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# BIBLIOGRAPHY OF TRACER APPLICATIONS OF DEUTERIUM TO BIOCHEMICAL STUDIES

by

R. C. Thompson

February 13, 1951

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# BIBLIOGRAPHY OF TRACER APPLICATIONS OF DEUTERIUM TO BIOCHEMICAL STUDIES

## INTRODUCTION

This bibliography was originally compiled for personal use and consequently has certain peculiarities which call for some explanation.

The coverage is limited primarily to tracer applications. The numerous papers dealing exclusively with the pharmacological effects of deuterium in high concentration have been excluded. A number of papers not primarily concerned with tracer applications have been included because of their obvious bearing on the subject; e.g., studies of the pharmacological effects of deuterium in low concentrations, studies of exchange reactions involving compounds of biochemical interest, studies on the normal deuterium content of biological materials, analytical methods, etc.

The compilation of a bibliography such as this is complicated by the fact that the use of deuterium as a tracer has become such a commonplace that the fact is often not reflected in the title of publications, and is frequently not indexed under deuterium in abstract journals. The present compilation was undertaken when it became evident that listings in the Bibliography of Research on Heavy Hydrogen Compounds by Kimball*, and in the subject indices of Chemical Abstracts, were incomplete. Papers listed in these two sources and in Nuclear Science Abstracts were consulted, wherever possible, and the bibliographies of these papers checked for additional references. By this procedure the total number of entries was more than doubled. A systematic search for references later than 1949 was not made, although numerous 1950 references are included.

* National Nuclear Energy Series, Div. III, Vol. 4C, McGraw-Hill, New York, 1949

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References are listed alphabetically by senior author and numbered consecutively. The different papers of a given senior author are arranged chronologically. Where a senior author's name has appeared as a junior author on other papers, the numbers of those papers are listed after his name. The names of junior authors who have never been the senior author on a paper, do not appear in the alphabetical listing.

Following the title of each paper there will be found, in parenthesis, a letter or letters which serve to indicate the general subject matter according to the following scheme:

A. Exchange reactions between deuterium and protium.

B. Biological fractionation of deuterium and protium.

C. Tracer applications involving deuterium oxide in studies of gross biological effects.

D. Tracer applications involving deuterium oxide in studies of water as such.

E. Tracer applications involving deuterium oxide in studies of its biological conversion to other compounds.

F. Tracer applications involving deuterium labeled compounds other than water.

G. Synthesis of deuterium labeled compounds.

H. Analytical methods, apparatus, etc.

I. Reviews.

The distinction between exchange reactions (A) and tracer applications (C, D, E, and F) has been made on the general basis of whether the reactions involved were carried out in vitro (A) or in vivo (C, D, E, or F). Papers listed under G are those which deal exclusively or in substantial part with questions of in vitro synthesis. Many of the papers listed under F will also

include information on the synthesis of the labeled compounds employed. Every effort has been made to secure complete coverage of papers in categories C, D, E, and F. The coverage of the other categories is not complete but should contain those papers of particular interest in connection with biochemical tracer applications.

The papers falling into each of these categories are listed by number at the end of the bibliography.

ALPHABETICAL LISTING OF PAPERS BY SENIOR AUTHOR

ANCHEL, M.

and R. Schoenheimer
1. Deuterium as an indicator in the study of intermediary metabolism. XV. Further studies in coprosterol formation. The use of compounds containing labile D for biological experiments. (A, F)
J. Biol. Chem. 125, 23-31 (1938), C.A. 32, 7985

ANKER, H. S.

and K. Bloch
2. Action of platinum on cholesterol in acetic acid solution. (A, G)
J. Am. Chem. Soc. 66, 1752-5 (1944), C.A. 39, 305

and K. Bloch
3. On the metabolism of $\Delta^{4,5}$-cholestenone. (F)
J. Biol. Chem. 178, 971-6 (1949)

ARNSTEIN, H. R. V.

and R. Bentley
4. Isotopic tracer technique. (I)
Quart. Revs. 4, 172-94 (1950)

BARBOUR, H. G.

and F. J. Cochran
5. Apparatus for $D_2O$ studies in small animals. (H)
Science 82, 179-80 (1935), C.A. 29, 7371

See also: 241

BARNES, T. C.

6. The effect of $D_2O$ of low concentration on Euglena. (C)
Science 79, 370 (1934), C.A. 28, 3752

and E. J. Larson
7. Influence of $D_2O$ of low concentration on Spirogyra, planaria and on enzyme action. (C)
Protoplasma 22, 431-43 (1934), C.A. 29, 1838

and H. Z. Gaw
8. Chemical basis for some biological effects of $D_2O$. (C)
J. Am. Chem. Soc. 57, 590-1 (1935), C.A. 29, 2986

9. The biological effects of $D_2O$. (C)
Am. J. Sci. 30, 14-15 (1935), C.A. 29, 6255

See also: 167

BARRETT, H. M.

C. H. Best and J. H. Ridout
10. A study of the source of liver fat using D as an indicator. (E, F, H)
J. Physiol. 93, 367-8 (1938), C.A. 32, 9234

BERNHARD, K.

and R. Schoenheimer
11. The inertia of highly unsaturated fat acids in the animal investigated with D. (E)
J. Biol. Chem. 133, 707-12 (1940), C.A. 34, 4128

and R. Schoenheimer
12. Rate of formation of stearic and palmitic acids in normal mice. (E)
J. Biol. Chem. 133, 713-20 (1940), C.A. 35, 2575

13. Source of acetyl groups in vivo. I. Acetylation of sulfanilamide and p-aminobenzoic acid during simultaneous dosage with deuterioacetic acid. (F)
Z. physiol. Chem. 267, 91-8 (1940), C.A. 35, 3693

14. The fate of alcohol in the animal body. (E, F)
Z. physiol. Chem. 267, 99-102 (1940), C.A. 35, 3693

15. Source of acetyl groups in vivo. II. Results of feeding of sulfanilamide and deuteriosuccinic acid. (F)
Z. physiol. Chem. 271, 208-10 (1941), C.A. 37, 3150

and E. Gressly
16. Oxidation of the benzene ring in the animal body. (F)
Helv. Chim. Acta 24, 83-7 (1941), C.A. 35, 4785

17. Chemical embryology. Lipide synthesis in the chick embryo. (E)
Helv. Chim. Acta 24, 1094-8 (1941), C.A. 36, 2318

18. Biological degradation of fat acids through methyl oxidation. Recovery and metabolism of dicarboxylic acids containing D. (F)
Helv. Chim. Acta 24, 1412-25 (1941), C.A. 36, 3812

19. Metabolism studies using isotopes. (I)
Schweiz. med. Wochschr. 71, 317-19 (1941), C.A. 36, 5869

and H. Steinhauser
20. The acetylation of amino acids in vivo. (F)
Z. physiol. Chem. 273, 31-8 (1942), C.A. 37, 3460

H. Steinhauser and F. Bullet
21. Investigations on fat metabolism with the aid of D as indicator. I. Question of fat acids necessary for life (essential fat acids). (E)
Helv. Chim. Acta 25, 1313-18 (1942), C.A. 38, 1771

BERNHARD, K. (Continued)

and F. Bullet
22. Fat metabolism with aid of D as indicator. II. Synthesis of fatty acids from carbohydrate. (E)
Helv. Chim. Acta. 26, 1185-9 (1943)

and H. Steinhauser
23. Fat metabolism with aid of D as indicator. III. Lipide synthesis in inanition. (E)
Helv. Chim. Acta 27, 207-10 (1944), C.A. 38, 3695

H. Steinhauser and A. Matthey
24. Fat metabolism with the aid of D as indicator. IV. Lipide synthesis from protein in albino rats. (E)
Helv. Chim. Acta 27, 1134-41 (1945), C.A. 39, 3815

and E. Vischer
25. The decomposition of behenic acid in the animal body. (F)
Helv. Chim. Acta 29, 929-35 (1946), C.A. 40, 5816.

and F. Bullet
26. The formation of fatty acids in the intestinal tract. (E)
Helv. Chim. Acta 30, 1784-6 (1947), C.A. 42, 1339

27. Formation of lipides by the micro-organism Phycomyces Blakesleeanus. (E)
Cold Spring Harbor Symposia Quant. Biol. 13, 26-28 (1948)

28. Recent results of metabolism studies with the help of isotopes. (I)
Bull. Schweiz. Akad. Med. Wiss. 5, 331-60 (1949).

29. On the use of D in biochemistry. (I)
Bull. Schweiz. Akad. Med. Wiss 5, 405-26 (1949)

See also: 65

BLOCH, K.

and D. Rittenberg
30. Biological formation of cholesterol from acetic acid. (F)
J. Biol. Chem. 143, 297-8 (1942), C.A. 36, 3203

and D. Rittenberg
31. On the utilization of acetic acid for cholesterol formation. (F)
J. Biol. Chem. 145, 625 (1942)

and D. Rittenberg
32. Preparation of deuteriocholesterol. (G)
J. Biol. Chem. 149, 505-9 (1943), C.A. 37, 2682

B. N. Borg and D. Rittenberg
33. Biological conversion of cholesterol to cholic acid. (F)
J. Biol. Chem. 149, 511-17 (1943), C.A. 37, 6282

BLOCH, K.

and D. Rittenberg
34. Sources of acetic acid in the animal body. (F)
J. Biol. Chem. 155, 243 (1944)

35. Some aspects of the metabolism of leucine and valine. (F, G)
J. Biol. Chem. 155, 255-63 (1944)

36. Biological conversion of cholesterol to pregnandiol. (F)
J. Biol. Chem. 157, 661-6 (1945), C.A. 39, 2553

and D. Rittenberg
37. An estimation of acetic acid formation in the rat. (F)
J. Biol. Chem. 159, 45-58 (1945), C.A. 39, 4660

E. Borek and D. Rittenberg
38. Synthesis of cholesterol in surviving liver. (F)
J. Biol. Chem. 162, 441-9 (1946), C.A. 40, 4786

and E. Borek
39. Biological acetylation of natural amino acids. (F)
J. Biol. Chem. 164, 483-4 (1946)

and D. Rittenberg
40. Metabolism of acetylamino acids. (F)
J. Biol. Chem. 169, 467-76 (1947), C.A. 41, 7481

41. Metabolism of acetic acid in animal tissues. (I)
Physiol. Rev. 27, 574-620 (1947)

42. The biological synthesis of lipides. (E, F)
Cold Spring Harbor Symposia Quant. Biol. 13, 29-34 (1948), C.A. 43, 5481

See also: 2, 3, 193, 213, 214

BOK, L. D. C.

and K. H. Geib
43. Exchange reactions of acetic acid and acetate ion in $D_2O$. (A)
Naturwissenschaften 26, 122 (1938), C.A. 32, 5283

and K. H. Geib
44. Exchange of hydrogen in aqueous solutions of acetic acid and acetates. (A)
Z. Physik. Chem. A183, 353-70 (1939)

BONHOEFFER, K. F.

and G. W. Brown
45. The exchange of H between $H_2O$ and H compounds dissolved in it. (A)
Z. Physik. Chem. B23, 171-4 (1933), C.A. 28, 406

BONHOEFFER, K. F. (Continued)

and R. Klar
46. Exchange of D atoms between water and organic compounds. (A)
Naturwissenschaften 22, 45 (1934), C.A. 28, 2609

47. Reactions of D. (I)
Z. Elektrochem. 40, 469-74 (1934), C.A. 28, 6448

and G. Günther
48. The polysaccharide synthesis in the yeast cell. (E)
Naturwissenschaften 25, 459 (1937), C.A. 31, 8589

49. Physiological chemical investigations with deutero compounds. (I)
Z. Elektrochem. 44, 87-98 (1938), C.A. 32, 2411

50. Deuteron transfer in solutions. (A)
Trans. Faraday Soc. 34, 252-59 (1938), C.A. 32, 2814
See also: 109, 111, 120, 121, 202, 203, 218

BOREK, C.

and D.Rittenberg
51. Metabolism of acetone by surviving rat liver. (F)
J. Biol. Chem. 179, 843-5 (1949)

See also: 39

BOTTOMLEY, G. H.

B. Cavanaugh and M. Polanyi
52. Enzyme catalysis of the exchange of D with $H_2O$. (A)
Nature 136, 103-4 (1935), C.A. 29, 6611

BOVARNIC, M.

53. Formation of extracellular d(-) glutamic acid polypeptide by B. subtilis. (F)
J. Biol. Chem. 145, 415-24 (1942), C.A. 37, 901

BOXER, G. E.

and D. Stetten, Jr.
54. The role of thiamine in the synthesis of fatty acids from carbohydrate precursors. (E)
J. Biol. Chem. 153, 607-16 (1944)

and D. Stetten, Jr.
55. Carbohydrate metabolism. II. Glycogenic response to glucose and lactate in previously fasted rats. (D, E)
J. Biol. Chem. 155, 237-44 (1944), C.A. 38, 6360

See also: 252

BRANDT, W.

56. $D_2O$ and its biological significance. (I)
Klin. Wochschr. 13, 1009-12 (1934), C.A. 28, 6734

57. The biological significance of D. (I)
Klin. Wochschr. 14, 521-6 (1935), C.A. 29, 5133

BREUSCH, F.

and E. Hofer
58. The ratio of $D_2O$ to $H_2O$ in the organism. (B)
Klin. Wochschr. 13, 1815-16 (1934), C.A. 29, 5132

BRICKWEDDE, F. G.

59. Interesting applications of D. (I)
J. Wash. Acad. Sci. 25, 157-66 (1935), C.A. 29, 3883

BRODSKII, A. I.

and O. Ch. Scarre
60. Exchange reactions of H with D. I. Exchange in carboxyl groups of succinic acid and in hydroxyl groups of hydroquinone. (A)
Acta Physicochem. U.R.S.S. 2, 603-10 (1935), C.A. 29, 6821

61. Reaction of the exchange of H for D. IV. Equilibrium constants of the exchange reactions in solution. (A)
J. Phys. Chem. (U.S.S.R.) 9, 755-62 (1937), C.A. 31, 8335

62. The exchange of H with D in solution. (A)
Trans. Faraday Soc. 33, 1180-5 (1937), C.A. 31, 8335

See also: 235, 239

BROOKS, J.

and T. Moran
63. The uptake of water by gelatin. (B)
Dept. Sci. Ind. Research, Rept. Food Investigation Board 1934, 289 (1935), C.A. 30, 1878

BROOKS, S. C.

64. The permeability of erythrocytes to $D_2O$. (D)
J. Cellular Comparative Physiol. 1, 163-71 (1935), C.A. 30, 1405

BULLET, F.

and K. Bernhard
65. Formation of oleic acid in organism compared with formation of saturated fatty acids. (E)
Helv. Physiol. Pharm. Acta 1, C39-41 (1943), C.A. 38, 5911

See also: 22, 26

CALVIN, M.

and S. Aronoff
66. Chlorophyll and photosynthesis. (E)
AECU-114 (UCRL-263) Dec. 30, 1948, 3 p.

CASTELLANI, E.

67. The effect of $D_2O$ at low concentrations on some micro-organisms. (C)
Bull. soc. intern. microbiol. Sez. ital. 7, 396-400 (1935), C.A. 30, 1813

CAVANAGH, B.

J. Horiuchi and M. Polanyi
68. Enzyme catalysis of the ionization of H. (A)
Nature 133, 797 (1934), C.A. 28, 5085

and H. S. Raper
69. Deuterium as an indicator in fat metabolism. (F)
Nature 137, 233-4 (1936), C.A. 30, 3871

and H. S. Raper
70. A study of the passage of fatty acids of food into lipides and glycerides of the body using D as an indicator. (F)
Biochem. J. 33, 17-21 (1939), C.A. 33, 4648

See also: 52

CHAMPETIER, G.

and R. Viallard
71. Penetration of $H_2O$ into the cellulose lattice. Interchange of H and D between cellulose and $D_2O$. (A)
Compt. rend. 205, 1387-8 (1937), C.A. 32, 1543

and R. Viallard
72. Exchange reaction of cellulose and $D_2O$. Hydration of cellulose. (A)
Bull. soc. chim. (5), 5, 1042-8 (1938), C.A. 32, 8767

CHOMSE, D.

73. Deuterium and its significance in problems of chemistry and biology. (D, I)
Monatsh. Veterinärmed 4, 191-3 (1949)

CLEMO, G. R.

and G. A. Swan
74. Synthesis of heavy dl-adrenaline. (F, G)
J. Chem. Soc. 1942, 395-7, C.A. 36, 5793

CLUTTON, R. F.

R. Schoenheimer and D. Rittenberg
75. Protein metabolism. XII. Conversion of ornithine into arginine in the mouse. (F, G)
J. Biol. Chem. 132, 227-31 (1940), C.A. 34, 1360

COGAN, D. G.

and V. E. Kinsey
76. The cornea. I. Transfer of $H_2O$ and NaCl by osmosis and diffusion thru excised cornea. (D)
Arch. Ophthalmol. (Chicago) 27, 466-76 (1942), C.A. 36, 4564

and V. E. Kinsey
77. The cornea. II. Transfer of $H_2O$ and NaCl by hydrostatic pressure through the excised cornea. (D)
Arch. Ophthalmol. (Chicago) 27, 696-704 (1943), C.A. 36, 4564

See also: 152

COHN, M.

S. Simmonds, J. P. Chandler and V. du Vigneaud
78. The effect of the dietary level of methionine on the rate of transmethylation reactions in vivo. (F)
J. Biol. Chem. 162, 343-51 (1946), C.A. 40, 2207

See also: 91, 220, 275, 276, 277, 278, 279, 280, 281

COPE, O.

H. Blatt and M. R. Ball
79. Gastric secretion. III. Absorption of $D_2O$ from pouches of body and antrum of stomach of dog. (D)
J. Clin. Invest. 22, 103-10 (1943), C.A. 37, 4780

CRIST, R. H.

G. M. Murphy and H. C. Urey
80. Isotopic analysis of water. (H)
J. Am. Chem. Soc. 55, 5060-1 (1933), C.A. 28, 697

G. M. Murphy and H. C. Urey
81. The use of the interferometer in the isotopic analysis of water. (H)
J. Chem. Phys. 2, 112-15 (1934), C.A. 28, 2989

CURRY, J.

R. Pratt and S. F. Trelease
82. Does dilute $D_2O$ influence biological processes? (C)
Science 81, 275-7 (1934), C.A. 29, 3697

DOLE, M.

83. The concentration of D in organic compounds. II. A general discussion with particular reference to benzene. (B)
J. Am. Chem. Soc. 58, 580-5 (1936)

and R. B. Givney
84. Deuterium abundance ratios in organic compounds. III. Cholesterol. (B)
J. Am. Chem. Soc. 58, 2552-5 (1936)

85. Isotopic fractionation of water by physical processes. (B)
Science 83, 351 (1936), C.A. 31, 3070

EHRLICH, G.

and H. Waelsch
86. The position of the higher fatty aldehydes in fatty acid metabolism of rat muscle. (E, F)
J. Biol. Chem. 163, 195-202 (1946), C.A. 40, 4424

ELWYN, D.

and D. B. Sprinson
87. The role of serine and acetate in uric acid formation. (F, G)
J. Biol. Chem. 184, 465-74 (1950)

ENDERS, C.

88. Isotopes in biochemical research. (I)
Angew. Chem. 53, 28-31 (1940), C.A. 34, 3170

ERLENMEYER, H.

and H. Gärtner
89. $D_2O$ content of water from milk. (B)
Helv. Chim. Acta 17, 334 (1934), C.A. 28, 3430

and H. Gärtner
90. $D_2O$ content of biological fluids. (B)
Helv. Chim. Acta 17, 549-50 (1934), C.A. 28, 6727

and H. Gärtner
91. Distribution of $H_2O$ and $D_2O$ in different systems. (A)
Helv. Chim. Acta. 17, 970-3 (1934), C.A. 29, 976

W. Schoenauer and H. Süllmann
92. Chemical and biochemical dehydrogenation of an ethane -d, -d'-d-dicarboxylic acid. (B, F)
Helv. Chim. Acta 19, 1376-80 (1936), C.A. 31, 1363

93. Preparation of compounds of D. (I)
Elektrochem. 44, 8-14 (1938)

1144408

See also: 177

EWART, A. J.

94. The influence of $D_2O$ on plants. (C)
Australian J. Exptl. Biol. Med. Sci. 13, 9-15 (1935), C.A. 29, 4781

FARKAS, A.

L. Farkas and J. Yudkin
95. Decomposition of sodium formate by E. coli in the presence of $D_2O$. (A)
Proc. Roy. Soc. (London) B 115, 373-9 (1934), C.A. 28, 6737

and E. Fischer
96. On the activation of molecular hydrogen by Proteus vulgaris. (A, G)
J. Biol. Chem. 167, 787-806 (1947)

and B. Schneidnesser
97. Hydrogenation of fumarate by D in presence of B. coli. (A, G)
J. Biol. Chem. 167, 807-9 (1947), C.A. 41, 3834

See also: 95

FELIX, K.

98. The isotopes of the elements important to life and their significance in the investigation of the intermediary metabolism. (I)
Jahreskurse ärztl. Fortbild. 31, No. 9, 45-52 (1940)

FENGER-ERIKSEN, K.

A. Krogh and H. H. Ussing
99. A micro-method for accurate determination of $D_2O$ in $H_2O$. (H)
Biochem. J. 30, 1264 (1936)

FETCHER, E. S., JR.

100. Modification of apparatus for $D_2O$ determination by the falling drop. (H)
Ind. Eng. Chem. Anal. Ed. 16, 412 (1944)

See also: 283

FISHMAN, W. H.

and M. Cohn
101. A comparative study of acetylation in vivo of phenylaminobutyric acid with p-aminobenzoic acid and sulfanilamide. (E)
J. Biol. Chem. 148, 619-26 (1943)

FLEXNER, L. B.

and A. Gellhorn
102. The transfer of water and sodium to the amniotic fluid of the guinea pig. (D)
Am. J. Physiol. 136, 757-61 (1942), C.A. 36, 5233

FLEXNER, L. B. (Continued)

A. Gollhorn and M. Merrell
103. Studies on rates of exchange of substances between the blood and extra vascular fluid. I. The exchange of water in the guinea pig. (D)
J. Biol. Chem. 144, 35-40 (1942)

D. B. Cowie and G. J. Vosburgh
104. Studies on capillary permeability with tracer substances. (D, I)
Cold Spring Harbor Symposia Quant. Biol. 13, 88-98 (1948)

See also: 128, 284

FOSTER, G. L.

A. S. Keston, D. Rittenberg and R. Schoenheimer
105. Deuterium as an indicator in the study of intermediary metabolism. XII. Action of proteolytic enzymes on peptides in $D_2O$. (A, E)
J. Biol. Chem. 124, 159-61 (1938), C.A. 32, 6272

D. Rittenberg and R. Schoenheimer
106. Deuterium as an indicator in the study of intermediary metabolism. XIV. Biological formation of deuteroamino acids. (E)
J. Biol. Chem. 125, 13-22 (1938), C.A. 32, 7984

See also: 211

FOX, D. L.

107. $D_2O$ and metabolism. (I)
Quart. Rev. Biol. 9, 342-6 (1934), C.A. 28, 6728

FRANKE, W.

and J. Mönch
108. Experiments with D as an indicator. (A, G)
Biochemische Z. 319, 174-83 (1949)

FREDENHAGEN, H.

and K. F. Bonhoeffer
109. Hexose rearrangements in $D_2O$. (A)
Z. Physik. Chem. A181, 392-405 (1938), C.A. 32, 4059

GAUDINO, M.

and M. F. Levitt
110. Influence of the adrenal cortex on body $H_2O$ distribution and renal function. (D)
J. Clin. Invest. 28, 1437-97 (1949)

GEIB, K. H.

and K. F. Bonhoeffer
111. The uptake of D in growing organisms III. (A, D)
Z. Physik. Chem. A175, 459-68 (1936), C.A. 30, 6014

See also: 43, 44

GOLDWATER, W. H.

and D. Stetten, Jr.
112. Fetal metabolism. (E, F)
J. Biol. Chem. 169, 723-38 (1947), C.A. 41, 7482

GOTO, K.

113. Studies on the chemical properties of sugars by means of D and $O^{18}$. III. Transformation of glucose in aqueous alkaline solution. (A)
J. Chem. Soc. Japan 63, 217-23 (1942), C.A. 41, 3062

GOULD, A. J.

and W. Bleakney
114. Possibility of interchange between D and H in compounds. (A)
J. Am. Chem. Soc. 56, 247-8 (1934), C.A. 28, 1599

W. Bleakney and H. S. Taylor
115. Inter-relations of H and D molecules. (A)
J. Chem. Physics 2, 362-73 (1934), C.A. 28, 5328

GOVAERTZ, J.

116. The use of $D_2O$ in studying the exchange of H and D atoms between water and blood proteins. (A, E)
Bull. soc. roy. sci. Liege 14, 442-6 (1945), C.A. 42, 7353

and A. Lambrechts
117. Penetration of water into erythrocytes with $D_2O$. (D)
Nature 157, 301 (1946), C.A. 40, 3519

and J. Leclercq
118. Demonstration by means of $D_2O$ vapor of exchanges between humidity of atmosphere and water of tissues of insects. (D)
Compt. rend. soc. biol. 140, 1028 (1946), C.A. 41, 5638

GREENE, C. H.

and R. J. Voskuyl
119. Relative proportions of D in some natural hydrogen compounds. (B)
J. Am. Chem. Soc. 56, 1649-50 (1934), C.A. 28, 5328

GUNTHER, G.

and K. F. Bonhoeffer
120. The fixation of D in growing organisms. (E)
Z. Physik. Chem. A180, 185-210 (1937), C.A. 32, 597

and K. F. Bonhoeffer
121. Introduction of D into growing organisms. VI. Biological fat synthesis. (B, E)
Z. Physik. Chem. A183, 1-8 (1938), C.A. 33, 650

See also: 48

HAHN, L.

and G. Hevesy
122. Rate of penetration of ions through the capillary wall. (D)
Acta. Physiol. Scand. 1, 347-61 (1941), C.A. 35, 4082

HAMILL, W. H.

and F. Freudenberg
123. Quantitative isotopic exchange reactions in the carbohydrate group. (A)
J. Am. Chem. Soc. 57, 1427-30 (1935), C.A. 29, 6575

124. Microanalysis for exchangeable hydrogen. (A)
J. Am. Chem. Soc. 59, 1152-3 (1937)

HANSEN, K.

and E. Rustung
125. Studies on the biological effects of $D_2O$ in warm blooded animals. I. (I)
Klin. Wochschr. 14, 1489-93 (1935). II. Ibid. 1530-1 (1935), C.A. 30, 2997

HARADA, M.

and T. Titani
126. The velocity of the exchange reaction of H atoms between sugar and water. (A)
Bull. Chem. Soc. Japan 11, 55-6 (1936), C.A. 30, 4076

See also: 265, 266

127. The isotopic exchange reactions between carbohydrates and $D_2O$.
J. Chem. Soc. Japan 57, 391-400 (1936), C.A. 30, 5860

HELLMAN, L. M.

L. B. Flexner, W. S. Wilde, G. J. Vosburgh and N. K. Proctor
128. The permeability of the human placenta to $H_2O$ and supply of $H_2O$ to the human fetus as determined with $D_2O$. (D)
Am. J. Obstet. Gynecol. 56, 861-8 (1948)

See also: 284

HERBST, R. M.

and D. Rittenberg
129. The transamination reaction. Mechanism of reaction between α-keto and α-amino acids. (E, F)
J. Org. Chem. 8, 380-9 (1943), C.A. 37, 5952

HEVESY, G.

and E. Hofer
130. Deuterium and fish. (D)
Nature 133, 495-6 (1934), C.A. 28, 4085

and E. Hofer
131. Elimination of water from the human body. (D)
Nature 134, 879 (1934)

and E. Hofer
132. How long does $H_2O$ remain in the human body ($D_2O$ as indicator). (D)
Klin. Wochschr. 13, 1524-6 (1934), C.A. 29, 1152

and E. Hofer
133. Water exchange in the body of the fish. (D)
Z. Physiol. Chem. 225, 28-34 (1934), C.A. 28, 4438

134. Deuterium in biology. (I)
Naturwissenschaften 23, 775-80 (1935), C.A. 30, 1074

E. Hofer and A. Krogh
135. The permeability of the skin of frogs to water as determined by $D_2O$ and $H_2O$. (D)
Skand. Arch. Physiol. 72, 199-214 (1935), C.A. 30, 524

and C. F. Jacobsen
136. Rate of passage of water through capillary and cell walls. (D)
Acta. physiol. Scand. 1, 11 (1940)

137. Historical sketch of the biological application of tracer elements. (I)
Cold Spring Harbor Symposia Quant. Biol. 13, 129-50 (1948)

See also: 122

HEYNINGEN, W.E. Van

D. Rittenberg and R. Schoenheimer
138. The preparation of fatty acids containing D. (A, G)
J. Biol. Chem. 125, 495-500 (1938), C.A. 32, 9041

139. Stable isotopes as indicators in biology. (I)
Biol. Rev. Cambridge Phil. Soc. 14, 420-50 (1939), C.A. 34, 1044

HOBERMAN, H. D.

and D. Rittenberg
140. Biological catalysis of the exchange reaction between $H_2O$ and H. (A)
J. Biol. Chem. 147, 212-27 (1943)

See also: 212

HOLLANDER, V.

P. Chang and Co Tui
141. $D_2O$ and thiocyanate spaces in protein depletion. (D)
J. Lab. Clin. Med. 34, 680-6 (1949)

See also: 242

HORIUCHI, J.

and M. Polanyi
142. A catalyzed reaction of H with $H_2O$. (A)
Nature 132, 819 (1933), C.A. 28, 2254

See also: 68

INDOVINA, R.

and A. Citarda
143. The action of $D_2O$ on carbohydrate metabolism. (C)
Biochim. terap. sper. 24, 236-47 (1943), C.A. 31, 8560

and A. Citarda
144. The physical, chemical and biological qualities of $D_2O$. (I)
Biochim. terap. sper. 24, 285-98 (1937), C.A. 32, 404

ITO, M.

K. Inoshita and T. Chitani
145. The action of dilute $D_2O$ on tuberculosis bacilli. (C)
Bull. Chem. Soc. Japan 10, 260 (1935), C.A. 29, 7361

JOHNSTON, H. L.

146. Deuterium as a research tool in the physical and biological sciences. (I)
Ohio J. Sci. 35, 362-87 (1935), C.A. 30, 1273

KARP, A.

and D. Stetten, Jr.
147. Effect of thyroid activity on certain anabolic processes studied with the aid of D. (E)
J. Biol. Chem. 179, 819-30 (1949), C.A. 43, 8030

KELLER, E. B.

J. L. Wood and V. du Vigneaud
148. An investigation of transmethylation from N'-methylnicotinamide. (F)
Proc. Soc. Exptl. Biol. Med. 67, 182-4 (1948)

J. R. Rachele and V. du Vigneaud
149. A study of transmethylation with methionine containing D and $C^{14}$ in the methyl group. (F)
J. Biol. Chem. 177, 733-38 (1949)

KESTON, A. S.

D. Rittenberg and R. Schoenheimer
150. Determination of D in organic compounds. (H)
J. Biol. Chem. 122, 227 (1937-38).

See also: 105, 211, 227

KINNEY, C. R.

and R. Adams
151. Dideuterio valine and dideuterioleucine. (G)
J. Am. Chem. Soc. 59, 897-8 (1937), C.A. 31, 4276

KINSEY, V. E.

M. Grant and D. G. Cogan
152. Water movement and the eye. (D)
Arch. Ophthalmol. (Chicago) 27, 242-52 (1942), C.A. 36, 4564
See also: 76, 77

KLEM, A.

153. Conversion of lauric and myristic acids into fat acids into fat acids of higher molecular weight in rats. (F)
Hvalradets Skrifter, Norske Videnskaps Akad. Oslo. No. 27, 26 pp. (1943), C.A. 40, 2200

154. Conversion of lauric and myristic acids to higher molecular weight fatty acids in the rat organism. (F)
Fette u. Seifen 51, 184-8 (1944), C.A. 42, 8918

KOGL, F.

155. Deuterium as an aid to cancer research. (F)
Verslag Gewone Vergader Afdeel. Naturk. Nederland Akad. Wetenschap. 52, 546-50 (1943), C.A. 41, 518

A. J. Klein, H. Erxleben and G. J. Van Veersen
156. Location of D atoms in deuterized glutamic acid. (E)
Rec. trav. chim. 65, 641-6 (1946), C.A. 41, 2481

KOGL, F. (Continued)

A. J. Klein, H. Erxleben and G. J. Van Veersen
157. Studies of the D-glutamic acid metabolism of tumors. I. Increase in $D_2O$ content of the body fluids in tumorous rats. (E)
Rec. trav. chim. 69, 822-33 (1950)

H. Erxleben, A. J. Klein and G. J. Van Veersen
158. Studies of D-glutamic acid metabolism of tumors. II. Feeding experiments with deuterio DL-glutamate. (F)
Rec. trav. chim. 69, 834-40 (1950)

H. Erxleben, A. J. Klein and G. J. Van Veersen
159. Studies of the D-glutamic acid metabolism of tumors. III. Injections with DL-, L-, and D forms of deuterioglutamate. (F)
Rec. Trav. Chim. 69, 841-50 (1950)

KOIZUMI, M.

and T. Titani
160. Exchange reaction of H atoms between sugar and water. (A)
Bull. Chem. Soc. Japan 13, 427-36 (1938), C.A. 32, 8892

KONIKOVA, A. S.

M. G. Kritsman and R. V. Teis
161. Study of the mechanism of transamination by means of D. XVII. Formation and decomposition of amino acids by inter-molecular transfer of the amino group. (F)
Biokhimiya 7, 86-92 (1942), C.A. 37, 4411

N. N. Dobbert and A.E. Braunstein
162. Labilization of the α-hydrogen of amino acids in the presence of aminophorase. (F)
Nature 159, 67-8 (1947), C.A. 41, 2456

See also: 163

KRITSMAN, M. G.

and A. S. Konikova
163. Application of D & $N^{15}$ in biochemistry. (I)
Advances in modern biol. (U.S.S.R.) 15, 27-47 (1942), C.A. 37, 4083

See also: 161

KROGH, A.

and H. H. Ussing
164. The exchange of H between the free water and the organic substances in the living organism. (D, E)
Skand. Arch. Physiol. 75, 90-104 (1936), C.A. 30, 8267

KROGH, A. (Continued)

and H. H. Ussing
165. Deuterium built into proteins and their amino acids in vivo and in vitro. (E)
Compt. rend. trav. lab. Carlsberg, Ser. chim. 22, 282-7 (1938), C.A. 32, 6265

166. Use of D in biological work. (H, I)
Enzymologia 5, 185-9 (1938), C.A. 33, 660

See also: 99, 135

LARSON, E. J.

and T. C. Barnes
167. Parasitism in $D_2O$ of low concentration. (C)
Nature 133, 873-4 (1934), C.A. 28, 5483

See also: 7

LAUDER, I.

168. Some recent work on the separation and use of stable isotopes. (I)
J. Proc. Roy. Soc. N.S. Wales 82, 183-95 (1949)

LIBERALLI, C. H.

169. The biological properties of $D_2O$. (I)
Rev. guim. farm (Brazil) 1, 59-62 (1935), C.A. 30, 1397

LOCKEMANN, G.

and H. Lounig
170. The effect of $D_2O$ on bacterial growth. (C)
Ber. 67B, 1299-1302 (1934), C.A. 28, 6744

LONDON, I. M.

and D. Rittenberg
171. Deuterium studies in normal man. I. Rate of synthesis of serum cholesterol. II. Measurement of total body water and water absorption. (D, E)
J. Biol. Chem. 184, 687-91 (1950)

LUCKE, B.

and E. N. Harvey
172. The permeability of living cells to $D_2O$. (D)
J. Cellular Comp. Physiol. 5, 473-82 (1935), C.A. 29, 4783

MACHT, D. A.

and H. F. Bryan
173. Effect of $D_2O$ on action of some enzymes. (C)
J. Am. Chem. Soc. 58, 729-31 (1936), C.A. 30, 4885

MARK, H.

and M. Wald
174. Our present knowledge of D and $D_2O$. (I)
Protoplasma 23, 109-27 (1935), C.A. 29, 7793

MARTINS, C.

175. Asymmetric degradation of deuteriated citric acid. (F, G)
Naturw. Rundschau 3, 375-6 (1950)

MAW, G. A.

and V. du Vigneaud
176. Compounds related to dimethylthetin as sources of labile methyl groups. (F)
J. Biol. Chem. 176, 1037-45 (1948)

McDOUGALL, E. J.

F. Verzar, H. Erlenmeyer and H. Gaertner
177. $D_2O$ in the animal body. (D)
Nature 134, 1006-7 (1934), C.A. 29, 2187)

MOORE, F. D.

178. Determination of total body water and solids with isotopes. (D)
Science 104, 157-60 (1946), C.A. 40, 7275

See also: 221

MOREHOUSE, M. G.

179. Metabolism of two di-deuterobutyric acids as indicated by D content of excreted B-hydroxybutyric acid. (F)
Proc. Soc. Exp. Biol. Med. 41, 595 (1939)

180. Studies on ketosis. XVI. The metabolism of α, β and β, γ- deuteriobutyric acids in the fasting rat. (F)
J. Biol. Chem. 129, 769-79 (1939)

See also: 290

and H. J. Deuel
181. Metabolism of α, β and β, γ- deuterocaproic acids. (F)
Proc. Soc. Exp. Biol. Med. 45, 96 (1940)

MOREHOUSE, M. G. (Continued)

182. Studies in ketosis. XXIII. The metabolism of isotopic tributyrin and partially hydrogenated linseed oil. (F)
J. Biol. Chem. 155, 33-8 (1944)

MOSS, A. R.

and R. Schoenheimer
183. The conversion of phenylalanine to tyrosine in normal rats. (F, G)
J. Biol. Chem. 135, 415 (1940)

MÜNZBERG, F. K.

and F. Haurowitz
184. Action of $D_2O$ on proteins and amino acids at body temperature. (A)
Z. Physiol. Chem. 256, 271-2 (1938), C.A. 33, 2155

OGAWA, E.

185. The exchange reactions between $D_2O$ and amino acids and carbohydrates. (A)
Bull. Chem. Soc. Japan 11, 367-74 (1936), C.A. 30, 6327

OLIPHANT, M. L.

186. Deuterium in contact with $H_2O$. (A)
Nature 132, 675 (1933), C.A. 28, 1265

ORBAN, G.

187. Concentration of $D_2O$ within human organism. (B)
Orvosi Hetilap 79, 193-4 (1935), C.A. 29, 2980

PARPART, A. K.

188. The permeability of the mammalian erythrocyte to $D_2O$. (D)
J. Cellular Comparative Physiol. 7, 153-61 (1935), C.A. 30, 1405

PATTERSON, W. I.

and V. du Vigneaud
189. The synthesis of tetradeuterohomocystine and dideuteromethionine. (G)
J. Biol. Chem. 123, 327-34 (1938), C.A. 32, 3338

PEARLMAN, W. H.

M. R. J. Pearlman and S. Elsey
190. The preparation of 3,4,5,-$d_3$-lithocholic acid. (G)
J. Am. Chem. Soc. 71, 4126-7 (1949)

PETERS, H. C.

and M. B. Visscher
191. The mechanism of active absorption from the intestine. (D)
J. Cellular Comparative Physiol. 13, 51-67 (1939), C.A. 33, 3440

192. Application of general fluid-circuit theory to (absorption from intestine of) chloride, bromide and $D_2O$. (D)
Bull. Math. Biophys. 3, 149-52 (1941), C.A. 37, 2427

PONTICORVO, L.

D. Rittenberg and K. Bloch
193. The utilization of acetate for the synthesis of fatty acids, cholesterol and protoporphyrin. (F)
J. Biol. Chem. 179, 839-42 (1949)

POPJÁK, G.

194. Use of isotopes in biology. (I)
Science Progress 36, 239-61 (1948), C.A. 42, 5061

and M. L. Beeckmans
195. Synthesis of cholesterol and fatty acids in fetuses and in mammary glands of pregnant rabbits. (E)
Biochem. J. 46, 547 (1950)

and M. L. Beeckmans
196. Extrahepatic lipid synthesis. (E)
Biochem. J. 47, 233-8 (1950)

PRATT, R.

197. Deuterium and living organisms. (I)
Terreya 36, 133-8 (1936), C.A. 31, 1828
See also: 82

RATNER, S.

R. Schoenheimer and D. Rittenberg
198. Protein metabolism. XIII. The metabolism and inversion of d (+)-leucine studied with two isotopes. (F)
J. Biol. Chem. 134, 653-8 (1940), C.A. 34, 5892

R. Schoenheimer and D. Rittenberg
199. The stability of H-C linkages in glutamic acid. (A, F)
J. Biol. Chem. 135, 357-8 (1940)

N. Weissman and R. Schoenheimer
200. Metabolism of d-lysine investigated with D and $N^{15}$. (F)
J. Biol. Chem. 147, 549-56 (1943), C.A. 37, 3156

See also: 212, 216, 230, 231

REA, C. E.

and S. Yuster
201. Effect of $D_2O$ on rat sarcoma R-39. (C)
Proc. Soc. Exptl. Biol. Med. 31, 1058-60 (1934), C.A. 28, 7269

REITZ, O.

and K. F. Bonhoeffer
202. The incorporation of D in growing organisms. (C)
Naturwissenschaften 22, 744 (1934), C.A. 29, 2183

and K. F. Bonhoeffer
203. The fixation of D in growing organisms. (C)
Z. Physik. Chem. A172, 369-88 (1935), C.A. 29, 5129

RICHARDS, O. W.

204. The effect of D on the growth of yeast. (C)
J. Bact. 28, 289-94 (1934), C.A. 29, 486

205. The analysis of growth as illustrated by yeast. (C)
Cold Spring Harbor Symposia 2, 157-66 (1934), C.A. 29, 8058

RITTENBERG, D.

and R. Schoenheimer
206. Deuterium as an indicator in the study of intermediary metabolism.
II. Methods. (E)
J. Biol. Chem. 111, 169-74 (1935), C.A. 29, 7353

and R. Schoenheimer
207. Deuterium as an indicator in the study of intermediary metabolisms.
III. The role of the fat tissues. (F)
J. Biol. Chem. 111, 175-81 (1935), C.A. 29, 7353

and R. Schoenheimer
208. Deuterium as an indicator in the study of intermediary metabolism.
VIII. Hydrogenation of fatty acids in the animal organism. (F)
J. Biol. Chem. 117, 485-90 (1937), C.A. 31, 2239

R. Schoenheimer and E. A. Evans, Jr.
209. Deuterium as an indicator in the study of intermediary metabolism.
X. Metabolism of butyric and caproic acids. (F)
J. Biol. Chem. 120, 503-10 (1937), C.A. 31, 8573

and R. Schoenheimer
210. Deuterium as an indicator in the study of intermediary metabolism.
XI. Further studies on the biological uptake of D into organic substances with specific reference to fat and cholesterol formation. (E)
J. Biol. Chem. 121, 235-53 (1937), C.A. 32, 200

RITTENBERG, D. (Continued)

A. S. Keston, R. Schoenheimer and G. L. Foster
211. Deuterium as an indicator in the study of intermediary metabolism. XIII. Stability of H in amino acids. (A)
J. Biol. Chem. 125, 1-12 (1938), C.A. 32, 7984

S. Rittner and H. D. Haberman
212. Catalytic hydrogenation with D. (G)
J. Am. Chem. Soc. 62, 2249-50 (1940), C.A. 34, 6575

and K. Bloch
213. The utilization of acetic acid for fatty acid synthesis. (F)
J. Biol. Chem. 154, 311 (1944)

and K. Bloch
214. The utilization of acetic acid for the synthesis of fatty acids. (F)
J. Biol. Chem. 160, 417 (1945)

See also: 30, 31, 32, 34, 37, 38, 40, 51, 75, 105, 106, 129, 138, 140, 150, 171, 193, 198, 199, 222, 223, 224, 225, 226, 227, 228, 229, 231, 232, 234, 246, 275

RIVIERE, D. de la

and E. Roux
215. Does $D_2O$ have any action on bacteria? (C)
Compt. rend. 200, 984-5 (1935)

ROLOFF, M.

and S. Ratner and R. Schoenheimer
216. The biological conversion of ornithine into proline and glutamic acid. (F)
J. Biol. Chem. 136, 561-2 (1940)

SALCEDO, J.

and D. Stetten, Jr.
217. The turnover of fatty acids in the congenitally obese mouse. (F)
J. Biol. Chem. 151, 413-16 (1943)

SALZER, F.

and K. F. Bonhoeffer
218. The fixation of D in growing organisms. IV. (E)
Z. Physik. Chem. A176, 202-8 (1936), C.A. 30, 7131

SAPIRSTEIN, L. A.

219. A simple method for the densiometric determination of $D_2O$. (H)
J. Lab. Clin. Med. 35, 793-4 (1950)

SCHENCK, J. R.

S. Simmonds, M. Cohn, C. M. Stevens and V. du Vigneaud
220. The relation of transmethylation to anserine. (F)
J. Biol. Chem. 149, 355-9 (1943)
See also: 277

SCHLOERB, P. R.

B. J. Friis-Hansen, I. S. Edelman, A. K. Solomon and F. D. Moore
221. The measurement of total body water in the human subject by $D_2O$ dilution; with a consideration of the dynamics of D distribution. (D)
J. Clin. Invest. 29, 1296-1310 (1950)

SCHOENHEIMER, R.

and D. Rittenberg
222. Deuterium as an indicator in the study of intermediary metabolism. I. (G, I)
J. Biol. Chem. 111, 163-8 (1935), C.A. 29, 7352

D. Rittenberg, and M. Greff
223. Deuterium as an indicator in the study of intermediary metabolism. IV. The mechanism of coprosterol formation. (F, G)
J. Biol. Chem. 111, 183-92 (1935), C.A. 29, 7353

and D. Rittenberg
224. Deuterium as an indicator in the study of intermediary metabolism. V. The desaturation of fat acids in the organism. (F)
J. Biol. Chem. 113, 505-10 (1936), C.A. 30, 3000

and D. Rittenberg
225. Deuterium as an indicator in the study of intermediary metabolism. VI. Synthesis and destruction of fat acids in the organism. (E)
J. Biol. Chem. 114, 381-96 (1936), C.A. 30, 6025

D. Rittenberg, B. N. Berg and L. Rousselot
226. Deuterium as an indicator in the study of intermediary metabolism. VII. Studies in bile acid formation. (F)
J. Biol. Chem. 115, 635-40 (1936), C.A. 31, 147

D. Rittenberg and A. S. Keston
227. Exchange reactions of organic compounds with $D_2SO_4$. (A, G)
J. Am. Chem. Soc. 59, 1765 (1937), C.A. 31, 7843

and D. Rittenberg
228. D as an indicator in the study of intermediary metabolism. IX. The conversion of stearic acid into palmitic acid in the organism. (F)
J. Biol. Chem. 120, 155-65 (1937), C. A. 31, 8572

SCHOENHEIMER, R. (Continued)

and D. Rittenberg
229. Protein metabolism. I. General considerations in the application of isotopes to the study of protein metabolism. The normal abundance of N isotopes in amino acids. (I)
J. Biol. Chem. 127, 285-90 (1939), C.A. 33, 1769

and S. Ratner
230. Studies in protein metabolism. III. Synthesis of amino acids containing $N^{15}$. (G)
J. Biol. Chem. 127, 301-13 (1939)

S. Ratner and D. Rittenberg
231. Studies in protein metabolism. X. The metabolic activity of body proteins investigated with L(-) leucine containing two isotopes. (F)
J. Biol. Chem. 130, 703-32 (1939)

and D. Rittenberg
232. The study of intermediary metabolism of animals with the aid of isotopes. (I)
Physiol. Rev. 20, 218-48 (1940)

233. The dynamic state of body constituents. (I)
Harvard University Press, Cambridge, Massachusetts, 1941

See also: 1, 11, 12, 75, 105, 106, 138, 150, 183, 198, 199, 200, 206, 207, 208, 209, 210, 211, 216, 249, 250, 260, 275 and 291

SHAPIRO, A.

H. Koster, D. Rittenberg and R. Schoenheimer
234. The origin of fecal fat in the absence of bile, studied with D as an indicator. (F)
Am. J. Physiol. 117, 525-8 (1936), C.A. 31, 151

SHERSHEVER, Zh. M.

A. I. Brodskii and M. M. Sluckaya
235. Exchange reactions of H with D. II. Exchange in $H_2SO_4$ and NaOH. (A)
Acta physicochim. U.R.S.S. 2, 611-14 (1935), C.A. 29, 6821

SIMMONDS, S.

M. Cohn, J. P. Chandler and V. du Vigneaud
236. The utilization of the methyl groups of choline in the biological synthesis of methionine. (F)
J. Biol. Chem. 149, 519 (1943)

and V. du Vigneaud
237. A further study of the lability of the methyl group of creatine. (F)
Proc. Soc. Exp. Biol. Med. 59, 293 (1945)

SIMMONDS, S. (Continued)

M. Cohn and V. du Vigneaud
238. Study of transmethylation with methionine containing varying amounts of D in methyl group. (F)
J. Biol. Chem. 170, 631-3 (1947), C.A. 42, 1339

See also: 78, 220, 277, 278, 279, 280, 281

SLATSKAYA, M. M.

Zh. M. Shershever and A. I. Brodskii
239. Hydrogen-deuterium exchange reaction. III. Exchange in amino groups. (A)
J. Phys. Chem. (U.S.S.R.) 9, 417-20 (1937), C.A. 31, 6536

SMITH, E. R.

240. The isotopic fractionation of $H_2O$ by physiological processes--an addition. (B)
Science 79, 454-5 (1934), C.A. 28, 4442

See also: 289

SMITH, P. K.

J. Trace and H. G. Barbour
241. The fate of D in the mammalian body. (D, E)
J. Biol. Chem. 116, 371-6 (1936), C.A. 31, 744

SOBERMAN, R.

B. B. Brodie, B. B. Levy, J. Axelrod, V. Hollander, and J. M. Steele
242. The use of antipyrene in the measurement of total body water in man. (D)
J. Biol. Chem. 179, 31-41 (1949).

SOLOMON, A. K.

I. S. Edelman and S. Soloway
243. The use of the mass spectrometer to measure D in body fluids. (H)
J. Clin. Invest. 29, 1311-19 (1950)

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SONDERHOFF, R.

and H. Thomas
244. Enzymic dehydrogenation of trideuteroacetic acid. (F)
Ann. 530, 195-213 (1937), C.A. 32, 1731

SPERRY, W. M.

H. Waelsch and V. A. Stoyanoff
245. Lipide metabolism in brain and other tissues of the rat. (F)
J. Biol. Chem. 135, 281-90 (1940), C.A. 34, 6683

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SPRINSON, D. B.

and D. Rittenberg
246. The metabolic activity of the α-, β-, and γ-hydrogen atoms of L-leucine and the α-hydrogen of glycine. (F, G)
J. Biol. Chem. 184, 405-16 (1950)

See also: 87

STEKOL, J. A.

and W. H. Hamill
247. Synthesis of protein and amino acids in mice with the aid of deuterium. (D, E)
Proc. Soc. Exp. Biol. Med. 35, 591-3 (1937)

and W. H. Hamill
248. The nonlabile D of amino acids subjected to treatment in the medium of dil. $D_2O$. (A, G)
J. Biol. Chem. 120, 531-6 (1937)

STETTEN, D., JR.

and R. Schoenheimer
249. The conversion of palmitic acid into stearic and palmitoleic acids in rats. (F)
J. Biol. Chem. 133, 329-45 (1940)

and R. Schoenheimer
250. The biological relations of the higher aliphatic alcohols to fatty acids. (F)
J. Biol. Chem. 133, 347-57 (1940)

and G. F. Grail
251. The rates of replacement of depot and liver fatty acids in mice. (F)
J. Biol. Chem. 148, 509 (1943)

and G. E. Boxer
252. Carbohydrate metabolism. I. Rate of turnover of liver and carcass glycogen studies with aid of D. (E)
J. Biol. Chem. 155, 231-6 (1944), C.A. 38, 6359

and J. Saledo, Jr.
253. The source of the extra liver fat in various types of fatty liver. (E)
J. Biol. Chem. 156, 27-32 (1944), C.A. 39, 734

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STETTEN, D., JR.

and G. E. Boxer
254. Studies in carbohydrate metabolism. III. Metabolic defects in alloxan diabetes. (E)
J. Biol. Chem. 156, 271 (1944)

255. Carbohydrate metabolism. IV. The turnover of glycogen in the liver and carcass of rats fed galactose. (E)
J. Biol. Chem. 159, 123-7 (1945), C.A. 39, 4654

and B. V. Klein
256. Studies in carbohydrate metabolism. V. Effects of adrenalin and insulin upon glycogenesis in rats. (E)
J. Biol. Chem. 159, 593-602 (1945), C. A. 40, 116

and B. V. Klein
257. Studies in carbohydrate metabolism. VI. Effects of hypo and hyperinsulinism in rabbits. (E)
J. Biol. Chem. 162, 377-82 (1946), C.A. 40, 2874

and M. R. Stetten
258. Studies in carbohydrate metabolism. VII. Distribution of D in a sample of deuterio-glucose excreted by a diabetic rabbit. (E)
J. Biol. Chem. 165, 147-55 (1946), C.A. 40, 7332

and B. V. Klein
259. Studies in carbohydrate metabolism. VIII. Origin of the stable H in glycogen formed from various precursors. (E)
J. Biol. Chem. 165, 157-62 (1946), C.A. 40, 7333

See also: 54, 55, 112, 147, 217, 261

STETTEN, M. R.

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260. The metabolism of l(-) proline studied with the aid of D and $N^{15}$. (F)
J. Biol. Chem. 153, 113-32 (1944), C.A. 38, 3700

and D. Stetten, Jr.
261. Biological conversion of inositol into glucose. (F, G)
J. Biol. Chem. 164, 85-91 (1946), C.A. 40, 6108

See also: 258

STEWART, W. W.

and R. Holcomb
262. Biological separation of $D_2O$. (B)
J. Am. Chem. Soc. 56, 1422-3 (1934), C.A. 28, 4759

TERAO, A.

and Y. Inono
263. Effect of $D_2O$ on population growth of the water flea, Moina macrocopa Strauss. (C)
Proc. Imp. Acad. (Tokyo) 10, 513-14 (1934)

THEIS, K.

264. Deuterium in biological cellular processes. (C, I)
Wochschr. Brau. 55, 36-9 (1938), C.A. 32, 7499

TITANI, T.

and M. Harada
265. The concentration of D in carbohydrates. (B)
Bull. Chem. Soc. Japan 10, 205 (1935), C.A. 29, 6139

and M. Harada
266. Concentration of D in carbohydrates. (B)
Bull. Chem. Soc. Japan 10, 261-3 (1935), C.A. 29, 7793

See also: 126, 160

UREY, H. C.

267. Deuterium and its compounds in relation to biology. (I)
Cold Spring Harbor Symposia 2, 47-56 (1934), C.A. 29, 8026

See also: 80, 81

USSING, H. H.

268. Glycogen formation in the liver studied by means of D. (A, E)
Skand. Arch. Physiol. 77, 85-6 (1937), C.A. 32, 610

269. The exchange of H and D atoms between $H_2O$ and protein in vivo and vitro. (A, E)
Skand. Arch. Physiol. 77, 107-22 (1937), C.A. 32, 610

270. The exchange of H and D atoms between $H_2O$ and protein in vitro and in vivo. (A, E)
Skand. Arch. Physiol. 78, 225-41 (1938), C.A. 32, 5009

271. Use of amino acids containing D to follow protein production in the organism. (F)
Nature 142, 399-400 (1938), C.A. 32, 8538

272. Analysis of protein by means of D-containing amino acids. (F)
Nature 144, 977 (1939), C.A. 34, 1346

273. Rate of protein renewal in mice and rats studied by means of D. (E)
Acta Physiol. Scand. 2, 209-21 (1941), C.A. 36, 1991

USSING, H. H. (Continued)

274. Fate or metabolism of D introduced in some amino acids by heating with $D_2O$ and $H_2SO_4$. (F)
Acta Physiol. Scand. 2, 222-6 (1941), C.A. 36, 1959

See also: 99, 164, 165

du VIGNEAUD, V.

M. Cohn, G.B. Brown, O.J. Irish, R. Schoenheimer and D. Rittenberg
275. The inversion of d-phenylaminobutyric acid and the acetylation of l-phenylaminobutyric acid by means of the isotopes of nitrogen and hydrogen. (E)
J. Biol. Chem. 131, 273-96 (1939), C.A. 34, 142

J. P. Chandler, M. Cohn and G. B. Brown
276. The transfer of the methyl group from methionine to choline and creatine. (F)
J. Biol. Chem. 134, 787-8 (1940)

M. Cohn, J. P. Chandler, J. R. Schenck and S. Simmonds
277. The utilization of the methyl group of methionine in the biological synthesis of choline and creatine. (F)
J. Biol. Chem. 140, 625-41 (1941)

S. Simmonds, J. P. Chandler, and M. Cohn
278. Synthesis of labile methyl groups in the white rat. (E)
J. Biol. Chem. 159, 755-6 (1945), C.A. 39, 5300

J. P. Chandler, S. Simmonds, A. W. Meyer and M. Cohn
279. The role of dimethyl and monomethylamino-ethanol in transmethylation reactions in vivo. (F)
J. Biol. Chem. 164, 603-13 (1946)

S. Simmonds, J. P. Chandler and M. Cohn
280. A further investigation of the role of betaine in transmethylation reactions in vivo. (F)
J. Biol. Chem. 165, 639-48 (1946)

S. Simmonds and M. Cohn
281. A further investigation of the ability of sarcosine to serve as a labile methyl donor. (F)
J. Biol. Chem. 166, 47-52 (1946)

C. Rossler and J. R. Racheio
282. The biological synthesis of "labile methyl groups". (E)
Science 112, 267-71 (1950)

See also: 78, 148, 149, 176, 189, 220, 236, 237, 238

VISSCHER, M. B.

E. S. Fetcher, Jr., C.W. Carr, H. P. Gregor, M. S. Bushey and D. E. Barker
283. Isotopic tracer studies on the movement of water and ions between intestinal lumen and blood. (D)
Am. J. Physiol. 142, 550-75 (1944), C.A. 39, 742

See also: 191

VOSBURGH, G. J.

L. B. Flexner, D. B. Cervic, L. M. Hellman, N. K. Proctor and W. S. Wilde
284. The rate of renewal in women of the $H_2O$ and Na of the amniotic fluid as determined by tracer techniques. (D)
Am. J. Obstet. Gynecol. 56, 1156-9 (1948)

See also: 104, 128

WAELSCH, H.

and W. M. Sperry
285. The composition of unsaponifiable lipids. (E)
J. Biol. Chem. 132, 787-8 (1940)

W. M. Sperry and V. A. Stoyanoff
286. Study of the synthesis and deposition of lipides in brain and other tissues with D as indicator. (E)
J. Biol. Chem. 135, 291-6 (1940), C.A. 34, 6683

W. M. Sperry and V. A. Stoyanoff
287. Lipide metabolism in brain during myelination. (E)
J. Biol. Chem. 135, 297-302 (1940), C.A. 34, 6684

W. M. Sperry and V. A. Stoyanoff
288. The influence of growth and myelination on the deposition and metabolism of lipids in brain. (E)
J. Biol. Chem. 140, 885-97 (1941)

See also: 86, 245

WASHBURN, E. W.

and E. R. Smith
289. The isotpic fractionation of water by physiological processes. (B)
Science 79, 188-9 (1934), C.A. 28, 2379

WEINMANN, E. O.

M. G. Morehouse and R. J. Winzler
290. Effect of succinic dehydrogenase on D-labeled succinic acid in absence of hydrogen acceptors. (A, F)
J. Biol. Chem. 168, 717-23 (1947), C.A. 41, 5155

WEISSMAN, N.

and R. Schoenheimer
291. Protein metabolism. XV. The relative stability of L(+) lysine in rats studied with D and $N^{15}$. (F)
J. Biol. Chem. 140, 779-95 (1941), C.A. 35, 7482

See also: 200

WOGLOM, W. H.

and L. A. Weber
292. $D_2O$ and tumor growth. (C)
J. Am. Med. Assoc. 102, 1289-90 (1934), C.A. 29, 3696

ZIRPOLO, G.

293. $D_2O$ in biology. (C)
Riv. fis. mat. sci. nat. 11, 372-7, 406-14 (1937). C.A. 33, 6363

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