

Number 43

October 25, 1976

Recently we published a list of citation classics, highly cited papers that appeared before 1930.¹ Here is a list of papers published in the 1930s that were still heavily cited during the period 1961-1975. The 59 papers listed in Figure 2 include only those in the life sciences. In a few weeks we will provide a list for the physical sciences and mathematics.

Of the 59 articles, 22 were published from 1930-1934. The remaining twothirds (37) appeared from 1935 to 1939. The 35 journals involved are listed alphabetically in Figure 1. Surprisingly most of them (23) produced only one or two of the articles. Journal of General Physiology and Biochemical Journal produced three and four respectively. Journal of Biological Chemistry produced eleven. The total absence of Science and Nature is surprising.

All articles on this list were cited more than 150 times during the period 1961-1975. Their average citation count was 465! And they're still being cited an average of 30 times a year.

About half of the articles are biochemical; most involve biochemical 'methods.' Many of the authors probably didn't think of them as such. Eleven can be called basic biology, and six basic physiologic studies. Seventeen are medical. Among the medical papers are those (10 and 55) that gave us the eponyms 'Crohn's disease' and 'Turner's syndrome.' The Quick of article 46 is the Quick of Quick's test for prothrombin time.

Fisher's paper (18) from Annals of Eugenics must surely be a milestone in numerical taxonomy. The journals that cited the article in 1975 show how wide its principles have been applied in classification; they include titles as diverse as Journal of Mathematical Biology, Annals of Statistics, Behavioral Research Methods and Instrumentation, Journal of Environmental Management, EEG and Clinical Neurophysiology, Indian Journal of Agricultural Sciences, IEEE Transactions on Computers, Journal of Soil Science, and American Journal of Hospital Pharmacy, among others.

The paper by Karber (31) certainly foreshadows what has become familiar under the term 'drug screening.' The papers by Bodian, Hill, Hursh, and Matthews (5, 26, 29 and 41) are neuromuscular classics. There are four papers (4, 24, 28 and 33) on the circulation and blood pressure whose titles have an almost 'historical' aura by this time. They are a good reminder of how recently hypertension was indeed malignant in almost all its forms, and of how much pharmacological research has Figure 1. Journals that published the highly cited articles listed in Figure 2. A = number of articles listed in Figure 2 published by the journal.

- ٨
- 2 Amer. J. Cancer
- 1 Amer. J. Hygiene
- 2 Amer. J. Med. Sci.
- 2 Amer. J. Physiol.
- 1 Amer. Naturalist
- 1 Anat. Record
- 1 Ann. Inst. Ocean. Monaco
- 1 Ann. Eugenics
- 1 Arbeitsphysiologie
- 1 Arch. Neurol. Psychiat.
- 1 Arch. Pathol.
- 4 Biochem. J.
- 2 Biochem. Zschr.
- 1 Brit. J. Exp. Pathol.
- 1 Canad. Med. Assoc. J.
- 1 Endocrinology
- 1 Genetics
- 2 Hoppe-Seylers Zschr.

- 1 J. Amer. Med. Assoc.
- 11 J. Biol. Chem.
- 1 J. Cell. Comp. Physiol.
- 2 J. Exp. Med.
- 1 J. Exp. Psychol.
- 3 J. General Physiol.
- 1 J. Hygiene
- 1 J. Lab. Clin. Med.
- 2 J. Nutrition
- 1 J. Pathol. Bacteriol.
- 1 J. Physiology
- 1 J. Psychol. Neurol.
- 1 Mikrochemie
- 1 Naunyn-Schmiedebergs Arch.
- 2 Proc. Roy. Soc. Lond. B
- 2 Proc. Soc. Exp. Biol. Med.
- 1 Soil Sci.

advanced in the relatively short time since those articles were written. There are behavioral papers: article 45 on a "proper mechanism of emotion;" and article 54, the famous paper by Stroop on verbal reactions. They are probably the only two psychological studies we've listed as classics until now. Biochemists will not find it surprising that so many of the papers relate to the analysis of

phosphorus and its physiologic compounds--there are too many to mention here.

These highly cited life-sciences classics are listed alphabetically by author in Figure 2. You will find the total citation counts for each article for the period 1961-1975, and the counts for the two years 1974-1975.

1. Garfield E. Highly cited articles. 26. Some classic papers of the late 19th and early 20th centuries. *Current Contents*[®] No. 21, 24 May 1976, p. 5-9.

Figure 2. Highly cited articles in the life sciences, 1930-1939. Articles are listed alphabetically by first author. A = item number. B = total number of citations during the period 1961-1975. C = total number of citations for the two years 1974-1975.

A	B	С	Bibliographic Data
1.	1000	169	Anson M L. The estimation of pepsin, trypsin, papain, and cathepsin with hemoglobin. J. General Physiol. 22:77-89, 1938.
2.	239	33	Anson M L & Mirsky A E. Protein coagulation and its reversal; the preparation of insoluble globin, soluble globin and heme. J. General Physiol. 13:469-76, 1930.
3.	667	50	Berenblum I & Chain E. An improved method for the determina- tion of phosphate. Biochem. J. 32:295-98, 1938.
4.	229	22	Bodansky A. Phosphatase studies. 2. Determination of serum phos- phatase; factors influencing the accuracy of determination. J. Biol. Chem. 101:93-104, 1933.
5.	180	85	Bodian D. A new method for staining nerve fibers and nerve end- ings in mounted paraffin sections. Anatomical Record 65:89-97, 1936.
6.	1349	181	Bratton A C & Marshall E K Jr. A new coupling component for sulfanilamide determination. J. Biol. Chem. 128:537-50, 1939.
7.	215	10	Callow N H, Callow R K & Emmens C W. Colorimetric deter- mination of substances containing the grouping -CH ₂ CO in urine extracts as an indication of androgen content. <i>Biochem. J.</i> 32:1312-31, 1938.
8.	175	13	Cameron G R & Karunaratne W A E. Carbon tetrachloride cir- rhosis in relation to liver regeneration. J. Pathol. Bacteriol. 42:1-22, 1936.
9.	260	17	Crampton E W & Maynard L A. The relation of cellulose and lignin content to the nutritive value of animal feeds. J. Nutrition 15:383-96, 1938.
10.	230	42	Crohn B B, Ginzberg L & Oppenheimer G D. Regional ileitis; a pathological and clinical entity. J. Amer. Med. Assoc. 99:1323-29, 1932.
11.	277	35	Danielli J F & Davson H. A contribution to the theory of per- meability of films. J. Cell. Comp. Physiol. 5:495-508, 1935.
12.	569	56	Dische Z. Ueber einige neue charakteristische Farbreaktionen der Thymonukleinsäure und eine Mikromethode zur Bestimmung derselben in tierischen Organen mit Hilfe dieser Reaktionen (Some new characteristic color reactions of thymonucleic acid and a micromethod for its determination in animal organs using these reactions). <i>Mikrochemie</i> 8:4-32, 1930.

13.	219	36	Drabkin D L & Austin J H. Spectrophotometric studies. 2. Pre- parations from washed blood cells; nitric oxide hemoglobin and hemoglobin and sulfhemoglobin. J. Biol. Chem. 112:51-65, 1935.
14.	171	38	Drach P. Mue et cycle d'intermue chez les crustaces decapodes (Molting and the inter-molting cycle in decapod crustaceans). Ann. Inst. Oceanogr. Monaco 19:103-391, 1939.
15.	756	78	Elson L A & Morgan W T J. A colorimetric method for the de- termination of glucosamine and chondrosamine. <i>Biochem. J.</i> 27:1824-28, 1933.
16.	268	56	Ephrussi B & Beadle G W. A technique of transplantation for Drosophilia. Amer. Naturalist 70:218-25, 1936.
17.	382	56	Evelyn K A & Malloy H T. Microdetermination of oxyhemoglobin, methemoglobin, and sulfhemoglobin in a single sample of blood. J. Biol. Chem. 126:655-62, 1938.
18.	168	37	Fisher R A. The use of multiple measurements in taxonomic prob- lems. Annals Eugenics 7:179-88, 1936.
19.	179	3 0	Fuller A T. The formamide method for the extraction of poly- saccharides from haemolytic streptococci. Brit. J. Exp. Pathol. 19:130-39, 1938.
20.	229	48	Gey G O & Gey M K. The maintenance of human normal cells and tumor cells in continuous culture. 1. Preliminary report: cultiva- tion of mesoblastic tumors and normal tissues and notes on methods of cultivation. Amer. J. Cancer 27:45-76, 1936.
21.	433	45	Goldblatt H, Lynch J, Hanzal R F & Summerville W W. Studies on experimental hypertension; the production of persistent eleva- tion of systemic blood pressure by means of renal ischemia. J. Exp. Med. 59:347-79, 1934.
22 .	304	24	Gomori G. Microtechnical demonstrations of phosphatase in tissue sections. Proc. Soc. Exp. Biol. Med. 42:23-26, 1939.
23.	646	67	Good C A, Kramer H & Somogyi M. The determination of glyco- gen. J. Biol. Chem. 100:485-91, 1933.
24.	557	46	Hamilton W F, Moore J W, Kinsman J M & Spurling R G. Studies on the circulation. 4. Further analysis of the injection method, and of changes in hemodynamics under physiological and pathological conditions. Amer. J. Physiol. 99:554-51, 1932.
2 5.	1259	239	Higgins G M & Anderson R M. Experimental pathology of the liver. 1. Restoration of the liver of the white rat following partial surgical removal. Arch. Pathol. 12:186-202, 1931.
26 .	517	78	Hill A V. The heat of shortening and the dynamic constants of muscle. Proc. R. Soc. London B Biol. 126:136-95, 1938.
27.	1469	236	Hoffman W S. A rapid photoelectric method for the determination

of glucose in blood and urine. J. Biol. Chem. 120:51-5, 1937.

28.	198	20	Hubbell R B, Mendel L B & Wakeman A J. A new salt mixture for use in experimental diets. J. Nutrition 14:273-85, 1937.
29 .	227	29	Hursh J B. Conduction velocity and diameter of nerve fibers. Amer. J. Physiol. 127:131-39, 1939.
30 .	246	50	Jendrassik L & Grof P. Vereinfachte photometrische Methoden zur Bestimmung des Blutbilirubins (Simplified photometric analy- sis of blood bilirubin). Biochem. Zschr. 297:81-90, 1938.
3 1.	341	56	Karber G. Beitrag zur kollektiven Behandlung pharmakologischer Reihenversuche (On collective treatment of serial pharmacologic studies). Naunyn-Schmiedebergs Arch. Exp. Path. Pharmakol. 162:480-83, 1931.
32 .	396	29	Keilin D & Hartree E F. On the mechanism of the decomposition of hydrogen peroxide by catalase. Proc. R. Soc. London B Biol. 124:397-405, 1938.
33 .	210	13	Keith N M, Wagner H P & Barker N W. Some different types of essential hypertension; their course and prognosis. Amer. J. Med. Sci. 197:332-43, 1939.
34 .	760	64	King E J. The colorimetric determination of phosphorus. Biochem. J. 26:292-97, 1932.
3 5.	273	26	King E J & Armstrong A R. A convenient method for determining serum and bile phosphatase activity. Canad. Med. Assoc. J. 31:376-81, 1934.
3 6.	1585	242	Krebs H A & Henseleit K. Untersuchungen über die Harnstoffbild- ung im Tierkörper (Studies on urea formation in the animal or- ganism). Hoppe-Seylers Zschr. Physiol. Chem. 210:33-66, 1932.
37.	195	22	Kunitz M & Northrup J H. Isolation from beef pancreas of cry- stalline trypsinogen, trypsin, a trypsin inhibitor and an inhibitor- trypsin compound. J. General Physiology 19:991-1007, 1936.
38 .	204	38	Lancefield R C. A serological differentiation of human and other groups of hemolytic streptococci. J. Exp. Med. 57:571-95, 1933.
39 .	212	52	Lorente de No R. Studies on the structure of the cerebral cortex. II. Continuation of the study of the ammonic system. J. Psychologie Neurologie 46:113-77, 1934.
40 .	660	53	Malloy H T & Evelyn K A. The determination of bilirubin with the photoelectric colorimeter. J. Biol. Chem. 119:481-90, 1937.
41.	243	25	Matthews B H C. Nerve endings in mammalian muscle. J. Physiology 78:1-53, 1933.
42.	1369	121	Mejbaum W. Ueber die Bestimmung kleiner Pentosemengen, ins- besondere in Derivaten der Adenylsäure (Determination of small quantities of pentose, particularly in derivatives of adenylic acid). Hoppe-Seylers Zschr. Physiol. Chem. 258:117-20, 1939.

43 .	205	16	Michaelis L. Der Acetat-Veronal-Puffer (The acetate-Veronal buffer). Biochem. Zschr. 234:139-41, 1931.
44.	633	102	Miles A A & Misra S S. The estimation of the bactericidal power of the blood. J. Hygiene Cambridge 38:732-48, 1938.
45.	303	87	Papez J W. A proper mechanism of emotion. Arch. Neurol. Psychiat. 38:725-43, 1937.
46 .	177	29	Quick A J, Stanley-Brown M & Bancroft F W. A study of the co- agulation defect in hemophilia and in jaundice. Amer. J. Med. Sci. 190:501-11, 1935.
47.	3323	426	Reed L J & Muench H. A simple method of estimating fifty per endpoints. Amer. J. Hygiene 27:493-97, 1938.
48 .	220	29	Robinson S. Experimental studies of physical fitness in relation to age. Arbeitsphysiologie 10:251-323, 1938.
49.	384	42	Roe J H. A colorimetric method for the determination of fructose in blood and urine. J. Biol. Chem. 107:15-22, 1934.
50.	286	20	Schoenheimer R & Sperry W M. A micromethod for the determination of free and combined cholesterol. J. Biol. Chem. 106:745-60, 1934.
51.	188	4	Schrek R. A method for counting the viable cells in normal and malignant cell suspensions. Amer. J. Cancer 28:389-92, 1936.
52 .	283	25	Sevag M G, Lackman D B & Smolens J. The isolation of the com- pounds of streptococcal nucleoproteins in serologically active form. J. Biol. Chem. 124:425-36, 1938.
53.	159	26	Sifferd R H & DuVigneaud V. A new synthesis of carnosine, with observations on the splitting of the benzyl group from carboben- zoxy derivatives and from benzylthio ethers. <i>J. Biol. Chem.</i> 108:753-61, 1935.
54.	196	41	Stroop J R. Studies of interference in serial verbal reactions. J. Exp. Psychology 18:643-62, 1935.
55.	233	23	Turner H H. A syndrome of infantilism, congenital webbed neck, and cubitus valgus. <i>Endocrinology</i> 23:566-74, 1938.
56.	246	41	Van Harreveld A. A physiological solution for freshwater crus- taceans. Proc. Soc. Exp. Biol. Med. 34:428-32, 1936.
5 7 .	158	40	Walkley A & Black I A. An examination of the Degtaiareff method for determining soil organic matter, and a proposed modification of the chromic acid titration method. Soil Science 37:29-38, 1934.
58.	243	43	Wright S. Evolution in Mendellian populations. Genetics 16:97-159, 1931.
59.	228	16	Youngburg G E & Youngburg M V. A system of blood phosphorus analysis. J. Lab. Clin. Med. 16:158-66, 1930.