

## BRADLEY R. SMITH

### EDUCATION

- 1988                   **Ph.D.**, Anatomy, Duke University, Durham, North Carolina.  
1983                   **M.A.**, Medical Illustration, Johns Hopkins School of Medicine, Baltimore,  
Maryland.  
1980                   **B.U.S.**, Art and Biology, University of Utah, Salt Lake City, Utah.

### APPOINTMENTS / EMPLOYMENT

- 2010                   **Professor**, School of Art & Design, University of Michigan, Ann Arbor,  
Michigan.
- 2004 – Present       **Associate Dean** for Creative Work, Research, and Graduate Education  
School of Art & Design, University of Michigan, Ann Arbor, Michigan.
- Development and oversight of graduate education including phasing in new, trans-disciplinary, three-year MFA curriculum.
  - Created MFA/MBA dual degree with the Ross School of Business.
  - Created MFA/MSI dual degree with the School of Information.
  - Implemented trans-disciplinary advising of MFA students with over 70 faculty participating from 32 distinct colleges and departments outside of visual arts during first 5 years of program.
  - Implemented trans-disciplinary elective course requirements for MFA students with 125 distinct courses taken from 49 departments and units across university campus.
  - Implemented 4 to 8-week international studies program for all first-year graduate students. Students studied in the following countries during the first 5 years of this program: China, Surinam, Germany, Japan, Chile, Thailand, Bangladesh, Costa Rica, India, Bosnia, Herzegovina, Croatia, Mexico, Belize, Ireland, France, Ghana, and Turkey.
  - Established Fulbright application assistance for all graduating MFA students with four Fulbrights awarded to the first four graduating classes.
  - Developed guidelines for new MFA requirement of written thesis that engages academic disciplines as they relate to visual creative work.
  - Instituted the publication of all MFA theses on Michigan's DeepBlue for Internet distribution and long-term archiving.
  - Established protocols for graduate student admissions, including recruitment, application reviews, invited interviews, and applicant selection. Achieved success in admitting students who are diverse

along many dimensions.

- Produced NASSAD accreditation self-study materials for graduate program and other administrative areas of the school.
- Assist School's full-time faculty to develop creative work and research programs.
- Develop internal and external funding opportunities for School's faculty.
- Develop opportunities for creative work and research collaboration with other university units.
- Educate faculty to conduct responsible research and creative work.

2004 - 2010      **Associate Professor**, School of Art & Design, University of Michigan, Ann Arbor, Michigan.

2003 - Present      **Research Associate Professor**  
Department of Radiology, University of Michigan, Ann Arbor, Michigan.  
Conduct research in visualization of developmental biology with magnetic resonance microscopy.

1999 - 04      **Associate Professor & Director**  
Biomedical Visualization Graduate Program.  
School of Art & Design, University of Michigan, Ann Arbor, Michigan.  
Directed graduate program in medical illustration and biomedical visualization, taught graduate and undergraduate courses relating imaging technologies, life sciences and visual arts, supervised graduate student research projects, conducted research in visualization of developmental biology.

- Restructured curriculum for Medical and Biological Illustration graduate program, moving from techniques orientated instruction to problem based teaching.
- Organized and conducted Information Visualization, a seminar series with local, regional, and national speakers.
- Obtained funding and created shared visualization lab for graduate program.
- Obtained funding and provided computer workstations for each student in biomedical visualization.
- Designed and implemented procedure to review applications and portfolios, and to interview graduate program applicants.
- Secured opportunities for art students to take coursework in medical school.

1999 - 03      **Senior Associate Research Scientist**  
Department of Radiology, University of Michigan, Ann Arbor, Michigan.  
Conducted research in visualization of developmental biology with magnetic resonance microscopy.

1992 - 99

**Assistant Research Professor**

Department of Radiology, Duke University Medical Center,  
Durham, North Carolina.

Conducted research in magnetic resonance microscopy (MRM) and cardiovascular development.

- Developed protocols in MRM used internationally for imaging cardiovascular development in small animals.
- Obtained and managed \$1.3 million in federally and locally funded research programs.
- Supervised collaborators, consultants, and lab personnel.
- Designed and produced MRM imaging coils for embryos.
- Designed and produced in-vitro (outside of uterus) MRM imaging device for live mouse embryos.
- Designed and implemented automated image database system for MRM experiments.
- Authored and published 22 manuscripts and abstracts.
- Presented seminars nationally and internationally.
- Consultant in medical imaging and 3D image reconstruction.

1988 - 92

**Research Associate**

Department of Radiology, Duke University Medical Center,  
Durham, North Carolina.

Provided laboratory research assistance in medical imaging of cardiovascular development. Developed protocols for stereo micro-angiography of mouse and chicken embryos, performed micro-surgical infusions of contrast materials into embryos, developed methods to produce three-dimensional computer images from serial histological cross-sections of embryos, analyzed and documented normal and abnormal cardiovascular development in mouse embryos, wrote research articles, and produced exhibits, illustrations, and images for manuscripts and meeting presentations.

1983 - 02

**Principal, BioImage**

Founded biomedical visualization and medical illustration business that designed and produced computer animations, medical-legal trial exhibits, print illustrations, and instructional graphics. Produced over 150 medical-legal case reviews and exhibits, and provided expert witness services in anatomy and embryology.

1984 - 94

**Instructor**

Durham Arts Council, Durham, North Carolina.

Developed curriculum and taught anatomy for artists and illustration techniques classes.

1984 - 87

**Teaching Assistant**

Duke University Medical Center, Durham, North Carolina.

Delivered lectures and taught labs for anatomy, histology, and embryology to medical students.

EXHIBITIONS / ANIMATIONS / PUBLISHED IMAGES

- 2010 (In Press)     **Human Biology.** Colleen Belk and Virginia Borden Baier, Benjamin Cummings/Pearson Education. Human embryo images.
- 2009                 **Cells: The Universe Inside Us.** Maryland Science Center, Baltimore, MD. 12 embryo animations and 12 embryo images for an exhibit.
- Neurosurgery.** Cover image, January, 2009.
- eGranary Digital Library.** Mirror site for The Multi-dimensional Human Embryo (<http://embryo.soad.edu>), distributed via hardware in African countries where Internet access is limited or not available.
- What is Life? A Guide to Biology.** Jay Phelan, W.H. Freeman, New York. Human embryo image.
- Icons of Life: A Cultural History of Human Embryos.** Lynn Morgan, University of California Press. Interview and Human embryo image montage.
- The Aponeurotic Tension Model of Craniofacial Growth.** Richard G. Standerwick and Eugene Roberts, BisEssays. Image of Carnegie stages of human embryos.
- Interstice: Public; private; Communal; exclusive; Civic; personal.** Annual faculty exhibition, Slusser Gallery, Ann Arbor, MI. Documented public intervention from Taipei, Taiwan.
- 2008                 **Espèces d’espèces (Something about Species).** Ex Nihilo films, Science Television, France. Human embryo time-lapse animation.
- Making a Virtual Embryo.** Tatjana Buklijas and Nick Hopwood, ‘Standards: Public embryology,’ Making the Visible Embryo. Human embryo animation. [[http://www.hps.cam.ac.uk/visibleembryos/s6\\_4.html](http://www.hps.cam.ac.uk/visibleembryos/s6_4.html)].
- A pregnant Woman: Psychological Health and Care.** Nadia Buhannad & Fadwa Almughairbi, Memory Media L.L.C; Dubai, UAE. Human embryo images.
- Embryo Totems.** Science Atrium, Calvin College, Grand Rapids, MI. Large format (150” x 44”) digital print of human embryo MRI data.
- Healthy Baby.** YouZeum, University of Missouri. Collaboration and animations for museum exhibit.
- 2007                 **Arts and Evolution Learning Studio.** Arts and Minds national conference

hosted by Arts on Earth, University of Michigan, Ann Arbor, MI. Organizer and presenter of an interactive session commingling artists' and scientists' practices on biological evolution.

**Digital'06 "Bio/Med SciART"**. New York Hall of Science. Two digital prints based on human embryo MRI data as transgenic totems: Frzb01 and Hox Voxels.

**The Seduction of Scale**. The Life Sciences Institute, University of Michigan, Ann Arbor, MI. Three digital prints.

**A Minima: New Media, Art Now**. Totems and Transgenics. ISSN: 1697-7777. Creative work images.

**MReidoscope**. Annual faculty exhibition, Slusser Gallery, Ann Arbor, MI. Five minute animation.

2006

**Shigeichi Nagata: Apoptosis**. Science Channel, Japan Science and Technology Agency, Japanese Ministry of Education. Three embryo images.

**Genetic ImPRINT: Printed Science**. University of Wisconsin. Two digital prints from human embryo MRI data reconfigured as transgenic totems: Frzb 02 and Embryo Totem 01.

**Du Baiser Au Bébé**. Fondation Claude Verdan, Musee de la Main, Lausanne, Switzerland. Interactive, time-lapse animation of human embryo growth demonstrating a time line and scale changes, for museum exhibit.

**Before (When Two Worlds Collide)**. Beaux Arts Gallery, London, England. A sculpture collaboration with Marilene Oliver. Stacked, glass plates with embryo data etched into the surfaces.

**Endless Forms: Engaging Evolution**. Work Gallery, University of Michigan. Totem 11252 11431, large format digital print of human embryo MRI's reconfigured as transgenic totems.

**Interactive Brain Development**. Robert E. Seegmiller and Keri Low. MRI images and animations for interactive CD on development of the embryonic brain.

**Voxel Artifacts**. Annual faculty exhibition, Work Gallery, Ann Arbor, MI. Animation series from magnetic resonance imaging of snails.

2005

**Antecedent**. Annual faculty exhibition, Slusser Gallery, University of Michigan. 8 foot tall hexagonal installation for six digital prints of totemic-like images of transgenic embryos based on MRI data.

- The God Show.** The Gallery Project, Ann Arbor, MI. Three large format digital prints from human embryo MRI data reconfigured as transgenic totems and plasmids: Embryo Totem 01, Embryo Totem 02, and Plasmid 01.
- 2004 **Developmental Degradation.** Annual faculty exhibition, Slusser Gallery, University of Michigan. Laminated embryo MRI's in varying states of decay, suspended on glass platform.
- 2003 **The Inner Adventure.** A documentary featuring my research and showcasing four short animations of human embryos, produced by Mona Lisa Productions for broadcast in France on a national channel and in North America on the Discovery Channel.
- Biology of Prenatal Development.** Animation sequences of human embryos for an educational video, distributed by the Endowment for Human Development to high school science classes.
- 2002 **The Incredible Human Body.** Two animation shorts for a National Geographic special, broadcast on PBS.
- Genetics: Decoding Life.** Six animations of embryos for a permanent, interactive exhibit at the Museum of Science and Industry, Chicago.
- 2001 **Life's Greatest Miracle.** Four-dimensional animation of human embryonic development for a NOVA special broadcast on PBS.
- Sexual Secrets Series.** Short animations of a human embryo, broadcast on Discovery Channel Canada.
- The Human Body.** Animation sequences of human embryos based on magnetic resonance imaging for inauguration of the London Science Museum's IMAX Theatre, produced by the BBC.
- Prenatal Imaging.** MRI images of human embryos for permanent exhibit at the Liberty Science Center, Jersey City, New Jersey.
- Mouse Embryo Morph.** A short animation of mouse embryonic development broadcast on the National Geographic documentary series "The Shape of Life".
- Observed.** Six animation sequences displayed at Immedia 1901, Media Union, University of Michigan.
- 2000 **Human Embryo at Stage 23.** A short animation for "The Body Changers," National Geographic Films.

- 1999           **The Multi-dimensional Human Embryo** (<http://embryo.soad.umich.edu>). A Web site for three-dimensional magnetic resonance microscopy images and animations of human embryos. The site is viewed by more than 500 visitors each day. The site is listed as the top site for Google searches using “human embryo” due to the numerous incoming links to this Web resource. In addition to technical manuscripts documenting this work, the site has also received numerous awards and mass media recognition (Washington Post, Science, The Scientist, NCRR Reporter, Popular Science, Sun Sentinel, Dallas Morning News, El Mundo).
- Rotating Embryo.** A short animation for “The Body Human,” a CBS documentary.
- 1998           **Human Embryo at Stage 19.** A short animation for “The Human Body: The incredible journey from birth to death,” a documentary produced by the BBC and The Learning Channel.
- 1995           **Digital Atlas of Mouse Embryology.** A CD-ROM digital atlas of mouse embryonic development based on magnetic resonance imaging. This atlas containing thousands of interactive images was the first digital atlas on mouse development ever published.

#### INVITED LECTURES / PRESENTATIONS

- 2009           *Reading Films, Reading Pictures: Comparing image reading rituals of radiologists and visual artists.* Invited speaker, Radiology Research Seminar, Department of Radiology, University of Michigan.
- 2008           *Taipei Drift: International Workshop for Art Academics.* Invited panelist, Taipei National University of the Arts, Taipei, Taiwan.
- Visualization as a Transgressive Practice.* Inaugural keynote speaker for the new Integrated Science Research Institute, Calvin College, Grand Rapids, Michigan.
- Human Genetics Visualization: What Next?* Invited speaker, Human Genetics Interdisciplinary Ph.D. program, University of Michigan, Ann Arbor, Michigan.
- Future Trends and their Impact on Medical Illustrators.* Invited panelist, Association of Medical Illustrators Annual Convention, Indianapolis, IN.
- 2007           *Status of Life Form: How is it Ascribed? MutaMorphosis: Challenging Arts and Sciences.* Invited speaker and presenter. Prague, Czech Republic.
- Arts and Evolution Learning Studio.* Arts and Minds Conference hosted by

Arts on Earth. Organizer and presenter of an interactive session commingling artists' and scientists' practices and ideas on biological evolution. University of Michigan, Ann Arbor, Michigan.

*Depicting the Embryo: Imaging, Imagining, Influencing*. Invited speaker, The Arts at Michigan, Engaging the Academic Experience, President's Advisor Council, University of Michigan, Ann Arbor, Michigan.

*Virtual Symposium on Visual Culture and Bioscience*. The National Academy of Science. One of 28 invited international panelists including artists, scientists, historians, ethicists, and sociologists.  
<http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=03082007>.

2006 *Medical Imaging*. Science and The Print. Invited speaker for Genetic ImPRINT at the Southern Graphics Council Conference, University of Wisconsin, Madison, Wisconsin.

*Comparing Visual Strategies of Artists and Scientists*. TRANS: Visual Culture Conference. Invited panelist. University of Wisconsin, Madison, Wisconsin.

*Social, Political, and Cultural Impact of Embryo Imaging*. Invited speaker to the OB/GYN Research Fellowship Program seminar series, University of Michigan, Ann Arbor, Michigan.

2005 *Advanced 3-D Imaging of the Embryo: Social and Cultural Impact*. Presented to Grand Rounds in the Department of OB/GYN, University of Michigan Medical Center, Ann Arbor, Michigan.

*Design and Sciences at the University of Michigan*. Invited presentation at the CAA and Leonardo annual meeting, round table on mentoring for Science/Art/Technology Education, Atlanta, Georgia.

2003 *The Embryo as Individual*. Tenure talk presented as part of the Penny Stamps Distinguished Lecture Series, School of Art & Design, University of Michigan, Michigan Theatre, Ann Arbor, Michigan.

*In-Utero: Imaging and Imagining*. Invited speaker and panelist for the series: "The Political Embryo: Re-conceiving Human Reproduction," Mount Holyoke College, South Hadley, Massachusetts.

*Imaging and Visualizing the Embryo and Embryonic Heart*. Invited Grand Rounds speaker, Department of Cardiology, New York University Medical Center, New York.

2002 *Added Dimensions from Virtual Slides*. Invited speaker, Medical University

of South Carolina, Charleston, South Carolina.

*3D Modeling from MRI/CT Data: Surface and Volume Based Models.* Invited speaker, Association of Medical Illustrators, Austin, Texas.

*NMR Imaging of Biological Dynamics.* Plenary speaker, International Conference on Complex Systems, Boston, Massachusetts.

2001 *Visualizing Four Dimensional Changes.* Invited speaker, departmental colloquium, Department of Gerontology, University of Michigan, Ann Arbor, Michigan.

*The Science and Art of Visualizing Genetics and Growth.* Invited speaker, departmental colloquium, Human Genetics, University of Michigan, Ann Arbor, Michigan.

*Where Does the Heart Begin?* Invited speaker and presenter, Immedia 1901, University of Michigan, Ann Arbor, Michigan.

2000 *Visualizing the Embryo with Magnetic Resonance Microscopy.* Invited speaker, Microscopy Society of America, East Lansing, Michigan.

*Analysis of Heart Development by Magnetic Resonance Microscopy.* Invited speaker, Future Perspectives of Solid State NMR in Biology; Leiden NMR Center, Leiden, Netherlands.

2000 *Magnetic Resonance Microscopy Analysis of Experimental Mouse Embryo Models.* Invited speaker, Parke-Davis Pharmaceuticals (Division of Toxicology), Ann Arbor, Michigan.

*MRI and Embryology of Heart Development.* Invited speaker, Congress on Three-dimensional Imaging of the Heart – Pediatric Cardiology and Cardiac Surgery, Venice, Italy.

*Three-dimensional Imaging of the Developing Heart: MRM.* Invited speaker, Cardiovascular Developmental Biology Center, Medical University of South Carolina, Charleston, South Carolina.

1999 *Visualization of Multi-dimensional Images.* Invited speaker, Next Generation Internet and Visible Human Project, Ann Arbor, Michigan.

*A Three-dimensional Phantom for the Human Embryo.* Invited speaker, Oak Ridge National Laboratory, Department of Energy, Embryo Phantom Group, Oak Ridge, Tennessee.

*MRI of the Murine Heart.* Invited speaker, American Heart Association Scientific Conference on Molecular Cellular and Integrated Physiological

Approaches to the Failing Heart, Snowbird, Utah.

*Imaging Techniques in the Study of Development.* Workshop chairman, Society of Developmental Biology, Charlottesville, Virginia.

*MRI of Embryos, an Internet Resource.* Invited speaker, FASEB (American Association of Anatomists, Clinical Anatomists), Washington, D.C.

*Volume and Surface Renderings: Are either suitable for teaching materials?* Invited speaker, Embryo Imaging and Education; Human Developmental Anatomy Center of the National Museum of Health and Medicine, Washington, D.C.

1998

*Magnetic Resonance Imaging and Analysis of the Embryonic and Fetal Heart.* Invited speaker, 5th International Symposium on Etiology and Morphogenesis of Congenital Heart Disease, Tokyo, Japan.

*Magnetic Resonance Imaging (MRI) of the Embryo: Techniques and Applications.* Invited speaker, Department of Anatomy & Developmental Biology Kyoto University, Kyoto, Japan.

*MRI Analysis of Embryos.* Invited speaker, Heart/Lung Institute, Ohio State University, Columbus, Ohio.

*MRI Analysis of the Embryo: Techniques and Applications.* Invited speaker, Cincinnati Children's Hospital, Cincinnati, Ohio.

*MRI Analysis of the Embryo: Techniques and Applications.* Invited speaker, Children's Hospital Stokes Research Institute, Philadelphia, Pennsylvania.

*The Human Embryo by MRI.* Presidential paper and keynote address, American Association of Clinical Anatomists, Lexington, Kentucky.

*Three-Dimensional Morphometric Analysis of the Embryo.* Invited speaker, National Heart, Lung and Blood Institute (NHLBI); Working Group on: The Role of Cholesterol and Lipids in Embryonic Development and Congenital Disease, Nashville, Tennessee.

*MRI Analysis of Embryos with Altered Gene Expression.* Invited speaker, Skirball Institute, New York University Medical Center, New York.

*Magnetic Resonance Analysis of Mouse Development.* Invited speaker, Ohio State University, Department of Biology, Columbus, Ohio.

*MRM Assessment of Experimental Mouse Embryo Models.* Invited speaker, MERK, Pennsylvania.

*MRI Analysis of Embryos with Altered Gene Expression.* Invited speaker, Lecture Series on Biological Imaging, University of Michigan, Ann Arbor.

1997 *Magnetic Resonance Microscopy: An Alternative that Provides MRI of Intact Biological Structures.* Invited speaker, Eastern Analytical Symposium, Somerset, New Jersey.

*Magnetic resonance imaging and volume rendering for three-dimensional analysis of embryos.* Invited speaker, NICHD, NIH Workshop on Computer-Assisted Imaging of Embryonic Development, Bethesda, Maryland.

*Role of Imaging Technology in the Medical Illustrator's Profession.* Invited speaker, Association of Medical Illustrators, Baltimore, Maryland.

*Magnetic Resonance Assessment Of The Developing Heart And Outflow Tract.* Invited speaker, Weinstein Cardiovascular Development Meeting, Cincinnati, Ohio.

*MRM of Human Embryos.* Invited speaker, Clinical Human Embryology, Armed Forces Institute of Pathology, Washington, D.C.

*Dynamic Imaging of Cardiovascular Development.* Invited speaker, FASEB meeting, New Orleans, Louisiana.

1996 *Magnetic Resonance Analysis of Mouse Development.* Invited speaker, Children's Hospital Research Foundation, Cincinnati, Ohio.

*Image Processing and Medical Illustration.* Invited speaker, Johns Hopkins, Department of Art as Applied to Medicine, Baltimore, Maryland.

*MRM and Altered Gene Expression.* Invited speaker, Microscopy Society of America, Minneapolis, Minnesota.

1995 *MR Microscopy of Cardiovascular Development.* Invited speaker, American Heart Association, Anaheim, California.

*Magnetic Resonance Microscopy.* Keynote speaker, AREMS Appalachian Regional Microscopy Society, Kingsport, Tennessee.

*New Images of the Embryo.* Invited speaker, Association of Medical Illustrators, Phoenix, Arizona.

*Cardiovascular Development and MR microscopy.* Invited speaker, Cardiac Morphogenesis and Development Group Meeting, Rochester, New York.

*Visualizing the Embryo with Magnetic Resonance Microscopy.* Invited lecture, Samson Feldman Visiting Scholar, Johns Hopkins University School

of Medicine, Baltimore, Maryland.

*Magnetic Resonance Microscopy: Imaging Embryos in Three and Four Dimensions*. Invited speaker, Experimental Biology, Research Imaging Symposium, Atlanta, Georgia.

*3D Magnetic Resonance Microscopy Imaging of Embryos*. Keynote speaker, NY Society of Experimental Microscopist and NY Microscopical Society, New York.

1994 *Magnetic Resonance Microscopy of Embryos*. Invited speaker, NICHD, NIH Workshop on Computer-Assisted Imaging of Embryonic Development, Bethesda, Maryland.

*Magnetic Resonance Imaging of Embryos*. Invited speaker, NC Academy of Laboratory Animal Medicine, Durham, North Carolina.

*Magnetic Resonance and Mouse Embryos*. Invited speaker, NIH Transgenic Mouse Research Group, Bethesda, Maryland.

*Magnetic Resonance Microscopy of Mouse and Human Embryos*. Invited speaker, Society of Pediatric Pathologists, San Francisco, California.

1993 *Magnetic Resonance of Mouse Embryo Vasculature*. Platform speaker, Society of Magnetic Resonance in Medicine, New York.

1992 *Magnetic Resonance and Embryonic Development*. Invited speaker, Human Developmental Anatomy Center, Armed Forces Institute of Pathology, Washington, D.C.

## GRANTS AND FUNDED ACTIVITIES

2003 - 04 **MRM Analysis of Rat Embryo Heart and Aortic Arches**. Principal Investigator, Pharmacia Corporation, \$172K.  
A magnetic resonance imaging analysis of rat embryo heart and vessel formation to compare normal animals to animals treated with a new drug. The therapeutic agent to be used by women during their child-bearing years is suspected to cause heart defects. This work helped elucidate the timing and mechanism of the harmful effect so the drug can be designed to maintain its efficacy while avoiding cardiovascular malformations. Three-dimensional images and time-lapse animations were produced as part of the analysis. Coinvestigator: Mary Ellen McNerney.

2003 - 04 **Intermediate Nuclear Physics at HERMES**. Collaborator (Wolfgang Lorenzon, P.I.), NSF, \$10K.  
A collaboration producing 8 animation shorts to explain the “Mystery of

Nucleon Spin.”

- 2001 - 02      **The University of Michigan Visible Human Project.** Coinvestigator (Brian Athey, P.I.), NLM, NIH, \$30K.  
Directed the design and testing of a graphical user interface for interacting with multi-gigabyte visible human image data sets over the Internet. Directed the design and production of virtual and interactive 3D models of human anatomy based on Visible Human data for training and teaching nurses, medical students, and surgeons.
- 1996 - 01      **The Multi-dimensional Human Embryo.** Principal Investigator, NICHD, NIH, \$1,017K.  
A contract to generate a seven-dimensional image database of 14 human embryos based on magnetic resonance microscopy. The database was made available over the Internet to researchers, teachers, students, and designers. As PI, I prepared embryo specimens, performed magnetic resonance microscopy, reconstructed image data, segmented organ systems from the image data, designed and launched a major web site to distribute the image data, and produced dozens of animations to demonstrate the richness of the data.
- 2000            **ITD Instructional Assistance Grants.** Principal Investigator, University of Michigan, \$15K.  
Supported the completion of a computer graphics, animation, and imaging studio for graduate students in the biomedical visualization program.
- 1999            **ITD Instructional Assistance Grants.** Principal Investigator, University of Michigan, \$15K.  
Supported the design and creation of a computer graphics, animation, and imaging studio for graduate students in the biomedical visualization program.
- 1997 - 99      **SBIR Phase II: Genesis, A Software Tool for Embryological Visualization.** Collaborator (Morten Bro-Neilsen, HT Medical, P.I.), NICHD, NIH, \$50K.  
Reviewed, tested, and provided design specifications for the production of computer visualization software intended for the display and manipulation of large image data sets of embryos.
- 1997 - 98      **Specialized Center of Research in Pediatric Cardiovascular Diseases.** Collaborator (Bradley Keller, P.I.), NIH, \$19K.
- 1994 - 98      **Integrated Center for In-Vivo Microscopy.** Collaborator (G. Allan Johnson, P.I.), NCRR, NIH, \$40K.  
Research in the development of magnetic resonance microscopy methods for imaging embryos and organ development. Included the development of intravascular magnetic resonance imaging contrast media, protocols for delivering the contrast media to embryos, magnetic resonance microscopy

protocols, and 3D data visualization methods.

- 1994 - 95      **In-Vitro Magnetic Resonance Microscopy of Mouse Embryos.** Principal Investigator, North Carolina Biotechnology Center, \$40K. Designed protocols and built systems to image live, explanted mouse embryos in a culture medium during 8 to 24 hours of magnetic resonance microscopy.
- 1994            **Magnetic Resonance Contrast Enhancement of Cardiovascular Development in Mouse Embryos.** Principal Investigator, Duke University Medical Center Small Research Grant, \$7K. Start-up grant supported the development of a magnetic resonance imaging contrast medium for imaging the developing heart and blood vessels in mouse embryos.

## PUBLICATIONS

- 2001            **Smith BR.** Magnetic Resonance Microscopy in Cardiac Development. *Microscopic Research Techniques* 2001; 52:323-330.
- 2000            **Smith BR.** MRI and Analysis of the Embryonic and Fetal Heart. In: EB Clark, M. Nakazawa, and A. Takao, ed's. Etiology and Morphogenesis of Congenital Heart Disease: Twenty Years of Progress in Genetics and Developmental Biology. New York, NY: Futura Publ. Co., 2000.
- Yuan B, Kimura S, Engelhardt RT, **Smith BR**, Minoo P. Inhibition Of Distal Lung Morphogenesis In Nkx2.1 (-/-) Embryos. *Developmental Dynamics* 2000; 217:180-190.
- Smith BR.** Magnetic Resonance Imaging Analysis of Embryos. In: Tuan RS and Lo CW, ed's. Methods in Molecular Biology: Developmental Biology Protocols. New Jersey: Humana Press, 2000.
- 1999            **Smith BR.** Visualizing Human Embryos. *Scientific American*, 1999; 280 (March):76-81.
- Dewhirst MW, Ong ET, Braun RD, **Smith BR**, Klitzman B, Evans SM, Wilson D. Quantification of Longitudinal Tissue pO<sub>2</sub> Gradients in Window Chamber Tumors: Impact on Tumor Hypoxia. *British Journal of Cancer* 1999; 79:1717-1722.
- Smith BR**, Huff DS, Johnson GA. Magnetic Resonance Imaging of Embryos: An Internet Resource for the Study of Embryonic Development. *Computerized Medical Imaging and Graphics* 1999; 23:33-40.
- 1998            Huang GY, Wessels A, **Smith BR**, Linask KK, Ewart JL, Lo CW. Alteration

in Connexin 43 Gap Junction Gene Dosage Impairs Conotruncal Heart Development. *Developmental Biology* 1998; 198:32-44.

**Smith BR**, Shattuch MD, Hedlund LW, Johnson GA. Time-Course Imaging of Rat Embryos In-Utero with Magnetic Resonance Microscopy. *Magnetic Resonance in Medicine* 1998; 39:673-677.

1996 **Smith BR**. Magnetic Resonance Microscopy with Cardiovascular Applications. *Trends in Cardiovascular Medicine* 1996; 6:247-254.

**Smith BR**, Linney E, Huff DS, Johnson GA. Magnetic Resonance Microscopy of Embryos. *Computerized Medical Imaging and Graphics* 1996; 20:483-490.

Jaber M, Koch JW, Rockman HA, **Smith BR**, Bond RA, Sulik K, Ross J Jr, Lefkowitz RJ, Caron MG, Giros B. Essential Role of  $\beta$ -Adrenergic Receptor Kinase 1 in Cardiac Development and Function. *Proceedings of the National Academy of Science, USA* 1996; 93:12974-12979.

1994 **Smith BR**, Johnson GA, Groman EV, Linney E. Magnetic Resonance Microscopy of Mouse Embryos. *Proceedings of the National Academy of Science, USA* 1994; 91:3530-3533.

Mellin AF, Cofer GP, **Smith BR**, Suddarth SA, Hedlund LW, Johnson GA. Three-Dimensional Magnetic Resonance Microangiography of Rat Neurovasculature. *Magnetic Resonance in Medicine* 1994; 32:199-205.

1993 Johnson GA, Benveniste H, Black RD, Hedlund LW, Maronpot RR, **Smith BR**. Histology by Magnetic Resonance Microscopy. *Magnetic Resonance Quarterly* 1993; 9:1-30.

1992 **Smith BR**, Effmann EL, Johnson GA. MR microscopy of Chick Embryo Vasculature. *Journal of Magnetic Resonance Imaging* 1992; 2:237-240.

1988 Effmann EL, Johnson GA, **Smith BR**, Talbot GA, Cofer G. Magnetic Resonance Microscopy of Chick Embryos In Ovo. *Teratology* 1988; 38:59-65.

1986 Effmann EL, Whitman SA, **Smith BR**. *Aortic Arch Development. Radiographics* 1986; 6:1065-1089.

1984 Stoskopf MK, **Smith BR**, Klay G. Clinical note: Blood Sampling of Captive Sharks. *Journal of Zoo Animal Medicine* 1984; 15:116-117.

## PROCEEDINGS

2009 **Smith BR**. Social Status of Life Forms: How is it Ascribed? *Conference Proceedings from Mutamorphosis: Challenging Arts and Sciences*. <http://mutamorphosis.wordpress.com/2009/01/15/social-status-of-life-forms-how-is-it-ascribed/>. Accessed July 20, 2009.

**Smith BR**. Visual Culture and Bioscience: an Online Symposium, Issues in Cultural Theory 12. Anker S, Talasek JD, ed's. The National Academy of Sciences and the Center for Art, Design and Visual Culture at the University of Maryland, 2009.

## ABSTRACTS

2003 O'Reilly D, James J, Fredrickson B, **Smith BR**, Gross M. Effect Of Body Representation On Perception Of Affect. *American Society of Biomechanics*, 2003, Toledo, OH.

2000 Bookstein FL, **Smith BR**. Inverting De-Development: Geometric Singularity Theory in Embryology. In: Wilson DC, Tagare HD, Bookstein FL, Preteux FJ, Dougherty ER, ed's. Mathematical Modeling, Estimation, and Imaging. *Proceedings of SPIE 2000*, Vol. 4121.

1997 Hu N, **Smith BR**, Lai C, Keller B. Dependence of Aortic Arch Morphogenesis on Intracardiac Blood Flow in the Chick Embryo. *Experimental Biology '97*, 1997; April, New Orleans, LA.

1996 Dewhirst M, Ong E, **Smith BR**, Evans S, Secomb T, Wilson D. Longitudinal Gradients Of Vascular Po<sub>2</sub> In R3230AC Tumor Microvessels In Dorsal Flap Window Chambers. *Sixth World Congress for Microcirculation* 1996; August 25-30:343-346; Munich, Germany.

Ewart JL, Cohen MF, Wessels A, Gourdie RG, Huang G-Y, Linask KK, **Smith BR**, Lo CW. Heart Malformations in Transgenic Mice Overexpressing the Cx43 Gap Junction Gene. *American Society of Cell Biology* 1996; December.

**Smith BR**. Magnetic Resonance Analysis of Mouse Embryos with Altered Gene Expression. *Microscopy and Microanalysis '96* 1996; August. Minneapolis, MN.

Ewart JL, Huang GY, Linask KK, Wessels A, Gourdie RG, **Smith BR**, Lo CW. Characterization Of Heart Defects in Transgenic Mice Overexpressing Cx43 Gap Junctions. *Weinstein Meeting for Cardiovascular Development* 1996; June. Philadelphia, PA.

- 1995            **Smith BR**, Linney E, Johnson GA. 3D MR Microscopy of the Normal Mouse Embryo. *Book of Abstracts, 14th Annual Meeting, Society of Magnetic Resonance in Medicine* 1995; 1:471.
- 1993            **Smith BR**, Johnson GA, Groman EV, Linney E. Contrast Enhancement of Normal and Abnormal Mouse Embryo Vasculature. *Book of Abstracts, 12th Annual Meeting, Society of Magnetic Resonance in Medicine* 1993; 1:303.
- 1992            Johnson GA, **Smith BR**, Benveniste H. Three-Dimensional Vascular Microscopy. *Book of Abstracts, 11th Annual Meeting, Society of Magnetic Resonance in Medicine* 1992; 2:4601.

SERVICE: NATIONAL AND INTERNATIONAL

- 2010            **Site Reviewer**. McIntire Department of Art, Programs in Studio Art, University of Virginia, Charlottesville, VA.
- 2009            **Promotion Reviewer**. University of Georgia, Lamar Dodd School of Art, Athens, Georgia.
- 2008            **Nomination Reviewer, MacArthur Fellows**. John D. And Catherine T. MacArthur Foundation.
- Chair, Site Reviewer, and Accreditation Appraisal Consultant, Ontario Council on Graduate Studies**. Evaluation of the Masters of Science in Biomedical Communications program, University of Toronto Medical School. Toronto, Canada.
- 2007            **National Advisory Panel Member, Visible Human Project: Scope and Scale for the Future**. National Library of Medicine, National Institutes of Health, Bethesda, Maryland.
- 1996 - 06        **Manuscript Referee**. *Magnetic Resonance in Medicine*.
- 2005            **Nomination Reviewer, MacArthur Fellows**. John D. And Catherine T. MacArthur Foundation.
- Panel Member**. CAA/Leonardo, Roundtable for Mentoring students in Science/Art collaborations.
- 2001 - 05        **Board Member, Journal of Biomedical Communications**. Setting editorial policies and guiding business decisions.
- 2001 - 05        **Secretary and Board Member, The Vesalius Trust**. Setting investment policy, fund-granting policies, and assuring proper use of financial resources. The Trust is a research granting organization to support education in medical

illustration.

- 1999 - 05      **Board Member, Council on Education, Association of Medical Illustrators.** Setting policies and guidelines for medical illustration curricula in North America.
- 2002 - 04      **Manuscript Referee.** *Clinical Anatomy.*
- 2003            **Manuscript Referee.** *Pediatric Research.*
- 2002            **Manuscript Referee.** *Nature (Genetics).*
- Promotion Reviewer.** University of Toronto, Department of Surgery, Biomedical Communications, Toronto, Canada.
- Advisory Board Member, The Endowment For Human Development.** Assuring factual integrity of materials and setting editorial direction.
- Organizer, 3-D Users Group.** Association of Medical Illustrators. Organized and conducted the first national meeting of medical illustrators working in computer modeling and animation; in conjunction with an annual Association of Medical Illustrators conference.
- 2001            **Appraisal Consultant, Ontario Council on Graduate Studies.** Evaluation of the MScBMC program in Biomedical Communications at the University of Toronto, Toronto, Canada.
- 2000            **External Reviewer, Cleveland Institute of Art (Ohio Board of Regents).** Graduate program in medical illustration, Cleveland, Ohio.
- 1999            **Co-chair, Technical Review Panel, Visible Human Project Atlas of the Head and Neck, National Library of Medicine, NIH.** Reviewed grant applications and established directions for future funding initiatives.
- Technical Review Panel Member, Visible Human Project From Data to Knowledge, Image Processing Tools, National Library of Medicine, NIH.** Reviewed grant applications and established directions for future funding initiatives.
- 1992 - 95      **Chair, Arts in Education, North Carolina Arts Council.** Governor Appointment; reviewed grant applications and set state-sponsored funding priorities for arts education across the state of North Carolina.

## SERVICE: UNIVERSITY OF MICHIGAN

- 2009 - Present     **Member, Faculty Productivity Study Group.** Provost's Office, University of Michigan.
- 2009 - Present     **Member, Academic Dispute Resolution Board.** Rackham Graduate School, University of Michigan.
- 2009 - Present     **Member, Arts-integration Working Group - Communications.** ArtsEngine, University of Michigan.
- 2009 - Present     **Member, Faculty and Graduate Studios Design Team.** School of Art & Design, University of Michigan.
- 2009 - Present     **Member, Financial Aid Committee.** School of Art & Design, University of Michigan.
- 2009 - Present     **Member, International Committee.** School of Art & Design, University of Michigan.
- 2009 - Present     **Member, Student Reviews Committee.** School of Art & Design, University of Michigan.
- 2007 - Present     **Member, Web/Print Materials Council (Chair 2007 -2009).** School of Art & Design, University of Michigan.
- 2007 - Present     **Chair, Graduate Program Committee.** School of Art & Design, University of Michigan.
- 2006 - Present     **Member, Associate Provosts, Associate Deans Group.** University of Michigan.
- 2004 - Present     **Member, Research Associate Deans Committee.** University of Michigan.
- 2004 - Present     **Member, Executive Committee.** (Ex-officio after 2006), School of Art & Design.
- 2004 – Present     **Juror, Bioartography.** Annual show of biological images. The Center for Organogenesis, University of Michigan.
- 2007 - 2009        **Member, Advisory Committee on Chair Orientation.** Provost's Office, University of Michigan.
- 2002 - 08          **Speaker, Summer Science Academy, Medical School.** Participated as a lecturer in this program created to increase the number of underrepresented minority and disadvantaged students in health professions.

- 2004 - 06      **Member, Graduate Student Instructor Training Evaluation Committee.** University of Michigan.
- 2003 - 06      **Chair, Graduate Student Selection Committee.** School of Art & Design.
- 2005            **Reviewer, Faculty Honors and Diversity Affairs Committee.** Rackham Graduate School.
- 2004 - 05      **Member, Integrative Project Committee.** School of Art & Design.
- 2002 - 03      **Member, Core Studios Committee.** Developed curriculum for undergraduate studio courses in the School of Art & Design.
- 2002            **Chair, Digital Studios Committee.** Developed course objectives in new undergraduate curriculum at the School of Art & Design.
- Member, Graduate Program Review Committee.** Developed new curriculum for graduate studies within the School of Art & Design.
- Reviewer, Rackham Non-Traditional Grant Review Board.**
- 2001            **Participant, Roads Scholar Program.** University of Michigan.
- Presenter, Health Sciences Scholarship Program.** Hosted undergraduate students interested in science research.
- 2000 - 01      **Chair, Academic Courses Task Group.** Developed non-major course requirements for new undergraduate curriculum at the School of Art & Design.
- 1999 - 01      **Member, OSHA Committee.** School of Art & Design.
- 1999 - 00      **Member, Web Development Committee.** School of Art & Design.
- Consultant, Visible Human Project, Next Generation Internet.** Advised on design and accuracy of anatomical content.

#### AWARDS AND HONORS

- 2009            **Rackham Master's Mentor Award.** Recognizing dedicated and inspiring mentors to foster a culture of high quality graduate mentoring, Rackham Graduate School, University of Michigan, Ann Arbor, MI.
- 2005 - 06      **Fellow, Academic Leadership Program.** Committee on Institutional Cooperation (a group of 12 research institutions). Developing the leadership and managerial skills of faculty who have demonstrated exceptional ability

and academic promise, and oriented to address the challenges of academic administration at major research universities.

- 1998            **Speaker, Presidential Address.** American Association of Clinical Anatomists, Lexington, Kentucky.
- 1995            **Samson Feldman Visiting Scholar.** Johns Hopkins University School of Medicine, Baltimore, Maryland.
- 1983 - 88       **Fellowship.** Department of Anatomy, Duke University School of Medicine, Durham, North Carolina.
- 1983            **Annete Burgess Award in Ophthalmological Illustration.** Johns Hopkins University, Baltimore, Maryland.