as a pleasure to place upon record a few points which have seemed to me to be of importance in the study of morbid growths.

Having felt the need of something more than the current theories of the day to solve the problems which arise before the practical microscopist in the study of cancer, I have found it necessary to supply the want for myself from the abundant material which has come under my observation; and I have come

to look upon the method which I have endeavored to bring forward in this paper, as one method, at least, if not the best method, for determining the quality of malignant growths.

Few studies tend to show the incompleteness of human knowledge more than that of pathology. Our entire stock of knowledge consists of a few simple facts, the result of observation and experience. Unfortunately, the great truths of pathology are surrounded by so much of theory, that it is difficult at first sight to distinguish the facts from the theories; and the benefit to be derived from the substantial fact is frequently lost. When a theory is put forward, there necessarily comes in to make up the thread a great deal which is not really truth, but which looks so much like it that when loosely stated it serves the purpose of supporting the theory based upon a few facts. And in this, I think, we find the reason why all theories pass away with the appearance of the new truths which are being constantly developed by the army of observers. Most of the theories of cell growth and decay are based upon the same facts; and their apparent difference, as stated by different observers, is to be found in the positive manner and detailed and exact method of stating them. Almost any theory which is based upon a real fact will hold good until its advocates push the arguments necessary to sustain the theory so far as to expose the real and usually small amount

of truth upon which it is based; and then there is a change of doctrine, and another set of arguments, and a different direction is given to the same truth; and we find ourselves supporting an entirely different and sometimes opposite theory, with the same little truth as its groundwork. Thus, with a few facts and several theories, we may be able to persuade ourselves that we are possessed of great knowledge, when, in fact, our knowledge extends no further than the simple fact upon which the theory is based.

I feel that I am in this position in regard to the theory of cancer. The known truth of this disease is so small that it admits of many theories, and medical men have not been wanting to spin them; so that there is but little chance for me to propound a new one, without the risk of doing injustice to the material used as a basis for this paper, which I would rather have appear as a practical contribution. Nevertheless, I find I cannot get through with my subject without the aid of some kind of theory; and the doctrine which accords best with the facts of my experience is a combination of the cell doctrine and the exudation doctrine.

The molecular theory seems to me to be so far out of the reach of our present methods of examination that it is next to impossible to demonstrate what little truth there may be in it. The practical application of this theory is as yet certainly out of the question.

It is probable that there are two methods for the development of morbid growths :—that of exudation, and that of continuous development from pre-existing cellular elements. At all events, these two doctrines will doubtless have each their advocates, from the fact that there is some proof for the existence of each.

The truth will be found to be nearest approached by accepting the two modes of new formation, or two theories :—the continuous cell development, and the exudation theory, in combination.

As nature has provided two ways for the healing of wounds (the union by "first intention—a kind of continuous cell development; and union by granulation—a kind of cell development by exudation), so we find she has two ways of producing new formations. That we can demonstrate the exudation of plastic lymph in some situations, and a subsequent organization of the same, need not hinder us from believing that we may also find in other situations organization produced by direct cell development, without the interposition of an exudation.

The first method we see illustrated in the exudation, on the pleura, and some serous and mucous tissues. Here the irritated tissues, blood-vessels, etc., through the instrumentality of cell action, pour out a liquid, which is used as a basis, afterwards, for the development of cells, which are a continuous development from the pre-existing cells in the surrounding part.

In a similar way we find a clot becoming organized, as it is called, by the surrounding cells of connective tissue, or of the blood vessels using this fibrinous element of the blood as a convenient substance for the development of cell growth—set about by irritation in the part.

This is one of Nature's restorative methods, and is a process of nature to repair either an injury already done to a part (wounds, etc.), or to protect a part from an injury about to occur (such as the effusions, etc.).

Although the exudation theory and the cell doctrine appear to differ greatly, yet, I think, on close examination, they prove to be the same process of cell development, with, in the case of exudation, an additional element in the material used by nature for the transformation. This second process of development is unconnected with inflammation, and is the process by which tubercle, cancer, etc., are formed.

According to this view, every cell must come from a pre-existing cell: there is no such thing as spontaneous generation. The exudation is the pabulum for cell development; but it is prepared by the pre-existing cells in the part or around it. As the bird prepares her nest for the egg and young bird, so the animal cell prepares a nest or pabulum for the development and growth of its own kind.

However much of truth there may be in the exudation theory, one thing concerning it is plain, viz.:

its application to the study of morbid growths is very limited; for, the only means by which we can hope to recognize a difference in the various kinds of exudation are such as are of a chemical nature; they are tedious and unsatisfactory; and, after all, the advocates of the exudation theory themselves resort to the use of cells for their illustrations.

There seems to be little hope, then, of recognizing any very definite and satisfactory characters in the exudations by our present mode of examination; and the cell is, after all, the ultimate element by which we must determine the character of morbid growths.

The object, then, of all microscopic examinations of tumors is, to discover the peculiar kind of cells which compose the specimen under examination. This is readily done; and the profession has already a great accumulation of material of this kind. Certainly, observations of this character have been made in sufficient numbers to establish thoroughly the peculiar varieties of cellular growths. This being done, the only question which remains is:—Have we a specific cancer cell, and is it diagnostic? Can we determine with certainty that one tumor is cancerous and another benign in its nature, by the character of its cells?

This question has not been satisfactorily answered to the minds of most physicians. There is a larger number who doubt the existence of a specific cell, which is necessarily present in all cases of cancer,

than there is of those who believe in its existence. For my own part, I am willing to count myself among those who have a positive and firm conviction of the existence of certain cells, which, when found in morbid growths, are diagnostic of cancer.

I think we have two such cells. One is the "mother cell," or "compound cancer cell," long recognized by authors as the "cancer cell." It is, no doubt, peculiar to cancer; and when we see this cell, there is no longer any doubt that the specimen under consideration is a cancer.

This is easy enough; but then we have tumors which do not present the mother cell, and yet go on to a fatal termination; and the microscopist may have great difficulty in placing the tumor in its proper category. Again, a tumor which at first does not present the mother cell may, in a short time, furnish plenty of them; and, besides, I think that no cancer in its early period presents the mother cell to any considerable extent, and perhaps not at all.

If we are to render the best service to the patient attacked with this disease, we must know early in the case what we have to deal with; for this would influence to a great extent the treatment of a tumor. This cannot be told in the majority of cases, if we rely only upon the presence of the "compound cancer cell."

If this be so, what else, then, is there to aid us in

the diagnosis. I think that what have been called "free nuclei" by authors, in their descriptions of cancer, are the elements upon which we can rely with great certainty, and are in reality as specific cancer cells as the mother cell. I believe this is no nucleus, but a complete cell; and, using the number and arrangement of these cells in a given tumor as a basis for reasoning, I would have no hesitation in pronouncing upon its malignity, as well as the inherent tendency there might be in the growth to affect other parts, or to return after excision.

The peculiar cell to which I refer is found, to a greater or less extent, in all cancers; and in the early as well as in the later stages of their development.

It has for its parent type the connective tissue corpuscle—the embryoplastic cell. It is, doubtless, from this physiological type that all the other cells which compose the body have their origin. It is sparsely scattered about in the tissues of the adult, but it is found in great abundance in the fœtus.

Indeed, it is best studied in the early development of the embryo, where, quickly changing its form, it passes readily into the fusiform caudate, epithelial or fibre cell, etc.

It was after a careful study of these cells and their development in the embryo, that the doctrine of heterology was found to be untenable, as it related to the division of tumors.

I believe that most pathologists have abandoned the use of the term Heterologous, as it was first used to indicate malignity ; and it is now generally restricted in its use to indicate only the abnormal manner in which tumors sometimes arise, viz : such a growth as is at variance with the typical formation of the body. It is thought that by a careful search into the early elements of the tissues, a physiologtcal type has been found for every pathological formation.

Heterology now means an error in the arrangements of the elements composing a tumor as to place or situation.

Homology means an error as regards the quantity of elements in the structure—an hypertrophy.

I desire to use these terms as thus defined—and to add to them another signification, which I hope to make plain as I proceed.

The microscope reveals the earliest form of the embryo as a mass of homogeneous (homologous) cells. The form of the cell is similar to that of the connective tissue corpuscle, or embryoplastic cell. From this type it seems that all the other forms of cells and tissues found in the adult body arise. At certain periods in the growth of the embryo, we find marked changes taking place in the form of the cells ; and, instead of the simple embryoplastic cell, we find elongated cells, fibres and tubes—indeed a heterogeneous (heterologous) mass. And just in proportion to the growth of the fœtus do we find this heteroge-

neity of cells, showing that normal development is dependent upon changes in the cells from a homogeneous to a heterogeous collection.

At one time tumors were divided into heterologous and homologous growths the idea of malignity being attached to heterologous ones and a benign character attributed to the homologous growths.

These terms are good to retain, but their application, as it was formerly understood, must be changed; for what were supposed to be heterologous growths are in reality not so, if considered in the relation of the growth—as a tissue—to the other tissues of the body; and if we restrict the use of the word heterologous to the growth itself, or rather to the tissue from which it has sprung, we then find that the cancer cell is not *heterologous* but *homologous*—that is to say, the tendency of cell development in a cancer is to reproduce cells all of one kind and in a cancer, we find with the microscope that those tumors are the most malignant which are composed of a large number of cells of the same kind, each cell reproducing its own kind, and having no tendency to take part in the support and normal growth of the tissue in which they are found. They have no natural limitation—influencing the cells in the neighboring parts to follow in the morbid process and in the tendency which they have to reproduce cells of a like kind with themselves; and if it were possible for the patient to live long enough. and the process to continue, the

whole structure of the body would become in the end one mass of homologous cells.

That is to say, it would be structureless, in the usual sense of the word ; it would lack that variety of cell development which creates the plasma, the cell, and the fibre—this constituting a healthy tissue.

Thus considered, normal tissue is heterologous, if looked at in reference to the cellular elements alone.

The tendency of all normal tissue is to continue heterologous, and the moment that the tendency to heterologous formation flags, we begin to find cancers or homologous growths take their place. The malignity of a growth is in direct proportion to its homology.

It appears, then, that all the normal tissues of the body have a heterologous structure. Nature seems to form perfect and staple structures upon this plan. Any deviation from this leads to unstable and short-lived structures. The more a tissue approaches homogeneity in its structure, the more it tends to decay and death. The more of heterogeneity there is about a structure, the more stable is its condition, and more perfect its character and function.

In the examination of a given tumor, to determine its character as to malignity, there are two questions to be answered by the microscope.

1st. Is the specimen of tumor heterologous or ho-

mologous, considered in its relations to the original or parent type of the tissue in which it is located?

2d. Is the specimen of cell found npon microscopic examination heterologous or homologous, considered as regards the intimate structure of the tumor itself, in the relation of cell to cell; that is, do the cells in the specimen present any decided variety of form? For example, do they tend to depart from their original cellular form and develop into fibre; or is there an arrest of the usual evolutions of cells which, under normal conditions, would form a definite tissue—a tissue which would be made up of a heterogeneous or heterologous mass of cells; for example, containing a due proportion of embryoplastic, fusiform, caudate and fibre cells? or is it composed of a homogeneous or homologous mass of cells—cells which do not tend to develop into fibre, or present the usual development of the same variety of cell in normal tissue, but to form cell after cell of the same kind, never reaching any higher development than the embryoplastic form —in this sense a homologous cell growth?

The solution of the question of malignity is to be found in the answers which the microscope gives to these questions.

A tumor may be heterologous as considered in its relations to itself as an individual structure, or heterologous in its relations to the other tissues of the body; and in both cases be benign in its character

But a tumor which is heterologous as to the other

tissues, and homologous as to its own cells, is surely malignant.

Again, a tumor which is homologous as to the other tissues and also homologous as to its own cells, is also malignant.

But a growth which is homologous as to the other tissues of the body, and heterologous as to its own elements, is in almost all cases benign.

These are the rules which may be applied to all kinds of tumors; and if the specimens for examination are taken in the stage of actual development of the tumor, and before its retrograde metamorphosis, they will usually be sufficient to determine with great accuracy the quality and degree of malignity of morbid growths.

The microscope has given us a convenient stopping place in the study of morbid growths, in the demonstration of their intimate and elementary structure, pointing out the fact that as a basis they are all composed of cells.

Let us study, then, the character of these cells, and under what circumstances we find them; their quality as regards malignity, and the tendency they have to return after extirpation; as well as their destructive tendency if left in the body.

For the purposes of this paper, morbid growths may be divided into malignant, semi-malignant, and benign.

A malignant growth is one which has an inherent

tendency to destroy the tissues in which it may arise, and to reproduce similar growths in the different textures of the body (even after extirpation), causing cachexia, and, finally, death.

A benign tumor is one whose injurious effects are entirely local, and the existence of which is usually compatible with good general health.

A semi-malignant growth occupies a place between the other two classes; commencing as a benign form, it subsequently assumes a malignant character.

Inasmuch as it has been found that all growths—normal or abnormal—proceed from some kind of development of the connective tissue corpuscle—the embryoplastic cell—it naturally follows that when a previously normal growth (heterologous) becomes cancerous (homologous), it returns to the original type of its parent cell—the connective tissue corpuscle. Therefore, we find the various forms of this cell as the chief elements of morbid growths. This cell seems to be the lowest and most elementary in the whole range of cells.

When in cancers an effort is made at a higher grade of cell development, we find a cell is usually produced which is at variance with the parent type of the tissue in which it is found; for example, cartilage or epithelial cells in the tissue of the uterus, etc.

From this fact, it has been supposed that great irregularity of form was one of the characteristics of cancer cells. This is not necessarily so; but it is

usual to find in tumors which come between the class of pure encephaloid and scirrhus tumors, an admixture of cells; and these cells will present a great variety of form. They are apparently the last efforts of nature to maintain the original tissue as a heterologous structure. In this sense, then, the great variety of cells found in some cancers is an accidental characteristic, which may or may not be present, and should be valued accordingly. Doubtless, industrious observers will hereafter find many varieties of such cells; but I think it matters very little whether they be cells having one spine or two spines—tails or ciliæ—they belong all to this class of aborted cells.

FORMS OF CANCER.

The following are the varieties of cancer in the order of their malignity:

1. Encephaloid Cancer.
2. Scirrhus Cancer.
3. Epithelioma.
4. Enchondroma.

It seems well to retain these standard names, although they do not perfectly express the kind of growth to which they are applied.

They are associated readily, however, with the class of growth to which they belong, and are convenient names on account of our familiarity with them.

Almost all the varieties of pure cancer can be included in one or the other of these primary divisions. Their sub-divisions it is not deemed necessary to enter upon in the limits of this work.

I shall now take up each of these forms of cancer separately, and apply to them the rules which I have proposed in the preceding pages, as follows :

ENCEPHALOID.

Encephaloid must be acknowledged as the type of cancer and malignity.

It is here that the cancer cell may be studied best.

In a pure encephaloid, one finds the two varieties of cancer cell in their perfection. Indeed, the encephaloid tumor is made up of these two varieties of cell. It is very rare that any other element is found to enter into its composition.

Encephaloid, examined according to the rules already laid down, presents the following varieties. It may be

1st. Heterologous as to the other tissues, and homologous as to its own cells. } *Malignant.*

Again—

2d. Homologous as to the other tissues, and homologous as to its own cells. } *Malignant.*

Encephaloid only occurs in these two forms.

When a tumor passes these limits, it must be classed with one of the other forms of growth.

SCIRRHUS.

This comes next in order after encephaloid, and is subject to degenerate into encephaloid. It is a grade higher in the scale of pathological tissues as to structure. It has more of the fibrous element in it, and in the least malignant forms it has some tendency to heterogeneity of cell growth. It is found to vary greatly in the proportion of its ccnstituent. Above it in the scale, we find the different forms of fibrous growths, and below it, the encephaloid.

As to malignity, it may be arranged thus:

I.

Heterologous as to the other tissues, and homologous as to its own cells. } *Malignant.*

II.

Heterologous as to the other tissues, and heterologous as to its own cells. } *Semi-Malignant; approaches fibrous tumor; will probably become Malignant.*

III.

Homologous as to the other tissues, and heterologous as to its own cells. } *A Fibrous Tumor, Benign. Can be removed without return.*

IV.

Homologous as to the other tissues, and homologous as to its own cells. } *Malignant.*

EPITHELIOMA.

The structure of an epithelioma is not composed

always of epithelial cells throughout its entire extent and it is usually only towards the extreme surface that we find an abundance of well-formed epithelial cells.

When an epithelioma is seated upon the skin, it usually extends itself by spreading to the surrounding surface and deeper parts, and is seldom found as a growth or tumor. A kind of ulceration follows this kind of cancer; and the true cancer cells, when they exist in an epithelioma, are to be found below the surface. Epithelioma remains benign so long as there is any heterology of structure as concerns the cellular elements; for example, presenting the connective tissue corpuscles, fusiform cells and epithelial cells together. As soon as the cells considered as parts of the tumor, as a whole (cell to cell), become homologous, then malignity begins. In this way an epithelial growth may become as thoroughly malignant as the worst form of encephaloid. Indeed, the entire face or a whole limb may be destroyed, bones and all, by this form of cancer.

Epithelioma will be malignant or benign according as it is.

I.

Heterologous as to the other tissues and homologous as to its own cells. } *Malignant.*

II.

Homologous as to the other tissues and heterologous as to its own cells. } *Benign.*

III.

Heterologous as to the other tissues and heterologous as to its own cells.	*Semi-Malignant, with tendency to become Malignant.*

IV.

Homologous as to the other tissues and homologous as to its own cells.	*Malignant.*

ENCHONDROMA.

Enchondroma presents the same qualities with regard to malignity as epithelioma. Indeed they are both most frequently benign in their nature.

These and all the other sub-divisions of cancerous growths depend so much upon retrograde changes (homologous changes), in the form of their cellular elements for the malignant type which they sometimes assume, that it is doubtful whether they ought to be classed with the encephaloid or scirrhus forms. Myoma and osteoma, which come next in the scale, are subject to the same degeneration, and might equally well be denominated cancer. A pure epithelioma or enchondroma cannot be malignant, so long as they sustain their structure perfect, as such Enchondroma belongs really to the semi-malignant group, and I have introduced it here more in illustration of the views expressed in this paper than on account of any claims of its own.

I therefore find it necessary to introduce a classification of the divisions and subdivisions of morbid growths, in keeping with the doctrines here set forth,

in order to aid in their practical application. Here it may be asked, What is to be done with tubercle? Is it not a homologous tissue considered as to its own cells? No! And here is just the explanation of the fact, that cancer and tubercle have always been separated by the pathologists. Examined in the early period of its growth, tubercle is really heterologous as to its own cells, and homologous as to the other tissues. That is, it is developed in connective tissue from connective tissue corpuscles, and these cells pass on to a stage of development which is heterologous. It must be classed, then, with the benign growths. This may appear strange to some, but I think, on close examination, it will prove correct. At all events it will not be likely to lead to any confusion, as tubercle is so readily recognized by the peculiar retrograde metamorphosis which its cells undergo.

CLASSIFICATION OF THE SUBDIVISIONS OF MORBID GROWTHS.

Malignant.....	Encephaloid. Scirrhus.
Semi-Malignant	Epithelioma. Myoma. Enchondroma.
Benign..... ..	Glandular tumors, etc., tubercle and some kinds of hypertrophy, etc.

This classification is intended to represent well-defined forms of growth. They may all vary, how-

ever, sooner or later in their course, and may even pass from one into the other.

To be *Malignant*, a growth must be either homologous as to the other tissues, and homologous as to its own cells; or, heterologous as to the other tissues, and homologous as to its own cells.

A *Semi-Malignant* growth is heterologous as to the other tissues, and heterologous as to its own cells.

A Benign growth is homologous as to the other tissues, and heterologous as to its own cells.

I may here add that, to determine the character of a morbid growth or tumor by the aid of the microscope, the specimen of tissue used for examination must be taken from the part of the tumor which is either in its earlier stage of growth or at its height, and which is not undergoing any retrograde metamorphosis. The examination must be carefully made, and several portions from different parts of the same growth must be examined. The cancerous tissue must not be confounded with any of the remaining uormal structure of the part in which the growth may have lodged itself.

When the two varieties of cancer cell exist in the same tumor, they are to be regarded as similar cells, and are not to interfere with the idea of homology; for they are in reality the same, in so far as one is capable of passing into the other, and neither have any tendency to further development—that is, to form fibre, etc. One is the "simple cancer cell,"

and the other the "compound cancer cell." The simple cancer cell is often found alone; but the compound cancer cell is never found without the simple cancer cell being also present. Strictly speaking, therefore, the simple cancer cell is, *par excellence*, the "cancer cell."

PROGNOSIS.

The prognosis of a given tumor will evidently depend upon the diagnosis as established by the plan laid down in the preceding pages. In fact, the prognosis is almost included in the diagnosis; for, if the growth be one of the four classes proposed, the process which has been gone over to place it in its proper category, and determine whether it is benign or malignant, has well nigh solved the question of prognosis. Still, this is to some extent vague, and it will be desirable to specify more particularly the individual species, and determine the prognosis for each.

All tumors are subject to stages of growth, and have a certain course and history which belongs to them as tissues. Thus, a tumor may be found at the time of examination in any of the following conditions:

1st. Condition of Development.

2d. State of Increase.

3d. State of Resolution.

4th. Condition of Abscess, Ulceration, Sloughing or Fatty Degeneration.

5th. It may be Stationary.

These may be called the natural tendencies of tumors, when not interfered with by the surgeon. It will be seen that two of the conditions are processes of nature for getting the removal of the tumor; and two are processes of development and increase. The fifth is a condition of inactivity.

The *first* condition applies to all growths, and is simply the early stage.

The *second* is the natural tendency of all tumors to grow, both by multiplication of their own cells, and by the involvement of surrounding parts.

The *third* is a condition which is seldom met with in any of the morbid growths; and in some, never.

The *fourth* is sometimes a process of cure, and at other times of destruction, and rarely of propagation.

The *fifth* is a condition to which all are liable, except encephaloid.

Now, we can arrive at a tolerably definite conclusion as to the prognosis in a given case, by finding out which of these conditions is the most likely to follow on in the natural order and tendency of the growth. Thus, it is plain that a tumor whose natural tendency is to resolve, or which has a history or record as a class to undergo resolution at times, and under certain favorable conditions would be entitled to a favorable prognosis, and those growths among which the process of resolution is seldom or never met with, would have an unfavorable prognosis; and

the most unfavorable or fatal tumors would be those whose natural course included the 1st, 2d and 4th conditions. In this way, we find that encephaloid has a tendency to increase, and no inclination to resolve, and usually goes on to ulceration or sloughing; and when the diagnosis has been clearly made out as encephaloid, there is no chance for the patient without the most vigorous and heroic treatment; and, even then, he would be indeed a hopeful surgeon who would place any confidence in the safety of his patient.

Scirrhus has a prognosis one degree towards favorable. It includes in its natural tendencies or conditions that of being (at times) stationary, and in this we may find a glimpse of encouragement, and the first step towards a favorable prognosis. I am confident, also, that there are cases of scirrhus which undergo resolution. I remember a case of scirrhus of the breast which pursued such a course.

Among the remaining kinds of growth some have an occasional tendency to spontaneous resolution (glandular growth, etc.); and others are susceptible of successful medical or surgical treatment under favorable circumstances.

Thus we find that all cancers and cancerous growths have not the same prognosis, and that the hopeless character of a tumor increases as we approach the encephaloid variety. All other varieties are found, at times, in conditions favorable enough to warrant

an encouraging prognosis, if placed under judicious treatment and favorable circumstances. However, a favorable result is usually only possible under treatment; if left to themselves, they rarely take on the condition of resolution. A few cases remain stationary for a long time, when left alone; but these cases are rare. The general prognosis in a case of cancer is, therefore, unfavorable.

So much for the prognosis as it is usually considered. But let us examine into the prognosis of morbid growths in another sense,—viz.:—What are the probabilities of a given tumor maintaining itself in its original or primary form; for example, a fibrous growth remaining benign, or a scirrhus tumor sustaining itself as such, or, on the contrary, manifesting a tendency to pass into encephaloid? And, again, what are the probabilities of a growth spreading to the surrounding healthy tissue? or of its becoming circumscribed and stationary, and in this sense influencing the general prognosis to be arrived at, if only the class of tumor, as a benign or malignant growth, be considered?

These questions, anticipating the direction in which a given growth is moving, or is likely to move, may be answered to a considerable extent by the examination of the growth according to the rules which we have given for each class of tumors; and it appears to me that this will be a great aid in determining the course of treatment to be pursued; for if we can de-

cide that a tumor has a tendency to remain stationary, we would perhaps be glad to let it alone; and if a scirrhus growth, or an epithelioma, showed a tentency to progress rapidly in the direction of malignity, the knife or other heroic treatment might be justified. I am satisfied that in a general way we may decide these questions. At all events, any light in this direction will not be unacceptable. I, therefore, refer to this point to indicate that the rules here set forth, while bearing upon the general prognosis, may also show, in most cases, the special tendency of a growth at the time of examination; thus giving a special prognosis, and one which would determine to a great extent the treatment appropriate for each case.

In forming the prognosis, then, two considerations are to be taken into account:

1st. The solution of the question of malignity.

2d. Whether the growth is capable of sustaining itself in its primary form.

This last point, of course, refers chiefly to the semi-malignant or benign forms. When applied to malignant forms, it would involve the question of the reproduction and return of tumors.

As these points may all be decided at the time of making up the diagnosis, and by the same rules, I wish here only to refer to them, and point out their extended application in this manner, as well as allude to their use in indicating the direction in which to look for a successful treatment. To sum up, then,

the prognosis for the different kinds of growths, we find encephaloid occurring in only two forms. It is either found as a growth which is

ENCEPHALOID.

1st. Heterologous as to the other tissues, and homologous as to its own cells; or,

2d. As one which is homologous as to the other tissues, and homologous as to its own cells.

The prognosis in both cases would be unfavorable. If any difference could be made, it would be, of course, in favor of the second form.

SCIRRHUS.

Scirrhus has a larger range, and includes four qualities of structure. Thus we find it:

1st DIVISION.—Heterologous as to the other tissues, and homologous as to its own cells.

In this form it is thoroughly malignant, and should have a prognosis quite as severe as a pure encephaloid.

2d DIVISION.—Heterologous as to the other tissues, and heterologous as to its own cells.

This is an example of the semi-malignant class. It approaches the fibrous tumor, and will have a tendency to become malignant or to remain stationary, according as its cells show a tendency to form, in the first case, a homologous collection; or, in the second case, a heterologous collection. The prognosis for this variety is also unfavorable; still, it includes some ground of hope, either from treatment or operation,

3d DIVISION.—Homologous as to the other tissues, and heterologous as to its own cells.

This arrangement of cells forms a simple fibrous tumor, which would have a very favorable prognosis. It is possible for such a tumor to remain stationary for a long time, and it may be extirpated with but little or no chance of a return. It is one of the forms of benign growth, and is given this place on account of its occasional malignant tendency.

4th DIVISION.—Homologous as to the other tissues, and homologous as to its own cells.

This, like the first form, bears the characters of malignity in a marked degree, and is entitled to a corresponding prognosis.

EPITHELIOMA.

In order to correctly determine the prognosis of an epithelioma, it is necessary to understand that all growths which come under this denomination do not present the same qualities as to malignity; and to recognize, also, that these growths may vary from a simple and harmless epithelial growth to the most severe cancer. The cells which are found in these tumors will also vary greatly, and may be chiefly epithelial or only in part such; and we may find at times cells which resemble in no respect the epithelial cell. A predominence of the epithelial form of cell, however, is usually a characteristic of epithelioma.

This form of growth is subject to the same possible variety of cell development, and to the same changes

in the quality and form of its cells, as scirrhus; and may be divided, like it, for the purpose of determining the prognosis, into four kinds, viz.:

1st Division.—Heterologous as to the other tissues, and homologous as to its own cells.

In which case it would be malignant, and must be given the same prognosis as the first forms of scirrhus and encephaloid. Such a growth will most certainly be reproduced or return after operation; unless, perhaps, the excision be performed very early, and followed by appropriate treatment.

2d Division.—Homologous as to the other tissues, and heterologous as to its own cells.

This would form a benign epithelioma, and may be treated or operated upon with confidence, in the probabilities of *no* return.

3d Division.—Heterologous as to the other tissues, and heterologous as to its own cells.

This has a semi-malignant character, and should have a prognosis according as its cells showed a tendency to sustain themselves as a heterologous collection, or the contrary.

4th Division.—Homologous as to the other tissues, and homologous as to its own cells.

This form possesses the same malignant character as the first division; but it has a more favorable prognosis, inasmuch as there is some tendency in it, at times, to remain stationary.

In connection with epithelioma, and before passing

to the consideration of enchondroma, it will be well to state (what in fact has been admitted all through this paper) that it is not absolutely necessary for either the compound cancer cell or the simple cancer cell to be present, in order that the growth may partake of a malignant character. A collection of epithelial cells, or cartilage cells, etc., may be arranged as a heterologous-homologous or homologous-homologous collection, and impress the growth with a corresponding character—a character which might be derived from such an arrangement of any variety of cells, and which would indicate more a tendency to pass on from a semi-malignant to a malignant form, than they would an already existing malignant form. When an epithelioma becomes malignant, there is always found among the epithelial cells one or the other of the forms of cancer cells. And upon the number and arrangement of the cancer cell present we may decide the prognosis.

ENCHONDROMA.

The enchondroma belongs, as has already been shown, to the same class as the myoma and osteoma.

These are all, properly speaking, semi-malignant, and as such are, of course, subject to a more favorable general prognosis. The *special* prognosis is to be determined by deciding (according to the rules given for scirrhus and epithelioma) whether the growth is capable of sustaining itself in its primary form; or whether it is passing on to the thoroughly malignant type.

For a description of the general characters of malignant disease, we must refer to more extended works on the subject. It is not in keeping with the limits prescribed for this paper to review the history of cancer, or to determine how ancient a disease it may be, or how faithfully its strange features have been portrayed to us by authors.

There are, however, a few points concerning the disease which are entitled to a special notice on account of their importance, and for the reason that all observers do not agree concerning them. As they have been adopted in this paper as facts, some explanation seems necessary to their proper understanding. For convenience they may be divided into six propositions, as follows:

PROPOSITION IST.—Cancers arise, as a rule, directly from tissues which were once healthy and normal.

This proposition seems self-evident, unless we admit the doctrine of spontaneous generation, or the exclusive exudation theory; and it need not detain us further than to refer for its demonstration to the case of cancer of the omentum (reported in another part of this paper), which illustrates well the production of cancer from normal cells. This was a clear case of cancer, developing in connective tissue from connective tissue cells.

The omentum, having no other cells from which the growth could spring, and the whole of the omentum being occupied by the disease, it is fair to suppose

that it must have once presented its normal cells in some part, at least, of its extent. That it does not now present in any part the normal connective tissue cell, seems to me proof that these cells have degenerated into cancer cells; and we are forced to believe that the normal tissues have been converted into this abnormal structure.

PROPOSITION 2D.—A benign tumor may assume a malignant character, and become in the end true cancer.

The truth of this proposition is not so clear to most physicians; yet, admitting the first, this naturally follows. It seems less improbable that a growth which is originally benign may take on a malignant course, than that a cancer should be found developed from a healthy tissue in the first instance. The doctrine is confirmed by every-day experience; for example, semi-malignant growths.

PROPOSITION 3D.—All morbid growths are endowed with the power of reproduction to a greater or less extent; and it is this power which determines and limits the degree of malignity of a tumor.

Such a property is accorded by all to cancers; but probably few will be willing to admit that what are known as benign tumors, are possessed of the power of reproduction. Nevertheless, the adoption of the two preceding propositions forces the acknowledgement of this one. It is not pretended here, however, that benign growths possess the

power of reproduction in any other than a latent state; otherwise, they would be removed at once from the benign category; but that there is a latent power of reproduction in benign growths is demonstrated by the facts observed by every surgeon. How often does it occur that a tumor, which has for a long time presented a benign history, suddenly, from the effect of some irritation, such as a surgical operation or an injury, takes on a malignant course, or develops the power of reproduction? The simple effect of operation or injury is certainly insufficient cause for the production of a malignant quality, unless there had already existed in the tumor an inherent or latent power, which only needed such a stimulus for its development. This doctrine is further supported by the general principles of cell development, and it is, besides, necessary that it should be adopted in order to take a comprehensive view of morbid growths, and to enable us to distinguish and separate the benign from the malignant. All cancers are not reproduced with the same rapidity, or with the same ease or frequency; and because we can trace the diminution of this power in growth, further and further, until we come to a growth which rarely manifests any such power, and we call this a benign growth, are we certain that this is any more than an apparent limit? I think not; and if, occasionally, benign growths are known to take on a malignant action, I believe it is sufficient to warrant us

in concluding that they also possess the power of reproduction, and that in them it is latent. So long as this power is not aroused by irritation or certain external circumstances, the tumor will remain benign.

Why is it that one kind of cancer is more easily reproduced than another?

An answer to this question can only be given by a study of the facts observed in the development of morbid growths.

It seems probable that one growth is more easily reproduced than another, according as it has its origin in the connective tissue corpuscles, or in the higher grades of cells.

Encephaloid is the most certainly and easily reproduced, because it originates in the connective tissue corpuscle, and because the original vice which causes such tumors is deeper seated and more thoroughly constitutional.

In encephaloid, the disease runs its course in one grade of cells; it has no changes of form to make; the malignant course once begun, it is easily continued. Nature uses the connective tissue corpuscle freely for all the repairs of structure; it is the tumor tissue, the scar tissue, and well called the connective tissue. Of all the cells of the body this is the most easily produced and reproduced. It is also the most convertible of all cells. It depends for its support directly upon the blood, and is therefore more readily affected by any constitutional vice.

The higher grades of cells which compose cancers are dependent for their support upon the surrounding cells, and are more local in their dependencies than cells of the lower grades or types forming cancers. These higher grades of cells, receiving their support more indirectly, depend less upon the constitutional taint.

Nature uses these cells for the structure of organs required for the functions of secretion, excretion or activity; they are more difficult to reproduce even normally, for we find the solution of continuity of any of these organs repaired by the connective tissue corpuscle, and it is only by reason of the peculiar convertible properties of the connective tissue cell, that the secreting or excreting cell, as the case may be, finally results.

These cells, coming originally from the embryoplastic cell, are more likely to return to this type when they undergo a retrograde development, or cancerous degeneration.

Indeed, it is necessary that they should return more or less to this form, before they can assume a thoroughly malignant type, thus requiring a double effort. They are, consequently, more difficult to reproduce after excision, because the abnormal cell which at first had undergone the retrograde change and become the starting point of a malignant development, being removed, some other cells have to succumb to the constitutional or cancerous vice, before

the process can continue; and thus a longer or shorter period of time must intervene between the removal and the reproduction of a growth. The length of time required depends upon the kind of cell, originally the seat of the disease; whether it is easily changed; and whether it assumes readily the form and function of the cells in question. If it does, there will be a short period; if it does *not*, then there will be a long period intervene. If the tumor be composed of cells which are of a very high grade of the scale, it will be reproduced with great difficulty, and under favorable circumstances not at all.

PROPOSITION 4TH.—A cancer once begun, either continues on in its original form, as an encephaloid, scirrhus, etc., as the case may be, or else it assumes the encephaloid form; each form of cancer reproducing either its own kind, or else the encephaloid. The possible exception to this rule is found in the encephaloid, which, as we would naturally suppose, may assume any of the other forms, having as it does the embryoplastic cell for its basis. The transition from the encephaloid to the scirrhus seems but a step; still, as this would be a step in the benign direction, it is probable that it rarely or never occurs.

PROPOSITION 5TH.—Any of the forms of cancer may reproduce the encephaloid instead of the original form. This change of form frequently occures, and the knowledge of it explains to us why it is that a

growth such as an epithelioma or scirrhus, which, might have been pursuing a semi-malignant course, and promised well to be successfully removed by operation, after the removal not only returns, but returns with much greater malignity, and runs its course rapidly and fatally. Such cases will be found, on examination, to have changed their original form for the encephaloid. The growth which was progressing slowly and with difficulty, with a high grade of cells as a basis, on the event of removal, finds it impossible to reproduce the same grade of cell, and at once takes hold of the connective tissue corpuscle as an easy prey, and the case terminates in an explosion of malignity. In most cases, however, the general rule holds good, and we usually find cancers reproducing their own kind.

PROPOSITION 6TH.—THE CONVERTIBILITY OF CELLS.—In order to interpret correctly the various pathological formations known as tumors, and especially that of cancer, we must recognize certain possible transformations of which the cells of any of the tissues, physiological as well as pathological, are capable—transformations upon which, indeed, in one sense, the development and growth of the tissues depend. This feature of cell growth may be conveniently called the *convertibility of cells*.

The study of the minute elements of the tissues of the body shows us that they are each composed of definite cellular elements, but that the cellular ele-

ments which are to be found composing an organ or a tissue in its perfect or mature form are not always the same, in appearance at least, as those found during its formative state. In some instances—as for example, in muscle, nerve, etc.—the difference between the appearance of the cells found in the examination of a tissue during its formative or embryonic state, and that found when it is fully developed, is so great that it would be possible to recognize them as the same only by following them in the different stages of development.

By taking each of the tissues and tracing these changes backwards, we find their ultimate form to be the embryoplastic cell. This cell may be changed into any of the other varieties of cell, and they in their turn may be reconverted into the embryoplastic cell. Thus we find a progressive change of cell formation, and a retrograde change of cell formation. Under the head of progressive change of cell formation, may be included the normal growth of tissues, the various simple hypertrophies, and some adventitious growths.

The retrograde changes of cell formation include the various morbid growths, cancers, tubercle and some hypertrophies, etc. Were it not for this convertibility of cells, the renewal, the waste and repair of tissues, and especially the development of morbid growths, would be impossible.

I think we find, in the doctrine of the convertibil-

ity of cells, a clue to a better understanding of the order in which we find morbid growths are developed and reproduced; for, the order of convertibility of the different cells is in keeping with the facts of development and malignity.

It explains also, how each diathesis may produce from a single form of cell, a growth peculiar to itself. The cancerous diathesis in developing locally produces cancerous tumors, by its influence upon this convertibility of cells. The tubercular diathesis uses the same cell for its development. Thus, from the same elementary cell, as a basis, we may have any of the varieties of tumors produced.

The embryoplastic cell comes first in the order of convertibility, and it is also first in malignity. The other forms being less convertible, and also less malignant.

The following table presents the order of the convertibility of cells in their physiological and pathological development; showing the relations of the degree of convertibility of cells, to the degree of malignity of tumors. In the first column we find a physiological cell development, in the second a pathological cell development:—

Order of Convertibility of Cells. Physiological.	*Order of Malignity of Tumors.* Pathological.
Form of Cell.	*Form of Tumor.*
Embryoplastic cells.	Encephaloid tumor.
Fusiform, caudate and fibre cells.	Scirrhus.
Epithelial cell.	Epithelioma.
Cartilage cell.	Enchondroma.
Muscle cell.	Myoma.
Cone cell.	Osteoma.
Nerve cell.	Neuroma.

The influence of a normal vital force acting upon the embryoplastic cell, converts it into its appropriate form for the tissue or organ for whose function it is required. The form of the cell is maintained only as long as the vital force is exerted normally upon it. As soon as this force is withheld or is exerted under abnormal influences (the various diatheses, etc.), the convertibility of the cells permits of the formation of tumors and cancers.

In virtue of this universal convertibility of cells, we find that a tumor may originate in any tissue, and i may partake of the cellular form of the elements of that tissue, or it may assume an entirely different form. And a tumor having commenced in one form, it may be converted into, and continued in, another form.

In normal processes it is necessary for the integrity of a tissue that its cellular elements should retain their typical form, or pass on in regular and successive stages to their final limits. The convertible properties of the cells are thus kept in their legitimate channel. In pathological processes concerned in the formation of tumors, this convertibility of cells is subject to the controlling influence of the predominating diathesis, and pursues an irregular course, following, to a certain extent, the physiological order, and developing a simple or benign tumor, and sometimes skipping several of the steps in this order, and forming tumors whose cellular elements are at variance with the form of cell found in the original tissue; at other times descending from a perfectly developed cell formation to the embryoplastic form, and producing cancers.

CAUSES OF CANCER.

In cancer, as in all other diseases, we must admit the existence of a positive and definite cause, acting, when under the same circumstances, always in the same way. A subtle and unknowable influence, which produces out of the once healthy tissues the abnormal products which we know as malignant growths. These growths are the results of the operation of a pathological law, which has its existence as well while the tissues are normal as when they become diseased. The law, however, is not

always in visible operation; but, like the other laws of nature, is usually set in operation by secondary causes. It would be useless for us to seek to know this prime cause or essence of morbid growths; but it is probably akin to the laws of attraction and gravitation.

The secondary causes, or those which operate in setting in motion this prime cause or pathological law, are proper subjects for our investigation and study. These causes we may observe and understand to a certain degree; a perfect knowledge of them would be a substantial basis upon which to found a successful treatment for the cure of these diseases, and it would also enable us to prevent them.

Looked upon in this light, the causes of cancer are numerous, and may be divided into external and internal causes.

The external causes of cancer are those which operate locally, such as injuries or local irritations, impressions made upon the tissues by forces acting from without.

The internal causes are those which are dependent upon forces within; the individual, for example, a constitutional vice, or a hereditary taint.

For our present purpose, the combined causes of cancer may be enumerated thus :—

1st. Heredity as a cause.

2d. The blood as a cause.

3d. The nervous system as a cause.

4th. Injury as a cause.

5th. Accidental errors of cell development, followed by a kind of contagion by cell contact.

6th. A retrograde tendency of cell growth, in which the whole system and all the tissues partake, and which is manifested locally in the form of cancerous tumors, and constitutionally in the form of cachexia.

HEREDITY AS A CAUSE.

The confidence which the professional mind has reposed in the fallacious arguments of statistics has done much to place the professsion in the humiliating position where it is found at present concerning the heredity of cancer—of at one time advocating as an established fact a doctrine which afterwards they protest against, upon the same grounds of proof as those upon which they at first advocated it. They go from one extreme to the other—having once taught that cancer was hereditary in most cases, they now teach that it is scarcely ever hereditary, and we are even asked to believe this statement on the ground that statistics prove it. Let us beware of statistics. having misled us once, they will probably do so again;

There is probably more value in individual impressions, gathered from a large and well considered field of observation or experience, summed up and divested of all prejudice, than can be found in a volume of statistics.

It is in this liberal manner that I propose to consider the causes of cancer, leaving the proofs of statistics for those who have more confidence in them than I have, and believing myself that, until we adopt a uniform method of diagnosis, no reliable data can be obtained from statistics.

We are, therefore, left, for the proof of the hereditary nature of cancer, to reasoning, analogy and experience.

WHAT IS HEREDITY.

Those peculiarities which belong to the individual as a member of the human family can hardly be said to be heredity, for we are all endowed with the traits of the race of mankind by the Creator from the beginning. One individual has not more to do with the transmission of these than another.

The diseases which follow the natural degenerations of the body as age advances cannot be said to be hereditary in any proper sense. Health is not hereditary, and cannot be: it is an endowment of nature.

Disease may be either acquired or hereditary.

An acquired disease is one which attacks an individual on account of some personal fault or habit of body, or is due to accidental influences.

Some acquired diseases make such an profound impression upon the individual, through the blood or the nervous system, or both, that they are identified with it, and are, or may be, transmitted to the offspring

of the individual, without the offspring ever being subjected to the influences which caused the disease in the parent in the first instance. Such a disease is said to be hereditary.

A hereditary disease, then, is one which is capable of leaving such an impress upon the blood or the nervous system of the individual first acquiring it, that it becomes one of the controlling forces of the economy, and is inherited by the offspring in the same way as the normal or vital controlling forces of the body are transmitted.

We do not want for examples of such hereditary diseases; we find them in syphilis, scrofula, tubercle, rheumatism, gout, etc. If a disease is hereditary, it must be so either on account of some constitutional poison or virus introduced into the blood or the system, and which has a specific effect, according to its kind, or else it is hereditary on account of some superinduced peculiarity of structure or texture of the tissues which renders them more liable to be affected by certain causes than they otherwise would be.

We have, therefore, two kinds of heredity:

1st. Constitutional taints, such as that caused by the syphilitic or other virus.

2d. Peculiarities of organization, and certain aptitudes of constitution, such as tubercle, rheumatism, scrofula, etc.

Having given this definition of heredity, and described some of its characters, we may now ask, is cancer hereditary? Let us examine it by the light of reason, analogy and experience.

for continuation see: Med. Gaz., N.Y., 1870-1, VI, 325-326; 337-340; 351-354.

Pages 49-end missing