wide bevel causes it to be somewhat too flexible for hard objects imbedded in paraffin. There are a number of stropping devices on the market which will prepare any of the blades mentioned above for sectioning. Twin-plex stroppers are very satisfactory and models are available for all types of blades. The Spiro stropper, made by John Watts, Sheffield, England, is very well constructed and convenient to use, although the claim made for it that the stroke is diagonal is not justified. Watts manufactures blades for use in Auto-strop razors which are perforated so that they can be sharpened with the Spiro stropper.

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ESTIMATION OF THE COLLOIDAL MATERIAL IN SOILS

IN conducting investigations to devise methods for determining the content of colloidal material in soils, one of the methods that has been tried and has proved most successful is the hydrometer method. By means of this method, the colloidal content of a soil can be estimated quite accurately in only fifteen minutes. The general procedure consists of dispersing in a mortar by means of a pestle 50 grams of soil, placing it in a high cylinder, adding a total volume of water equal to 1,050 cc, shaking the mixture vigorously for about two minutes and then placing a hydrometer in the mixture and measuring the density or grams per liter. It has been found that the percentage of the material, based on the original sample taken, that stays in suspension at the end of fifteen minutes is equal to the percentage of the colloids as found by the heat of wetting method. This remarkable relationship is almost incredible, but it has been actually found to hold true in all kinds of soils, ranging from sandy loams to very heavy clays and even when different proportions of soil samples are used. The only places where the relationship between the percentage of material staying in suspension at end of fifteen minutes in a liter of water and the percentage of colloids as determined by the heat of wetting method does not hold very close is in abnormal soils which refuse to stay dispersed and in soils whose organic matter is not completely decomposed. Out of thirty-one soils used, however, only three refused to give a very close relationship. In the other soils the relationship is identical in many cases, and in the others it is only about 3 per cent. apart.

From the work thus far done it appears that the hydrometer method can be used confidently to estimate the colloidal content of soils quite close. In some unusual soils the estimated amount may be about 10 per cent. off of the true amount or the amount shown by the heat of wetting method, but when it is considered that by our present methods it takes almost one week to determine the colloidal content of a soil, any method that can give in fifteen minutes the colloidal content of soil should be considered very valuable, even though in some cases the results may be about 10 per cent. off.

The hydrometer method is able not only to estimate the colloidal content of soils, but also to measure the rate of settling, from which a distribution curve of the soil particles of various sizes may be worked out.

The hydrometer employed is of a lactodensimeter type, which has a large volume and weight, both of which make it very sensitive. It was calibrated to read directly in grams of material per liter of water.

A detailed report of these investigations is being published elsewhere.

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PERMANENT CULTURES

VERY frequently instructors are required to keep Protozoan cultures over long periods of time. The following method has been used with great success for such cultures as paramecia, the smaller forms of amoeba and certain forms of flagellates.

A large number of hay infusions are started in ordinary drinking tumblers, using pond water from different localities. They are then placed in various positions about the room and examined from time to time until the proper culture has been found. When a desired culture is found it should be fed five or six scrapings of dried whole wheat bread. These scrapings are made by simply taking a scalpel and scraping a crust of bread, care being taken so as to feed only what the culture will utilize. The glasses are then covered and the process repeated every two weeks or so. Whole wheat bread is far superior to ordinary wheat bread.

Using the above method I have kept ordinary classroom cultures alive for a period of a year.

It is also excellent for maintaining such cultures as rotifers and the small crustaceans.

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SPECIAL ARTICLES

THE FILTERABLE CELL OF THE ROUS CHICKEN SARCOMA AND THE QUESTION OF THE CAUSATIVE AGENT

IN a previous note[1] I reported that desiccated or glycerinated tissues of the Rous chicken sarcoma No. 1 often contain many viable cells. The bearing of this observation on the question of the so-called causative agent which has long been supposed to exist in this

[1]Nakahara, W., SCIENCE, 1926, LXIII, 549.

class of tumors is obvious, for the hypothesis of such an agent depended entirely upon the freedom from living cell of the desiccated, glycerinated or filtered tissue, by which these sarcomas can be transmitted. These materials had been inferred to be free from viable cells on the basis of the impossibility of transmitting mammalian tumors by the similarly treated material, thus giving rise to the belief in the existence in avian sarcomas of some entity which is separable from sarcoma cells. It would seem not impossible that some fundamental differences which might exist between the cells of the peculiar avian sarcomas and the cells of mammalian neoplasms might well account for the differences in their transmissibility, yet this point has scarcely been considered.

The purpose of this note is to show that the last of the three evidences, namely, the filterability, is also of no essential value in supporting the hypothesis of the causative agent. For a detailed description of the experiments the reader is referred to my article in *Gann*, vol. XX, No. 2, June, 1926, the journal of the Japanese Society of Cancer Research.

At first sight it would seem quite impossible that a cell of a higher animal should pass through a bacteria-tight filter. It must be admitted, however, that a soft, jelly-like cell, even much larger than bacteria, might readily "stream" through the pores of the filter when filtered under negative pressures, as is usually done. It was felt that such might indeed be the case with the Rous sarcoma No. 1, because of the frequent occurrence in this tumor of very minute cells, measuring 1.5 x 1.5 to 2.5 micra in sections fixed in formalin. Filtration experiments showed that a similar type of minute cells *do* pass through Berkefeld filters, V and N.

The usual method of filtration was followed, using, however, distilled water instead of physiological solution for suspending the mashed tumor tissue. Berkefeld filters were proved to be bacteria-tight by previous or simultaneous tests with *Bacillus prodigiosus*. About 10 cc of the clear filtrate was centrifugated at a high speed for half-an-hour, smear preparations were made of the bottom portion of the fluid and the stained smears were then carefully examined. Some minute but intact cells were demonstrated in this manner in three out of five different tumor filtrates through Berkefeld V candle, and in three out of seven filtrates through the N candle.

The cells found in the smears of filtrates measured on an average about 2.5 x 3 micra. They have round or oblong, well-stained nuclei, which are often surrounded by a small halo. The cytoplasm stains pale blue with Giemsa solution and usually shows what appear to be minute ameboid processes.

As the consequence of the invalidation of all the experimental foundations upon which the hypothetical causative agent is based, the chicken sarcoma can now be considered on a level with the true neoplasms of mammals. The retention of the identical histological characteristics by the avian tumors through their various processes of transmission (by desiccated material, by filtrates, etc.) can now be most satisfactorily explained as being due to the actual transplantation of sarcoma cells.

The recent work of Gye and Andrews[2] demonstrates that the filterability of the Rous sarcoma No. 1 varies from generation to generation during transplantation, filterable tumors giving rise to non-filterable ones, and *vice versa*. This observation, as the British authors state, must bring about a serious consequence on the filterable agent as the essential cause of the growth. From the recognition of the filterable cell, the variation in the filterability can be readily explained on the basis of the well-known cellular polymorphism of the Rous sarcoma.

CONCLUSION

The demonstration of filterable cells which frequently occur in the Rous sarcoma No. 1 renders it impossible to accept Berkefeld filtrates as being cell-free. This fact, taken together with the extraordinary resistance of sarcoma cells to desiccation and glycerination previously reported, may be regarded as removing completely the necessity for assuming the existence of the so-called filterable causative agent.

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GLASS AS A FOURTH STATE OF MATTER

IN the past a glass has been generally considered to be simply a super-cooled liquid. As a consequence, the transition between the glassy and liquid states has been imagined as gradual and continuous. This is by no means the case, however, as recent studies on both inorganic and organic glasses[1] have demonstrated. With n-propyl alcohol, for instance, the softening or "melting" of the glass takes place rather sharply within the temperature interval 90°–102° K.

[2] Gye, W. E., and Andrews, C. N., *Brit. J. Exp. Path.*, 1926, VII, 81.

[1] A number of inorganic glasses have been studied qualitatively by Tool and Volasek, U. S. Bureau of Standards Scientific Papers, *15*, 537 (1919). In the case of several organic glasses the specific heat-temperature curve has been worked out quantitatively: n-propyl alcohol by Gibson, Parks and Latimer, *J. Am. Chem. Soc.*, *42*, 1547 (1920), and more recently by the present authors in an unpublished investigation; glycerol by Gibson and Giauque, *J. Am. Chem. Soc.*, *45*, 94 (1923), and ethyl alcohol by Parks, *ibid.*, *47*, 338 (1925).