and his interests were deep and burning. He loved great works of science and made idols of the men who created them. The many full-page portraits in this volume so caressingly displayed, the exquisite care given in that spacious but ill-balanced bibliography, the excessive citation of the works of the very great and of many lesser lights who happened to win his favor, all attest this intense interest in the persons of science. He loved his countrymen, but the men of his college more; he read much and labored long; now and then he reflected on the manifold speculations concerning human life.

All this he has put into this remarkable book. Its title changed to "The Adventures of a Scientist," however inadequate, would have been a more descriptive title. For no treatise on the principles of a science ever turned out to be such a palpably human document.

Paraphrasing the words of the chief editor, the book must indeed now stand as a monument to the memory of Sir William Maddock Bayliss, and as a witness to the affection of his friends. But let the stranger outside the gate use as caption to every page the motto that adorns the title page,

"πάντα δοκῖμά ζετε
το καλόν κατέχετε"

which translated as Sir William expounds in his original preface reads: Prove all things, hold fast to that which is good, and beautiful, and therefore, even as Plato taught, of a necessity also true.

CHARLES D. SNYDER
THE JOHNS HOPKINS UNIVERSITY

CANCER IN PLANTS AND IN MAN

RECENTLY in *Klinisches Wochenschrift* (3 Jahr., Nr. 25) and in *Zeits. für Krebsforschung* (21 Bd., 5 Heft.) Dr. Ferdinand Blumenthal, director for some years of the Universitäts Krebsforschung Laboratories, connected with the great Charity Hospital, Luisenstrasse, Berlin, with two assistants, Dr. Hans Auler and Fraulein Paula Meyer, claim to have isolated several times from human breast carcinoma schizomycetes in pure culture with which they have been able to produce malignant transplantable tumors in white rats (carcinomas and sarcomas). One form of this organism, that used most successfully, they state to be indistinguishable from *Bacterium tumefaciens* isolated from plant tumors and studied for many years in the U. S. Department of Agriculture by Erwin F. Smith and his colleagues. With this form, known as *PM,* they have also produced repeatedly, in the hothouse and out of doors, tumors on plants indistinguishable from crown galls.

The rat tumors are now in the eleventh and twelfth generation of transplants. The rat tumor is often a mixed tumor, but sometimes it seems to be a diffuse carcinoma and at other times it looks like a pure sarcoma. I have slides showing this wide difference made from two gland metastases taken from the same rat, one day apart. The tumor metastasizes freely into the glands, the mediastinum, the lungs, etc., but, unlike common rat sarcoma, has not been found in the kidneys. So far the best results have been obtained with *PM* and *L,* both cultures isolated from breast carcinomas. Various other isolations have been made from malignant human tumors (carcinomas, sarcomas and epitheliomas) to the number of sixteen, but for want of assistants and experimental animals all have not been tested on animals. The two strains mentioned (*PM* and *L*) are the most like the crown-gall organism, especially *PM* (the first one isolated, two years ago) which has given remarkable results in both plants and animals, many of which I have seen. It should be noted, however, that isolations are not easy, and that only a small proportion of the inoculated rats have given persistent, transplantable, metastasizing tumors. In the greater number of rats (something not surprising) the tumors receded. It is also to be noted that the bacteria have not been recovered from the transplants.

At the great Actien-Gesellschaft Serumwerk, in Dresden, which I have also visited, the Berlin experiments have been repeated with the same results, *i.e.* (1) They have obtained in white rats numerous good, freely metastasizing tumors (I saw a dozen or more dissected rats and also live ones) by successive transplants beginning with a transplant tumor-bearing rat received a year ago from Dr. Blumenthal. This proves nothing, of course, as to the etiology of the tumor. But (2) they have also obtained two transplantable freely metastasizing tumors, now in the fifth and sixth generation, starting from pure-culture inoculations of *PM* to which was added Kieselgur (sterile diatomaceous earth), but no oedematous cancer serum or cancer juice, such as Dr. Blumenthal used, but which used alone or with Kieselgur, he says, did not cause any transplantable tumors. In the Dresden experiments, as in Berlin, only a small proportion of the bacterially inoculated rats gave persistent metastasizing tumors (two out of fifty), but it is the same type of tumor.

It begins to look, contrary to my belief hitherto, as if *Bacterium tumefaciens* might occur frequently on or in man and be the cause of some of his cancers.

I came here with great scepticism, but I have seen enough, here and in Dresden, to lead me to think that the Berlin experiments should be repeated, as now undoubtedly they will be, in many other cancer lab-

oratories, and snap judgments should not be taken if the first isolations fail.

The results of Dr. Blumenthal and his associates are the more interesting because they started out on their crown-gall studies a half dozen years ago, entirely sceptical as to its cancerous nature. Along with all other Germans, they regarded it as a granuloma and only as they studied its behavior more and more were they gradually forced to change their views. The following is one paragraph from the summary in their second paper which is best given in their own words:

Aus diesen Untersuchungen ergiebt sich, dass es zum *erstenmal* gelungen ist aus menschlichen Krebsgeschwülsten Parasiten zu gewinnen und in Reinkultur zu züchten, mit denen wir experimentell an Tieren bösartige Geschwülste erzeugen konnten. Diese Geschwülste lassen sich in vielen Generationen fortzüchten. Sie zeigten in ihrem histologischen Bau namentlich bei Übertragungen Carcinom-häufiger Sarkomcharakter, wuchsen bis zur halben Grösse des Tieres heran und bildeten Metastasen, die fast Walnussgrösse erreichten. Sie gaben bei der 4. Übertragung 75% Ausbeute. Auch an Pflanzen lässt sich mit diesen Kulturen, ohne Zusatz irgend eines Reizmittels wie Kieselgur u. dgl., eine Tumorbildung hervorrufen, die in ihrer Ausdehnung in nichts der durch *Bacterien tumefaciens* erzeugten nachgab. Wir glauben, dass die neoplastischen Bacillenstämme, die wir fortgezüchtet haben, dem *B. tumefaciens* nahestehen und mit diesem eine Gruppe bilden, die man als neoplastische Gruppe bezeichnen kann (p. 407).

ERWIN F. SMITH,
President of the American Association for Cancer Research
BERLIN, MARCH 5, 1925

SPECIAL ARTICLES

NOTES ON THE DEVELOPMENT OF THE SEA-CUCUMBER, THYONE BRIAREUS[1]

WHILE staying at the Marine Biological Laboratory, Woods Hole, Mass., in the summer of 1921, I was fortunate enough to have an opportunity, from June 21 to 24, to obtain eggs of *Thyone briareus,* which were reared successfully for nearly three months during my sojourn there.

The present preliminary account is mostly confirmatory of what is known in other Echinoderms, such as starfishes and sea-urchins, but since our knowledge of the embryology of holothurians is still meager, I think it desirable to put it on record.

In the ovarian tube of *Thyone briareus* are found eggs which may roughly be classified into three stages. To the first (1) belong late oogonia or early oocytes with a comparatively large nucleus, in which the chromosomes arrange themselves in pairs and often show more or less distinct polar orientation. The second stage (2) is characterized by diversities in the size of the cell body, which fact shows that the oocytes are now rapidly growing. In the nucleus there are a number of nucleoli and the chromatin nets stain very faintly. In early ones, however, paired chromosomes are still recognizable. Among rather late ones the nuclear contents show homogeneous chromatic granulations, and the chromosomes, now gemini, are well formed and assume the shapes of O, X, Y, etc., scattered near the periphery of the nucleus. A single nucleolus is usually found. Probably this stage is passed very rapidly, and after that the nucleus again assumes the appearance of an ordinary germinal vesicle.

In the growing oocytes, but never in those of other stages, is found a peculiar structure in the cytosome. It consists of a few chromatic fibers in the form of a minute spindle or aster, sometimes surrounded by faint rays, and always situated near the end which later becomes the animal pole. It is found only in the specimens fixed with picro-sulphuric, but has invariably disappeared in those fixed with Bouin. A similar but somewhat different structure can also be seen in my slides of other sea-cucumbers, *Cucumaria saxicola* and *C. echinata.* Van der Stricht described a peculiar structure in the growing oocytes of the sea-urchins, *Echinus microtuberculatus* and *Sphaerechinus granularis,* and called it the astrophere. I believe it is identical with the structure in my preparations and should be taken as a modified centrosome (yolk-nucleus of some authors). The fact that it appears coincidently with the growth period suggests that the structure has something to do with the yolk formation.

The third stage (3), to which belong the full-grown oocytes ready to be laid, can be readily distinguished from the others by the presence between the egg surface and the follicular epithelium of a thick jelly coating. It is quite possible that between this and the preceding stage (2) a whole year intervenes, that is, the eggs of the second stage are to be laid next summer. The oocyte, now in its full size, is hemispherical or flattened sphere in shape, as is well known in the eggs of other sea-cucumbers. The germinal vesicle is large and lies eccentrically near the animal pole. This pole is usually directed toward the internal lumen of the ovarian tube, and is readily recognizable by the presence of a short conical process, which I once called the "micropyle appendage." The centrosomal structure, which was found in the preceding stage, is no more to be found. Instead of it, from the micropyle appendage a bundle of achromatic fibers

[1] Contributions from the Zoological Laboratory, Kyushu Imperial University, No. 1.