

abdominal nerves. The symptoms noted for one bird were "injury or paralysis of the right leg." This one improved and was returned to the laying pen. She was probably injured rather than paralyzed. Another fowl showed symptoms of unsteadiness on legs and jerking head movements. This bird apparently recovered, but one of the controls showing similar symptoms recovered without any treatment and hatched 33 out of 34 eggs in the past breeding season.

Twenty-one hens were fed wheat germ oil, 14 receiving 6 cc or more, and of these fourteen, 8 received 14 cc or more. Of the 21 birds 14 showed at autopsy gross lesions of neurolymphomatosis, one showed lymphomatosis of the liver, another showed tumors of the feet, comb and internal organs. Two others, with typical symptoms, were negative. Of two birds with uncoordinated head movements, one improved and laid 29 eggs in the next 50 days. The other is still affected, showing no improvement.

Of the 10 controls 7 showed gross lesions of neurolymphomatosis on autopsy, one showed lymphomatosis of the liver and ovary, and one which had shown only uncoordinated head movements as symptoms was negative. One bird returned to laying condition for a brief period but eventually died. This hen never regained control of its paralyzed right leg. One bird (mentioned above) recovered completely.

Fowls showing uncoordinated head movements, twisting of neck to one side or over the back, generally eventually die of inanition. In some cases gross and microscopic lesions of neurolymphomatosis have been observed in the eighth or ninth cranial nerves of these birds. In other cases it is doubtful if the condition actually represents true neurolymphomatosis.

The evidence presented, involving 31 paralyzed fowls treated with cold-pressed wheat germ oil in amounts similar to or greater than those suggested by Butler and Warren, does not support their contention that vitamin E or wheat germ oil can bring about

quick recovery from true *neurolymphomatosis gallinarum*.

RANDALL K. COLE

DEPARTMENT OF POULTRY HUSBANDRY,
CORNELL UNIVERSITY

A PARADOX IN THE SCORING OF COMPETING TEAMS

LET us suppose that a number of teams of three men each are competing in an academic contest and that the best three teams are to be selected on the basis of a special examination. How shall the merits of the several teams be computed?

Two possible methods of scoring suggest themselves: (1) we may list all the contestants in order of rank, and define the rank of each team as the sum of the ranks of its members; or (2) we may consider only the actual examination-grade of each contestant, and define the score of each team as the sum of the scores of its members. The first method we may call the rank method, the second the sum-of-the-grades method.

The rank method is regularly used in scoring inter-collegiate cross-country runs. It should be noted, however, that the situation in the case of the cross-country run is not the same as the situation in the case of the academic examination. In the athletic contest, the order of rank in which the men cross the finishing line supplies the only data available (since the individual times are not usually recorded), while in the academic case we have not only the rank of each contestant but also his actual examination-grade, on the basis, say, of 100. The sum-of-the-grades method is used in the popular frog-jumping contests. Here the score for each "team of three" (consisting, to be sure, of three jumps of a single frog) is computed by adding the lengths of the individual jumps recorded for that team.

In many practical cases it will make no difference which method is used. Nevertheless, the question has a certain theoretical interest which seems to be worth discussing.

The purpose of the present paper is to show that

TABLE I

I			II			III			IV			V			VI		
B ₁	98	1	B ₁	98	1	B ₁	98	1	B ₁	98	1	B ₁	98	1	B ₁	98	1
A ₁	96	2	A ₁	96	2	D ₁	97	2	D ₁	97	2	A ₁	96	2	A ₁	96	2
D ₁	94	3				A ₁	96	3	A ₁	96	3						
C ₁	93	4	C ₁	93	3	D ₂	94	4	C ₁	93	4	C ₁	93	3	C ₁	93	3
A ₂	92	5	A ₂	92	4	A ₂	92	5	A ₂	92	5	A ₂	92	4	A ₂	92	4
D ₂	91	6	D ₁	91	5												
C ₂	89	7	C ₂	89	6	C ₂	89	7	C ₂	89	6	C ₂	89	5	C ₂	89	5
			D ₂	88	7							D ₁	88	6			
B ₂	87	8	B ₂	87	8	B ₂	87	8	B ₂	87	7	B ₂	87	7	B ₂	87	6
C ₃	84	9	C ₃	84	9	C ₃	84	9	C ₃	84	8	C ₃	84	8	C ₃	84	7
												D ₂	83	9	D ₁	83	8
B ₃	82	10	B ₃	82	10	B ₃	82	10	B ₃	82	9	B ₃	82	10	B ₃	82	9
A ₃	80	11	A ₃	80	11	A ₃	80	11	D ₂	81	10				D ₂	81	10
D ₃	79	12	D ₃	79	12	D ₃	79	12	A ₃	80	11	A ₃	80	11	A ₃	80	11
									D ₃	79	12	D ₃	79	12	D ₃	79	12
A	18		A	17		B	19		B	17		C	16		C	15	
B	19		B	18		A	20		A	18		A	17		B	16	
C	20		B	19		C	21		A	19		B	18		A	17	

the rank method, when applied to the academic case here considered, fails to satisfy the following postulate, which may be regarded by many people as a fundamental principle:

Postulate of relevancy. The relative position of any two teams—or the relative position of any three teams among themselves—ought to be determinable on the basis of the actual examination-grades obtained by the members of these teams alone. In other words, in determining the relative standing of any teams among themselves, it ought not to be necessary to take into account the performance of any contestants who do not belong to these teams.

To show that the rank method fails to satisfy this postulate, we construct the six following examples, each of which is a hypothetical, but entirely possible, case. There are four teams of three men each: “team A” has members A₁, A₂, A₃; “team B” has members B₁, B₂, B₃; and similarly for “team C” and “team D.” The actual scores obtained by each of the twelve con-

method is employed. This method gives A 268, B 267, C 266, thus determining the order ABC.

As an even more striking illustration of the paradoxes which may result from the rank method, we construct two further examples, VII and VIII, as shown in the second table. Here there are four teams A, B, C, D, and the question raised concerns the order of the two teams A and B. In passing from case VII to case VIII every member of team B has improved his grade, while every member of team A has lowered his grade. Yet if the method of ranks is adopted, B starts out higher than A in case VII and then falls below A in case VIII. The change which has brought about this reversal of order is due entirely to changes in the grades of two men, D₁ and D₂, who do not belong to either of the teams A or B.

This paradoxical situation would not occur if the sum-of-the-grades method were used. According to this method we would have A 271 and B 268 in case VII, and B 271 and A 268 in case VIII, so that the change in the final order of merit in passing from case VII to case VIII would reflect in a natural manner the improvement in B's grade and the deterioration in A's grade.

These examples may suffice to show that if the postulate of relevancy is accepted, some method other than the method of ranks must be adopted.

E. V. HUNTINGTON

HARVARD UNIVERSITY

BOOKS RECEIVED

BECK, REGENA C. *Laboratory Manual of Hematologic Technic, Including Interpretations.* Pp. 389. 79 figures. Saunders. \$4.00.

BENSLEY, R. R. and S. H. BENSLEY. *Handbook of Histological and Cytological Technique.* Pp. viii + 167. University of Chicago Press. \$2.00.

CROWTHER, J. G. *About Petroleum.* Pp. viii + 181. Illustrated. Oxford University Press. \$2.25.

GOLDBLATT, L. A., Editor. *Readings in Elementary Organic Chemistry.* Pp. 150. Illustrated. Appleton-Century. \$1.25.

HARROW, BENJAMIN. *Biochemistry for Medical, Dental and College Students.* Pp. 383. 52 figures. Saunders. \$3.75.

HOGBen, LANCELOT. *Science for the Citizen; A Self-Educator Based on the Social Background of Scientific Discovery.* Pp. xiii + 1082 + xix. 480 figures. Knopf. \$5.00.

National Research Council of Japan. *Japanese Journal of Botany; Translations and Abstracts, Vol. IX, No. 2.* Pp. vii + 121–267 + 98. *Japanese Journal of Geology and Geography; Translations and Abstracts, Vol. XV, Nos. 1 and 2.* Pp. iv + 129 + 37. Both illustrated. The Council, Tokyo.

SKINNER, B. F. *The Behavior of Organisms; An Experimental Analysis.* Pp. ix + 457. 148 figures. Appleton-Century. \$5.00.

TINKER, MILES A. and KENNETH H. BAKER. *Introduction to Methods in Experimental Psychology.* Pp. vi + 222. 26 figures. Appleton-Century. \$2.75.

YATES, RAYMOND F. *Making and Operating Model Railroads.* Pp. xxii + 315. Illustrated. Appleton-Century. \$3.00.

TABLE II

Case VII			Case VIII		
C ₁	99	1	C ₁	99	1
A ₁	98	2	A ₁	97	2
			B ₁	95	3
B ₁	94	3			
A ₂	93	4	A ₂	92	4
			D ₁	91	5
B ₂	89	5	B ₂	90	6
D ₁	88	6			
C ₂	87	7	D ₂	88	7
			C ₂	87	8
B ₃	85	8	B ₃	86	9
D ₂	84	9			
C ₃	81	10	C ₃	81	10
A ₃	80	11	A ₃	79	11
			D ₃	78	12
D ₃	78	12			
B	16		A	17	
A	17		B	18	

testants, in each of the six cases I, II, III, IV, V, VI, and shown in the table; and the question is, how shall we determine the relative merits of teams A, B, C, in each of the six cases?

If we accept the postulate above, the relative standing of the teams A, B, C, whatever it may be, must obviously be the same in all six cases, since the actual grades obtained by the members of these teams do not vary from case to case. On the other hand, if we adopt the method of ranks, we see from the table that each of the six possible orders ABC, ACB, BAC, BCA, CAB, CBA, is represented by one of the six cases. The actual scores recorded in the six cases differ only in the scores obtained by two men, D₁ and D₂; and yet the variation in these two supposedly irrelevant items is enough to upset completely the order of merit among the three teams A, B, C.

No such ambiguity arises if the sum-of-the-grades

A PARADOX IN THE SCORING OF COMPETING TEAMS

E. V. Huntington

Science **88** (2282), 287-288.
DOI: 10.1126/science.88.2282.287

ARTICLE TOOLS

<http://science.sciencemag.org/content/88/2282/287.citation>

PERMISSIONS

<http://www.sciencemag.org/help/reprints-and-permissions>

Use of this article is subject to the [Terms of Service](#)

Science (print ISSN 0036-8075; online ISSN 1095-9203) is published by the American Association for the Advancement of Science, 1200 New York Avenue NW, Washington, DC 20005. The title *Science* is a registered trademark of AAAS.

Copyright © 1938 The Authors, some rights reserved; exclusive licensee American Association for the Advancement of Science. No claim to original U.S. Government Works.