

R E P O R T R E S U M E S

ED 019 804

EC 002 496

ELECTRICAL STIMULATION OF THE SKIN--A SELECTED BIBLIOGRAPHY.

BY- GIBSON, ROBERT H., COMP.

AMERICAN FOUNDATION FOR THE BLIND, NEW YORK, N.Y.

PUB DATE JUL 67

EDRS PRICE MF-\$0.25 HC-\$1.08 25P.

DESCRIPTORS- *EXCEPTIONAL CHILD RESEARCH, *VISUALLY HANDICAPPED, *PERCEPTION, HAFTIC PERCEPTION, BIBLIOGRAPHIES, SENSORY EXPERIENCE, PHYSIOLOGY, ELECTRICAL STIMULI, BLIND, STIMULUS DEVICES, PERCEPTION TESTS, CUTANEOUS SENSE,

ONE OF A SERIES OF PROVISIONAL BIBLIOGRAPHIES IN THE FIELD OF SENSORY RESEARCH RELATED TO SENSORY (ESPECIALLY VISUAL) IMPAIRMENT, THE DOCUMENT LISTS 284 SELECTED WORKS ON ELECTRICAL STIMULATION OF SKIN. PRIMARILY JOURNAL ARTICLES, BUT INCLUDING SOME BOOKS AND SEVERAL THESES, THE ITEMS DATE FROM 1891 THROUGH 1967 (IN PRESS). PUBLICATIONS CITED ARE IN ENGLISH, ITALIAN, FRENCH, GERMAN, AND RUSSIAN. (JD)

Electrical Stimulation of the Skin - A Selected Bibliography

Issued by IRIS
American Foundation for the Blind, Inc.
15 West 16th Street, New York, New York
July, 1967

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

EDITOR'S NOTE:

The following pages contain another in the series of provisional bibliographies which we are privileged to issue in the field of sensory research related to sensory impairment, with special reference to the blind and severely visually impaired.

The bibliography was prepared for us by Dr. Robert H. Gibson, Associate Professor of Psychology, University of Pittsburgh, Pittsburgh, Pennsylvania.

The title of the bibliography expresses Dr. Gibson's wish that it represents a selected not a comprehensive listing of references related to the electrical stimulation of the skin.

Comments by users on suggested inclusions, revisions, corrections of the inevitable errors (especially in the translation of foreign titles), and the like, can be sent to IRIS for incorporation in the next edition of the bibliography.

EC 002 496

ELECTRICAL STIMULATION OF THE SKIN - A SELECTED BIBLIOGRAPHY

Robert H. Gibson
Associate Professor of Psychology
University of Pittsburgh
Pittsburgh, Pennsylvania

- Abramson, H. A. Electrokinetic Phenomena and Their Application to Biology and Medicine, New York: Chemical Catalog Co., 1934.
- Abramson, H. A. "Skin Reaction; III: The Elementary Theory of Electro-phoresis of Drugs through the Skin," Urologic and Cutaneous Rev., 42: 279-81 (April, 1938).
- Adrian, E. D. "The Response of Human Sensory Nerves to Currents of Short Duration," J. Physiol., 53: 70-85 (1919).
- Albert, R. E. and Palmes, E. D. "Evaporative Rate Patterns from Small Skin Areas as Measured by an Infrared Gas Analyzer," J. Appl. Physiol., 4: 208-14 (1951).
- Alluisi, E. A. "Toward Optimizing Man's Tactile Communication," Percept. Mot. Skills, 12: 235-45 (1961).
- Alluisi, E. A., Morgan, B. B., Jr., and Hawkes, G. R. "Masking of Cutaneous Sensations in Multiple Stimulus Presentations," Percept. Mot. Skills, 20: 39-45 (February, 1965).
- Amassian, U. "Studies on Organization of a Somesthetic Association Area, Including Single Unit Analysis," J. Neurophysiol., 17: 39-58 (1954).
- Amberton, W. R. and Downing, A. G. "The Electric Response of Nerve to Two Stimuli," J. Physiol., 68: 1-18 (1929).
- Anderson, A. B. and Munson, W. A. "Electrical Excitation of Nerves in the Skin at Audio Frequencies," J. Acoust. Soc. Am., 23: 155-9 (1951).
- Arnand, B. K. and Dua, S. "Feeding Responses Induced by Electrical Stimulation," Indian J. Med. Res., 43: 113-22 (1955).
- Barnett, A. "The Phase Angle of Normal Human Skin," J. Physiol., 93: 349-66 (1938).

- Barnett, A. "Skin Impedance Findings in Mental Disease," Proc. Soc. Exp. Biol. and Med., 41: 697-9 (1939).
- Barnett, A. "Seasonal Variations in the Epidermal Impedance of Human Skin," Am. J. Physiol., 129: 306 (1940).
- Battaglini, S. "Contributo alla studio della reattività cutanea con speciale riferimento al metodo elettrometrico" (Contribution to the Study of Cutaneous Reactivity with Special Reference to the Electrometric Method), Gior. Ital. di dermatol. e sif., 80: 79-113 (1939).
- Bayliss, W. M. "The Electrical Changes in Electrical Tissues," Brit. Med. J., 1: 670-71 (1919).
- Bekesy, G. v. "Funneling in the Nervous System and Its Role in Loudness and Sensation Intensity on the Skin," J. Acoust. Soc. Am., 30: 399-412 (1958).
- Bekesy, G. v. "Pitch Sensation and Its Relation to the Periodicity of the Stimulus: Hearing and Skin Vibrations," J. Acoust. Soc. Am., 33: 341-8 (1961).
- Bellows, R. M. "An Experimental Isolation of Some Factors Determining Response to Rhythmic Cutaneous Stimulation: I. Frequency, Pressure, and Time," J. Exp. Psychol., 19: 716-31 (1936).
- Bergonie, J. "La puissance électrique absorbée par l'électro-vibrEUR; conditions du meilleur emploi de cet appareil" (The Electrical Power Used by the Electro-vibrator; Conditions for the Best Use of this Apparatus), Arch. d'électric. méd., 25: 343 (1915).
- Bergonie, J. "Préceptes à suivre pour l'installation et l'emploi chirurgical de l'électro-vibrEUR" (Precepts to Follow for the Installation and Surgical Use of the Electro-vibrator), Arch. d'électric. méd., 26: 21-31 (1916).
- Binger, C. A. L., and Christie, R. V. "General and Local Heat Developed in Living Animal Body by Passage by High Frequency Currents," Proc. Soc. Exp. Biol. and Med., 24: 677-83 (1927).
- Bishop, G. H. "Responses to Electrical Stimulation of Single Sensory Units of the Skin," J. Neurophysiol., 6: 361-82 (1943).
- Bishop, G. H. "The Peripheral Unit for Pain," J. Neurophysiol., 7: 71-80 (1944).

- Blair, E. A., and Erlanger, J. "Observations on the Development of Electrical Excitation in Nerve," Am. J. Physiol., 3: 12 (1935).
- Blair, H. A. "On the Intensity-Time Relations for Stimulation by Electric Currents: I," J. Gen. Physiol., 5: 731-55 (1932).
- Blair, H. A. "On the Relation of Direct Currents to Linearly Rising Currents as Stimuli," Am. J. Physiol., 111: 515-29 (1935).
- Blair, H. A. "The Equation of the Voltage-Capacity Curve for the Excitation of the Sciatic Nerve of Rana Pipiens," Am. J. Physiol., 112: 277-85 (1935).
- Blair, H. A. "Temperature Coefficients in Electrical Excitation," J. Comp. Physiol., 6: 291-316 (1935).
- Blank, I. H., and Finesinger, J. E. "Electrical Resistance of the Skin: Effect of Size of Electrodes, Exercise, and Cutaneous Hydration," Arch. Neurol. Psychiat., 56: 544-57 (1946).
- Boursin, A. "Sur un électro-vibreur à haute fréquence combinée" (On an Electro-vibrator of Complex High Frequency), C. R. Soa. Soc. Biol. Fil., 202: 95 (1936).
- Brazier, M. A. B. "Physiological Mechanisms Underlying Electrical Activity of the Brain," J. Neurol. Psychiat., 11: 118-33 (1948).
- Brazier, M. A. B. "The Electrical Fields at the Surface of the Head During Sleep," EEG Clin. Neurophysiol., 1: 195-204 (1949).
- Brazier, M. A. B. The Electrical Activity of the Nervous System. New York: Macmillan, 1951.
- Brown, J. E. A Parametric Study of Neuroelectric Responses to Skin Stimuli. Unpublished M.A. thesis, MIT, 1960.
- Brown, R. L., Galloway, W. D., and Gildersleeve, K. R. "Effects of Intense Noise on Processing of Cutaneous Information of Varying Complexity," Percept. Mot. Skills, 20: 749-54 (1965).
- Brown, R. L., Galloway, W. D., and San Giuliano, R. A. "Effects of Time-Sharing and Body Positional Demands on Cutaneous Information Processing," Percept. Mot. Skills, 20: 1021-6 (1965).
- Brown, R. L., Spern, R. A., Schmitt, K., and Solomon, A. "Recognition Thresholds and Accuracy for Differing Body Regions as a Function of Number of Electrodes and Their Spacing," Percept. Mot. Skills, 23: 1247-54 (1966).

- Brown, R. L., Spern, R. A., Schmitt, K., and Solomon, A. "Stimulus Parameter Considerations and Individual Differences in Cutaneous Sensitivity to Electropulse Stimulation," Percept. Mot. Skills, 23 (3, part 2): 1215-22 (1966).
- Bugnard, L., and Hill, A. V. "The Effect of Frequency of Excitation on the Total Electric Response of Medullated Nerve," J. Physiol., 83: 394-406 (1935).
- Burns, R. C. "Study of Skin Impedance," Electronics, 23: 190-96 (1950).
- Chaffee, E. L. and Light, R. U. "A Method for the Remote Control of Electrical Stimulation of the Nervous System. Supplementary Notes," Yale J. Biol. Med., 7: 83-128 (1934); 7: 441-50 (1935).
- Chocholle, R. "Sensation auditive engendrée par stimulation électrique de l'épiderme céphalique au moyen d'un courant alternatif" (Auditory Sensation Generated by Electrical Stimulation of the Skin of the Head with an Alternating Current), C. R. Soa. Soc. Biol. Fil., 142: 467-9 (1948).
- Chocholle, R. "Emission d'ondes acoustiques audibles par l'épiderme sous l'action d'un courant électrique alternatif" (Emission of Audible Acoustic Waves by the Skin through the Action of Alternating Electric Current), C. R. Soa. Soc. Biol. Fil., 142: 469-71 (1948).
- Chocholle, R. "Effet de la polarisation sur la sensation auditive engendrée par stimulation de l'épiderme au moyen d'un courant alternatif" (Effect of Polarization on the Auditory Sensation Generated by Stimulation of the Skin with Alternating Electric Current), C. R. Soa. Soc. Biol. Fil., 142: 1393-5 (1948).
- Cole, K. S. "Electrical Conductance of Biological Systems," Cold Spring Harbor Symp. Quant. Biol., 1: 107-16 (1933).
- Conklin, J. E. "Three Factors Affecting the General Level of Electrical Skin Resistance," Am. J. Psychol., 64: 78-86 (1951).
- Conrad, A. G., Haggard, H. W., and Teare, B. R. "Electrical Studies of Living Tissue," Elec. Engng., 55: 768-72 (1936).
- Coppee, G. "Stimulation by Alternating Current," Cold Spring Harbor Symp. Quant. Biol., 4: 150-62 (1936).
- Croner, M. D. Some Parameters of Cutaneous Square-Wave Electrical Stimulation. Unpublished M.A. thesis, Carnegie Institute of Technology, 1961.

- Crook, M. N. "The Sensory Aspect of Electrical Stimulation," J. Gen. Psychol., 6: 49-69 (1932).
- Crozier, W. J., and Holway, A. H. "On the Law for Minimal Discrimination of Intensities," Proc. Nat. Acad. Sci., 23: 23-8 (1937).
- Dallenbach, K. M., and Neff, W. S. "The Chronaxie of Pain and Pressure," Am. J. Psychol., 48: 632-7 (1936).
- Dalziel, C. F. "Effects of Electric Current on Man," Elec. Engng., 60: 63-6 (1941).
- Dalziel, C. F. "Effects of Electric Shock on Man," IRE Trans. Med. Elec., PGME-5 (1956), pp. 44-62.
- Danilewsky, B., and Worobjew, A. "Ueber die Fernwirkung elektrischer Hochfrequenzstrome auf die Nerven" (The Distant Effect of Electrical High Frequency Currents on Nerve), Pflug. Arch. ges. Physiol., 236: 440-52 (1935).
- Darrow, C. W. "Sensory, Secretory and Electrical Changes in the Skin Following Bodily Excitation," J. Exp. Psychol., 10: 197-226 (1927).
- Davis, D. R., and Kennard, D. W. "Influence of Electric Current on the Skin," Nature, 193: 1186-7 (1962).
- Davis, R. C. "Electrical Skin Resistance Before, During and After a Period of Noise Stimulation," J. Exp. Psychol., 15: 108-15 (1932).
- De Almeida, M. O. "Sur la theorie de l'excitation électrique des nerfs et des muscles" (On the Theory of Electrical Stimulation of Nerves and Muscles), Annee Physiol., 3: 129 (1927).
- Dewson, J. H. "Cortical Responses to Patterns of Two-Point Cutaneous Stimulation," J. Comp. Physiol. Psychol., 58: 387-9 (1964).
- Ekman, G., Frankenhaeuser, M., Levander, S., and Nellis, I. "Scales of Unpleasantness of Electrical Stimulation," Scand. J. Psychol., 5: 257-61 (1964).
- Erlanger, J., Gasser, H.-S., and Bishop, G. H. "The Compound Nature of the Action Current of Nerve as Disclosed by the Cathode Ray Oscillograph," Am. J. Physiol., 70: 624-66 (1924).

Euler, C. von, and Skoglund, C. R. "Responses of Different Types of Nerve Fibres to Ascending and Descending Currents," Acta Physiol. Scand., 14 (Suppl. 47): 1-19 (1947).

Fabre, P., and Swyngedauw, J. "Sur la constance de la quantité d'électricité débitée dans l'excitation des nerfs par déscharges brèves" (On the Constancy of the Quantity of Electricity Required in the Stimulation of Nerves by Short Discharges), C. R. Soa. Soc. Biol., 113: 765-8 (1933).

Faddeev, T. D. "The Problem of Resistance," Sovietsk Psikhonevrol., 6: 207-15 (1933).

Feng, T. P. "The Response of Muscle to Prolonged Electric Current," Chinese J. Physiol., 10: 35-52 (1936).

Fleisch, A., Sugar, A., and Hofstetter, J. R. "Actions de différents courants électriques sur la sensibilité cutanée" (Differential Sensitivity of the Skin to Electrical Currents), J. Physiol., 42:891-9 (1950).

Floyd, W. F. "Electrical Phenomena Recorded from the Skin," J. Physiol., 85: 27-8 (1935).

Forbes, T. W. "Skin Potential and Impedance Responses with Recurring Shock Stimulation," Am. J. Physiol., 117: 189-99 (1936).

Forbes, T. W., and Bernstein, A. L. "The Standardization of 60-Cycle Electrical Shock for Practical Use in Psychological Experimentation," J. Gen. Psychol., 12: 436 (1935).

Forbes, T. W., Muenzinger, K. F., and Wendt, G. R. "Report of Roundtables on the Use of Electric Shock," Psychol. Bull., 32: 185 (1935).

Foulke, E. "The Locus Dimension as a Basis for Electrocuteaneous Communication," J. Psychol., 57: 253-7 (1964).

Frey, M. von. "Physiologische Versuche über das Vibrationsgefühl" (Physiological Experimentation on the Vibration Sense), Z. Biol., 65: 417-27 (1915).

Gault, T. H., and Crane, G. W. "Tactual Patterns from Certain Vowel Qualities Instrumentally Communicated from a Speaker to a Subject's Fingers," J. Gen. Psychol., 1: 353-9 (1928).

Geets, W., and Colle, J. "Mesures de déphasage et d'impédance électrique de la peau humaine" (Measurement of Phase Displacement and Electrical Impedance of the Human Skin), C. R. Soa. Soc. Biol., 140: 701-704 (1946).

Geisuri, G. V., and Volokhov, A. A. "On the Effect of Alternating Currents on the Cochlea," J. Physiol., 89: 113-21 (1937).

Geisuri, G. V., Volokhov, A. A., and Arapova, A. A. "A Further Analysis of the Action of Alternating Currents on the Auditory Apparatus," J. Physiol., 89: 122 (1937).

Geldard, F. A. "Adventures in Tactile Literacy," Am. Psychologist, 12: 115-24 (1957).

Geldard, F. A. Envelope Variations in Electrical Stimulation. Office Naval Res. Rep., No. 36, Project NR 140-598, University of Virginia, 1958.

Geldard, F. A. "Cutaneous Channels of Communication," in W. A. Rosenblith (ed.), Sensory Communication, Cambridge, Mass.: MIT Press, 1961, pp. 73-87.

Gibson, R. H. "Conditions of Painless Electrical Stimulation," in Virginia Cutaneous Project, Office Naval Research Report, No. 36, Project NR 140-598, University of Virginia, 1958.

Gibson, R. H. "Painless Electrical Cutaneous Stimulation," Va. J. Sci., 9: 443-4 (1958).

Gibson, R. H. "Painless Electrical Cutaneous Stimulation," Va. J. Sci., 10: 305 (1959; abstract).

Gibson, R. H. "Conditions of Painless Electrical Stimulation," in Virginia Cutaneous Project, Office Naval Research Report, No. 42, Project NR 140-598, University of Virginia, 1960.

Gibson, R. H. "Electrical Stimulation of the Skin - On Purpose," Va. J. Sci., 2: 108 (1960).

Gibson, R. H. "Electrical Stimulation of the Skin," in J. W. Linsner (ed.), Proceedings of the Mobility Research Conference, Washington, D. C. and Cambridge, Mass., 1961. New York: American Foundation for the Blind, 1962, pp. 128-38.

Gibson, R. H. Conditions of Painless Electrical Stimulation of Touch. Paper presented at the Eastern Psychological Association, April 26-28, 1962.

Gibson, R. H. Temporal Factors in Electrical Stimulation of Pain and Touch. Unpublished Ph.D. dissertation, University of Virginia, 1962.

Gibson, R. H. "Communication by Electrical Stimulation of the Skin," in L. L. Clark (ed.), Proceedings of the International Congress on Technology and Blindness, Vol. II, New York: American Foundation for the Blind, 1963, pp. 183-207.

Gibson, R. H. Cutaneous Perception of Apparent Movement from Electric Stimuli. Paper presented at the Eastern Psychological Association, April 11-13, 1963.

Gibson, R. H. "Electrical Stimulation of Pain and Touch Systems," Nature, 199: 307-308 (1963).

Gibson, R. H. Tactile Perception with Electric Stimuli. Paper presented at the Living Systems Section. WESCON, August 23, 1963.

Gibson, R. H. Tactual Perception by Electrical Stimulation of the Skin. Paper presented at the Psychonomic Society, August 29-31, 1963.

Gibson, R. H. Communication by Electrical Stimulation of the Skin. Progress Report No. 1, NSF Grant B-15440 and NINDB Grant NB-05099-01, NASA, University of Pittsburgh, January, 1965. Mimeo.

Gibson, R. H. Communication by Electrical Stimulation of the Skin. Space Research Coordination Center, Report No. 21, NASA, University of Pittsburgh, November 17, 1965.

Gibson, R. H. Communication by Electrical Stimulation of the Skin. Progress Report No. 2, NSF Grant B-15440 and NINDB Grant NB-05099-01, NASA, University of Pittsburgh, May, 1965. Mimeo.

Gibson, R. H. Communication by Electrical Stimulation of the Skin. Progress Report No. 3, NSF Grant B-15440 and NINDB Grant NB-06304-01, NASA, University of Pittsburgh, February, 1966. Mimeo.

Gibson, R. H. "Electrical Stimulation of Touch and Pain," in D. Kenshalo (ed.), Proceedings of the International Symposium on the Mechanisms of Cutaneous Sensitivity, Springfield, Illinois: Charles C. Thomas, 1967.

Gibson, R. H. "Apparent Movement from Cutaneous Electrical Stimulation," Science (in press).

- Gibson, R. H. "Tactile Stimulation," in Proceedings of the St. Dunstan's International Conference on Sensory Devices, London: 1967 (in press).
- Gildemeister, M. "Die Elektrizitätserzeugung der Haut und der Drüsen" (Electrical Production in the Skin and Glands). in Bethe, Handb. d. norm. u. path. Physiol., 812: 766-77 (1928).
- Gildemeister, M. "Die Passiv-elektrischen Erscheinungen in Tier. und Pflanzenreich" (The Passive Electrical Phenomenon in Plant and Animal Life), in Bethe, Handb. d. norm. u. path. Physiol., 812: 657-702 (1928).
- Gildemeister, M. "Untersuchungen über die Wirkung der mittelfrequenzströme aus den Menschen" (An Examination of the Effect of Medium Frequency Current in Man), Arch. d. ges. Physiol., 247: 366-404 (1944).
- Gilmer, B. von H. "The Sensitivity of the Fingers to Alternating Electrical Currents," Am. J. Psychol., 49: 444-9 (1937).
- Gilmer, B. von H. "Possibilities of Cutaneous Electropulse Communication," in G. R. Hawkes, (ed.), Symposium on Cutaneous Sensitivity, U.S. Army Med. Res. Lab., Fort Knox, Kentucky, Feb. 11-13, 1960, USAMRL Report No. 424. USAMRL Project No. 6X95-25-001. U.S. Army Med. Res. and Dev. Command, December 22, 1960, pp. 76-84.
- Gilmer, B. von H. "Toward Cutaneous Electro-Pulse Communication," J. Psychol., 52: 211-22 (1961).
- Goodfellow, L. D. "Sensory Discrimination for Alternating Current Stimuli," Psychol. Bull. 36: 632 (1939).
- Goody, W. "On the Nature of Pain," Brain, 80: 77-118 (1957).
- Gottechall, A. W., Jr. The Course of Cutaneous Adaptation to Audio-Frequency Currents. Unpublished M.A. thesis, University of Virginia, 1953.
- Gougerot, L. "Recherches sur l'impédance cutanée en courant alternatif de basse fréquence au cours de différent dermatoses" (Research on Cutaneous Impedance Using an Alternating Current of Low Frequency during the Course of Various Dermatoses), Ann. de Dermat. et Syph., 7 (Series 8): 101-11 (1947).
- Green, R. T. "Absolute Threshold for Electric Shock," Nature, 194: 1303-1304 (1962).

- Grings, W. W. "Methodological Considerations Underlying Electrodermal Measurement," J. Psychol., 35: 271-82 (1953).
- Guelke, R. W., and Huyssen, R. M. J. "Development of Apparatus for the Analysis of Sound by the Sense of Touch," J. Acoust. Soc. Am., 31: 799-809 (1959).
- Hahn, J. F. "Cutaneous Vibratory Thresholds for Square-Wave Electrical Pulses," Science, 127: 879-80 (1958).
- Hahn, J. F. "Communications Via the Skin," in The Application of External Power in Prosthetics and Orthotics. Nat. Acad. Sci., Nat. Res. Council Committee on Prosthetics Research and Development, Washington, D.C., 1961, pp. 145-9.
- Hartridge, H. "Methods of Reducing the Errors in Testing Due to Variations in Skin Resistance," Brit. J. Radiol., 4: 652-7 (1931).
- Hausman, G. "Muskelgrosse, Reizstarke und Zuckungshohe bei direkter Reizung mis Sättigungs stromen" (Muscle Size, Strength of Stimulus, and Amplitude of Response in Direct Stimulation with Saturation Currents), Pflug. Arch. f. d. ges. Physiol., 229: 288-98 (1931).
- Hausmann, T. "Tastversuche mit dem electrosmotisch gänzlich anästhesierten Finger" (Tactual Experiments with the Finger Completely Anesthetized by Electro-osmosis), Z. f. Sinnesphysiologie, 62: 141-57 (1931).
- Hawkes, G. R. Cutaneous Adaptation to Alternating Current. Unpublished M.A. thesis, University of Virginia, 1956.
- Hawkes, G. R. "Communication by Electrical Stimulation of the Skin," U.S. Army Med. Res. Lab. Rep., No. 400, September, 1959.
- Hawkes, G. R. Cutaneous Discrimination of Electrical Intensity. Unpublished Ph.D. dissertation, University of Virginia, 1959.
- Hawkes, G. R. An Evaluation of the Magnitude Estimation Technique Using Electrical Stimulation of the Skin. U.S. Army Med. Res. Lab. Rep., No. 428, 1960.
- Hawkes, G. R. "Cutaneous Communication: Absolute Identification of Electrical Intensity Level," J. Psychol., 49: 203-12 (1960).
- Hawkes, G. R. "Absolute Identification of Duration," Percept. Mot. Skills, 13: 203-209 (1961).

Hawkes, G. R. Communication by Electrical Stimulation of the Skin: VI. The Effect of Intensity Level and Stimulus Spacing on Information Transmitted Via Stimulus Duration. U.S. Army Med. Res. Lab. Rep., No. 492, 1961, i + 9 pp.

Hawkes, G. R. "Cutaneous Discrimination of Electrical Intensity," Am. J. Psychol., 74: 45-53 (1961).

Hawkes, G. R. "Information Transmitted Via Electrical Cutaneous Stimulus Duration," J. Psychol., 51: 293-8 (1961).

Hawkes, G. R. Absolute Identifications of Cutaneous Stimuli Varying in Both Intensity Level and Duration. Fed. Aviation Agency Civil Aeromedical Res. Inst. Reps., No. 62-16, 1962, 6 pp.

Hawkes, G. R. "Effect of Skin Temperature on Absolute Threshold for Electrical Current," J. Appl. Physiol., 17: 110-12 (1962).

Hawkes, G. R. "Predictability of Multidimensional Absolute Identifications from Information Transmitted with Unidimensional Stimuli," J. Psychol., 54: 309-16 (1962).

Hawkes, G. R., and Loeb, M. "Vigilance for Cutaneous and Auditory Stimuli as a Function of Intersignal Interval and Signal Strength," J. Psychol., 53: 211-18 (1962).

Hawkes, G. R., and Warm, J. S. Communication by Electrical Stimulation of the Skin: Absolute Identification of Stimulus Intensity Level. U.S. Army Med. Res. Lab. Rep., 1959.

Hawkes, G. R., and Warm, J. S. Communication by Electrical Stimulation of the Skin: III. Maximum I_t for Absolute Identification of Current Intensity Level. U.S. Army Med. Res. Lab. Rep., 1959.

Hawkes, G. R., and Warm, J. S. "Maximum I_t for Absolute Identification of Cutaneous Electrical Intensity Level," J. Psychol., 49: 279-88 (1960).

Hawkes, G. R., and Warm, J. S. "The Sensory Range of Electrical Stimulation of the Skin," Am. J. Psychol., 73: 485-7 (1960).

Hawkes, G. R., and Warm, J. S. " ΔT for Electrical Cutaneous Stimulation," J. Psychol., 51: 263-71 (1961).

Hawkes, G. R., Bailey, R. W., and Warm, J. S. "Method and Modality in Judgments of Brief Stimulus Duration," J. Aud. Res., 1: 133-44 (1961).

Heise, G. A., and Rosenblith, W. A. "Electrical Response to Acoustic Stimuli Recorded at the Round Window of the Pigeon," J. Comp. Physiol. Psychol., 45: 401 (1952).

Hemphill, R. E. "Electrical Resistance of the Skin," J. Ment. Sci., 88: 285-305 (1942).

Hill, A. B. "The Two-Time Factors in the Electric Excitation of Nerve," Setchenov J. Physiol. USSR, 19: 131-43 (1935).

Hill, A. V. "The Strength-Duration Relation for Electrical Excitement of Medullated Nerve," Proc. Roy. Soc. London, B 119: 400 (1936).

Hill, A. V., and Bugnard, L. "Electric Excitation of the Fin Nerve of Sepia," J. Physiol., 83: 425-38 (1935).

Hill, H. E., Flanary, H.G., Kornetsky, C.H., and Wikler, A. "Relationship of Electrically Induced Pain to the Amperage and the Wattage of Shock Stimuli," J. Clin. Invest., 31: 464-72 (1952).

Hill, L., and Taylor, H. J. "Action of the Galvanic Current on the Skin," J. Physiol., 90: 93-4 (1937).

Hirvonen, M. "Über die Reizbarkeit des Gesamtmuskels bei elektrischer Reizung" (On the Irritability of the Total Muscle Under Electrical Stimulation), Skand. Arch. f. Physiol., 63: 1-99 (1932).

Hoorweg, J. L. "Über die elektrische Nervenerregung" (On the Electrical Excitation of Nerves), Pfluger's Arch., 53:587 (1893).

Horton, J. W., and Van Ravenswaay, A. C. "Electrical Impedance of the Human Body," J. Franklin Inst., 220: 557-72 (1935).

Jackson, T. A., and Riess, B. F. "Electric Shock with Different Size Electrodes," J. Genet. Psychol., 45: 262-6 (1934).

Jones, R. C., Stevens, S. S., and Lurie, M.H. "Three Mechanisms of Hearing by Electrical Stimulation," J. Acoust. Soc. Am., 12: 281 (1940).

Katz, B. "The Response of Medullated Nerve to Alternating High Frequency Stimulation," J. Physiol., 86: 285-90 (1936).

Katz, B. Electric Excitation of Nerve. London: Oxford University Press, 1939.

Kellaway, P. "The Electrophonic Response to Phase Reversal," J. Neurophysiol., 7: 227 (1944).

- Kennedy, J. L., and Travis, R. C., "Surface Electrodes for Recording Bioelectric Potentials," Science, 108: 103 (1948).
- Lambert, E. F., and Rosenblueth, A. "A Further Study of the Electrical Responses of Smooth Muscle," Am. J. Physiol., 114: 147-59 (1935/36).
- Landau, W., and Bishop, G. H. "Pain from Derman, Periostal, and Cascial Endings and from Inflammation; Electrophysiological Study Employing Differential Nerve Blocks," Arch. Neurol. Psychiat., 69: 490-504 (1953).
- Landis, C. "The Electrical Phenomena of the Skin (Psychogalvanic Skin Response)," Psychol. Bull., 29: 693-752 (1932).
- Landis, C., and Dewick, N. "The Electrical Phenomena of the Skin (Psychogalvanic Reflex)," Psychol. Bull., 26: 64-119 (1929).
- Lanier, L. H. "An Experimental Study of Cutaneous Innervation," Proc. Assoc. Res. Nerv. Ment. Dis. 15: 437-56 (1934).
- Lapicque, L. "On Electric Stimulation of Muscle Through Ringer's Solution," J. Physiol., 73: 219-46 (1931).
- Lawler, J. C., et al. "Electrical Characteristics of the Skin: The Impedance of the Surface Sheath and Deep Tissues," J. Investigative Dermatol., 34: 301-308 (1960).
- Lele, P. P., Sinclair, D. C., and Weddell, G. "The Reaction Time to Touch," J. Physiol., 123: 187-203 (1954).
- Lewis, T. "Experiments Relating to Cutaneous Hyperalgesia and Its Spread Through Somatic Nerves," Clin. Sci., 2: 373-417 (1936).
- Lewis, T., and Zotterman, Y. "Vascular Reactions of the Skin to Injury: VIII. The Resistance of the Human Skin to Constant Currents in Relation to Injury and Vascular Responses," J. Physiol., 62: 280-88 (1926).
- Libotte, O. "Physiologie des courants de haute fréquence et de haute tension" (The Physiology of High Frequency and High Voltage Currents), Annee électrob. Lille, 9: 17-28 (1906).
- Liebig, G. F. "The Influence of Repeated Electric Shocks on the Organism," Fiziol. Zh. USSR, 16: 187-98 (1933).

Light, R. U., and Chaffee, E. I. "Electrical Excitation of the Nervous System-Introducing a New Principle: Remote Control. Preliminary Report," Science, 79: 299-300 (1934).

Lillie, R. S. "Electrolytic Local Action as the Basis of Propagation of the Excitation-Wave," Am. J. Physiol., 41: 126 (1916).

Lindner, R. "Physiologische Grundlagen zum elektrischen Sprachetasten und ihre Anwendung auf den Taubstummenunterricht" (Physiological Bases of the Sensation of Electricity on the Tongue and Its Application to the Teaching of the Deaf and Dumb), Z. F. Sinnesphysiol., 67: 114-44 (1937).

Loeb, M., and Hawkes, G. R. Detection of Differences in Duration of Acoustic and Electrical Cutaneous Stimuli in a Vigilance Task. U. S. Army Med. Res. Lab. Rep., No. 522, 1961, ii + 11 pp.

Loewenstein, W. R. "The Generation of Electric Activity in a Nerve Ending," Ann. N.Y. Acad. Sci., 81: 367-87 (1959).

Loewenstein, W. R., and Rathkamp, R. "Localization of Generator Structure of Electric Activity in a Pacinian Corpuscle," Science, 127: 341 (1958).

Lorente de Nò, R. "A Study of Nerve Physiology," in Studies from the Rockefeller Institute for Medical Research, Vol. 131 and 132. New York: Rockefeller Institute for Medical Research, 1947.

Love, C. T., McCulloch, W. S., Prescott, C. H., and Dusser de Barenne, J. G. "A New Method for the Investigation of the Electrical Properties of Living Tissue," Am. J. Physiol., 113: 85-6 (1935).

Lowenbach, H., and Morgan, J. E. "The Human Skin as a Conductor of 60-Cycle Alternating Current of High Intensity, Studied on Electroshock Patients," J. Lab. Clin. Med., 28: 1195-8 (1942/43).

Lueg, W. "Elektrochemische Untersuchungen der menschlichen Haut" (Electrochemical Investigation of the Human Skin), Z. F. klin. Med., 106: 21-7 (1927).

Mallinckrodt, E., Hughes, A. L., and Sleator, W., Jr. "Perception by the Skin of Electrically Induced Vibrations," Science, 118: 277-8 (1953).

Maragliano, V. "Electrovibrator in Removal of Magnetic Foreign Bodies," La riforma medica, 52: 352-5 (1936).

Marchant, E., and Jones, H. W. "The Effect of Electrodes Made of Different Metals on the Skin Currents," Brit. Heart J., 2: 97-100 (1940).

Margaria, R. "La cunduttivita elettrica della cute in funzione della temperatura" (The Electrical Conductivity of the Skin as a Function of Temperature), Arch. di sci. biol., IX: 84-98 (1928).

Martin, E. G. The Measurement of Induction Shocks. New York: Wiley, 1912.

Matin, E. Temporal Aspects of Cutaneous Interaction with Two-Point Electrical Stimulation. Unpublished Ph. D. dissertation, Columbia University, 1959.

Matthews, B. H. C. "The Response of a Single End Organ," J. Physiol., 71: 64 (1931).

McCleary, Robert A. "The Nature of the Galvanic Skin Response," Psychol. Bull., 47: 97-117 (1950).

Melzack, R., and Wall, P. D. "On the Nature of Cutaneous Sensory Mechanisms," Brain, 85: 331-56 (1962).

Monnier, A. M. "L'excitation electrique des tissus" (The Electrical Excitation of Tissue), Essai d'interpretation physique, Paris: Hermann et Cie, 1934.

Montagna, W. "The Skin," Sci. Am., 212: 55-66 (1965).

Moor, T. V. "The Influence of Temperature and the Electric Current on the Sensibility of the Skin," Psychol. Rev., 17: 347-80 (1910).

Moore, A. R., and Brucke, E. T. "Über unterschiede zwischen direkter und indirekter Erregung eines Muskels und seiner einzelnen Fasern" (The Difference Between Direct and Indirect Excitation of a Muscle and of Its Separate Bundles), Pflug. Arch. f. d. ges. Physiol., 228: 619-31 (1931).

Morrell, F., Naquet, R., and Gastant, H. "Evolution of Some Electrical Signs of Conditioning. Part I. Normal Cat and Rabbit," J. Neurophysiol., 20: 547-87 (1957).

Morris, J. C. "On Vital Electrical Vibrations," Proc. Am. Phil. Soc., XXIX: 80-81 (1891).

Mueller, E. E., Loeffel, R., and Mead, S. "Skin Impedance in Relation to Pain Threshold Testing by Electrical Means," J. Appl. Physiol., 5: 746-52 (1953).

Offner, F. "Electrical Properties of Tissues in Shock Therapy," Proc. Soc. Exp. Biol. Med., 49: 571-5 (1942).

Offner, F. "Stimulation with Minimum Power," J. Neurophysiol., 9: 387-90 (1946).

Pattle, R. E., and Weddell, G. "Observations on Electrical Stimulation of Pain Fibers in an Exposed Human Sensory Nerve," J. Neurophysiol., 11: 93-8 (1948).

Penfield, W., and Boldrey, E. "Somatic Motor and Sensory Representation in the Cerebral Cortex of Man as Studied by Electrical Stimulation," Brain, 60: 689 (1937).

Pieron, H. "De la variation du temps perdu de la sensation en fonction de l'intensité de l'excitation" (On the Variability of Time Lag in Sensation as a Function of the Intensity of Excitation), Comptes Rendus des séances de l'acad. des Sci., 154: 998-1001 (1912).

Pieron, H., and Segal, J. "Recherches sur la sensibilité tactile digitale par stimulation électrique du nerf cutanée" (Research on Digital Tactile Sensitivity with Electrical Stimulation of the Cutaneous Nerve), Annee Psychol., 39:218-25 (1939).

Pieron, H., and Segal, J. "Le sensibilité tactile digitale étudiée par stimulation électrique du nerf cutanée" (Digital Tactile Sensitivity as Affected by Electrical Stimulation of the Cutaneous Nerve), C. R. Soa. Soc. Biol. Fil., 128: 762 (1938).

Pieron, H., and Segal, J. "Sur un phénomène de facilitation retroactive dans l'excitation électrique de branches nerveuses cutanées (sensibilité tactile)" (On a Phenomenon of Retroactive Facilitation in the Electrical Stimulation of Branches of the Cutaneous Nerves [tactile sensitivity]), J. Neurophysiol., 2: 178 (1939).

Poznanskaia, N. "Effect of Ionic Permeability of the Skin on the Volume of Rheobase in Various Electrolyte Solutions," Biull. eksp. Biol. Med., 10: 172-5 (1940).

Pozzo, G. "Le lesioni cutanee da elettricità: II. Prove sperimentali della resistenze elettriche dei vari strati cutanei," Gior. Ital. di dermatol. e sif., 90: 382-90 (1949).

Reboul, J., and Rosenblueth, A. "Action of Alternating Current on Electrical Excitability of Nerve," Am. J. Physiol., 125: 205-15 (1939).

Rein, H. "Experimentelle Studien über Elektroendosmose an überlebender menschlicher Haut" (Experimental Studies of Electrical Endosmosis on Surviving Human Skin), Z. f. Biol., 81: 125-40 (1924).

Richter, C. P. "Significant Changes in the Electrical Resistance of the Body During Sleep," Proc. Nat. Acad. Sci., 12: 214 (1926).

Richter, C. P. "Electrical Skin Resistance, Diurnal and Daily Variations in Psychopathic and Normal Persons," Arch. Neurol. Psychiat., 19: 488 (1928).

Richter, C. P. "Physiological Factors Involved in the Electrical Resistance of the Skin," Am. J. Physiol., 88: 596-615 (1929).

Richter, C. P. "High Electrical Resistance of the Skin of New Born Infants and Its Significance," Am. J. Dis. Children, 40: 18 (1930).

Richter, C. P., and Woodruff, B. G. "Changes Produced by Sympathectomy in the Electrical Resistance of the Skin," Surgery, 10: 957 (1941).

Richter, C. P., and Woodruff, B. G. "Facial Patterns of Electrical Skin Resistance. Their Relation to Sleep, External Temperature, Hair Distribution, Sensory Dermatomes and Skin Disease," Bull. Johns Hopkins Hosp., 70: 442-59 (1942).

Rizollo, A. "Effet de l'excitation électrique de la peau sur l'excitabilité de l'écorce cérébrale" (The Effect of Electrical Excitation of the Skin on the Excitability of the Cerebral Cortex), C. R. Soa. Soc. Biol. Fil., 97: 1608-11 (1927).

Roberts, W. H. "A Two-Dimensional Analysis of Discrimination of Differences in the Frequency of Vibrations by Means of the Sense of Touch," J. Franklin Inst., 213: 286-312 (1932).

Rosenberg, H. "Electrotonus and Excitation in Nerve," Proc. Roy. Soc., B124: 309-35 (1937).

Rosenblith, W. A., and Vidale, E. B. "A Quantitative View of Neuroelectric Events in Relation to Sensory Communication," in S. Koch (ed.), Psychology: A Study of a Science, Vol. 4. New York: McGraw-Hill, 1962, p. 334.

Rosenblueth, A., and Ramos, J. G., "The Local Responses of Mammalian Spinal Roots to Alternating Sinusoidal Currents," J. Cellular Comp. Physiol., 38: 321-45 (1951).

Rosenblueth, A., and Reboul, J. "The Blocking and Deblocking Effects of Alternating Current on Nerve," Am. J. Physiol., 125: 251-64 (1939).

- Rosenblueth, A., Reboul, J., and Gross, A. M. "The Action of Alternating Currents on the Spike-Potential Magnitude, Conduction Velocity, and Polarization of Nerve," Am. J. Physiol., 130: 527-41 (1940).
- Rosenblueth, A., and Rioch, D. M. "Electrical Excitation of Multifibered Nerves," Am. J. Physiol., 104: 519-29 (1933).
- Rosendal, T. The Conducting Properties of the Human Organism to Alternating Current. Copenhagen: Munksgaard, 1940.
- Rosendal, T. "Studies on the Conducting Properties of the Human Skin to Direct Current," Acta Physiol. Scandinav., 5: 130-51 (1943).
- Rosendal, T. "Further Studies on the Conducting Properties of Human Skin to Direct and Alternating Current," Acta Physiol. Scandinav., 8: 183-202 (1944).
- Rosendal, T. "Concluding Studies on the Conducting Properties of Human Skin to Alternating Current," Acta. Physiol. Scandinav., 8: 39-49 (1945).
- Rosner, B. S. "Neural Factors Limiting Cutaneous Spatiotemporal Discriminations," in W. A. Rosenblith (ed.), Sensory Communication, Cambridge, Mass.: MIT Press, 1961, pp. 725-37.
- Rosner, B. S. "Temporal Interaction Between Electrocuteaneous Stimuli," J. Exp. Psychol., 67: 191-2 (1964).
- Rosner, B. S., and Coff, W. R. "Electrical Responses of the Nervous System and Subjective Scales of Intensity," in W. D. Neff (ed.), Contributions to Sensory Physiology, Vol. 2. New York: Academic Press, 1967.
- Rosner, B. S., and Coff, W. R. "Electrical Responses of the Nervous System," in D. W. Neff (ed.), Sensory Physiology, Vol. 2. New York: Academic Press (in press).
- Rosner, B. S., Schmid, E., Novak, S., and Allison, J. T. "Responses at Cerebral Somatosensory I and Peripheral Nerve Evoked by Graded Electrocuteaneous Stimulation," Am. J. Physiol., 196: 1083-7 (1959).
- Rubinstein, D. L., and Pevzner, V. I. "Significance of Electric Power in Manifestation of Unilateral Permeability of the Skin," J. Physiol. USSR, 22: 473-82 (1937, English summary).
- Rushton, W. A. H. "Normal Presence of α and γ Excitabilities in Nerve-Muscle Complex," J. Physiol., 72: 265-87 (1931).
- Schmid, E. "Temporal Aspects of Cutaneous Interaction with Two-Point Electrical Stimulation," J. Exp. Psychol., 61: 400-409 (1961).

- Schobel, E. "Experiments on Intensity Discrimination by Electrical Touch of Various Frequencies," Z. Sinnesphysiol., 61: 262-73 (1936).
- Schriever, H. "Untersuchungen über die elektrische Erregbarkeit der Sinnesnerven" (Studies of the Electrical Excitability of the Nerve Senses), Z. Biol., 90: 347 (1930).
- Schwarz, F. "Quantitative Untersuchungen über die optische Wirkung sinusförmiger Wechselströme" (Quantitative Investigations on the Visual Effects of Sinusoidal Alternating Currents), Z. Sinnesphysiol., 68: 1-26 (1940).
- Schwarz, F. "Die Wirkung niederfrequenter elektrischer Schwingungen auf die Sensibilität der Mundhöhlenschleimhaut" (The Effect of Low Frequency Alternating Current on the Sensibility of the Mucous Membrane of the Mouth), Z. Sinnesphysiol., 69: 41-59 (1940).
- Schwarz, F. "Über die Reizung des Sehorgans durch nieder frequente elektrische Schwingungen" (Stimulation of the Visual Organ by Low-Frequency Electric Vibrations), Z. Sinnesphysiol., 69: 92-118 (1940).
- Schwarz, F. "Über die Reizung des Sehorgans durch doppel phasige und gleichgerichtete elektrische Schwingungen (On the Stimulation of the Visual Organ by Diphasic and Rectified Electrical Oscillations), Z. Sinnesphysiol., 69: 158-172 (1941).
- Schwarz, F. "Über die Wirkung niederfrequenter elektrischer Schwingungen auf sensible nerven der Haut" (On the Action of Low-Frequency Electrical Oscillations on the Sensory Nerves of the Skin), Z. Sinnesphysiol., 69: 173-92 (1941).
- Schwarz, F. "Über die Wirkung gleichgerichteter elektrischer Schwingungen auf den sensiblen Apparat der Mundhöhlenschleimhaut" (On the Action of Rectified Electrical Oscillations on the Sensitive Apparatus of the Buccal Mucosa), Z. Sinnesphysiol., 69: 193-204 (1941).
- Scott, D. "Strength-Duration Curves for Repetitive Stimulation of Medullated Nerve," J. Physiol., 82: 321-31 (1934).
- Shagass, C., and Schwartz, M. "Evoked Cortical Potentials and Sensation in Man," J. Neuropsychiat., 2: 262-70 (1961).
- Shagass, C., and Schwartz, M. "Cerebral Responsiveness in Psychiatric Patients," AMA Arch. Gen. Psychiat., 8: 177-89 (1963).

Sheridan, J., Foulke, E., and Allusisi, E. A. "Some Factors Influencing the Threshold of the Electrocuteaneous Stimulus," Percept. Mot. Skills, 22: 647-54 (1966).

Sherrick, C. W., Jr. "Observations Relating to Some Common Psychological Functions Applied to the Skin," in G. R. Hawkes (ed.), Symposium of Cutaneous Sensitivity. U. S. Army Med. Res. Lab. Rep., No. 424, 1960.

Sigel, H. "High Frequency Square-Wave Current in Dermatology: Epilation, Iontophoresis, Cutaneous Sensory Threshold. Preliminary Report," J. Invest. Dermatol., 15: 167-72 (1950).

Sigel, H. "Cutaneous Sensory Threshold Stimulation with High Frequency Square-Wave Current: I. The Relationship of Electrode Dimensions to the Sensory Threshold," J. Invest. Dermatol., 18: 441-5 (1952).

Sigel, H. "Cutaneous Sensory Threshold Stimulation with High Frequency Square-Wave Current: II. The Relationship of Body Site and of Skin Diseases to the Sensory Threshold," J. Invest. Dermatol., 18: 447-51 (1952).

Sigel, H. "Prick Threshold Stimulation with Square-Wave Current: A New Measure of Skin Sensibility," Yale J. Biol. Med., 26: 145-54 (1953).

Skoglund, C. R. "The Responses to Linearly Increasing Currents in Mammalian Motor and Sensory Nerves," Acta Physiol. Scand., Vol. 4, Suppl. XVI (1942).

Stevens, S. S. "Cross-Modality Validation of Subjective Scales for Loudness, Vibration, and Electric Shock," J. Exp. Psychol., 57: 201-209 (1959).

Stevens, S. S., Carton, A. S., and Shickman, G. M. "A Scale of Apparent Intensity of Electric Shock," J. Exp. Psychol., 56: 328-34 (1958).

Sticht, T. G. A. "Reaction Time to Cutaneous Onset and Offset Stimulation," Percept. Mot. Skills, 19: 611-14 (1964).

Sticht, T. G. A., and Foulke, E. "Reaction Time as a Function of Electrocuteaneous Onset and Offset Stimulation," Psychonomic Sci., 4: 213-14 (1966).

Sticht, T. G. A., and Sitterley, T. "Frequency and Latency of Response to Onset-Offset Sequences of Cutaneous Stimulation," Psychonomic Sci., 3: 425-6 (1965).

Strohl, A., and Djourno, A. "Modifications du courant de peau de grenouille pendant l'excitation électrique" (Modifications in the Skin Current of Frog during Electrical Stimulation), C. R. Soa. Soc. Biol. Fil., 125: 6-25 (1937).

Sumby, W. H. An Experimental Study of Vibrotactile Apparent Motion. Unpublished M.A. thesis, University of Virginia, 1955.

Terson, A. "Sur l'adaptation ophthalmologique de l'électro-vibreur de Bergonié" (On the Ophthalmological Adaptation of the Electro-vibrator of Bergonié), Arch. d'élect. Med., 26: 232 (1916).

Thompson, I. M. "The Effects of Alternating Currents upon Cutaneous Sensory Thresholds," Science, 78: 268-9 (1933).

Thompson, I. M., Banks, G. F., Barren, E., Fzatis, A. M., Jr., and Mattison, B. F. "Differential Elevation of Cutaneous Sensory Thresholds by Alternating Current Applied to a Nerve," Univ. Calif. Publ. Anat., 1: 167-94 (1934).

Tompkins, S. S. "An Analysis of the Use of Electric Shock with Human Subjects," J. Psychol., 15: 285 (1943).

Travis, L. E., and Griffith, P. E. "Electric Current Thresholds at Audio Frequency," Am. J. Psychol., 48: 422-33 (1936).

Travis, L. E., and Lindsley, D. B. "The Relation of Frequency and Extent of Action Currents to Intensity of Muscular Contraction," J. Exp. Psychol., 22: 269 (1938).

Tschiriew, S., and Dewatteville, A. "On the Electrical Excitability of the Skin," Brain, 2: 163-80 (1880).

Uttal, W. R. "Cutaneous Sensitivity to Electrical Pulse Stimuli," J. Comp. Physiol. Psychol., 51: 549-54 (1958).

Uttal, W. R. "A Comparison of Neural and Psychophysical Responses in the Somesthetic System of Man," J. Comp. Physiol. Psychol., 52: 485-90 (1959).

Uttal, W. R. "Inhibitory Interaction of Responses to Electrical Stimuli in the Fingers," J. Comp. Physiol. Psychol., 53: 47-51 (1960).

Uttal, W. R. "The Neural Coding of Somesthetic Sensation: A Psychophysical-Neurophysiological Comparison," in G. H. Hawkes (ed.), Symposium on Cutaneous Sensitivity, U.S. Army Med. Res. Lab., Fort Knox, Kentucky, Feb. 11-13, 1960, USAMRL Report No. 424, USAMRL Project No. 6X95-25-001. U.S. Army Med. Res. and Dev. Command, December 22, 1960, pp. 76-84.

Uttal, W. R. Neural Responses to Long Duration Electrical Pulse Stimuli in the Somesthetic System of Man. Information Research Memorandum 00195, IBM Research Center, October, 1958.

Uttal, W. R. "The Three Stimulus Problem: A Further Comparison of Neural and Psychophysical Responses in the Somesthetic System," J. Comp. Physiol. Psychol., 53: 42-6 (1960).

Uttal, W. R. The Response of the Somesthetic System to Patterned Trains of Electrical Stimuli: An Approach to the Problem of Sensory Coding. Mental Health Research Institute, University of Michigan, 1966.

Uttal, W. R., and Cook, L. "Systematics of the Evoked Somato Sensory Cortical Potential," IBM J. Res. Develop., 6: 179-99 (1962).

Vernon, J. A. "Electrical Stimulation and Sensory Fatigue," Va. J. Sci., 1: 398 (1950).

Vernon, J. A. "Cutaneous Beats from Combined Electrical and Mechanical Vibratory Stimulation," Va. J. Sci., 3: 347 (1952).

Vernon, J. A. Simultaneous Electrical and Mechanical Vibratory Stimulation of the Skin. Unpublished Ph.D. dissertation, University of Virginia, 1952.

Vernon, J. A. "Cutaneous Interaction Resulting from Simultaneous Electrical and Mechanical Vibratory Stimulation," J. Exp. Psychol., 45: 283-7 (1953).

Vernon, J. A., and Wessman, A. "The Effect of Phase Manipulation Upon Electrocuteaneous Stimulation," J. Comp. Physiol. Psychol., 49: 293-7 (1956).

Wagner, H. N., Jr. "Electrical Skin Resistance Studies in Two Persons with Congenital Absence of Sweat Glands," Arch. Dermatol. Syph., 65: 543-8 (1952).

Ward, H. P. "Stimulus Factors in Septal Self-Stimulation," Am. J. Physiol., 196: 779-82 (1959).

Whelan, F. G. "An Instrument for Use in Measuring the Electrical Resistance of the Skin," Science, 111: 496-7 (1950).

Whelan, F. G., and Richter, C. P. "Electrical Skin Resistance Technique Used to Map Areas of Skin Affected by Sympathectomy and by Other Surgical or Functional Factors," Arch. Neurol. Psychiat., 49: 454-6 (1943).

Whitchurch, A. K. "The Illusory Perception of Movement on the Skin," Am. J. Psychol., 32: 472-89 (1921).

Wilkerson, V. A. "The Chemistry of Human Skin; the Electrokinetic Effect of Various Ions upon Suspended Particles of Stratum Corneum," J. Gen. Physiol., 23: 165-70 (1939/40).

Wollman, B. "Gleichzeitige sensible Reizung der menschlichen Haut durch zwei Wechselströme verschiedener Frequenz" (Simultaneous Sensory Stimulation of the Human Skin with Alternating Currents of Different Frequency), Z. f. Sinnesphysiol., 67: 19-38 (1936).

Zeigler, H. P. "Electrical Stimulation of the Brain and the Psychophysiology of Learning and Motivation," Psychol. Bull., 54: 263-382 (1957).

Zotterman, Y. "Touch, Pain, and Tickling: An Electro-Physiological Investigation on Cutaneous Sensory Nerves," J. Physiol., 95: 1 (1939).