BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors. Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: **Toris, Carol**

eRA COMMONS USER NAME (credential, e.g., agency login): **ctoris**

POSITION TITLE: **Professor**

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Rockford College, Rockford, IL	BA	05/73	General biology
University of Minnesota, St. Paul, MN	MS	09/77-08/79	Animal Physiology
University of Minnesota, Minneapolis	PhD	09/84-01/90	Human physiology, uveoscleral outflow
Allergan (sabbatical)		01/2000-07/2000	Outflow pathways and IOP lowering drugs

A. Personal Statement

B. I have been interested in aqueous humor dynamics (AHD) for over three decades. I have investigated many aspects of AHD in adult humans and in numerous animal species including dogs, cats, rats, mice, rabbits and monkeys. Our human work included the study of numerous ocular pathologies affecting intraocular pressure (IOP) and normal changes that take place during aging and over a 24-hour period. We also investigate new FDA approved treatments in patients with glaucoma or ocular hypertension.

C. Positions and Honors

1990-2001 Assistant Professor, Department of Ophthalmology, University of Nebraska Medical Center, Omaha, NE
1993- Member, Graduate Faculty, University of Nebraska Medical Center, Omaha, NE
1993-2001 Assistant Professor, Courtesy Appointment, Department of Physiology, University of Nebraska Medical Center, Omaha, NE
2001-2007 Director of Glaucoma Research and Tenured Associate Professor, Department of Ophthalmology and Visual Sciences, University of Nebraska Medical Center, Omaha, NE
Associate Professor, Courtesy Appointment, Department of Physiology, University of Nebraska Medical Center, Omaha, NE
2007-2014 Director of Glaucoma Research and Tenured Professor, Department of Ophthalmology and Visual Sciences, University of Nebraska Medical Center, Omaha, NE
Professor, Courtesy Appointment, Department of Physiology, University of Nebraska Medical Center, Omaha, NE
2015- Vice Chair of Translational Research and Professor, Department of Ophthalmology and Visual Sciences, Case Western Reserve University, Cleveland OH

Other Experience and Professional Memberships

1984-	Association for Research in Vision and Ophthalmology (ARVO), Trustee, Vice President
1986-	International Society for Eye Research (ISER)
1995-	Association for Ocular Pharmacology and Therapeutics (AOPT), Trustee, Secretary
2003-	American Glaucoma Society
2002, 2003, 2004, 2010, 2014	NIH Peer Review Committee, ad hoc reviewer

Honors

1969-1973	Jane Addams Scholarship, Rockford College
1989	IJ Fox Memorial Award for graduate research in physiology, University of Minnesota
1993	Ruth Salta Junior Investigator Achievement Award, American Health Assistance Foundation
2006	Dr. Stan Truhlsen Research Award, Prevent Blindness Nebraska
2009	ARVO FARVO, Gold award
2010	Silver U Award, UNMC

C. Contributions to Science

1. Uveoscleral outflow in inflammation

My early publications found that uveoscleral outflow is an important contributor to the hypotony seen in inflammation. This was documented in monkeys with experimental iridocyclitis.

Toris CB and Pederson JE. Aqueous humor dynamics in experimental iridocyclitis. Invest Ophthalmol Vis Sci 28 (3): 477-481, 1987.

Toris CB, Gregerson DS, and Pederson JE. Uveoscleral outflow using different sized fluorescent tracers in normal and inflamed eyes. Exp Eye Res 45 (4): 525-532, 1987.

Pederson JE and Toris CB. Uveoscleral outflow: diffusion or flow? Invest Ophthalmol Vis Sci 28 (6): 1022-1024, 1987.

2. Efficacy of new drug classes

With my colony of trained cynomolgus macaques, I have learned much about how new classes of drugs lower IOP in primates. Some examples are below.

Krauss A, Impagnatiello F, Toris CB, Gale D, Prasanna G, Borghi V, Chiroli V, Chong WK, Carreiro S, Ongini E. Ocular hypotensive activity of BOL-303259-X, a nitric oxide donating prostaglandin-F2alpha agonist, in preclinical models. Exp Eye Research, Mar 9, 2011. PMID: 21396362

Prasanna G, Carreiro S, Anderson S, Gukasyan H, Sartnurak S, Younis H, Gale D, Xiang C, Wells P, Dinh D, Almaden C, Fortner J, Toris CB, Niesman MR, LaFontaine J, Krauss AH Effect of PF-04217329 a Pro-Drug of a Selective Prostaglandin EP2 Agonist on Intraocular Pressure in Preclinical Models of Glaucoma, Exp Eye Res. 2011 Mar 3. PMID: 21376717

Sharif N, Parvaneh K, Daniel S, Li L, Kelly C, Xu S, Husain S, Toris C, Crosson C, FR-190997, A Non-Peptide Bradykinin B2-Receptor Partial Agonist, is a Potent and Efficacious Intraocular Pressure Lowering Agent in Ocular Hypertensive Cynomolgus Monkeys. Drug Development Research, Drug Dev Res. 2014 Jun;75(4):211-23. doi: 10.1002/ddr.21174. Epub 2014 May 2.

3. Aging changes aqueous humor dynamics

In studying healthy aging in human volunteers, we found that uveoscleral outflow in humans is much more than originally thought 50 years ago. Surprisingly, it is more than half of total outflow in healthy young adults. Not only are there aging changes in the trabecular outflow pathway, there are aging changes in the uveoscleral outflow pathway as well. We were the first to report the slowing of uveoscleral outflow with aging.

Toris CB, Yablonski ME, Camras CB, and Wang Y-L. Aqueous humor dynamics in the aging human eye. Am J Ophthalmol 127:407-412, 1999.

4. Changes in aqueous humor dynamics throughout a 24 hour day

We were the first to discover that uveoscleral outflow is not constant throughout a 24 hour day. This was found in a study of New Zealand white rabbits. Later we found that in human volunteers, uveoscleral outflow decreases significantly at night and increases every morning. Uveoscleral outflow is not the only change in aqueous humor dynamics at night. We confirmed the decrease in aqueous flow originally reported by Richard Brubaker and we also found that outflow facility decreases significantly at night, a similar finding to that of Arthur Sit. When posture is taken into consideration the IOP decreases at night because of the inflow and outflow changes. When seated during the day and supine at night which is the normal posture of humans, the IOP increases at night because of increases in episcleral venous pressure.

Zhao M, Hejkal J, Camras CB, Toris CB. Aqueous Humor Dynamics during the Day and Night In Juvenile and Adult Rabbits. Invest Ophthalmol Vis Sci. 2010 Jun;51(6):3145-51.

Liu H, Fan S, Gulati V, Camras LJ, Zhan G, Ghate D, Camras CB, Toris CB. Aqueous humor dynamics during the day and night in healthy mature volunteers. Arch Ophthalmol. 2011 Mar;129(3):269-75.

Fan S, Hejkal JJ, Gulati V, Galata SL, Camras CB, Toris CB. Aqueous humor dynamics during the day and night in volunteers with ocular hypertension. Arch Ophthalmol. 2011 Sep;129(9):1162-6.

5. Drug effects on aqueous humor dynamics

My team and I have published many papers on how established IOP-lowering drugs alter aqueous humor dynamics. We have papers on rabbits, cats, monkeys and humans and have investigated all classes of approved drugs and many investigational drugs. We also have studied the effects of IOP lowering drugs at night as well as during the day. Below are the studies examining the mechanism of action of IOP-lowering drugs in humans.

Toris CB, Zhan GL, Camras CB, McLaughlin: Effects of travoprost on aqueous humor dynamics in monkeys. J. of Glaucoma 14:70-73, 2005

Gulati V, Fan S, Maslonka M, Gangahar C, Toris CB, Diurnal and Nocturnal Variations in Aqueous Humor Dynamics of Patients with Ocular Hypertension on Medical Therapy. Arch Ophthalmol. 2012 Jun;130 (6):677-84. PMID: 22332206

Fan S, Agrawal A, Gulati V, Neely DG, Toris CB. Day and nighttime effects of brimonidine on IOP and aqueous humor dynamics in participants with ocular hypertension. J Glaucoma. 2014 Jun-Jul;23(5):276-81.

A complete List of Published Work can be found in MyBibliography:

D. Current Research Support

Pharmaceutical company (Toris) 11/26/13-12/31/18
Nicox
Title: Nitric oxide donating compounds for the treatment of glaucoma
The goals of this project are screen and select new nitric oxide donating compounds for use in glaucoma therapy.

Device company (Toris) 10/15/16-12/31/18
Ivantis
Title: Comparison of G2s iStents with Hydrus
The goal of this study is to determine the effect of Schlemm's canal drainage devices on outflow facility in human globes.

1R44EY027244-01 NIH SBIR (Camras) 09/01/16 – 6/30/19
NIH SBIR

Safety and Efficacy of a Titratable External Shunt
The major goals of this project are to test the IOP efficacy and device safety of an external shunt in monkeys. I am directing this research at UNMC.

Foundation grant (Toris) 10/01/17 – 09/30/18
Ohio Lions Eye Research Fund
Title: Structure and function of trabecular outflow tissues differs among people of African and European Descent
The goal of this study is to better understand how people of African descent differ from people of Northern European descent to help explain why one ethnic group is more prone to glaucoma than the other and why treatments so often fail.

Start up company
Auven
Title: Effects of OTX-202 on IOPs in monkeys with experimental glaucoma
The goal of the study is to determine the effect of OTX-202 on IOP in monkeys.

Pharmaceutical Company 09/01/18 – 12/31/2020
Alcon
Title: Effects of the CyPass on IOP and aqueous humor dynamics in patients with glaucoma
The goal of this project is to determine how the Cypass device lowers IOP in patients with glaucoma.