of the mammal-like reptiles have abdominal ribs hitherto been found and we may feel quite certain in concluding that in the Anomodonts at least they did not occur, and had they occurred in the Therocephalians it is likely they would have been discovered. The combination of characters seems to point to *Galechirus* being a primitive Therapsidian reptile most closely related to the Therocephalians, but with distinct Rhynchocephaloid affinities. As the American Pelycosaurs are undoubtedly Rhynchocephaloid, it seems not improbable that the common ancestor of the Pelycosaurs and the African mammal-like forms may have been an early Rhynchocephaloid reptile rather than a Cotylosaurian, as some of us had thought.

Another type which I have discovered in the last few months seems in some respects almost as important as *Galechirus* in that it is another "missing link" discovered. A few years ago I pointed out that the old order "Theriodontia" of Owen was an unnatural group including two well-marked divisions—the *Therocephalia* with a Rhyncephalian type of palate, single occipital condyle, simple molars and large angular and surangular bones in the lower jaw, and the *Cynodontia* with a mammalian type of palate, two condyles, complex molars and the lower jaws almost wholly formed by the dentary. The Therocephalians are almost entirely confined to the Middle and Upper Permian beds, the Cynodonts to the Middle and Upper Triassic beds. The new type, which I propose to call *Bauria,* was found in Upper Triassic beds, and while it must be placed among the Cynodonts it shows affinities with the Therocephalians not present in the other known genera. In general shape the skull is not unlike that of *Trirachodon,* but about one half larger than *T. kannemeyeri.* The dental formula is i 4, c 1, m 10 above and apparently the same below. The molars are remarkable by being simple uncusped teeth with flattened tops. There is a secondary palate as in typical Cynodonts, but unlike all previously discovered forms the postorbital arch is incomplete, the postorbital bone not meeting the jugal. The appearance thus produced is very mammal-like. There is apparently no parietal foramen. The squamosal is more like that of the Therocephalians than that of the Cynodonts, and the quadrate is very minute. The occipital condyle is intermediate between that of the Therocephalians and the Cynodonts in that while it is really double the two parts are so close to each other that it is practically single. The lower jaw is almost typically Therocephalian, the angular and surangular being large and the dentary only forming the anterior two thirds of the jaw. While *Bauria* is thus typically Cynodont in the structure of its palate and must therefore be placed in the *Cynodontia,* in the simplicity of its molars, the condition of the occipital condyle, and in the structure of the lower jaw it shows distinct affinities with the more primitive Therocephalians.

In the Lower Triassic beds an imperfect skeleton of a small *Mesosaurus*-like reptile has been discovered. It is less typically an aquatic form and has slender ribs. Abdominal ribs are well developed. The skull, which is imperfectly preserved, is long and pointed and, so far as can be made out, is Rhynchocephaloid in its characters. Until other specimens throw further light on the form it will provisionally be placed in the *Mesosauria.* It has been named *Heleosaurus.*

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NOTE ON THE FERMENTATIVE REACTIONS OF THE B. COLI GROUP

IN view of the fact that Prescott[1] and others have recorded the presence of organisms resembling *Bacillus coli* on grains, it seemed to us of interest to make a somewhat careful comparison of these forms with intestinal *B. coli* in regard to their power of fermenting carbohydrates. The success of Gordon and Houston[2] in clearing up the relations of the

[1] SCIENCE, N. S., XV., 363; *Medicine,* XI., 20; "Biological Studies" by the pupils of William Thompson Sedgwick, Boston, 1906.

[2] Report of the Medical Officer to the Local

streptococci from various sources by comparison of fermentative power encouraged us to hope for results.

With this end in view, fifty-two cultures of dextrose-fermenting organisms were isolated from human feces. The procedure in all cases consisted in the inoculation, with a small portion of the material, of a fermentation tube from which litmus-lactose-agar plates were made on the first appearance of gas. Of the 52 cultures thus isolated, 5 failed to give a typical reaction in milk, 7 failed to reduce nitrates, 6 formed no indol, and 16 liquefied gelatin. Thirty-one of the 52 cultures proved to be *B. coli,* as determined by the five tests mentioned above, and 25 of them were used for comparative tests in various carbohydrates.

After the work with the intestinal *B. coli* was completed the attempt was made (in the summer of 1907) to secure similar forms from growing grains. Heads of grains and grasses of various sorts were collected from fields in eastern Massachusetts and brought to the laboratory in sterile test-tubes. Portions of perhaps an inch in length were placed in dextrose fermentation tubes and when gas formation began litmus-lactose-agar plates were inoculated. One hundred and seventy-eight samples of grain, however, showed gas in the dextrose tube only 50 times; and 40 samples of grasses failed to show gas at all. Of the 50 samples plated on litmus-lactose-agar only three showed red colonies, and of the organisms isolated all three liquefied gelatin. Time was not available to pursue this investigation further. It seemed to us, however, that our inability to isolate *B. coli* from 218 samples of grains and grasses was in itself of some interest. The experience corresponds with that of Laurent,[3] and Klein, and Houston,[4] but not with the results of Prescott (*l. c.*), and Papasotiriu.[5]

The results obtained with the intestinal *B. coli* may perhaps be of some assistance to workers along similar lines. Each of the 25 cultures studied was inoculated into 12 different fermentable media in fermentation tubes. The basis of the medium was in each case nutrient broth, to which 1 per cent. of the substance to be tested had been added, sterilization being carried out at 100° on three successive days. Two monosaccharides, dextrose and galactose; 5 polysaccharides, lactose, maltose, xylose, saccharose and raffinose; two alcohols, dulcite and mannite, two starch-like bodies, dextrin and inulin, and one albuminoid, nutrose—were used as substances to be fermented.

ACID PRODUCTION BY B. COLI (INTESTINAL)

Acidity in terms of c.c. N/20 NaOH per c.c. of the culture medium. 72 hours' incubation

Culture	Lactose	Maltose	Dextrose	Saccharose	Raffinose	Xylose	Nutrose	Dulcite	Inulin	Dextrin	Mannite	Galactose
1	.3	.2	.3	—.1	.05	.3	.1	.4	0	.2	0	.3
2	.3	.3	.3	0	0	.2	0	.25	.05	.2	.4	.3
3	.3	.35	.3	.3	.3	.3	0	.3	0	.3	.4	.35
4	.3	.25	.3	0	0	.2	0	0	0	.2	0	.25
5	.3	.4	.3	.1	.2	.3	0	.2	0	.2	.4	.4
6	.35	.25	.3	.2	.2	.3	—.05	.4	0	.2	.4	.45
7	.3	.4	.3	0	0	.3	0	.2	.1	.2	.4	.35
8	.3	.2	.3	0	0	.3	—.1	0	.05	.2	0	.3
9	.3	.3	.4	—.05	0	.3	0	.2	0	.4	.4	.3
10	.25	.3	.4	—.05	0	.3	0	.15	0	.2	0	.35
11	.3	.3	.3	—.05	.3	.3	0	.3	.05	.2	.4	.35
12	.3	.4	.3	—.05	0	.3	0	.3	.05	.2	.4	.4
13	.25	.25	.3	—.05	0	.3	—.05	.3	0	.3	.4	.3
14	.25	.35	.4	0	.25	.3	—.05	.35	.05	.1	0	.35
15	.3	.4	.4	.1	.3	.35	0	0	.05	.2	.4	.35
16	.3	.4	.3	0	0	.3	.1	.3	0	.2	.35	.4
17	.3	.25	.4	—.05	0	.25	0	.3	.05	.2	.3	.35
18	.3	.4	.4	0	0	.3	0	.3	.05	.2	.4	.35
19	.3	.4	.3	—.1	0	.35	0	.3	.05	.35	0	.35
20	.3	.4	.3	0	0	.2	0	.3	0	.4	.4	.3
21	.3	.35	.3	0	0	.4	.15	.35	0	.15	.4	.35
22	.3	.4	.3	.15	.3	.3	—.05	.35	0	.2	.4	.35
23	.3	.4	.3	.35	.3	.25	—.05	.35	.2	.2	.4	.35
24	.3	.3	.3	.35	.2	.3	—.05	.3	.05	.3	.4	.4
25	.4	.3	.3	.3	.3	.3	—.05	.4	.05	.1	.4	.45

After 72 hours' incubation at 37° the occurrence of gas formation was observed and the reaction of the medium was determined by titration against *N*/20 NaOH. Uninoculated tubes were, of course, titrated in parallel as controls. The general results of the titrations are indicated in the table below, the acidity in

Government Board for 1902–3; Report of the Medical Officer to the Local Government Board for 1903–4.

[3] *Ann. de l'Inst. Pasteur,* 1899, 13.

[4] Report of the Medical Officer to the Local Government Board for 1899–1900.

[5] *Archiv für Hygiene,* XLI., 204.

each case being the amount of $N/20$ NaOH in c.c., necessary to neutralize one cubic centimeter of the broth, phenolphthalein being used as an indicator. Gas formation coincided with acidity except in the case of dextrin. With this medium acidity was produced in every case, but gas was formed only by cultures 7, 8, 12, 14, 17 and 21.

Inspection of the table shows that all the cultures produced acid in the two monosaccharids; in the polysaccharids, lactose, maltose and xylose, and in the starch-like body, dextrin, the final acidity produced being notably uniform except in the case of dextrin. None of the cultures fermented inulin or nutrose actively, though slight acidity was recorded in one or two cases. No gas was formed in any case in these two media. The other four substances, the polysaccharids, saccharose and raffinose and the two alcohols show diagnostic differences. Seven of the cultures fermented all of these substances; one fermented all but dulcite; one all but saccharose; and one attacked raffinose and dulcite. These ten cultures may be roughly grouped together as organisms of high fermentative power. None of the other fifteen strains produced acid in either saccharose or raffinose. Smith[6] long ago pointed out that saccharose was attacked by some bacteria of the colon group, and not by others. Raffinose is evidently acted on by the same organisms which attack saccharose; and it is of interest to note that these two polysaccharides differ from lactose and maltose in lacking the aldehyde group which shows itself in the reduction of Fehling's solution. The group of organisms, which possess the power of fermenting saccharose, was distinguished by Dunham as *B. coli communior,* and by Ford as *B. communior,* the name *B. coli* being restricted to the type which fails to ferment saccharose. On this basis, Nos. 3, 5, 6, 11, 14, 15, 22, 23, 24 and 25 in the table would be related to *B. communior,* No. 11 varying in failing to act on saccharose, No. 14 failing to ferment saccharose and mannite and No. 15 failing to act on dulcite. Of these ten cultures, only No. 14 formed gas in dextrin.

[6] "Wilder Quarter-Century Book," Ithaca, 1893.

The other fifteen strains are typical *B. coli,* not attacking saccharose or raffinose; but among them several subgroups may be distinguished according to their action on the alcohols and dextrin. Six cultures, Nos. 2, 9, 13, 16, 18 and 20, fermented both alcohols but formed no gas in dextrin. Four cultures, Nos. 7, 12, 17 and 21, fermented both alcohols and did form gas in dextrin. Nos. 4 and 8 formed no acid in the alcohols. Nos. 1, 10 and 19 produced acid in dulcite but not in mannite and no gas in dextrin.

Whether these differences are of systematic significance can only be determined by the examination of a larger series of cultures. MacConkey,[7] in a study of 480 coli-like organisms from feces, found 120 which fermented neither saccharose nor dulcite, 178 which fermented dulcite but not saccharose, 110 which fermented both saccharose and dulcite and 72 which fermented saccharose but not dulcite. Our results, classified in the same way, and ignoring the action upon raffinose and mannite, show 2 cultures in the first group, 15 in the second, 7 in the third and 1 in the fourth.

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CURRENT NOTES ON METEOROLOGY AND CLIMATOLOGY

MONTHLY WEATHER REVIEW

No. 8, Vol. XXXV., *Monthly Weather Review,* 1907, contains the following articles:

G. N. Coffey: "Influence of Temperature and Moisture upon the Rate of Growth of Tobacco"; review of Bulletin 39, Bureau of Soils, on "Effect of Shading on Soil Conditions," dealing with experiments on tobacco grown under shade at Tariffville, Conn. The conclusion is: the soil moisture was always sufficient in quantity; the relative humidity had little, if any, influence on the rate of growth, but a decided rise or fall in temperature was followed by an acceleration or diminution, respectively, in the rate of growth of the plants.

W. A. Bentley: "Studies of Frost and Ice Crystals." This paper is intended as a com-

[7] *Journal of Hygiene,* V., 333.