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Bacteriological Characteristics of Monilia Found in Pernicious Anemia and Certain Other Pathological Conditions.

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(Introduced by R. Kinsella.)

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The presence of *Monilia* in the intestinal tract, skin lesions, and bronchial secretions of individuals afflicted with various pathological conditions has long been recognized, particularly through the work of Castellani,¹ Ashford² and Fleisher.³

Lately, Wood⁴ suggested the possible relationship between *Monilia* and pernicious anemia, and cited some instances wherein he had isolated *Monilia*, identical with the *Monilia Psiliosis* of Ashford, from the stools of pernicious anemia cases.

We have succeeded in isolating *Monilia* from 9 out of 10 cases of pernicious anemia. The single case in which we did not find the organism, was in state of remission at the time of the bacteriological examination. Our present paper deals with the bacteriological characteristics of these strains of *Monilia* found in cases of pernicious anemia as compared to a large number of closely related organisms.

In the past year we have studied over 50 strains of *Monilia*; of these, 10 were stock strains of known organisms secured from Dr. Fleisher, or from the American Type Culture Collection of Chicago. Nine strains were obtained from active cases of pernicious anemia. The remaining were isolated from cases such as:

Diarrheas -----	14	Thrush -----	2
Sprue -----	2	Diabetes -----	2
Bronchitis -----	8	Ca. of stomach -----	1
Lung Abscess -----	3	Duodenal ulcer -----	1
Asthma -----	2	Cardio-renal -----	1
Blastomycosis -----	2	Pyelitis -----	1
Normal -----	2		

It was found that there was no difference in the mode of growth on solid (French proof agar) media with the exception of strain No. 6. Here the growth was dry, with a tendency to pile up, resembling very much the growth of tubercle bacilli, in comparison with the smooth creamy white growth of the other strains. All these organisms produce mycelia either laterally or dipping down

into the media, with the exception of the above mentioned strain No. 6.

A study of the mode of growth in gelatin shows three types. The first and largest group consisting of those in which the growth was just along the gelatin stab, with no mycelial extensions and no liquefaction of the gelatin; this group would include 4 of the pernicious anemia strains—30, 31, 33, 23.

The second group would consist of those that throw off mycelial extensions into the gelatin, giving the inverted pine-tree appearance. This group includes 5 pernicious anemia strains—Nos. 1, 22, 32, 34, 27.

The third group would consist of those which liquified gelatin. This group includes no pernicious anemia strains.

By far the most interesting results are observed in the sugar fermentation tests. For these we used the following fourteen sugars maltose, dextrose, levulose, lactose, sucrose, inulin, xylose, mannite, raffinose, galactose, arabinose, dulcitol, sorbitol and dextrin.

If arranged by the number of sugars in which they produce acid, we find that they fall into eight general groups and sub-groups, A, B, C, etc., according to the sugars they act upon.

According to this classification our ten stock strains fall into the following groups:

No. 39	Monilia Krusei	-----Group	II Type B.
No. 37	Monilia Macedonensis	-----Group	III Type A.
No. 40	Endomyces Albicans	-----Group	III Type B.
No. 41	Oidium Albicans	-----Group	III Type C.
No. 42	Sacchromyces Cerviciae	-----Group	III Type D.
No. 43	Sacchromyces	-----Group	IV Type A.
No. 35	Monilia Albicans	-----Group	IV Type A.
No. 36	Monilia Psiliosis 893	-----Group	IV Type A.
No. 38	Monilia Psiliosis (Ashford)	-----Group	V Type B.
No. 44	Fleishman's Yeast	-----Group	VIII Type A.

The organisms from miscellaneous cases fall into the following groups:

No. 2	Blastomycosis	-----Group	III Type E.
No. 3	Thrush	-----Group	III Type E.
No. 10	Duodenal ulcer	-----Group	III Type E.
No. 18	Blastomycosis	-----Group	IV Type A.
No. 25	Pus from jaw	-----Group	IV Type A.
No. 45	Ca. of stomach	-----Group	IV Type A.
No. 17	Weakness	-----Group	IV Type A.
No. 28	Cardiac	-----Group	VIII Type A.

CHART I.
Sugar Fermentation Groups

Group	Type	Dextrose	Levulose	Maltose	Galactose	Dextrin	Sucrose	Lactose	Mannite	Inulin	Arabinose	Sorbitol	Xylose	Raffinose	Dulcitol	Example No.
I	A	A		A	A											6
II	A	A	A	A												8
III	B	A	A		A		A									39
III	B	A	A		A		A									37
III	B	A	A		A		A									40
III	C	A	A		A		A									41
III	D	A	A		A		A									42
III	E	A	A		A		A									14
IV	A	A	A	A	A	A	A									36
V	A	A	A	A	A	A	A	A								26
V	A	A	A	A	A	A	A	A								33
VI	B	A	A	A	A	A	A	A	A							27
VI	B	A	A	A	A	A	A	A	A				A			21
VII	A	A	A	A	A	A	A	A	A	A						29
VIII	A	A	A	A	A	A	A	A	A	A	A	A		A		44

Seven strains fall into the pulmonary infection group. Of these 15, 12, 11, taken from cases of bronchitis, and one, 5, from a case of asthma, fall into Group III—Type E. One of bronchitis, No. 24, falls into Group IV—Type A, and two of lung abscesses, 20 and 19, fall into the same groups and types.

Of the ten strains isolated from cases of diarrhea, Nos. 6 and 8

fall into Group I—Type A and Group II—Type A, respectively. Six strains, Nos. 16, 14, 13, 9, 7, 4, fall into the same group, III, and the same type, E. Of the remaining two, No. 21 falls into Group VI, Type A, and the other, No. 29, falls into Group VII—Type A.

The nine strains of pernicious anemia fall into the following groups: Four of them, Nos. 30, 31, 34, 23, fall into Group IV—Type A. Two, Nos. 26 and 23, fall into Group V—Types A and B. The remaining three into Group VI—Type A.

Summary: 1. A study of the sugar fermentation reactions of the strains of *Monilia* isolated from cases of pernicious anemia, shows that all act upon dextrose, levulose, maltose, galactose, dextrin and sucrose. The action on lactose, mannite and inulin varies with the different strains. These reactions can be used to distinguish these organisms from various stock strains of yeasts. They resemble closely those given by the stock strains of *Monilia psiliosis*.

2. *Monilia* isolated from other pathological conditions, in general, seem closely related to the pernicious anemia strains in type of growth, and fermentation reactions, although some slight differences are found in many strains.

We take this opportunity to express our appreciation to Dr. Moyer S. Fleisher for his cooperation and encouragement throughout this work.

This is a preliminary report.

¹ Castellani, A., and Chalmers, A. J., *Man. Trop. Med.*, 1913, pp. 820-32.

² Ashford, B. K., *Am. J. Med. Sci.*, 1915, cl, 680.

³ Fleisher, M. S., and Wachowiak, M., *Am. J. Med. Sci.*, 1924, clxviii, 371.

⁴ Wood, E. J., *So. Med. J.*, 1925, xviii, 157-162.

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Simultaneous Cholecystography and Determination of Liver Function.

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Since the introduction of cholecystography by us three years ago, we have instituted many changes and modifications to enhance its value. A short time ago we substituted phenoltetraiodophthalein