

CARMEN J. WILLIAMS, M.D., PH.D.
CURRICULUM VITAE

Work Address:

National Institute of Environmental Health
Sciences
111 T. W. Alexander Drive
Research Triangle Park, NC 27709
Phone: 919-541-2158
Fax: 919-541-0696
Email: williamsc5@niehs.nih.gov

Major Professional Interests:

Mammalian gametes and preimplantation embryos, human reproduction and infertility

Education and Professional Positions

Clinical Investigator, Tenure-track

Reproductive Medicine Group
Laboratory of Reproductive and Developmental Toxicology
National Institute of Environmental Health Sciences
Research Triangle Park, NC
September 2007 – present

Assistant Professor

Division of Reproductive Endocrinology & Infertility
Department of Obstetrics & Gynecology
University of Pennsylvania
Philadelphia, PA
July 2000 – September 2007

Research Associate

Department of Obstetrics & Gynecology
University of Pennsylvania Health System
Philadelphia, PA
July 1992 – June 2000

Doctor of Philosophy

Cell and Molecular Biology Graduate Group
School of Biomedical Graduate Studies
University of Pennsylvania
Philadelphia, PA
September 1992 – August 1997

Fellow in Reproductive Endocrinology & Infertility

Department of Obstetrics & Gynecology
Hospital of the University of Pennsylvania
Philadelphia, PA
July 1990 – June 1993

Resident in Obstetrics & Gynecology

Pennsylvania Hospital
Department of Obstetrics & Gynecology
Philadelphia, PA
July 1986 – June 1990

Doctor of Medicine

Duke University School of Medicine
Durham, NC
August 1982 – May 1986

Engineer in Computer Graphics Design Division

International Business Machines, Inc.
Poughkeepsie, NY
June 1981 – August 1982

Bachelor of Science in Engineering

Department of Electrical Engineering
Duke University
Durham, NC
September 1978 – May 1981

Awards and Honors

- 1982-1986 Charles B. Strickland Memorial Scholarship, Duke University School of Medicine
- 1986-1987 Outstanding Obstetric Resident in the Intensive Care Nursery, Pennsylvania Hospital
- 1989 Obstetrics & Gynecology Resident Teaching Award, University of Pennsylvania
- 1992 Physician Scientist Award, National Institutes of Health, NICHD
- 1997 Burroughs Wellcome Fund Career Award in the Biomedical Sciences
- 2002 Society for Reproductive Endocrinology and Infertility Fellowship Research Prize Paper Award, Society for Gynecological Investigation Annual Meeting

Certification/Licensure/Medical Appointments

Specialty Certification:

1994-present American Board of Obstetrics & Gynecology

Medical Licensure:

1986-present Pennsylvania (MD041090E)

1993-2007 New Jersey (MA059112)

Medical/Hospital Appointments:

1993-1994 Medical Staff, Dept. of Obstetrics & Gynecology, West Jersey Health System, Camden, NJ

1993-1994 Medical Staff, Summit Surgical Center, Voorhees, NJ

2000-2007 Attending Physician, Hospital of the University of Pennsylvania, Philadelphia, PA

2004-2007 Attending Physician, Hospital of the University of Pennsylvania Reproductive Surgery Facility, Philadelphia, PA

Publications

Peer Reviewed Papers:

1. Lakoski, K., **Williams, C.**, Saling, P: Proteins of the Acrosomal Region in Mouse Sperm: Immunological Probes Reveal Post-Testicular Modifications. *Gamete Research* 23(1): 21-37, May 1989.
2. **Williams, C.J.**, Schultz, R.M., Kopf, G.S.: Role of G Proteins in Mouse Egg Activation: Stimulatory Effects of Acetylcholine on the ZP2 to ZP2f Conversion and Pronuclear Formation in Eggs Expressing a Functional m1 Muscarinic Receptor. *Dev. Biol.* 151: 288-296, May 1992.
3. **Williams, C.J.**, Schultz, R.M., Kopf, G.S.: G protein gene expression during mouse oocyte growth and maturation, and preimplantation development. *Mol. Reprod. Dev.* 44: 315-323, July 1996.
4. **Williams, C.J.**, Mehlmann, L.M., Jaffe, L.A., Kopf, G.S., Schultz, R.M: Evidence that Gq family G proteins do not function in mouse egg activation at fertilization. *Dev. Biol.* 198: 116-127, 1998.
5. McAvey, B.A., Wortzman, G.B., **Williams, C.J.**, Evans, J.P.: Involvement of calcium signaling and the actin cytoskeleton in the membrane block to polyspermy in mouse eggs. *Biol. Reprod.* 67: 1342-1352, October 2002.
6. Brown, R.L., Ord, T., Moss, S.B., **Williams, C.J.**: A-kinase anchor proteins as potential regulators of protein kinase A function in oocytes. *Biol Reprod* 67: 981-987, 2002.

7. Xu, Z., **Williams, C.J.**, Kopf, G.S., Schultz, R.M.: Maturation-associated increase in IP3 receptor type 1: Role in conferring increased IP3 sensitivity and Ca²⁺ oscillatory behavior in mouse eggs. *Dev. Biol.* 254(2): 163-171, February 2003.
8. Deng, M., Kishikawa, H., Yanagimachi, R., Kopf, G.S., Schultz, R.M., **Williams, C.J.**: Chromatin-mediated cortical granule redistribution is responsible for the formation of the cortical granule-free domain in mouse eggs. *Dev. Biol.* 257: 166-176, May 2003.
9. Brown, R.L., August, S.L., **Williams, C.J.***, Moss, S.B.*: AKAP7 gamma is a nuclear RI-binding AKAP. *Biochem. Biophys. Res. Comm.* 306: 394-401, June 2003. *equal contribution
10. Dayal, M.D., Wheeler, J., **Williams, C.J.**, Barnhart, K.T.: Disruption of the upper female reproductive tract epithelium by nonoxynol-9 (N-9). *Contraception* 68(4): 273-279, October 2003.
11. Ecker, D.J., Stein, P., Xu, Z., **Williams, C.J.**, Kopf, G.S., Bilker, W.B., Abel, T., Schultz, R.M.: Long-term effects of culture of preimplantation mouse embryos on behavior. *Proc. Nat. Acad. Sci.* 101(6): 1595-1600, February 2004.
12. Tutuncu, L., Stein, P., Ord, T.S., Jorgez, C.J., **Williams, C.J.**: Calreticulin on the mouse egg surface mediates transmembrane signaling linked to cell cycle resumption. *Dev. Biol.* 270(1): 246-260, June 2004.
13. Travis, AJ, Tutuncu, L, Jorgez, CJ, Ord, T, Jones, BH, Kopf, GS, **Williams, C.J.**: Requirements for Glucose Beyond Sperm Capacitation During In Vitro Fertilization in the Mouse. *Biol. Reprod.* 71(1): 139-145, July 2004.
14. Deng, M., **Williams, C.J.***, Schultz, R.M.*: Role of MAP kinase and myosin light chain kinase in chromosome-induced development of mouse egg polarity. *Dev. Biol.* 278(2): 358-366, February 2005. *equal contribution
15. Duncan, F.E., Moss, S.B., Schultz, R.M.*, **Williams, C.J.***: PAR-3 defines a central subdomain of the cortical actin cap in mouse eggs. *Dev. Biol.* 280: 38-47, March 2005. *equal contribution
16. Michaut, M.A., **Williams, C.J.***, Schultz, R.M.*: Phosphorylated MARCKS: A novel centrosome component that also defines a peripheral subdomain of the cortical actin cap in mouse eggs. *Dev. Biol.* 280: 26-37, March 2005. *equal contribution
17. Knott, J.G., Kurokawa, M., Fissore, R.A., Schultz, R.M.*, **Williams, C.J.***: Transgenic RNAi reveals role for mouse sperm phospholipase C zeta in triggering Ca²⁺ oscillations during fertilization. *Biol. Reprod.* 72(4): 992-996, April 2005. *equal contribution
18. Nipper, R.W., Chennothukuzhi, V., Tutuncu, L., **Williams, C.J.**, Gerton, G.L., Moss, S.B. : Differential RNA expression and polyribosome loading of alternative transcripts of the Akap4 gene in murine spermatids. *Mol. Reprod. Devel.* 70(4): 397-405, April 2005.

19. Hess, K.C., Jones, B.H., Marquez, B., Chen, Y., Ord, T.S., Kamenetsky, M., Miyamoto, C., Kopf, G.S., Suarez, S.S., Levin, L.R.*, **Williams, C.J.***, Buck, J.*, Moss, S.B.*: The 'soluble' adenylyl cyclase in sperm mediates multiple signaling events required for fertilization. *Dev. Cell* 9: 249-259, August 2005. *equal contribution
20. Wadehra, M., Forbes, A., Pushkarna, N., Goodglick, L., Gordon, L.K., **Williams, C.J.**, Braun, J.: Epithelial membrane protein-2 regulates surface expression of alpha v beta 3 integrin in the endometrium. *Dev. Biol.* 287: 336-345, October 2005.
21. Wadehra, M., Dayal, M., Mainigi, M., Ord, T., Iyer, R., Braun, J., **Williams, C.J.**: Knockdown of the tetraspan protein epithelial membrane protein-2 inhibits implantation in the mouse. *Dev. Biol.* 292: 430-441, February 2006.
22. Wadehra, M., Natarajan, S., Seligson, D.J., **Williams, C.J.**, Braun, J., Soslow, R.A.: Expression of Epithelial Membrane Protein-2 is associated with endometrial adenocarcinoma of unfavorable outcome. *Cancer* 107(1): 90-98, July 2006.
23. Knott, J.G., Gardner, A.J., Madgwick, S., Jones, K.T., **Williams, C.J.***, Schultz, R.M.*: Calmodulin-dependent protein kinase II triggers mouse egg activation and embryo development in the absence of Ca²⁺ oscillations. *Dev. Biol.* 296(2): 388-395, August 2006. *equal contribution
24. Duncan, F.E., Moss, S.B., **Williams, C.J.**: Knockdown of the cAMP-dependent protein kinase (PKA) type I α regulatory subunit in mouse oocytes disrupts meiotic arrest and results in meiotic spindle defects. *Dev. Dyn.*, 235(11):2961-2968, November 2006.
25. Gardner, A.J., **Williams, C.J.**, Evans, J.P.: Establishment of the mammalian membrane block to polyspermy: Evidence for calcium-dependent and -independent regulation. *Reproduction* 133(2):383-393, February 2007.
26. Alvarez, J.D., Hansen, A., Ord, T., **Williams, C.J.**, Moss, S.B. and Sehgal, A.: The circadian clock protein BMAL1 is necessary for fertility and proper testosterone production in mice. *J. Biol. Rhythms*, *in press*.

Editorials, Reviews, Chapters:

27. Schultz, R.M., **Williams, C.J.**: The Science of ART. *Science* 296(5576): 2188-2190, June 2002.
28. **Williams, C.J.**: Signalling mechanisms of mammalian oocyte activation. *Hum Reprod Update* 8(4): 313-321, Jul-Aug 2002.
29. Schultz, R.M., **Williams, C.J.**: Sperm-egg fusion unscrambled. *Nature* 434: 152-153, March 2005.
30. Thompson, J.R., **Williams, C.J.**: Genomic Imprinting and ART: Connections and potential risks. *Seminars in Reproductive Medicine* 23(3): 285-295, August 2005.

31. **Williams, C.J.**, Schultz, R.M.: Transgenic RNAi: A tool to study testis-specific genes. *Mol. Cell. Endocrinol.* 247: 1-3, March 2006.
32. Strauss, III, J.F., **Williams, C.J.**: The Ovarian Life Cycle. *Reproductive Endocrinology: Physiology, Pathophysiology, and Clinical Management*", 5th edition. Strauss, III, J.F., Barbieri, R.L. (eds.). W.B. Saunders, Philadelphia, 2004.

Invited Speaker

(last 5 years)

- Oct, 2002 "Spatial regulation of PKA by AKAP-RI interactions in mouse oocytes and embryos", Dept. of Biology, Univ. of Pennsylvania
- Oct, 2002 "Molecular Signaling at Fertilization.", Roundtable Luncheon presentation, American Society for Reproductive Medicine Annual Meeting, Seattle, WA
- Dec, 2002 "Spatial regulation of PKA by AKAP-RI interactions in mouse oocytes and embryos", Center for Research on Reproduction & Women's Health, Univ. of Pennsylvania
- May, 2003 "Spatial regulation of PKA by AKAP-RI interactions in mouse oocytes and embryos", Dept. of Cell Biology, Georgetown University Medical Center
- Jul, 2003 "AKAP7gamma is an embryonic RI-binding AKAP", Annual Meeting of the Society for the Study of Reproduction, Cincinnati, OH
- Jun, 2004 "Control of Implantation by Epithelial Membrane Protein-2 (EMP2)", Gordon Conference on Reproductive Tract Biology, New London, CT
- Nov, 2004 "Polarity and signaling at the initiation of mouse development", Cell & Molecular Biology Training Grant seminar, Univ. of Pennsylvania, Philadelphia, PA
- Nov, 2004 "Polarity and signaling at the initiation of mouse development", Dept. of Biochemistry & Molecular Biology, Johns Hopkins University Bloomberg School of Public Health, Baltimore, MD
- Jan, 2005 "Polarity and signaling at the initiation of mouse development", Germ Cell Seminar series, University of Pennsylvania School of Veterinary Medicine, New Bolton Center, Kennett Square, PA
- Oct, 2005 "Developmental programming - Use of genomic and proteomic tools to identify critical gene and signal pathways", in Postgraduate Course #5: Developmental Competence of Oocytes and Embryos: What We Know, What We Think We Know, and What We Fear, ASRM Annual Meeting, Montreal, Quebec
- Oct, 2005 "Epigenetic risks related to art: Impact of stimulation and lab culture", in Postgraduate Course #5: Developmental Competence of Oocytes and Embryos: What We Know, What We Think We Know, and What We Fear, ASRM Annual Meeting, Montreal, Quebec
- Oct, 2005 "Understanding the role of epigenetics in the oocyte and embryo", in Postgraduate Course #5: Developmental Competence of Oocytes and Embryos:

- What We Know, What We Think We Know, and What We Fear, ASRM Annual Meeting, Montreal, Quebec
- Nov, 2005 "Control of Implantation by Epithelial Membrane Protein-2 (EMP2)", Tufts University School of Medicine, Boston, MA
- May, 2006 "Development of polarity during mouse oocyte maturation", Reproductive Biology and Medicine Branch, NICHD, NIH
- Jun, 2006 "Calcium signaling and embryo development: Importance of the sperm factor", Duke University, Durham, NC
- Jul, 2006 "In vitro fertilization at 25: The state of the ART (Assisted Reproductive Technologies)", The Penn Science Cafe, Philadelphia, PA
- Oct, 2006 "Introduction to epigenetics: Why does it matter?", Annual Meeting of the American Society for Reproductive Medicine, New Orleans, LA
- Feb, 2007 "Epithelial membrane protein-2 (EMP2) in endometrial function and dysfunction", NIEHS, Research Triangle Park, NC
- Jul, 2007 "Polarity (or asymmetry) of the mammalian egg and early embryo", Gordon Conference on Fertilization and the Activation of Development, Plymouth, NH

Organizing Roles in Scientific Meetings

- Jun, 2002 Chairperson, Mid-Atlantic Reproductive Biology meeting Center for Research on Reproduction & Women's Health, University of Pennsylvania, Philadelphia, PA
- Sep, 2004 Seminar Series Organizer, Center for Research on Reproduction & Women's Health University of Pennsylvania, Philadelphia, PA
- Oct, 2005 Moderator, "Clinical Female Infertility and Gynecology" oral abstract session at the Annual Meeting of the American Society for Reproductive Medicine, Montreal, Quebec, Canada
- Mar, 2006 Moderator, "Ovarian Biology/Neuroendocrinology" oral abstract session at the 53rd Annual Meeting of the Society for Gynecological Investigation, Toronto, Canada
- Oct, 2006 Moderator, "Prize Paper Candidates" oral abstract session, Annual Meeting of the American Society for Reproductive Medicine, New Orleans, LA
- Oct, 2006 Symposium chair, "Understanding Epigenetics and the Clinical Impact of IVF", Annual Meeting of the American Society for Reproductive Medicine, New Orleans, LA
- Mar, 2007 Moderator, "Gynecology" oral abstract session at the 54th Annual Meeting of the Society for Gynecological Investigation, Reno, Nevada
- Jul, 2007 Moderator, plenary session "Egg and embryo polarity", Gordon Conference on Fertilization and the Activation of Development, Plymouth, NH

Societies / Professional Organization Membership/Professional Activities

- Selection Committee, Reproductive Scientist Development Program
- Society for the Study of Reproduction
 - Clinical Outreach Committee (2001-2003)
 - Program Committee (2006-present)
- Endocrine Society
- American Society for Cell Biology
- Society for Gynecological Investigation
- American Society of Reproductive Medicine
- Fellow, American College of Obstetricians & Gynecologists
- Member, Developmental Systems Advisory Panel, National Science Foundation, Animal Development and Evolution of Development, October 2005
- Special Grants Review Committees, National Institute of Health, Child Health and Human Development (RFA HD-02-012; RFA HD-02-029; RFA HD-01-011)
- Guest editor, Seminars in Reproductive Medicine 23(3), August 2005; special issue entitled "Frontiers in Gamete Biology".
- Ad Hoc referee for:
 - National Science Foundation (Grants)
 - United States Department of Agriculture; Reproductive Efficiency Section (Grants)
 - Israel Science Foundation (Grants)
 - Development*
 - Developmental Biology*
 - Biology of Reproduction*
 - Journal of Biological Chemistry*
 - Molecular Reproduction and Development*
 - Cellular and Molecular Life Sciences*
 - Human Reproduction*
 - Reproduction*
 - Reproductive Sciences*
 - Fertility and Sterility*

Academic and Institutional Committees

- | | |
|-----------|---|
| 1998-2007 | Member, Advisory/Admissions Committee for Combined Degree Program, University of Pennsylvania School of Medicine |
| 2000-2007 | Member, Admissions Committee for University of Pennsylvania School of Medicine |
| 2005-2007 | Member, Search Committee for tenure track Professor, Dept. of Ob/Gyn and Director, Center for Research on Reproduction & Women's Health |

- 2006-2007 Member, Work Group on Translational Research, Dept. of Obstetrics & Gynecology, University of Pennsylvania
- 2006-2007 Member, Admissions Committee for Cell & Molecular Biology Graduate Group, Combined Degree Program, University of Pennsylvania School of Medicine

Teaching

- Medical School Curriculum 2000, Reproduction Block
 - 2000-2007 Lecturer
 - 2007 Facilitator for Reproductive Bioethics
- Medical School Curriculum 2000, Human Embryology
 - 2006-2007 Lecturer
- Introductory Obstetrics & Gynecology clinical rotation (OG200)
 - 2000-2007 Lecturer
 - 2000-2007 Preceptor for small group
- Scientific Writing (CAMB 695)
 - 2004-2007 Section leader
- Reproductive Endocrinology & Infertility Fellow weekly teaching conferences
 - 2000-2007 Lecturer
 - 2001-2004 Organizer
- Medical Resident Management Conferences
 - 2001 Lecturer
- Bioethics Workshops, School of Biomedical Graduate Studies
 - 2002 Facilitator
 - 2005 Facilitator
- Laboratory course for Reproductive Endocrinology & Infertility Fellows "Introduction to Mouse In Vitro Fertilization & Micromanipulation"
 - 2002-2004 Organizer, instructor

Training

Postdoctoral Fellows

- | | | |
|--------------|---|-----------|
| Molina Dayal | Postdoctoral Fellow
MD, MPH/1995/Johns Hopkins University
Project: Role of EMP2 in mouse implantation
Current Position: Assistant Professor, Dept. of Reproductive Endocrinology & Infertility, George Washington University, Washington, DC | 2001-2002 |
| Jason Knott | Postdoctoral Fellow
PhD/2002/Univ. of Massachusetts, Amherst
Project: Phospholipase C isoform functions during mouse egg activation
Current Position: Staff Scientist, Serono Research Institute, Boston, MA | 2003-2005 |

- Marcela Michaut Postdoctoral Fellow 2002-2005
 PhD/2001/National Univ. of San Luis, Argentina
 Project: PKC and phosphorylated MARCKS in mouse oocyte maturation
 Current Position: Investigador Asistente CONICET, Instituto de Histologia y Embriologia, Facultad de Ciencias Medicas, Universidad Nacional de Cuyo, Mendoza, Argentina
- Monica Mainigi Postdoctoral Fellow 2004-2006
 MD/2000/New York Univ. School of Medicine
 Project: Role of EMP2 in mammalian implantation and endometriosis
 Training Grant in Reproductive Biology (T32 HD007305), 2004-2006
 Current Position: Clinical Fellow, Division of Reproductive Endocrinology & Infertility, Dept. of Ob/Gyn, Univ. of Pennsylvania Health System, Philadelphia, PA
- Scott Edwards Postdoctoral Fellow 2005-2007
 MD/1991/Yale Univ. School of Medicine
 Project: Effect of extracellular ATP on sperm motility and in vitro fertilization
 Current Position: Assistant Professor, Division of Reproductive Endocrinology & Infertility, Dept. of Ob/Gyn, Univ. of Pennsylvania Health System, Philadelphia, PA

Graduate Students

- Rebecca Brown Medical Student 1999-2000
 BA/1996/University of Pennsylvania
 Howard Hughes Medical Student Fellowship, 1999-2000
 Project: A kinase anchor proteins in mouse oocytes and embryos
 Current position: Assistant Professor, Division of Medical Endocrinology, Dept. of Medicine, University of Chicago Hospitals
- Katherine Masek VMD/PhD Student 2000
 Funding: Research Training Program Fellow, Summer 2000
 Project: Soluble adenylate cyclase in mouse oocytes and embryos
- Francesca Duncan Graduate Student, Cell & Molecular Biology Graduate Group 2001-2006
 BS/2000/Haverford College
 National Science Foundation Predoctoral Fellowship, 2002-2004
 Dissertation: *The role of PAR-3 (Partitioning-Defective Gene-3) in the development of asymmetry during mouse meiotic maturation*
 Current Position: Postdoctoral Fellow, Biology Dept., Univ. of Pennsylvania
- Timothy Georoff VMD/PhD Student 2001
 Project: Identification of mouse oocyte AKAPs by SELDI-TOF mass spectrometry
- Jessica Bertout VMD/PhD Student 2003
 Funding: Research Training Program Fellow, Summer 2003
 Project: Steroid hormone regulation of EMP2 expression in endometrial cells

Jennifer Thompson Medical Student

Project: Screening an oocyte library for AKAPs

Current position: Resident in Obstetrics & Gynecology, Jefferson University,
Philadelphia, PA

Undergraduate Honors Students

Anna Azvolinsky	Undergraduate	BIO399	2002
Amanda Doherty	Undergraduate	BIO399/BIO499	2002 - 2003
Kathleen Sullivan	Undergraduate	BIO399	2004

Funding Record

Past—Funded

Source	P.I.	Title	Role on project	Dates	Direct Cost/Year
NIH/NICHD R01 HD044740	C. Williams	Spatial Regulation of PKA by AKAP-RI Interactions	P.I.	04/01/2004- 03/31/2009	\$180,000
NIH/NICHD R01 HD22732	R. Schultz	Mechanisms of Fertilization/Polyspermy Block	Co-Investigator	09/01/2002- 08/31/2007	\$262,676
NIH D43 TW000671	C. Williams	Reproductive Biology Research Training for Latin America	P.I.	5/1/2001- 4/30/2008 (no- cost extension)	\$225,000
Duska Therapeutics	S. Moss	Efficacy and safety of culture medium additive for in vitro fertilization	Co-Investigator	07/01/2005- 06/30/2006	\$195,000
CONRAD/ Mellon Foundation	C. Williams	Tetraspan Protein Function in Primate Implantation	P.I.	04/01/2003- 03/31/2004	\$88,000
NIH/NICHD R03 HD40376	C. Williams	Role of the Tetraspanin Emp2 in Early Reproduction	P.I.	04/01/2001- 03/31/2003	\$50,000
Andrew Mellon Contraceptive Centers Flexible Center Grant	C. Williams	Role of the Tetraspanin Emp2 in Early Reproduction	P.I.	07/01/2000- 12/31/2002	\$50,000
Burroughs Wellcome Fund Career Award in the Biomedical Sciences	C. Williams	Signal Transduction Mechanisms During Mouse Egg Activation	P.I.	09/01/1997- 08/31/2005	\$57,750
American Society for Reproductive Medicine/Serono Grant in Reproduction	C. Williams	Signal Transduction Mechanisms During Mouse Egg Activation	P.I.	07/01/1997- 06/30/1999	\$25,000
NIH/NICHD K11 HD00985	C. Williams	Signal Transduction Mechanisms in Mouse Egg Activation	P.I.	01/01/1992- 12/31/1997	\$135,840
Commonwealth of Pennsylvania	C. Williams	Developing Eggs from Stem Cells	P.I.	05/01/2004- 04/30/2006	\$100,000

b.