

Resume (Short)

Norman R. Scott

Biological & Environmental Engineering
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EDUCATION

YearDegreeInstitution

1962Ph.D.Cornell University
1958BSAE (with honors)Wash. State University

ACADEMIC RANKS (year achieved)

Professor:1976
Associate Professor:1968
Assistant Professor:1962

PRIMARY DEPARTMENT/ Unit Program Areas: Biological & Environ. Engr.

Bioengineering, Engineering for Sustainable Development, Environmental Engineering

AREAS OF EXPERTISE (key words)

Sustainable development, renewable energies, biologically derived fuels, agro-eco-industrial systems

PROFESSIONAL EXPERIENCE

YearExperience

2011-Professor Emeritus
1998-2011Professor, Dept. Biol. & Environ. Engr., Cornell
1989-1998Vice President for Research Cornell University and Advanced Studies
1998-1999Acting President Cornell Research Foundation
1988-1989Acting V. Provost Computing Cornell University
1984-1989Director for Research College Agr. & Life Sciences, Cornell
1984-1989Director Cornell Univ. Agr. Exp. Station
1978-1984Chairman Dept.of Agr. Engr. Cornell
1976-2011Professor Dept. of Agr. Engr. Cornell
1968-1976Assoc. Professor Dept. of Agr. Engr. Cornell
1962-1968Asst. Professor Dept. of Agr. Engr. Cornell
2006-presentAdvisory Professor Shanghai Jiao Tong University
2009-2012Adjunct Professor Shenzhen Graduate School of Peking Univ.

HONORS AND AWARDS

Elected to National Academy of Engineering, 1990
Chairman, Consortium of U. S. Universities and Institutions in Cooperation with China for Agriculture (Consortium of Thirteen major Land-Grant Universities), [2001 –2004]
President, Institute of Biological Engineering (IBE), 2001
President, ASABE: American Society of Agricultural & Biological Engineers, (1993-1994)
Technical Vice President of ASABE for a term of three years (1990-1993)
Board on Agriculture and Natural Resources of the National Research Council (1993 1996); (2006- 2012, Chair 2009-12)
Received four paper awards from ASABE in recognition of outstanding research publications in ASABE Transactions

Elected Fellow of ASABE, 1986

Received the McCormick - Case Gold Medal (ASABE) in 2002

Received the Henry Giese Award (ASABE) in 1989

Alumni Achievement Award, Washington State Alumni Association, 1991

Elected as a Founding Fellow of American Institute for Medical and Biological Engineering (AIMBE), 1992

Elected Fellow of American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), 1996

Senior Member, Instrumentation Society of America

J.P. and Mary Barger Excellence in Teaching Award, Cornell College of Engineering, 2003

Chancellor's Award for Excellence in Faculty Service, State University of New York, 2007

Kenneth A Goldman Excellence in Teaching Award, Cornell College of Engineering, 2008

Outstanding Faculty Award, College of Agriculture & Life Sciences, CALS Alumni Association, 2011

PROFESSIONAL ACTIVITIES

PROFESSIONAL SOCIETIES

American Society of Agricultural & Biological Engineers (ASABE)

American Society of Heating, Refrigeration & Air Conditioning Engineers (ASHRAE)

American Society for Engineering Education (ASEE)

American Institute for Medical & Biological Engineering (Founding Fellow 1992)

Instrument Society of America (ISA)

American Association for the Advancement of Science (AAAS)

Institute for Biological Engineering (IBE)

PROFESSIONAL ASSIGNMENTS

ASABE Offices

Past President 1994-95

President 1993-94

President-elect 1992-93

Technical Vice President 1989-92

Director, Professional Development Dept. 1987-89

IBE Offices

President 2000

President-elect 1999

NAE Committees:

1991- 93 Peer Committee (Section 12)

1999-00 Nominating Committee (representative of Section 12)

2000-03 Russ Prize Committee (Bioengineering)

PUBLICATIONS: (* Refereed Publications)

Koehler, T A., N.R. Scott and R.A. Parsons. 1965. Earth-air heat exchange study. 1964.

Scott, N. R., Progress Report to the New York Farm Electrification Council, 7 pages. May.

Scott, N.R. 1966. Earth-air heat exchange study. 1965 Progress Report to the New York Farm Electrification Council, 8 pages. May.

*Scott, N.R. and L.L. Boyd. 1967. Heat transfer through masonry walls. Trans of ASAE 10(1):123-127.

Jordan, K.A. and N.R. Scott. 1968. Animal calorimetry - An instrumentation challenge. Leeds & Northrup Technical Journal, Spring Issue, No. 3. pp. 10-15.

*Bagnall, LO., W.F. Millier and N.R. Scott. 1970. Drying of the alfalfa stem. Trans. of ASAE 13(2):232-236, 245.

*Scott, N.R., A.T. Johnson and A. van Tienhoven. 1970. Measurement of hypothalamic temperature and heart rate of poultry. Trans. of ASAE 13(3):342-347.

- *Wahla, M.I., N.R. Scott and A. H. Nilson. 1971. Direct measure of bond-slip in reinforced concrete. *Trans. of ASAE* 14(4):762-767.
- *Johnson, A.T. and N.R. Scott. 1971. A computer model to analyze and simulate thermo receptor action. *Trans. of ASAE* 14(5):828-836, 840.
- Scott, N.R. and C.A. Pettibone. 1971. Physiological parameters related to poultry thermoregulation. Paper presented at First Conference on Biometeorology, (Abstract). *Bulletin of the Am. Meteorological Society* 52(4):297. April.
- *Scott, N.R. and A. van Tienhoven. 1971. Simultaneous measurements of hypothalamic and body temperatures and heart rate of poultry. *Trans. of ASAE* 14(6):1027-1033.
- *Scott, N.R. and A.T. Johnson. 1972. Telemetry system and heart rate counter for determination of heart rate of small animals. *Trans. of ASAE* 15(1):14-18, 23.
- *Magshood, J., N.R. Scott, R.B. Furry and R. Sexsmith. 1973. Linear and non-linear finite element analysis of wood structural members. *Trans. of ASAE* 16(3):490-496.
- *Albright, L.D. and N.R. Scott. 1974. The low-speed non-isothermal wall jet. *J. of Agr. Engr. Res.* 19:25-34.
- Scott, N.R. 1974. Agribioengineering: a new field of research. *New York Food and Life Sciences Quarterly* 7(1):3-7.
- *Albright, L.D. and N.R. Scott. 1974. An analysis of steady periodic building temperature variations in warm weather - Part I: A mathematical model, pp. 88-92, 98; Part II: Experimental verification and simulation, pp. 93-98. *Trans. of ASAE* 17(1).
- Albright, L.D. and N.R. Scott. 1974. Predicting the daily variations of air temperature inside buildings. 31st Annual Progress Report to the New York Farm Electrification Council. pp. 42-45.
- *Scott, N.R., A. van Tienhoven and C.A. Pettibone. 1974. Thermoregulation in poultry. *Proc. of the Int'l. Livestock Environment Symposium, Special Publication SP-0174, ASAE, St. Joseph, MI.* pp. 211-219.
- *Scott, N.R. and A. van Tienhoven. 1974. Biogenic amines and body temperature in the hen, *Gallus domesticus*. *Amer. J. of Physiology.* 227(6):1399-1405. Dec.
- Price, D.R., N.R. Scott, L.D. Albright, D.L. Good and W.W. Gunkel. 1975. Solar energy. Heating and cooling of greenhouses and rural residences. 32nd Annual Progress Report to New York Farm Electrification Council. pp. 46-47.
- *Scott, N.R. 1975. Radio telemetry. Chapt. 12, In *Instrumentation and Measurement for Environmental Sciences.* A. Z. Henry (ed.), ASAE, St. Joseph, MI.
- Reitsma, S.Y. and N.R. Scott. 1975. To measure dynamic response of a cow's teat. *Agr. Engr.* 56(11):17-18.
- Scott, N.R. (ed.) 1976. *Bioengineering for the agricultural engineer.* *Agr. Engr.* 57(3): 14-17.
- *Gartland, P., J. Schiavo, C.E. Hall, R.H. Foote and N.R. Scott. 1976. Detection of estrus in dairy cows by electrical measurements of vaginal mucus and milk progesterone. *J. of Dairy Science* 59(5):982-985.
- *Pettibone, C.A. and N.R. Scott. 1976. Relationship of temperatures in the cervical blood vessels to brain temperatures in chickens. *Trans. of ASAE* 19(4):736-742, 748.
- *Hillman, P.E., N.R. Scott and A. van Tienhoven. 1977. Impact of centrally applied biogenic amines upon the energy balance of fowl. *Am. J. Physiology: Regulatory, Integrative and Comparative Physiology.* 235(5) R137-R144.
- *Schwartz, A., J.D. Weaver, N.R. Scott and T.J. Cade. 1977. Measuring the temperature of eggs during incubation under captive falcons. *J. of Wildlife Management.* 41(1): 12-17.
- *Chowdhury, A.H., R.N. White and N.R. Scott. 1977. Small scale models for reinforced concrete structures. *Trans. of ASAB* 20(1): 132-137, 144.
- *Cole, G.W. and N.E. Scott. 1977. A mathematical model of the dynamic heat transfer from the respiratory tract of a chicken. *Bulletin of Math. Biol.* 39:415-433.

- *Albright, L.D. and N.R. Scott. 1977. Diurnal temperature fluctuation in multi-space buildings. *Trans. of ASAE*. 20(2):319-326.
- Wilson, G.E, D.R. Price, L.D. Albright, N.R. Scott, R.W. Langhans and P. Chandra. 1977. Experimental results of a greenhouse solar collection and modular gravel storage system. Presented at Conf. on Solar Energy for Heating Greenhouse and Greenhouse – Residential Combinations. Cleveland, Ohio. March. Also in 34th Annual Progress Report of New York Farm Electrification Council.
- *Horowitz, K.A., N.R. Scott, P.E. Hillman and A. van Tienhoven. 1978. Effects of feathers on instrumental thermoregulatory behavior in chickens. *Physiology and Behavior*. 21:233-238
- Balthazar, J.A. and N.R. Scott. 1978. Response of the dairy cow's teat by finite element analysis. *Proc. of International Symposium on Machine Milking*. Nat'l. Mastitis Council, Washington, D.C. pp. 63-79.
- Reitsma, S.Y. and N.R. Scott. 1978. Dynamic responses of the teat end related to linerless milking. *Proc. of International Symposium on Machine Milking*. Nat'l. Mastitis Council, Washington, D.C. pp. 162-175.
- Scott, N.R. and S.Y. Reitsma. 1978. Factors which affect milk flow rate in linerless milking systems. *Proc. of International Symposium on Machine Milking*. Nat'l. Mastitis Council, Washington, D.C. pp. 162-175.
- *Reitsma, S.Y. and N.R. Scott. 1979. Dynamic responses of the dairy cow's teat to step changes in pressure. *J. Dairy Res.* 46:15-25.
- *Reitsma, S.Y. and N.R. Scott. 1979. A frequency response of the dairy cow's teat. *J. Dairy Res.* 46:27-33.
- *Foote, R.H., E.A.B. Oltenacu, J. Mellinger, N.R. Scott and R.A. Marshall. 1979. Pregnancy rate in dairy cows inseminated on the basis of electronic probe measurements. *J. Dairy Sci.* 62:69-73.
- *Heckman, G.S., L.S. Katz, R.H. Foote, E.A.B. Oltenacu, N.R. Scott and R.A. Marshall. 1979. Estrus cycle patterns in cattle monitored by electrical resistance and milk progesterone. *J. Dairy Sci.* 62:64-68. Jan.
- *Froehlich, D.P., L.D. Albright, N.R. Scott and P. Chandra. 1979. Steady-periodic analysis of glasshouse thermal environment. *Trans. of ASAE* 22(2): 387-399.
- Scott, N.R., S.Y. Reitsma and J.A. Balthazar. 1979. An engineering analysis of teat milk removal. Paper 11-1-15. *Proc. Ninth Int'l. Congress of Agricultural Engineering*, Michigan State Univ. July. 10 pp.
- Doane, M.K., R.P. Natzke and N.R. Scott. 1979. Air flow utilization in milking parlors with single operators. *J. Dairy Sci.* 62 (Suppl. 1):230.
- Doane, M.K., R.P. Natzke and N.R. Scott. 1979. Air flow utilization in milking parlors with two operators. *J. Dairy Sci.* 62 (Suppl. 1):127.
- *Marshall, R., N.R. Scott, M. Barta and R.H. Foote. 1979. Electrical conductivity probes for detection of estrus in cattle. *Trans. of ASAE*. 22(5):1145-1151, 1156.
- *van Tienhoven, A., N.R. Scott and P.E. Hillman. 1979. The hypothalamus and thermoregulation. *J. Poultry Sci.* 58:1633-1639.
- *Reitsma, S.Y. and N.R. Scott. 1979. Modeling milk flow rate from the dairy cow's teat. *Trans. of ASAE*. 22(6):1471-1474.
- Scott, N.R., M.J. Delwiche, S.Y. Reitsma, J.A. Balthazar and C. Magee. 1979. Biomechanics of teat milk flow of the dairy cow. 32nd Annual Conference on Engineering in Medicine and Biology. Denver, CO. October 6-10.
- *Sagi, R., N.R. Scott and W.G. Merrill. 1980. Milk flow patterns and machine milking. *Trans. of ASAE*. 23(5):1283-1286.
- *Delwiche, M.J., N.R. Scott and C.J. Drost. 1980. Ultrasonic measurement of teat milk flow. *Trans. of ASAE*. 23(3):746-752.
- *Rowe-Murphy, D.L., A. van Tienhoven, N.R. Scott, P.E. Hillman, L.L. Wood and W.S. Schwark. 1980. Effects of 6-hydroxydopamine and pimozide on thermoregulation of the chicken. *Am. J. of Physiology*. 239:R296-302.

- *Hillman, P.E., N.R. Scott and A. van Tienhoven. 1980 Effect of centrally applied 5- hydroxytryptamine and acetylcholine upon the energy budget of chickens (*Gallus domesticus*). *Am. J. of Physiology*. 239:R57-R61.
- Scott, N.R. and R. Marshall. United States Patent. Method and electrical resistance probe for detection of estrus in bovine. #4,224,949. Sept. 30, 1980. 20 pp.
- Sagi, R., N.R. Scott and R.P. Natzke. 1980. Vacuum pump capacity, pipeline size and modified cluster design: influence on vacuum stability and cross contamination. E. Mayer (Ed.). 11th Int'l. Congress on Disease of Cattle, Israel. pp. 200-210
- Scott, N.R., M.J. Delwiche, R. Sagi, J.A. Balthazar, R.S. Gates, C. Magee, M. Doane, R.P. Natzke, R.C. Gorewit, W.G. Merrill and R.W. Guest. 1980. Computer assisted management and recent advances in machine milking research. Nat'l. Milking Center Design Conf., Rochester, NY. Nov. 18-20. pp. 168-198.
- *Doane, M.K., R.P. Natzke, N.R. Scott, M.J. Delwiche and D.R. Bray. 1982. Air flow utilization in milking parlors. *J. of Dairy Sci.* 65:835-842.
- *Gates, R.S., R. Sagi and N.R. Scott. 1981. Theoretical considerations in sizing milk pipelines. *Trans. of ASAE*. 24(6):1600-1604.
- *Chandra, P., L.D. Albright and N.R. Scott. 1981. A time dependent analysis of greenhouse thermal environment. *Trans. of ASAE*. 24(2):442-449.
- Drost, C.J., G.G. Thomas, P.E. Hillman and N.R. Scott. 1981. Ultrasonic transit-time measurement of blood flow in the chicken leg. In: *Bioengineering Proc. of 9th New England Conf.* Editor, Walter Welkowitz. Pergamon Press, New York. pp. 387-390.
- *Hillman, PE., N.R. Scott and A. van Tienhoven. 1982. Vasomotion in the chicken foot: dual innervation of arteriovenous anastomoses. *Am. J. of Physiology*. 242:R582- R590.
- *Delwiche, M.J., N.R. Scott and C.J. Drost. 1982. Analysis of instantaneous milk flow rate patterns. *Trans. of ASAE*. 25(3):475-484.
- *Sagi, R., R.S. Gates and N.R. Scott. 1982. Milking characteristics with reduced liner wall movement. *J. Dairy Sci.* 66:266-274.
- Scott, N.R. 1982. Discussion on the state of the art in animal production and health. *Proceedings of 2nd Int'l. Livestock Environment Symposium*. ASAE Publication 3-82. St. Joseph, MI. pp. 8-16.
- Cooper, M.D., D.R. Bray, R.P. Natzke and N.R. Scott. 1983. What size does your vacuum pump need to be? *Hoard's Dairyman* 128(16):1036, 1061.
- *Scott, N.R. 1983. Radio telemetry. Chapter 12. In: *Instrumentation and Measurement for Environmental Sciences*. B. W. Mitchell (Ed.). Special Publication 13-82, Second Edition ASAE, St. Joseph, MI.
- Scott, N.R., N.A. Sigrimis, A.T. Sobel, R.A. Marshall, D.V.H. Drenkard and C. Montemagno. 1983. Electronic developments in dairy herd management. *Proc. of Symp. Automation in Dairying*. IMAG. Wageningen, The Netherlands. pp. 221-236.
- Scott, N.R. and P.E. Hillman (Editors). 1983. Biomeasurement and experimental techniques for avian species. *Northeast Regional Research Project NE-61 Publication*. August. 85 pp.
- *Scott, N.R., J.A. DeShazer and W.L. Roller. 1983. Effects of the thermal and gaseous environment on livestock. Chapter 7. In: *Ventilation of Agricultural Structures*. M. A.
- Hellickson and J. N. Walter (Eds.) ASAE Monograph No. 6. ASAE, St. Joseph, MI. pp. 121- 165.
- *Sigrimis, N.A. and N.R. Scott. 1984. A passive electronic identification system for livestock. In: *Agricultural Electronics - 1983 and Beyond*. Vol. II. Controlled Environments, Livestock Production Systems, Materials Handling and Processing. *Proceedings of the Nat'l. Conference on Agricultural Electronics Applications*. ASAE Publ. 9-84. ASAE, St. Joseph, MI. pp. 543-555.

- *Delwiche, M.J. and N.R. Scott. 1984. Instantaneous milk flow rate patterns from conventional teat cups. *Trans. of ASAE*. 27(1):214-218.
- *Magee, C., R. Sagi, N.R. Scott and R.S. Gates. 1984. Bacterial transport within and among various teatcup and cluster assemblies during milking. *J. Dairy Sci.* 67:2034- 2040.
- Scott, N.R. 1984. Biotechnology: The molecular revolution. *Agr. Engr.* 65(9):8-11
- Gorewit, R.C., D.V. Henke Drenkard and N.R. Scott. 1984. Physiological effects of electrical current on dairy cows. In: *Stray Voltage: Proceedings of the National Stray Voltage Symposium*. October 10-12, Syracuse, NY. ASAE, St. Joseph, MI pp. 1-19.
- Scott, N.R., R.C. Gorewit and D. V. Henke Drenkard. 1984. Effects of electrical current on milking and behavior. 1984. In: *Stray Voltage: Proceedings of the Nat'l. Stray Voltage Symposium*. October 10-12, Syracuse, NY. ASAE, St. Joseph, MI. pp. 20-32.
- *Gorewit, R.C., N.R. Scott and C.S. Czarniecki. 1985. Responses of dairy cows to alternating electrical current administered semi-randomly in a nonavoidance environment. *J. Dairy Sci.* 68:718-725.
- *Hillman, PE., N.R. Scott and A. van Tienhoven. 1985. Physiological responses and adaptations to hot and cold environments. In: *Stress Physiology in Livestock*. Vol. III, Poultry. M. K. Yousef (Ed.). CRC Press, Inc., Boca Raton, FL. pp. 1-71.
- *Sigrimis, N.A., N.R. Scott and C.S. Czarniecki. 1985. A passive transponder identification system for livestock. *Trans. of ASAE*. 28(2):622-629.
- Sigrimis, N.A. and N.R. Scott. 1985. United States Patent. Remote Passive Identification System. #4,510,495. April 9, 1985. 14 pp.
- *Henke Drenkard, D.V., R.C. Gorewit, N.R. Scott and R.Sagi. 1985. Milk production, health, behavior and endocrine responses of cows exposed to electrical current during milking. *J. Dairy Sci.* 68:2694-2702.
- *Gates, R.S., N.R. Scott, R.E. Pitt and D. Bartel. 1986. Elastic constitutive laws for cow teat tissue undergoing finite deformations. *Biorheology*. (22)495-508:495-508.
- Gettens, J.W., N.A. Sigrimis and N.R. Scott. 1986. Passive Activity Monitor for Livestock. #4,618,861. Oct.21, 1986. 8pp.
- *Gorewit, R.C. and N.R. Scott. 1986. Cardiovascular responses of cows given electrical current during milking. *J. Dairy Sci.* 69:1122-1127.
- *Gates, R.S. and N.R. Scott. 1986. Measurements of effective teat load during machine milking. *Trans. of the ASAE*. 29(4):1124-1130.
- *Scott, N. R. 1987. Water Quality and Management. *Agricultural Research for a Better Tomorrow*. Proceedings of the Hatch Act Centennial. U. S. Department of Agriculture. March 2-3. Washington, D.C., pp. 123-134.
- *Hillman, P.E. and N. R. Scott. 1989. Energy budget of the chicken foot. *Journal of Thermal Biology* 14(4):205-17.
- Scott, N. R. and J. R. Wiesenfeld. 1989. Capitalizing on promising research frontiers: emphasis on ?New Technologies?. The Governor's Conference on Science and Engineering Education, Research and Development: Developing New York State's Action Plan for the 1990's, December. Albany, New York, pp. 43-46.
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- Scott, N.R. 1992. Sustainable Communities Save Energy. *Agricultural Engineering*. March. pp. 22-24.
- *Scott, N.R. and B. F. Chabot. 1992. Agriculture: a system, a science, or a commodity. In: *Agriculture and the Un-*

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- Scott, N.R. 1994. Sustainable development - an evolutionary concept. Proceedings of The 5th Annual CAEP Conference. NRAES. May 3-5. Albany, NY. pp. 15-20.
- Scott, N.R. 1994. Knowledge transfer: a perspective and case studies from Cornell. Academic Cities Conference '94, Kyoto Research Park, Kyoto, Japan. November 24, 1994. 12 pp.
- Scott, N. R., et. al. 1997. Agricultural and biological systems. In Engineering Response to Global Climate Change: Planning a Research and Development Agenda, edited by Robert G. Watts. Lewis Publishers, 339-74.
- *Scott, N.R. 1998. Strategy for Activating University Research. *Technological Forecasting and Social Change* 57: 217-218.
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- Scott, N. R. 2000. Transition toward a sustainable world: The importance of agriculture. Proceedings Agriculture of the New Century: Managing Bioresources and Biodiversity, National Taiwan University, April 14-15, 2000, 111-118.
- Scott, N.R., S. J. Minott and K. Tejasen. 2000. Feasibility of Fuel Cells on Dairy Farms, Annual Conference, National Food and Energy, St. Paul, MN, August 7-9, 2000, 14 pp.
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- Peranginangin, N. and N. R. Scott, 2002. Transition toward resource recovery on dairy farms: A case study of AA Dairy. Report. Department of Biological & Environmental Engineering, Cornell University. pp 27.
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- *Bastian, K.R., K.G. Gebremedhin and N.R. Scott. 2003. A finite element difference model to determine conduction heat loss to a water-filled mattress for dairy cows. *Transactions of the ASAE*. 46(3): 773-780.
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- *Scott, N.R. 2005. Nanotechnology and Animal Health. In *OIE Scientific and Technical Review*. 24(1): 425-432. World Organization for Animal Health. Paris, France.
- ?Scott, N. R. 2005. DNA of Biological Engineering: An Engineering Discipline? *International J. Engineering Education* 21(6): 9-13.
- Scott, N.R. 2005. Creating Collaborations between Shanghai Jiaotong University and Cornell University in Agriculture and Biology. Foreword *Journal of Shanghai Jiaotong University (Science)*.vol. E-10, Sup.1 December.
- ?Scott, N. R. 2007. Impact of Nanoscale Technologies in Animal Management. In *Animal Production and Animal Science Worldwide*, World Association for Animal Production (WAAP) book of the year 2006. Wageningen Academic Publishers. The Netherlands, p.283-291.
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PROFESSIONAL OVERVIEW AND OBJECTIVES

Scott has been involved in bioengineering research and teaching for over 20 years prior to spending 14 years as a Cornell administrator. His early research was focused on thermoregulation in poultry, biomechanics of machine milking of dairy cows and electronic applications in agriculture, with particular attention to automatic identification and estrus detection of livestock, as well as the effects of transient current on dairy cows. Since returning to the faculty in 1998, he has focused on research in sustainable development. This research is directed to development of sustainable communities with emphasis on biologically derived fuels, renewable energy, recycling, managed ecosystems and industrial ecology. Grant support has been obtained from New York State Energy Research & Development Authority and USDA.