History of Health Sciences
Fall Term | Ph.D. Program

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The Impact of Medical Technologies: Extending the Five Senses

When René Laennec promoted the technique of auscultation and developed the first stethoscope (from the Greek, "seeing the chest") in 1816, it opened a new dimension to the techniques of medical diagnosis, where learning to listen properly became a new skill. It took nearly 100 years before diagnostic skills were again altered with new ways of seeing, aided by X-Ray, ultrasound, computed tomography, magnetic resonance, and laser-optic imaging among other technologies. This course examines the development of human tacit skills, the ethnography of medical practice, and the public perception of hi-tech medicine that have been shaped throughout the history of emerging medical technologies.

This course does *not* proceed chronologically throughout the ages to introduce and explain devices that might constitute a medical technology. Rather, we begin by questioning what constitutes "technology", and we explore different ways—historical and contemporary—that such technologies have impacted the medical profession and affected the intellectual and physical practices involved with the production of medical knowledge. The topics and readings presented in the course schedule below will frame our analysis and relate our discussions to the historiography of science that has already begun to tackle fundamental issues involved with this subject. What is not listed, but will be accommodated throughout the course, is reference to further "case studies" where a wide variety of particular medical technologies will be discussed. The selection of case studies will be generated through class discussion and student preference.

COURSE OBJECTIVES

- Identify the main themes in the development of medical technologies and practices.
- Understand how new medical technologies—for diagnostic procedures as well as patient management—have changed dominant medical thinking and changed the nature of human skills in assessing states of health and disease.
- Synthesize the development and impact of medical technologies into larger currents in intellectual, political, social and culture history.
- Critically use primary scientific and secondary scholarship in Science and Technology Studies to frame questions about the social impact of medical technologies.
- Examine case studies regarding the ethics of using medical technologies in the delivery of health care.
- Appreciate and interpret the complexity and diversity of past situations, events and mentalities.

- Evaluate problems inherent in the historical record and apply critical skills to the interpretation of complex, ambiguous, and incomplete materials.

- Gather, sift, select, organize, and synthesize large quantities of evidence (as the availability and multiplicity of sources increases dramatically in the 20th century).

- Formulate appropriate questions and provide reasoned answers or arguments using valid and relevant evidence.

General Readings

Overviews
Stuart Blume, *Insight and industry: On the dynamics of technological change in medicine* (Cambridge, MA: MIT Press, 1992)

Audrey Davis, *Medicine and its Technology* (London: Greenwood Press, 1981)

Stanley Joel Reiser, *Medicine and the Reign of Technology* (Cambridge: Cambridge University Press, 1978)

Louise Russell, *Technology in hospitals: Medical advances in their diffusion* (New York: Brookings Institution, 1979)

On Medical Imaging
Wolbarst, Anthony Brinton and Gordon Cook. *Looking within: How X-ray, CT, MRI, ultrasound, and other medical images are created, and how they help physicians save lives* (Berkeley: University of California Press, 1999)

Kevles, Bettyann. *Naked to the bone: Medical imaging in the twentieth century* (New Brunswick, NJ: Rutgers University Press, 1997)

Dumit, Joe. *Picturing Personhood: Brain Scans and Biomedical Identity* (Princeton University Press, 2003)

Course Requirements

Throughout the course, you will be required to demonstrate your engagement with the literature and the topics explored through two forms of in-class presentation:

1) You will need to be able to present a critical perspective on the readings. What are the main points of each reading? What is the author's main argument? What kind sources and evidence does the author use to support the argument?

2) Following each meeting—once we have discussed the main issues relating to the impact of technology on the practice of medicine and the production of scientific knowledge—you will be

asked to conduct research to find examples from medical literature illustrating the points discussed. You will present your findings the following week in a brief (5 minute) presentation. We will discuss how such research can be conducted and what the parameters of your investigations will be during the first meeting.

Course Schedule:

1. What is a Technology? (178)

a) The sociology and anthropology of technology

Howard S. Frazier and Frederick Mosteller, eds., *Medicine worth paying for: assessing medical innovations* (Cambridge, Mass.: Harvard University Press, 1995), chapter 2, "Evaluating Medical Technologies", 9-35 (26) **COURSE PACK**

Casper, Monica and Koenig, Barbara. "Reconfiguring nature and culture: Intersections of medical anthropology and technoscience studies", *Medical Anthropology Quarterly* 10 (1996), 523-536 (13). 

Casper, Monica and Marc Berg. "Constructivist perspectives on medical work: medical practices and science and technology studies", *Science, Technology & Human Values* 20 (1995), 395-407. (12) 

Berg, Marc. "The politics of technology: On bringing social theory into technological design", *Science, Technology & Human Values* 23 (1998), 456-90. (34) 

Meeting one continued …

b) The body as technology

Lawrence, Christopher. 1985. "Incommunicable Knowledge: Science, Technology and the Clinical Art in Britain 1850-1914", *Journal of Contemporary History*, 20: 503-520. (17)

Marcell Mauss, "Body Techniques", in (1934) in Fraser, M. and M. Greco, eds., *The Body: A Reader* (London: Routledge, 2005), 73-77. (5) **COURSE PACK**

Laurence Brockliss, "In Bad Odour: Smell and its Significance in Medicine from Antiquity to the Seventeenth Century", in W.F. Bynum and Roy Porter, eds., *Medicine and the Five Senses* (Cambridge: Cambridge University Press, 1993), 61-68. (7) **COURSE PACK**

Collins, H.M., G. H. de Vries, and W. E. Bijker. 1997. "Ways of going on: An analysis of skill applied to medical practice", *Science, Technology & Human Values* 22: 267-285. (18)

Case Study:

Hearing:
Réné-Théophile-Hyacinthe Laënnec, *On Mediate Auscultation* (Paris, 1819; English trans. 1834), from *Sourcebook of Medical History*, 313-330. (17) **COURSE PACK**

Stanley Reiser, *Medicine and the Reign of Technology* (Cambridge: Cambridge University Press, 1978), chapter 2, "The Stethoscope and the Detection of Pathology by Sound", 23-43. (20) **COURSE PACK**

John Stone, "From the Listening End of the Microscope", in Robert Coles and Randy Testa, *A Life in Medicine* (New York: New Press, 2001), 158-163. (7) **COURSE PACK**

Oliver Wendell Holmes, "The Stethoscope Song: A Professional Ballad", from Richard Reynolds and John Stone, eds., *On Doctoring* (Simon & Schuster, 1998). (2) **COURSE PACK**

Optional Readings:

Thomas Hughes, "The Evolution of Large Technological Systems", in Wiebe E. Bijker, Thomas Hughes and Trevor Pinch, eds, *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (Cambridge, MA: MIT Press, 1987), 51-82.

Trevor Pinch and Wiebe E. Bijker, "The Social Construction of Facts and Artifacts: Or how the Sociology of Science and the Sociology of Technology Might Benefit Each Other", in Wiebe E. Bijker, Thomas Hughes and Trevor Pinch, eds, *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (Cambridge, MA: MIT Press, 1987), 17-50.

W. Bijker and J. Law, eds., *Shaping technology, building society: Studies in sociotechnical change* (Cambridge, MA: MIT Press, 1992).

Jacques Ellul, *The Technological Society* (New York: Vintage, 1964).

Jonathan Sterne, *The Audible Past: Cultural Origins of Sound Reproduction* (Duke University Press, 2003).

2. Extending the Senses (208)

a) Shifting Focus from the Bedside to Bench

Susan Lawrence, *Charitable Knowledge: Hospital Pupils and Practitioners in Eighteenth-Century London* (Cambridge: Cambridge University Press, 1996), chapter 8, "Hospital Men Make Medical Knowledge", 289-334 (45) **COURSE PACK**

Nicholas Jewson, "The Disappearance of the Sick-Man from Medical Cosmology, 1770-1870", *Sociology* 10 (1976), 225-44. (19) **COURSE PACK**

Mary Fissell, "The Disappearance of the Patient's Narrative and the invention of Hospital Medicine", in Roger French and Andrew Wear, eds., *British Medicine in the Age of Reform* (London and New York: Routledge, 1991), 92-109. (17) **COURSE PACK**

John Harley Warner, "Fall and rise of professional mystery: epistemology, authority and the emergence of laboratory medicine in nineteenth-century America" in Andrew Cunningham and Perry Williams, eds., *The Laboratory Revolution in Medicine* (Cambridge: Cambridge University Press), 110-141. (31) **COURSE PACK**

Timothy Lenoir, "Science for the Clinic", in William Coleman and Frederic L. Holmes, eds., *The Investigative Enterprise: Experimental Physiology in Nineteenth-Century Medicine* (Berkeley: University of California Press, 1988). (40) **COURSE PACK**

b) Science, Technology & Medicine: A Collaborative Enterprise

Steven Shapin, "Invisible Technicians", from his *Social History of Truth* (Chicago: University of Chicago Press, 1994), pp. 355-67; 378-89; 403-07. (27) **COURSE PACK**

Murray Eden, "The Engineering-Industrial Accord: Inventing the Technology of Health Care", in Stanley Joel Reiser and Michael Anbar, eds., *The Machine at the Bedside: Strategies for Using Technology in Patient Care* (Cambridge: Cambridge University Press, 1984), 49-64. (15) **COURSE PACK**

Daniel Lee Kleinman, "Untangling Context: Understanding the University Laboratory in the Commercial World", *Science, Technology & Human Values* 23 (1998), 285-314 (29)

Annetine Gelijns and Nathan Rosenberg, "The Changing Nature of Medical Technology Development", in Nathan Rosenberg, et. al., *Sources of Medical Technology: Universities and Industry* (Institute of Medicine, 1995), 3-40. (12) **COURSE PACK**

Case study:
Steinberg, Earl and Alan Cohen. *Nuclear magnetic resonance imaging technology: A clinical, industrial, and policy analysis* (Washington, D.C.: Office of Technology Assessment, 1984)

Optional Readings:

Frank Schlich, *Surgery, Science and Industry: A Revolution in Fracture Care, 1950s-1990s* (Basingstoke: Palgrave, 2002).

3. Technological Representation and Intervention (234)

Ian Hacking, "Introduction", "Microscopes", from his *Representing and Intervening: Introductory Topics in the Philosophy of Natural Science* (Cambridge: Cambridge University Press, 1983), 1-17; 186-209. (41) **COURSE PACK**

Simon, Christian. "Images and Image: Technology and the Social Politics of Revealing Disorder in a North American Hospital", *Medical Anthropology Quarterly* 13 (1999), 141-162. (21)

Amit Prasad, "Making Images/Making Bodies: Visibilizing and Disciplining through Magnetic Resonance Imaging (MRI)", *Science, Technology and Human Values* 30 (2005), 291-316.

Thomas Csordas, "Computerized Cadavers: Shades of Being and Representation in Virtual Reality", in Paul Brodwin, ed., *Biotechnology and Culture: Bodies, Anxieties, Ethics* (Bloomington: Indiana University Press, 2000), 173-192. **COURSE PACK**

Case study: The Emergence of the "Difference Image"

Brian Dolan, "Pedagogy through print: James Sowerby, John Mawe, and the problem of colour illustration in early nineteenth-century natural history", *British Journal for the History of Science*, **31** (1998), 275-304. (29) **COURSE PACK**

Steven Shapin, "The Politics of Observation: Cerebral Anatomy and Social Interests in the Edinburgh Phrenology Disputes", in R. Wallis, ed., *On the Margins of Science* (Keele, Staffordshire, 1979), 139-178. (39) **COURSE PACK**

Kovalev, Vassili and Maria Petrou, "Texture analysis in three dimensions as a cue to medical diagnosis", in Isaac Bankman, ed. *Handbook of medical imaging: Processing and analysis* (San Diego: Academic Press, 2000). (10) **COURSE PACK**

William Uttal,, *The new phrenology: The limits of localizing cognitive processes in the brain* (Cambridge, MA: MIT Press, 2001), 29-87 (57) **COURSE PACK**

Optional readings:

James Griesemer, "Three Dimensional Models in Philosophical Perspective", in Nick Hopwood and Soraya de Chadarevian, eds., *Models: The Third Dimension of Science* (Stanford University Press, 2004).

Anthony Brinton Wolbarst and Gordon Cook, *Looking within: How X-ray, CT, MRI, ultrasound, and other medical images are created, and how they help physicians save lives* (Berkeley: University of California Press, 1999).

Lisa Cartwright, *Screening the Body: Tracing Medicine's Visual Culture* (Minneapolis: Minnesota University Press, 1995).

4. Mediating Machines: The Influence of Technology on Medical Decision Making (172)

a) Learning to Act

W.C. Rappleye, "Medical Education", *Journal of Higher Education* 1 (1930), 154-159. (5)

Marc Berg, "Turning a Practice into a Science: Reconceptualizing Postwar Medical Practice", *Social Studies of Science* 25 (1995), 437-476. (39)

"Keeping up with Technology and the Changing Role of Medicine", *Contemporary Issues in Medical Education* 2 (1999). (2)

"Telemedicine: Extending our Horizons", *Contemporary Issues in Medical Education* 3 (2000). (2)

K.A. Miles, "Diagnostic imaging in undergraduate medical education: an expanding role", *Clinical Radiology* 60 (2005), 742-745. (4)

Abd-El-Khalick, F., R.L. Bell and N.G. Lederman. 1998. "The nature of science and instructional practice: Making the unnatural natural", *Science Education* 82: 417-37.

Warwick Anderson, "The Reasoning of the Strongest: The Polemics of Skill and Science in Medical Diagnosis", *Social Studies of Science* 22 (1992), 653-684. (31)

Harry Collins, "Tacit Knowledge, Trust, and the Q of Sapphire", *Social Studies of Science* 31 (2001), 71-85. (14)

b) The Skill of Machines:

Joanne Hartland, "Automating Blood Pressure Measurements: The Division of Labor and the Transformation of Method", *Social Studies of Science* 26 (1996), 71-94.

Diana Forsythe, “New bottles, old wine: Hidden cultural assumptions in a computerized explanation system for migraine sufferers”, *Medical Anthropology Quarterly* 10 (1996), 551-574. (23)

Brian Dolan, “Pixels, Patterns, and Problems of Vision: Interpretive Uncertainties and Computer-Aided Diagnosis in the Case Study of Mammography”, typescript. (28)

5. **Technology and Health Policy: The Hospital-University-Corporate Matrix**

a) Hospitals and Technology (149)

J.H. Warner and J.A. Tighe, “Technological Imperative? Hospitals, Professions, and Patient Expectations, 1890-1950,” in *Major Problems in the History of American Medicine and Public Health* (Boston: Houghton Mifflin, 2000), 349-387. (38) **COURSE PACK**

Bonnie Kaplan, “The Computer Prescription: Medical Computing, Public Policy, and Views of History”, *Science, Technology, & Human Values*, 20 (1995), 5-38. (33)

Joel D. Howell, *Technology in the hospital: transforming patient care in the early twentieth century* (Baltimore: Johns Hopkins University Press, 1996), 30-68. (38) **COURSE PACK**

Louise Russell, *Technology in hospitals: Medical advances in their diffusion* (New York: Brookings Institution, 1979), 1-40 (40) **COURSE PACK**

b) Technological incentives

Joanne Spetz, "Physicians and Physicists: The Interdisciplinary Introduction of the Laser to Medicine", in Nathan Rosenberg, A. Gelikns and Holly Dawkins, eds., Sources of Medical Technology: Universities and Industry (Institute of Medicine, 1995), 41-66. Available on-line through the National Academies Press: http://books.nap.edu/books/0309051894/html/index.html

Optional:

“The Nature of Technological Change: Incentives Matter!”, in A. Gelijns and Holly Dawkins, eds, *Adopting New Medical Technology* (Institute of Medicine, 1994), available **on-line** through the National Academies Press: http://www.nap.edu/books/0309050359/html/8.html

“Learning the Use of Rational Technology in Medicine”, in Stewart Wolf, ed., *The Technological Imperative in Medicine* (New York and London: Plenum Press, 1981), 1-34 (and the other essays are good).

H. David Banta, *An approach to the social control of hospital technologies* (Geneva: Division of Strengthening of Health Services, World Health Organization, 1995).

Foote, Susan Bartlett, *Managing the Medical Arms Race: Innovation and Public Policy in the Medical Device Industry* (Berkeley: University of California Press, 1992). **ON-LINE through CDL (UC networked computers)**

6. Technology and the Patient

Patient's Point of View:

Steven Johnson, *Mind Wide Open: Your Brain and the Neuroscience of Everyday Life* (Scribner, 2004). **COURSE PACK**

William Hoskin, "Neurology Rounds", pp. 262-3, from *The Tyranny of the Normal: An Anthology,* Carol Donley and Sheryl Buckley, eds. (Kent State, 1996) **COURSE PACK**

Oliver Wendell Holmes, "The Stethoscope Song, a Professional Ballad", from *On Doctoring: Stories, Poems, Essays,* Richard Reynolds and John Stone, eds (Simon & Schuster, 2001) pp. 25-6 **COURSE PACK**

Randall Jarrell, "The X-Ray Waiting Room in the Hospital", from *On Doctoring: Stories, Poems, Essays,* Richard Reynolds and John Stone, eds (Simon & Schuster, 2001) p. 154 **COURSE PACK**

Anatole Broyard, "Doctor, Talk to Me", from *On Doctoring: Stories, Poems, Essays,* Richard Reynolds and John Stone, eds (Simon & Schuster, 2001) 166-172 **COURSE PACK**

David Hilfiker, "Mistakes", from *On Doctoring: Stories, Poems, Essays,* Richard Reynolds and John Stone, eds (Simon & Schuster, 2001) 325-36 **COURSE PACK**

Raymond Carver, "A Small, Good Thing", in *A Life in Medicine,* Robert Coles and Randy Testa, eds. (The New Press, 2002), 180-203. **COURSE PACK**

Law:

William Curran, "The Unwanted Suitor: Law and the Use of Health Care Technology", in Stanley Joel Reiser and Michael Anbar, eds., *The Machine at the Bedside: Strategies for Using Technology in Patient Care* (Cambridge: Cambridge University Press, 1984), 119-134. **COURSE PACK**

Harold Bursztajn, Robert Hamm, and Thomas Gutheil, "The Technological Target: Involving the Patient in Clinical Choices", in Stanley Joel Reiser and Michael Anbar, eds., *The Machine at the Bedside: Strategies for Using Technology in Patient Care* (Cambridge: Cambridge University Press, 1984), 177-191. **COURSE PACK**

Techno-patients:

Elizabeth Cartwright, "The Logic of Heartbeats: Electronic Fetal Monitoring and Biomedically Constructed Birth", in Robbie Davis-Floyd and Joseph Dumit, eds, *Cyborg Babies* (New York: Routledge, 1998), 240-254. **COURSE PACK**

Ann Rudinow Saetnan, Nelly Oudshoorn, and Marta Kirejczyk, eds., "Imagined men: representations of masculinities in discourses on male contraceptive technology", in *Bodies of technology: women's involvement with reproductive medicine* (Columbus, OH: Ohio State University Press, 2000). **COURSE PACK**

Information Overload:
Jan Hoffman, "Awash in Information, Patients face a Lonely, Uncertain Road", *New York Times*, August 14, 2005. **COURSE PACK**

7. Technology and Medical Surveillance

a) Technology and the Gaze

Andrew Warwick, "X-Rays as Evidence in German Orthopaedic Surgery, 1895-1900", *Isis* 96 (2005), 1-24.

David Armstrong, "The Rise of Surveillance Medicine", *Sociology of Health and Illness* 17 (1995), 393-404. **COURSE PACK**

b) Technology and Subjection

Stanley Joel Reiser, "The Emergence of the Concept of Screening for Disease", *Health and Society* 56 (1978), 403-23. **COURSE PACK**

Laura Woliver, "New Reproductive Technologies: Challenges to Women's Control of Gestation and Birth", in Robert Black and Miriam Mills, eds, Biomedical Technology and Public Policy (New York: Greenwood Press, 1989), 43-56. **COURSE PACK**

Patricia Kaufert, "Screening the Body: The Pap Smear and the Mammogram", in Margaret Lock, Alan Young, and Alberto Cambrosio, eds., *Living and Working with the New Medical Technologies* (Cambridge: Cambridge University Press, 2000), 165-183. **COURSE PACK**

Marianne H. Whatley and Nancy Worcester, "The Role of Technology in the Co-option of the Women's Health Movement: The Cases of Osteoporosis and Breast Cancer Screening", in Kathryn Strother Ratcliff, ed., *Healing Technology: Feminist Perspectives* (University of Michigan Press, 1989), 199-220. **COURSE PACK**

Case study: The Mammography Debate

Barbara Monsees, "Screening mammography: Who will meet the need?", *Radiology* 184 (1992), 30-31.

Elizabeth Morris, "Breast MRI for Cancer Screening in High-Risk Patients", *Applied Radiology* Supplement (2005), 4-9. **COURSE PACK**

Optional:
Foucault, Michel. 1983. "The Subject and Power", in Hubert Dreyfus and Paul Rabinow, *Michel Foucault: Beyond Structuralism and Hermeneutics* (University of Chicago Press, 2nd ed.), 208-226. **On-reserve (short term loan) at Parnassus**

8. Making Medicine Mobile

a) Technology Transfer and Post-Colonial Technoscience

Warwick Anderson, "Postcolonial Technoscience", *Social Studies of Science* 32 (2005), 643-58. **COURSE PACK**

Amit Prasad, "Scientific Culture in the 'Other' Theater of 'Modern Science': An Analysis of the Culture of Magnetic Resonance Imaging Research in India", *Social Studies of Science* 35 (2005), 463-489.

b) Telemedicine: Hands Free Medicine

Cutchin, M. P., "Virtual Medical Geographies: Conceptualizing Telemedicine and Regionalization", *Progress in Human Geography* 26 (2002), 19-39.

Nettleton, S., "The Emergence of E-Scaped Medicine?", *Sociology* 38 (2004): 661-679.

Pattanasak Mongkolwat, Alexandr Kogan, Jennifer Koh, David Channan, "Blogging your PACS", *Journal of Digital Imaging* (2005), 1-7.

David Bandon, Christian Lovis, Antoine Geissbühler and Jean-Paul Vallée, **"**Enterprise-wide PACS: Beyond Radiology, an Architecture to Manage All Medical Images", *Academic Radiology* 12 (2005), 1000-1009.

Case studies:
Guided Intervention
Rural Health Care Delivery

Optional readings:

Sinha, A., "An Overview of Telemedicine: The Virtual Gaze of Health Care in the Next Century", *Medical Anthropology Quarterly* 14 (2000): 291-309.

Cartwright, L., "Reach Out and Heal Someone: Rural Telemedicine and the Globalization of U.S. Health Care" In *Biotechnology and Culture: Bodies, Anxieties, Ethics*, P. E. Brodwin, ed., (Indiana University Press, Bloomington, 2000), 241-263

Steven Viegas and Kim Dunn, *Telemedicine: Practicing in the Information Age* (Lippincott Williams & Wilkins, 1998)

Adam Darkins and Margaret Cary, *Telemedicine and Telehealth: Principles, Policies, Performance and Pitfalls* (Springer Publishing Company, 2000)

Sandra Harding, *Is Science Multicultural? Postcolonialisms, Feminisms, and Epistemologies* (Bloomington, IN: Indiana University Press, 1998)

Daniel Headrick, *The Tentacles of Progress: Technology Transfer in the Age of Imperialism, 1850-1940* (New York: Oxford University Press, 1988)

9. Technological Transformations: "Heterotypical Technology"
GUEST SPEAKER: DR. LARRY CROOKS

a) One Technology, Many Functions

Michel Foucault, "Of Other Spaces" (1986) 

Stephen Barley, "The Social Construction of a Machine: Ritual, Superstition, Magical Thinking and Other Pragmatic Responses to Running a CT Scanner", in M. Lock and D. Gordon, eds, *Biomedicine Examined* (Kluwer Academic Publishers, 1988), 497-539. **COURSE PACK**

Bettyann Kevles, Naked to the Bone: Medical Imaging in the Twentieth Century (New Brunswick: Rutgers University Press, 1999), chapter 8. **COURSE PACK**

Case study:
MRI for Brain, Breast and Sport Medicine

b) Evolving Technologies
Aldo Luisada, *From Auscultation to Phonocardiography* (St. Louis: C.V. Mosby Co., 1965).

Aldo Luisada, "The Reminiscences of a Scientist", *Practical Cardiology*
Vol. 11 No.9 (August 1985) (His archive is at Ohio State)

10. Implications

Gerald P. McKenny, *To relieve the human condition: bioethics, technology, and the body* (Albany, N.Y.: State University of New York Press, 1997), chapter 1. **COURSE PACK**

GENERAL BIBLIOGRAPHY

Armstrong, David. 1994. "A social role for technology: Making the body legible", in Ian Robinson, ed., *Life and death under high technology medicine*. Manchester University Press, 235-243.

Armstrong, David. 1995. "The Rise of Surveillance Medicine", *Sociology of Health and Illness* 17: 393-404.

Berg, Marc and Annemarie Mol, eds. 1998. *Differences in medicine: Unraveling practices, techniques, and bodies*. Durham: Duke University Press.

Berg, Marc. 1997. *Rationalizing medical work: Decision support techniques and medical practices.* Cambridge, MA: MIT Press.

Berg, Marc. 1998. "The politics of technology: On bringing social theory into technological design", *Science, Technology & Human Values* 23: 456-90.

Bijker, W. and J. Law, eds. 1992. *Shaping technology, building society: Studies in sociotechnical change.* Cambridge, MA: MIT Press.

Bijker, W.E., T. P. Hughes, and T. Pinch, eds. 1987. *The social construction of technological systems: New directions in the sociology and history of technology*. Cambridge, MA: MIT Press.

Blume, Stuart. 1992. *Insight and industry: On the dynamics of technological change in medicine*. Cambridge, MA: MIT Press.

Bowker, Geoffrey, Susan Leigh Star, William Turner, Les Gasser, eds. 1997. *Social science, technical systems, and cooperative work: Beyond the great divide*. Mahway, NJ: Lawrence Erlbaum Associates.

Bradley, William. 2001. *MRI of the brain*. Lippincott: Williams and Wilkins.

Cartwright, Lisa. 1995. *Screening the Body: Tracing Medicine's Visual Culture* (Minneapolis: Minnesota University Press)

Cartwright, Lisa. 1995. *Screening the body: Tracing medicine's visual culture.* Minneapolis: University of Minnesota Press.

Casper, Monica and Koenig, Barbara. 1996. "Reconfiguring nature and culture: Intersections of medical anthropology and technoscience studies", *Medical Anthropology Quarterly* 10: 523-536.

Casper, Monica and Marc Berg. 1995. "Constructivist perspectives on medical work: medical practices and science and technology studies", *Science, Technology & Human Values* 20: 395-407.

Clarke, Adele and Joan Fujimura, eds. 1992. *The right tools for the job. At work in 20th-century life sciences*. Princeton, NJ: Princeton University Press.

Collins, H.M., G. H. de Vries, and W. E. Bijker. 1997. "Ways of going on: An analysis of skill applied to medical practice", *Science, Technology & Human Values* 22: 267-285.

Conceicao, Pedro, David V. Gibson, Manuel V. Heitor, Syed Shariq, eds. 2000. *Science, technology, and innovation policy: Opportunities and challenges for the knowledge economy* (International Series on Technology Policy and Innovation) New York: Quorum Books.

Csordas, Thomas J. 2000. "Computerized cadavers: Shades of being and representation in virtual reality", in Paul Brodwin, ed., *Biotechnology and culture: Bodies, anxieties, ethics*. Bloomington, IN: Indiana University Press, 173-192.

Damadian, Raymond. 1971. “Tumor detection by nuclear magnetic resonance”, *Science* 171: 1151.
Eden, Murray. 1984. “The engineering-industrial accord: Inventing the technology of health care”, in Stanley Joel Reiser and Michael Anbar, eds., *The machine at the bedside: Strategies for using technology in patient care*. Cambridge: Cambridge University Press, 49-64.
Foote, Susan Bartlett.1992. *Managing the Medical Arms Race: Innovation and Public Policy in the Medical Device Industry.* Berkeley: University of California Press.
Forsythe, Diane. 1992. “Blaming the user in medical informatics”, *Knowledge and Society: The Anthropology of Science and Technology* 9: 95-111.
Gore, John. 2003. “Principles and practice of functional MRI of the human brain”, *Journal of Clinical Investigations* 112: 4-9.
Herfkens, R. J., P. Davis, L. Crooks, et. al. 1981. “Nuclear magnetic resonance imaging of the abnormal live rat and correlations with tissue characteristics”, *Radiology* 141: 211-218.
Hillman, Alan L. and J. Sanford Schwartz. 1985. "The adoption and diffusion of CT and MRI in the United States: A comparative analysis," *Medical care* 23: 1283-1294.
Howell, Joel. 1995. *Technology in the Hospital: Transforming Patient Care in the early Twentieth Century* (Baltimore: Johns Hopkins University Press) (gender and technological gaze—ch 5; hospital and scientific management-chapter 2; clinical traditions, ch. 3)
Johnson, Steven. 2004. *Mind wide open: Your brain and the neuroscience of everyday life*. New York: Scribner.
Kevles, Bettyann. 1997. *Naked to the bone: Medical imaging in the twentieth century*. New Brunswick, NJ: Rutgers University Press.
Latour, Bruno. 1987. *Science in action: How to follow scientists and engineers through society*. Cambridge, MA: Harvard University Press.
Lederman, N.G. and M. O’Malley. 1990. “Student perceptions of tentativeness in science: Development, use and sources of change”, *Science Education* 74: 225-39.
Löwy, Ilana, ed. 1993. *Medicine and change: Studies of medical innovation*. Paris: Les Editions INSERM.
Martin, Steven C.. 1993. “Chiropractic and the Social Context of Medical Technology, 1895-1925”, *Technology and Culture* 34: 808-834. 
National Research Council. 1996. *National science education standards*. Washington, D.C.: National Academic Press.
Pauly, Philip J.. 2000. *Biologists and the Promise of American Life: From Meriwether Lewis to Alfred Kinsey* (Princeton University Press)
Prasad, Amit. 2004. “Cultures of Technoscience: A Study of Magnetic Resonance Imaging (MRI) Research and Development in the United States and India”. Ph.D. Dissertation, University of Illinois.
Prasad, Amit. 2005. “Making Images/Making Bodies: Visibilizing and Disciplining through Magnetic Resonance Imaging (MRI)”, *Science, Technology and Human Values* 30: 291-316.
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