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JFI 239 (1945)

1469
2105
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apparatus revealed three components present, whether the preparation was derived from H, O, or Vi-containing strains. Each of the three fractions provided some protection against infection with virulent typhoid organisms to mice, but were not in any way superior to the unfractionated concentrate. The fractions obtained from the Vi-containing strains were most potent in this respect. It was also noted that while only the gamma fraction showed serological activity as indicated by precipitin reactions in the case of the H and O strains, with the Vi strains the beta component was also serologically active. Indeed, it appeared that the Vi antigen was associated with this fraction.

Abstract of **The Biochemistry of Vibrio cholerae. III. Acid Regulation by Means of the Carbon-Dioxide-Bicarbonate Buffering System.**—ROBERT K. JENNINGS AND RICHARD W. LINTON (*Archives of Biochemistry*, 4: 311, 1944). As an outgrowth of the studies reported in the previous paper a still more satisfactory culture method was devised. Relying on the minerals carried over in a large inoculum of salts-C-D culture for inorganic requirements the new BRF medium had only to supply glucose and a small amount of amino acids (in the form of casein-digest) as nutrient matter. Sodium bicarbonate added to this substrate permitted the establishment of a CO_2-exchange buffering system by regulating the CO_2 content of the aerating gases. This made possible the utilization of much more glucose without appreciable pH drop, and concomitant increase in the crop of vibrios. The final culture is extremely dense. It may be killed with phenylmercuric nitrate and used directly as a vaccine without further manipulation.

Abstract of **The Ribonuclease Activity of Pasteurella pestis (Plague Bacillus).**—GLADYS E. WOODWARD (*Journal of Biological Cehmistry*, 156: 143, 1944). Analytical data, obtained from hydrochloric acid precipitation and uranium fractionation, show that yeast nucleic acid is enzymatically decomposed by living cells of *Pasteurella pestis*, cells killed by phenylmercuric nitrate and by a cell-free preparation. Only part of the nucleic acid decomposed is hydrolyzed to mononucleotides, the remainder probably existing in a depolymerized state. The decomposition is accompanied by liberation of only a trace of inorganic phosphate.

All of the enzymes of the ribonuclease system are inactivated somewhat by heat, the least inactivation of the depolymerase being produced at pH 6.5 and of the tetranucleotidase and mononucleotidase at pH 7.6.

Tables of Numbers Related to the Tangent Coefficients.—H. M. TERRILL AND ETHEL M. TERRILL. The numbers K_n may be defined by

$$K_n = 2(2^{2n} - 1)B_n, \qquad (1)$$

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(1)

where B_n is the nth Bernoulli number, e.g. $B_5 = 5/66$. The numbers K_n have been attributed to Genocchi by Lucas ("Theorie des Nombres," Paris, 1891, p. 251) who gives a small table of them.

These numbers are integers and have important mathematical applications in several branches of analysis. It may be noted that $(-1)^n K_n$ is sometimes denoted by G_{2n}. An extensive theory of these numbers has been elaborated by Bell (*Transactions of the American Mathematical Society*, **28**: 129, 1926; **31**: 405, 1929). Lacunary recurrence formulas for their computation have been given by Lehmer (*Annals of Mathematics*, **36**: 637, 1935).

The numbers H_n may be defined by 2n

$$nH_n = 2^n(2^n - 1)B_n. \qquad \text{Yuk} \tag{2}$$

An equivalent definition is

$$2^{n-1}H_n = T_n, \tag{3}$$

where T_n is the nth tangent coefficient, in the notation used by Peters ("Zehnstellige Logarithmentafel," Vol. 1, Anhang, Berlin, 1922). The H_n are known to be integers (Nörlund, *Acta Mathematica*, **43**: 121, 1922: Chowla, *Messenger of Mathematics*, **57**: 122, 1927).

Since

$$nH_n = 2^{n-1}K_n, \tag{4}$$

the numbers H_n and K_n may be readily checked against each other. Other methods of checking are also available, however.

We define the numbers $K_n{}^p$ for positive values of p and n by the recurrence formula

$$p^2K_n{}^p - (p+1)^2K_n{}^{p+1} = K_{n+1}{}^p \tag{5}$$

with the initial values $K_2{}^p = 1$, $p = 1, 2, 3$, etc. Following is a small table of $K_n{}^p$.

$n \backslash p$	1	2	3	4
2	1	1	1	1
3	−3	−5	−7	−9
4	17	43	81	131
5	−155	−557	−1367	−2729

As an example of (5), we have

$$K_5{}^2 = 4K_4{}^2 - 9K_4{}^3 = 4\cdot 43 - 9\cdot 81 = -557.$$

The numerical values of K_n may be checked against those of $K_n{}^1$ which occur in the first column.

1469

In similar manner we define the numbers H_n^p by the recurrence formula

$$2p^2H_n^p - (p + 1)(2p + 1)H_n^{p+1} = H_{n+1}^p \qquad (6)$$

with initial values $H_2^p = 1$, $p = 1, 2, 3$, etc.

$n \backslash p$	1	2	3	4
2	1	1	1	1
3	−4	−7	−10	−13
4	34	94	184	304
5	−496	−2008	−5200	−10702

As an example of (6) we have

$$H_5^2 = 8H_4^2 - 15H_4^3 = 8\cdot 94 - 15\cdot 184 = -2008.$$

The numerical values of H_n may be checked against those of H_n^1.

The recurrence formula (6) is related to one given for the generalized Euler numbers by Terrill (*American Mathematical Monthly*, **44**: 526, 1937).

Values of K_n are given in Table I and those of H_n in Table II.

For the ratio of two successive values of H_n, we have

$$H_n/H_{n-1} = \tfrac{1}{2}T_n/T_{n-1}. \qquad (7)$$

Thus the ratios T_n/T_{n-1}, given by Peters (*op. cit.*), are immediately

TABLE I.

n	K_n
1	1
2	1
3	3
4	17
5	155
6	2073
7	38227
8	9 29569
9	288 20619
10	11096 52905
11	5 19432 81731
12	290 51510 42481
13	19132 96724 83963
14	14 65562 61547 68697
15	1291 88508 84480 17715
16	1 29848 16368 11073 01953
17	147 61446 73378 41640 01387
18	18845 15541 72881 86751 12649
19	26 84635 31464 16547 14826 81379

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n
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applicable to the table
equals approximately $\frac{1}{4}$
the ratios E_n/E_{n-1} are gi
Further,

$H_n/$

Thus, as n becomes large

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TABLE II.

n	H_n
1	1
2	1
3	4
4	34
5	496
6	11056
7	3 49504
8	148 73104
9	8197 86496
10	5 68142 28736
11	483 54473 17504
12	49581 24445 83424
13	60 28356 44995 62496
14	8575 63496 14189 40416
15	14 11083 01927 54881 49504
16	2659 30677 61890 77543 99744
17	5 69062 45479 13405 71761 70496
18	1372 26233 93637 76229 91313 96096
19	3 70400 54732 70641 75559 76856 53504

applicable to the table of H_n. Also, it can be shown that K_n/K_{n-1} equals approximately $\frac{1}{4}E_n/E_{n-1}$ where E_n are the Euler numbers and the ratios E_n/E_{n-1} are given by Peters.

Further,

$$H_n/H_{n-1} = \frac{2(n-1)}{n}K_n/K_{n-1}. \tag{8}$$

Thus, as n becomes large, one ratio is approximately twice the other.