22 March 2017
Padjadjaran University
Bandung, Indonesia
International Peace Foundation
Bridges Dialogue

Opening Doors Worldwide through Medical Science

Peter Agre, M.D.
Bloomberg Distinguished Professor
Director, Johns Hopkins Malaria Res Inst
Bloomberg School of Public Health
Baltimore, Maryland

World Views of United States Science

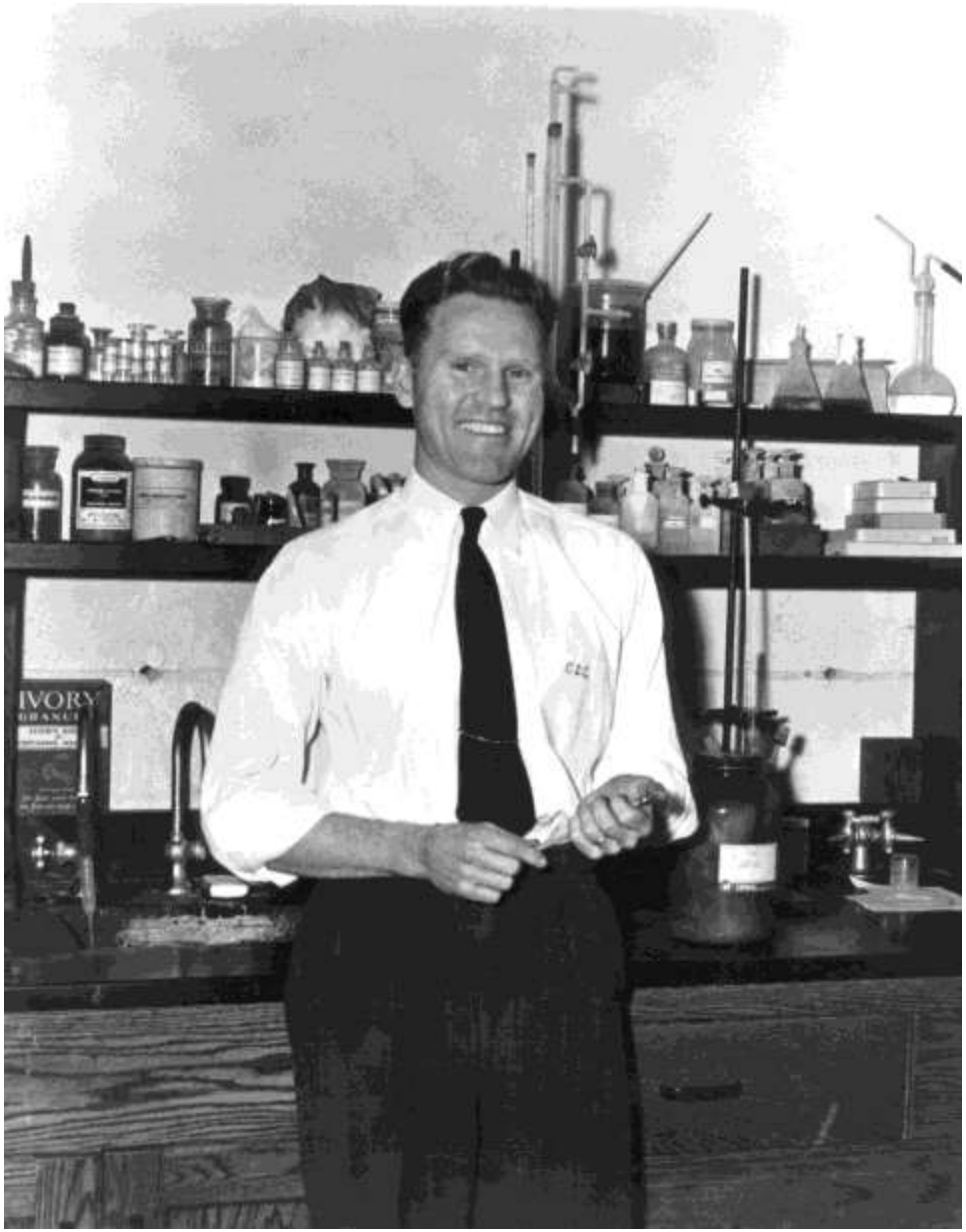
	U.S. in general		U.S. science & technol	
Country	Favorable	Unfavorable	Favorable	Unfavorable
Morocco	11%	88	90	08
Saudi Arabia	04	94	48	51
Jordan	15	78	83	13
Lebanon	20	69	52	46
UAE	14	73	84	12

From: Arab Views toward America, Zogby 2004

Science Diplomacy in the 21st Century

1. Scientific upbringing
2. Science as an international career
3. Science and human rights
4. Science diplomacy visits

Ancestral home in Gaaserud, Norway



Court Agre in his lab, 1950

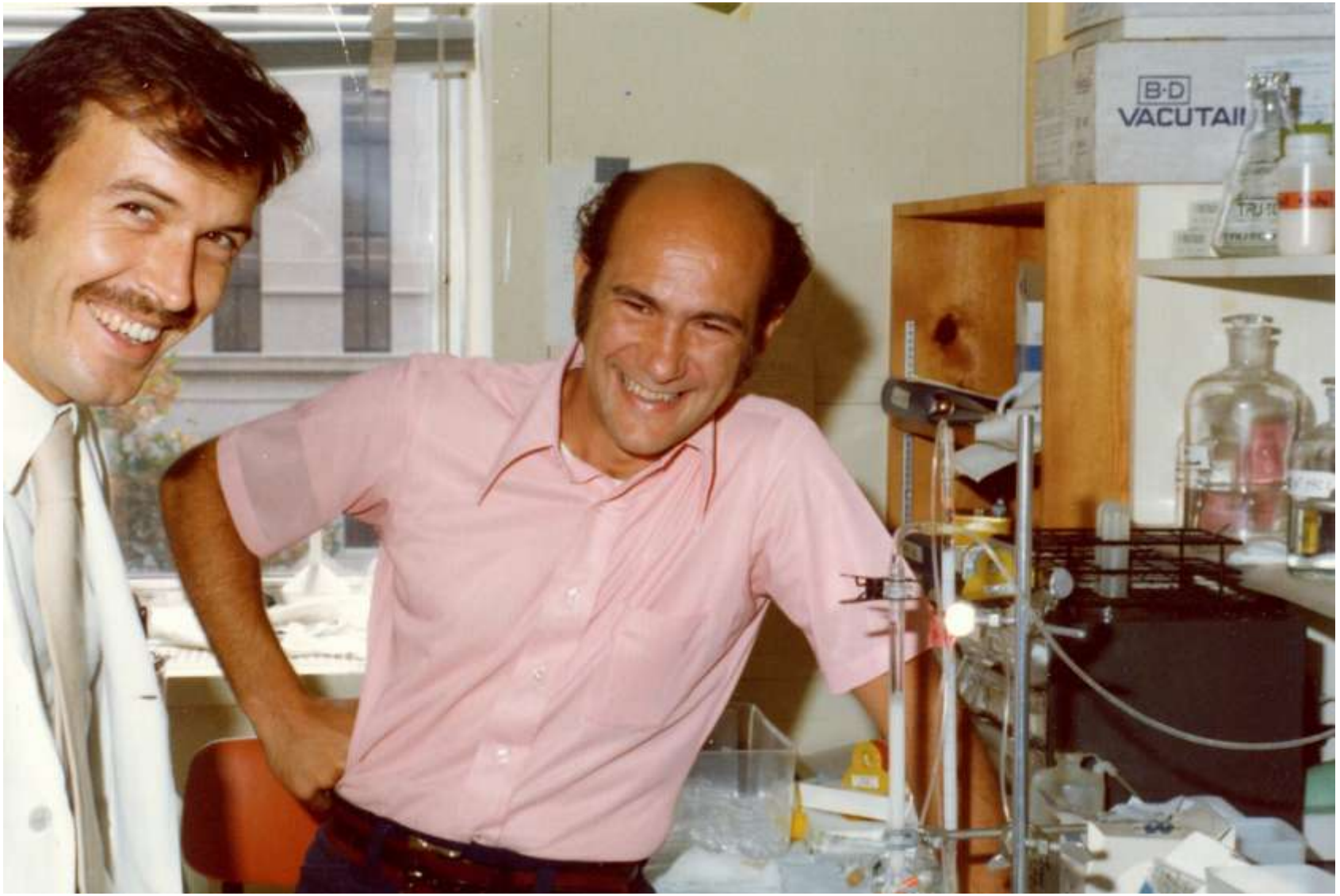
Linus Pauling, Ph.D.
Physical Chemist
California Inst
Technology

Linus Pauling

White House, 1962
Leading nuclear testing protest

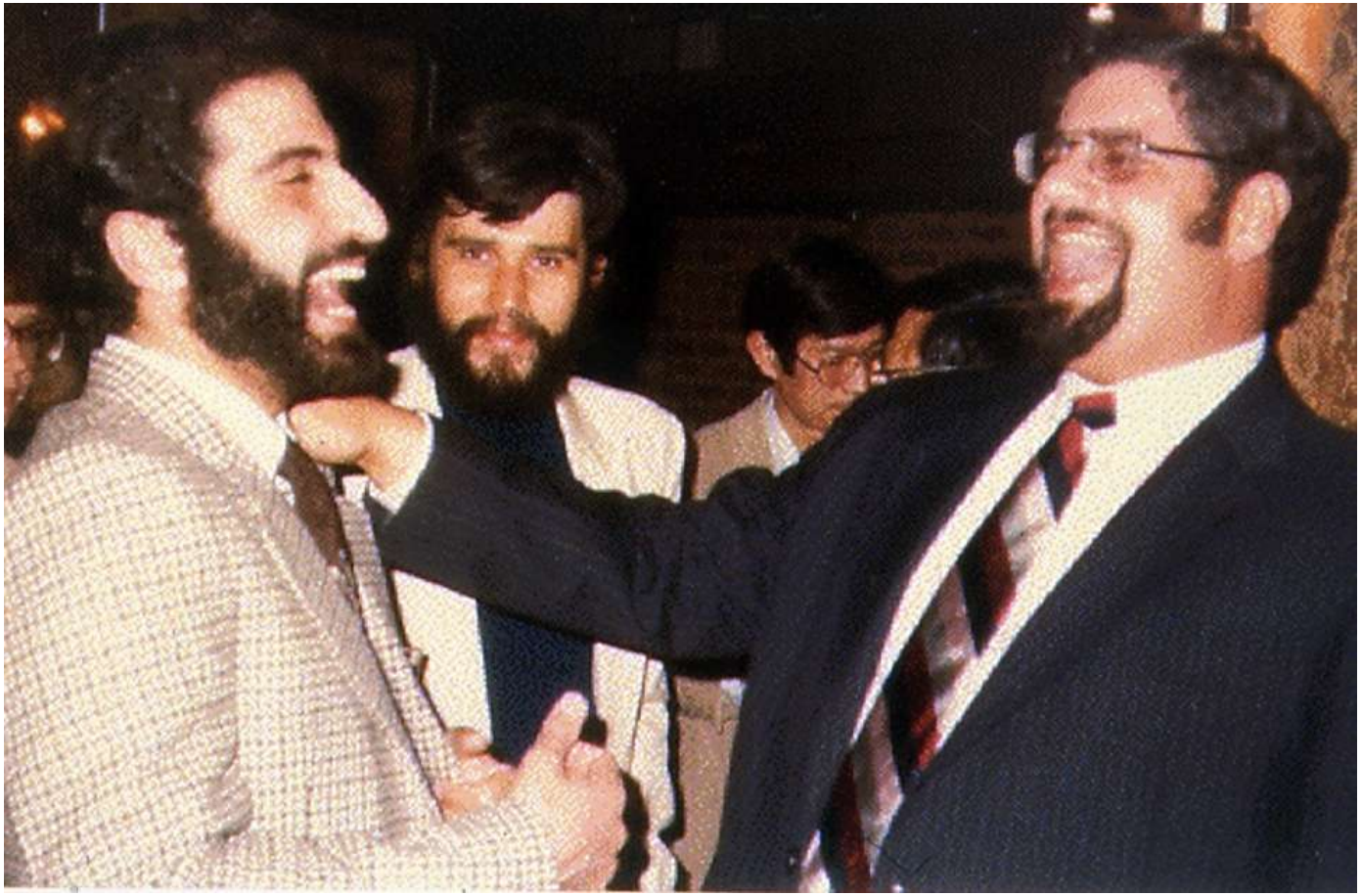
1954 Nobel Prize in Chemistry
1962 Nobel Peace Prize

en route to Johns Hopkins, 1970



Gianfredo and Pedro

Cuatrecasas Lab, 1974



Naji and Marvin

Science Diplomacy in the 21st Century

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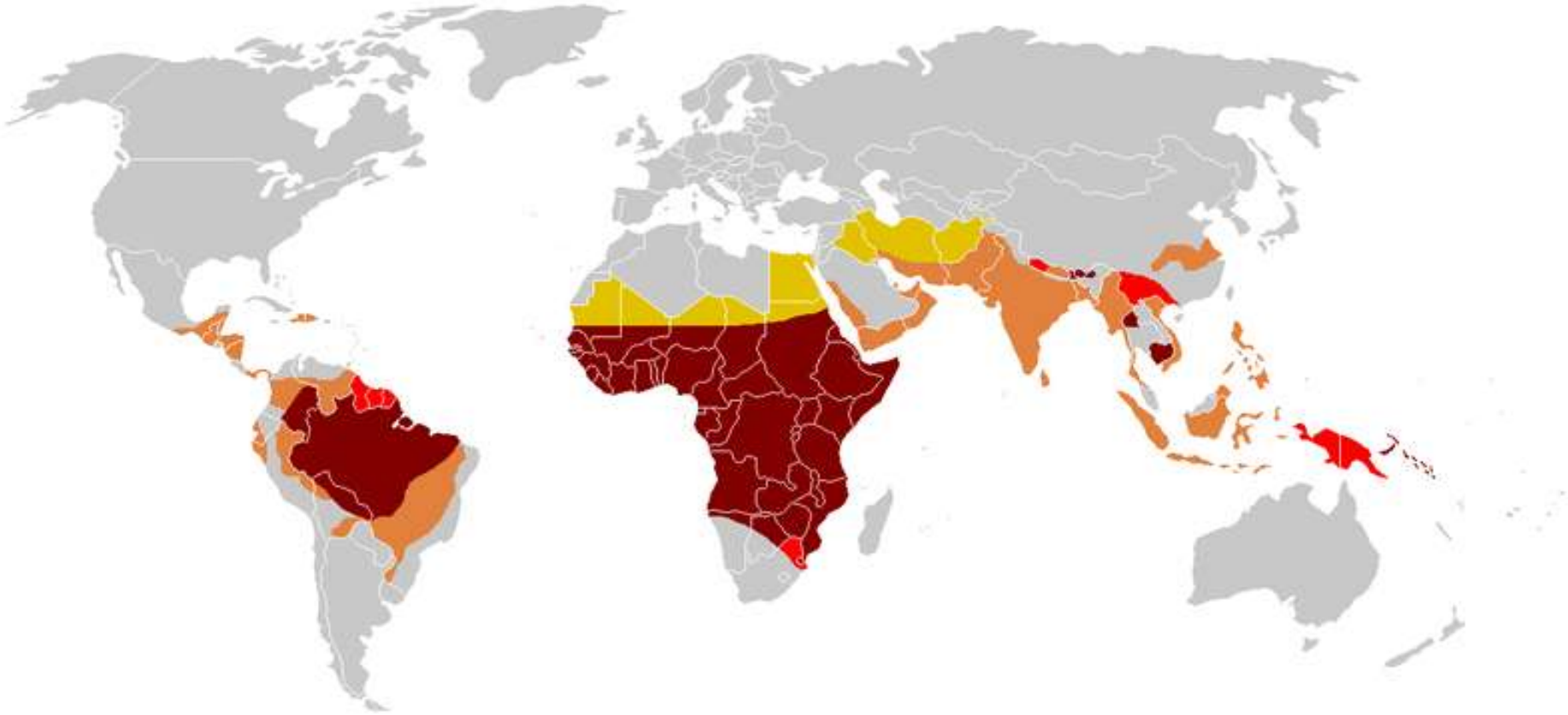
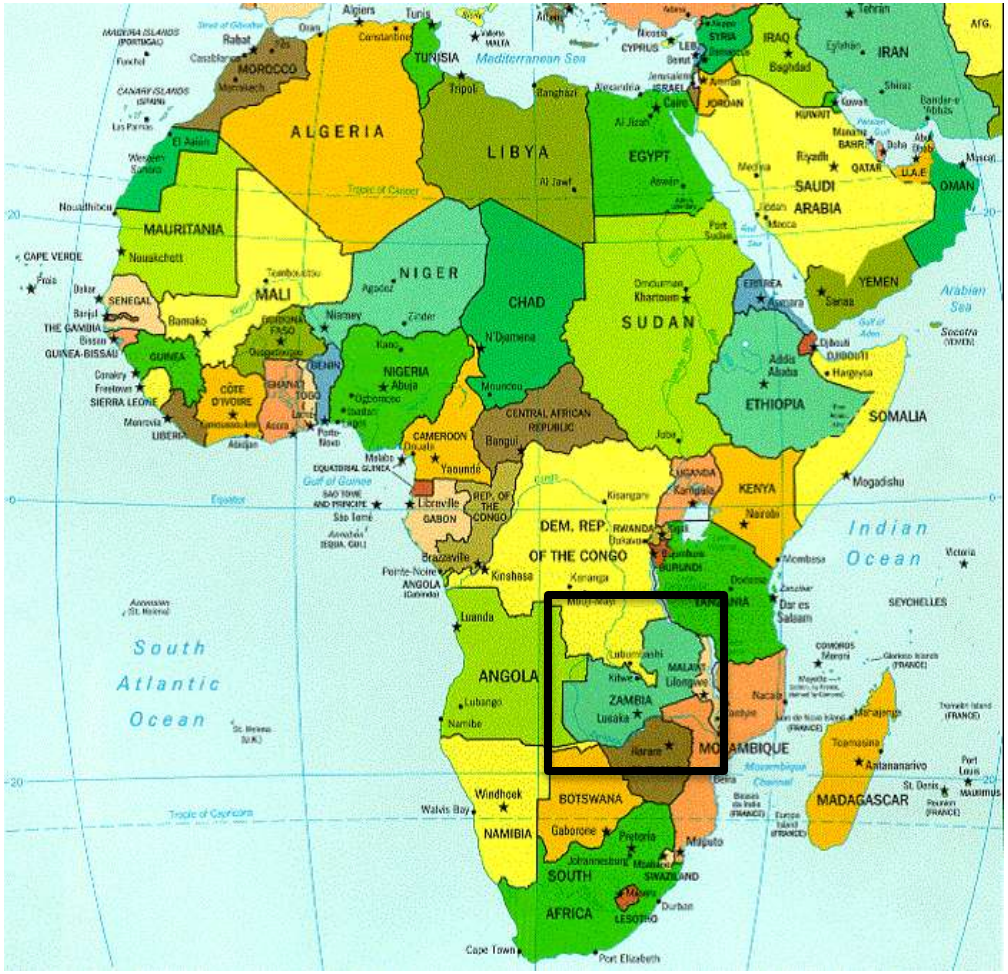
10 December 2003

World Malaria Map

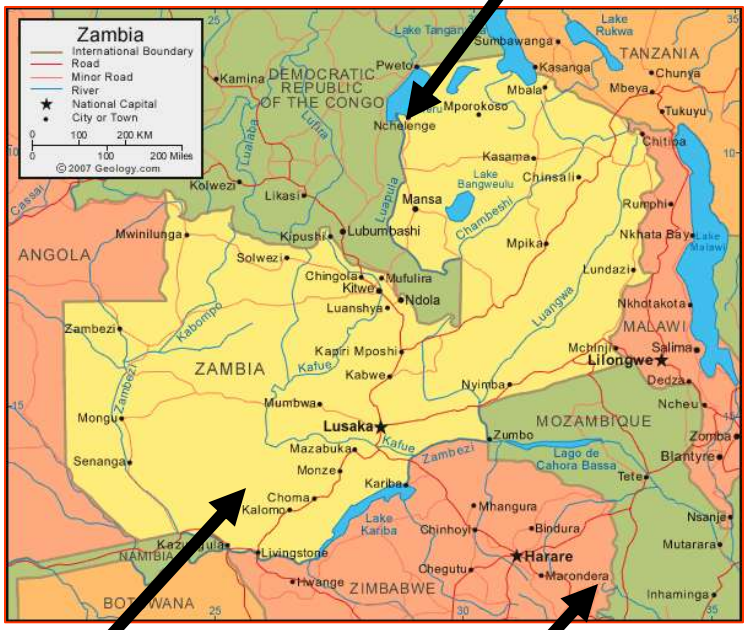
NIH International Centers of Excellence
for Malaria Research



International Center of Excellence for Malaria in Southern Africa

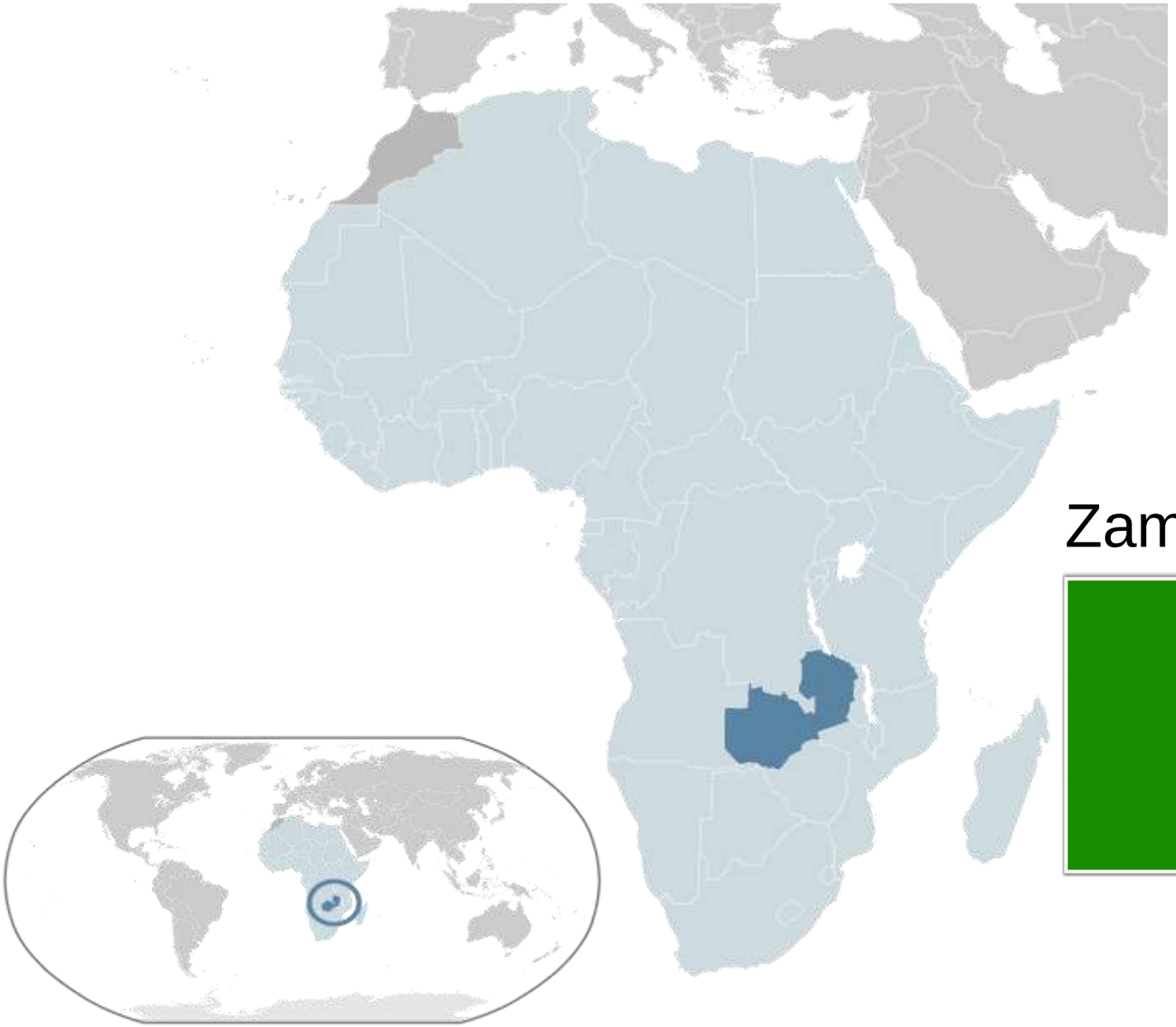


Nchelenge, ZM
Kilwa, DRC
Uncontrolled



Macha, ZM
Controlled

Mutasa, ZW
Resurgent

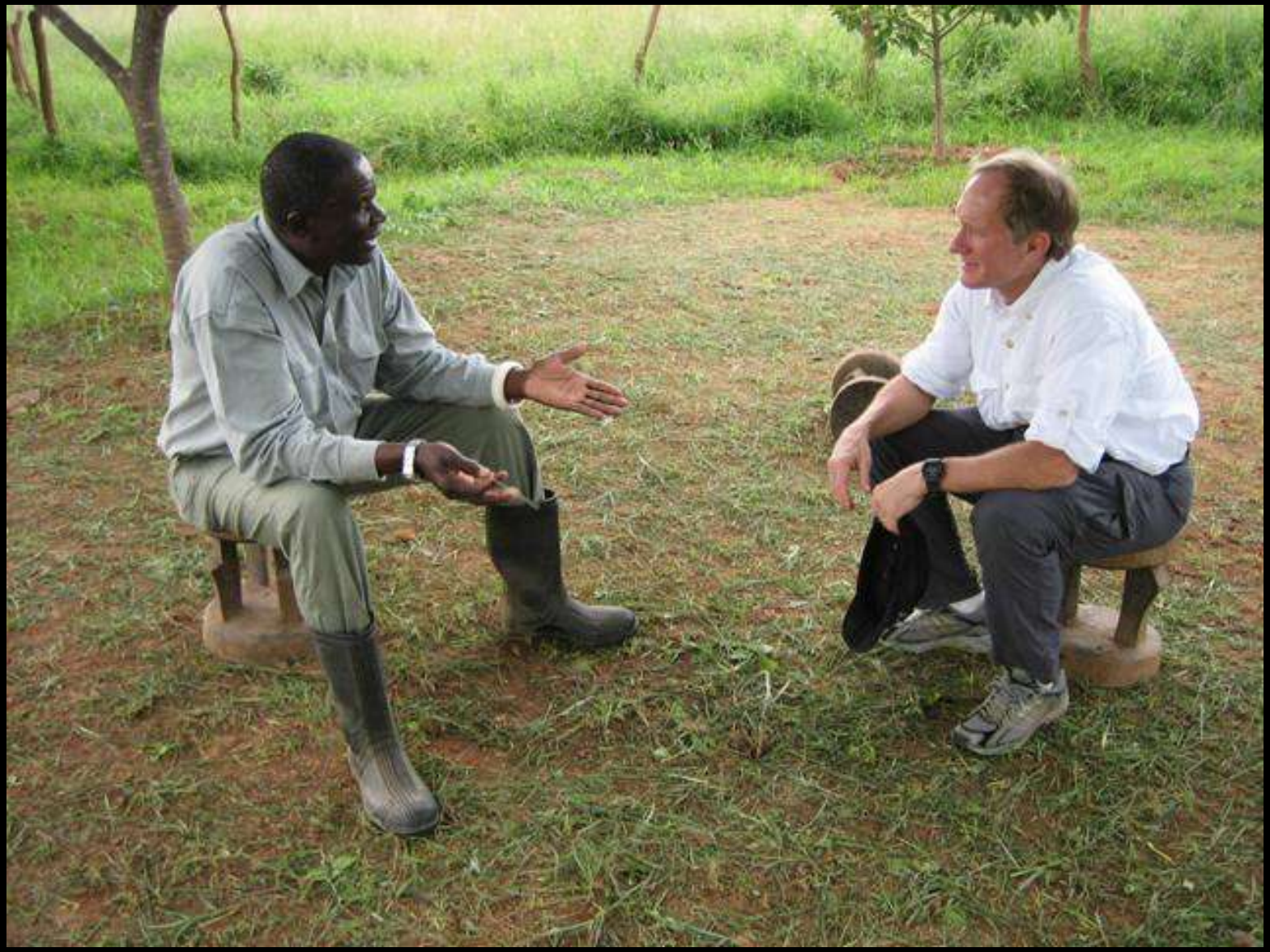


Zambia


J & J
COFFINS
& CASKETS
UNITURTLE AGENTS
SINMBE ENT
AUTO PARTS MOTOR BIKE SPARES
CANTER

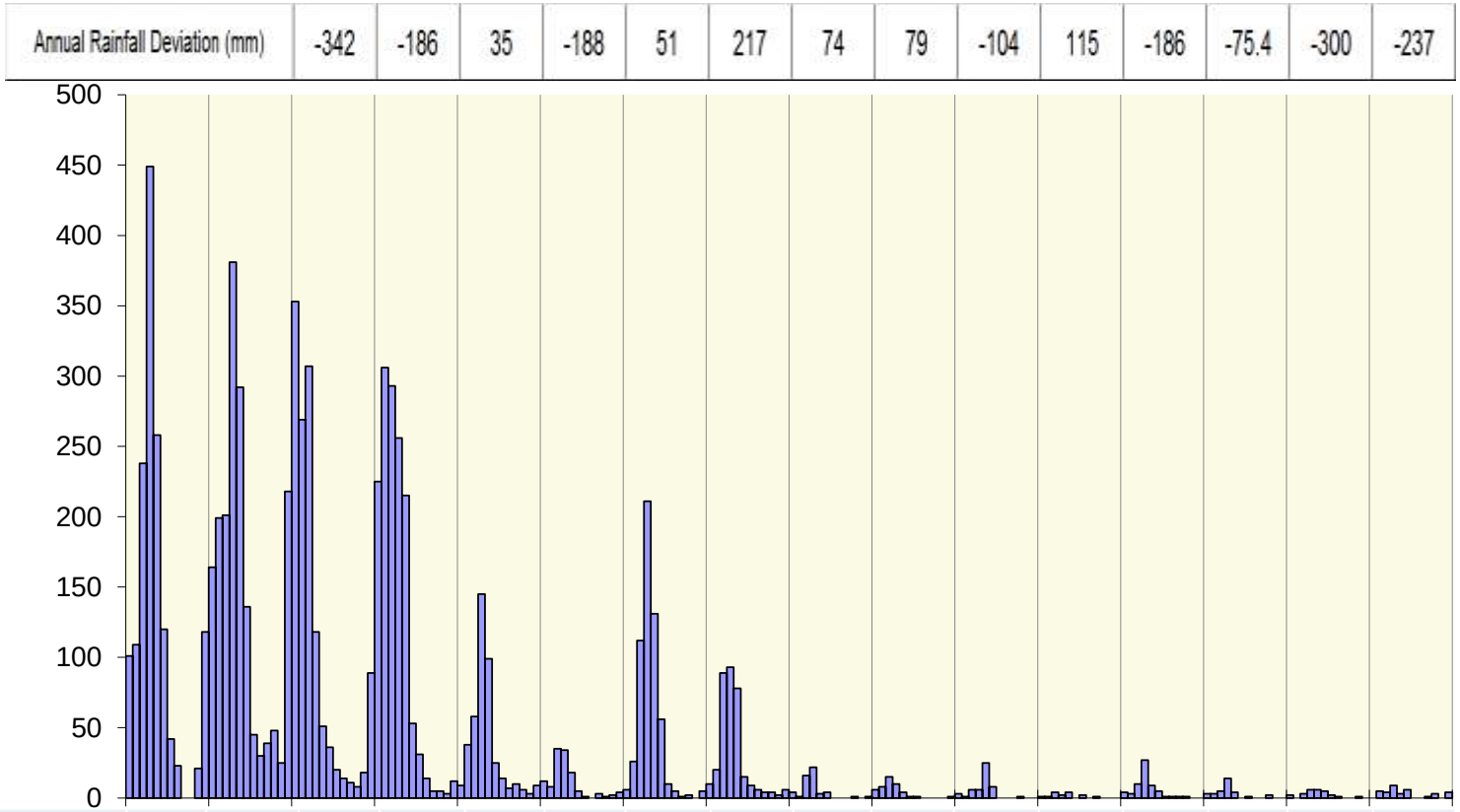
Children of rural Africa

Consequences of cerebral malaria




MALARIA INSTITUTE
AT MACHA
MACHA MALARIA
RESEARCH INSTITUTE
JHMRI
JOHNS HOPKINS MALARIA RESEARCH INSTITUTE

Child Malaria - Macha Hospital, Zambia



Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Malaria cases	1479	1778	1294	1418	423	123	565	336	52	46	50	15	62	32	26	35
Malaria Deaths	106	65	32	34	18	6	24	24	2	2	5	1	3	2	1	3

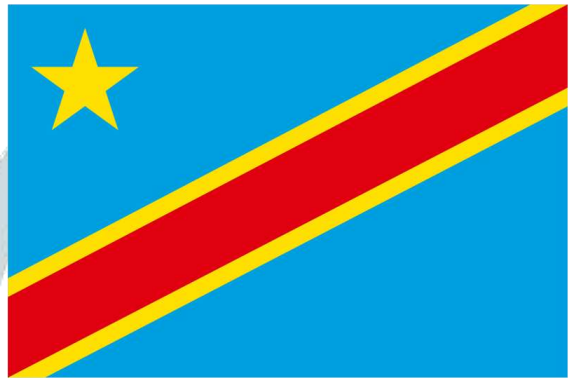

JHMRI
Johns Hopkins
Malaria Research
Institute


BOATS


MOH
GF
ORT


REBEL
71
GEAR

Dem Rep Congo




La Commande des
Syllabus de PEDIATRIE prendra
fin Ce Samedi 14/02/2015

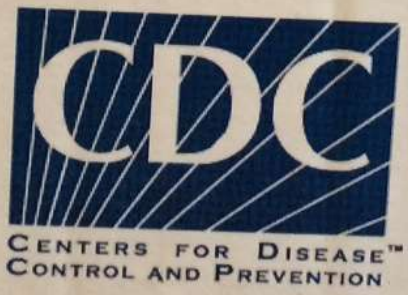

LUBUMBASHI

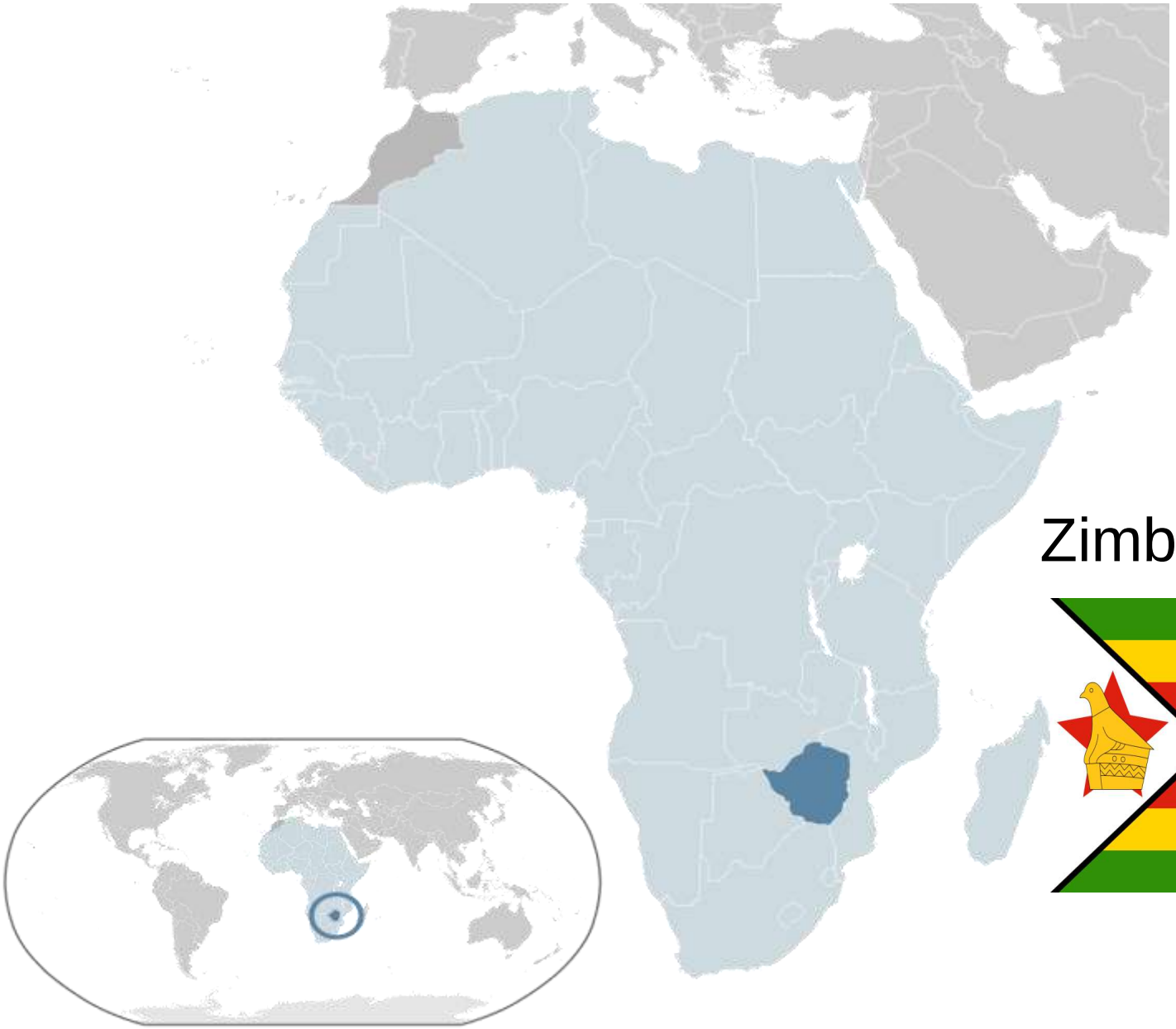

SITE
OF
HAMMARSKJÖLD
PLANE CRASH
18TH SEPTEMBER 1961

USAID

FROM THE AMERICAN PEOPLE

PRESIDENT'S MALARIA INITIATIVE





Zimbabwe

His Excellency, the President of the Republic of Zimbabwe, Cde. Robert Gabriel Mugabe


MUTERERE
HIGH SCHOOL
2512


ST. PETER'S CLINIC

Science Diplomacy in the 21st Century

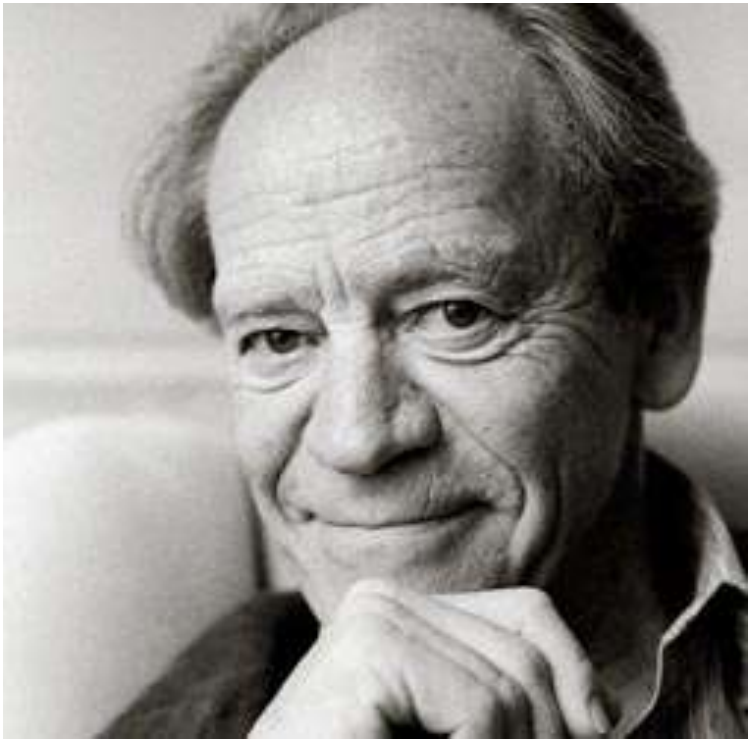
1. Scientific upbringing
2. Science as an international career
3. Science and human rights
4. Science diplomacy visits

U.S. National Academy of Sciences
Committee on Human Rights

Scientists, engineers,
and health professionals

Appeals and moral support

More than 600 cases resolved



Torsten Wiesel, MD
Chair 1996-2005

Egyptian sociologist, Saad Ibrahim, PhD
Released from prison, 2003

Bulgarian Nurses and Palestinian Physician On trial in Libya, 2005

Arrival in Bulgaria after release from Libyan prison, 2007

Indian Pediatrician, Dr. Binayak Sen
Released on bail 25 May 2009
Convicted with life sentence 24 Dec 2010

IPSO—Israeli Palestinian Science Organization

Founded 2006 to foster and sustain cooperation between scientists

Funds joint scientific research proposals

UNESCO Affiliate

Menahem Yaari, PhD (Stanford)
President Israeli Academy of Science and Humanities

Sari Nusseibeh, PhD (Harvard)
President Al Quds University

Science Diplomacy in the 21st Century

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AAAS
ADVANCING SCIENCE, SERVING SOCIETY

AAAS Center for Science Diplomacy

Vaughan Turekian PhD, Director

Cuba

Myanmar (Burma)

Iran

DPRK (North Korea)

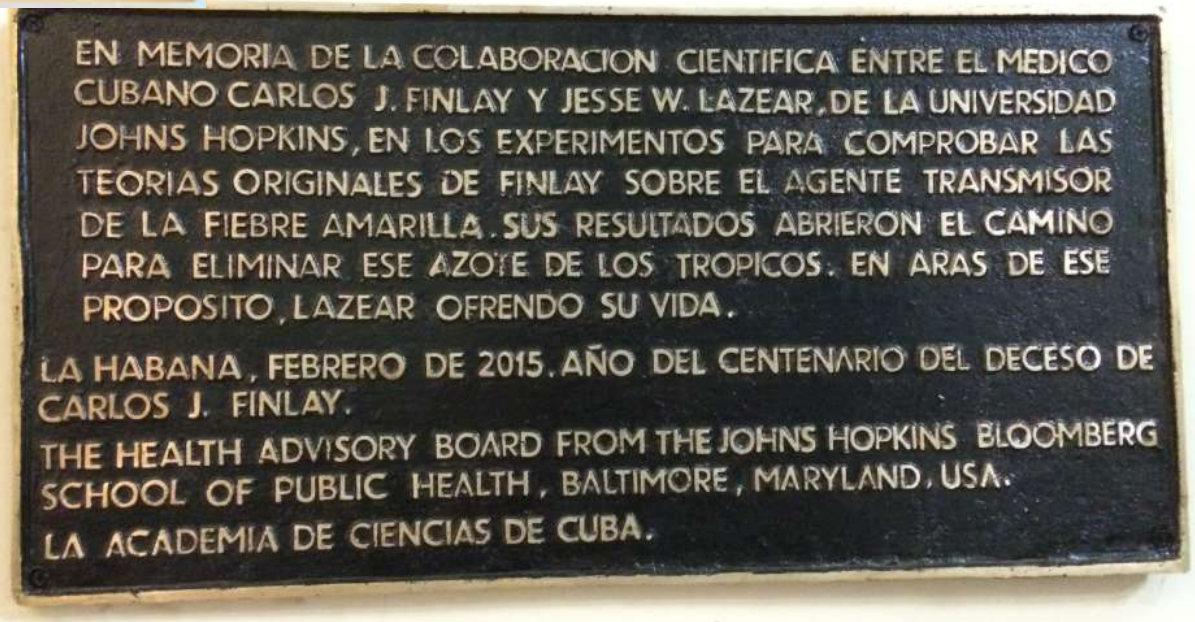
Cuba

1900 Yellow Fever Commission in Havana

Carlos Finlay 1833-1915

Jesse Lazear 1866-1900


IN MEMORY OF
JESSE WILLIAM LAZEAR
BORN 2 MAY 1866 AT BALTIMORE
GRADUATED IN ARTS AT
THE JOHNS HOPKINS UNIVERSITY IN 1889
AND IN MEDICINE AT COLUMBIA UNIVERSITY IN 1892
IN 1895-96 ASSISTANT RESIDENT PHYSICIAN
IN THE JOHNS HOPKINS HOSPITAL
MEMBER OF THE YELLOW FEVER COMMISSION IN 1900
WITH THE RANK OF ACTING ASSISTANT SURGEON
HE DIED OF YELLOW FEVER AT QUEMADOS CUBA
25 SEPTEMBER 1900.
WITH MORE THAN THE COURAGE AND DEVOTION OF THE SOLDIER HE RISKED AND LOST HIS LIFE TO SHOW HOW A FEARFUL PESTILENCE IS COMMUNICATED AND HOW ITS RAVAGES MAY BE PREVENTED.


EN MEMORIA DE LA COLABORACION CIENTIFICA ENTRE EL MEDICO CUBANO CARLOS J. FINLAY Y JESSE W. LAZEAR, DE LA UNIVERSIDAD JOHNS HOPKINS, EN LOS EXPERIMENTOS PARA COMPROBAR LAS TEORIAS ORIGINALES DE FINLAY SOBRE EL AGENTE TRANSMISOR DE LA FIEBRE AMARILLA. SUS RESULTADOS ABRIERON EL CAMINO PARA ELIMINAR ESE AZOTE DE LOS TROPICOS. EN ARAS DE ESE PROPOSITO, LAZEAR OFRENDO SU VIDA.
LA HABANA, FEBRERO DE 2015. AÑO DEL CENTENARIO DEL DECESO DE CARLOS J. FINLAY.
THE HEALTH ADVISORY BOARD FROM THE JOHNS HOPKINS BLOOMBERG SCHOOL OF PUBLIC HEALTH, BALTIMORE, MARYLAND, USA.
LA ACADEMIA DE CIENCIAS DE CUBA.


Te vemos cada día
... puro como un niño
o como un hombre puro,
Che Comandante, amigo

Havana Cuba


CUBA
BDM461
3

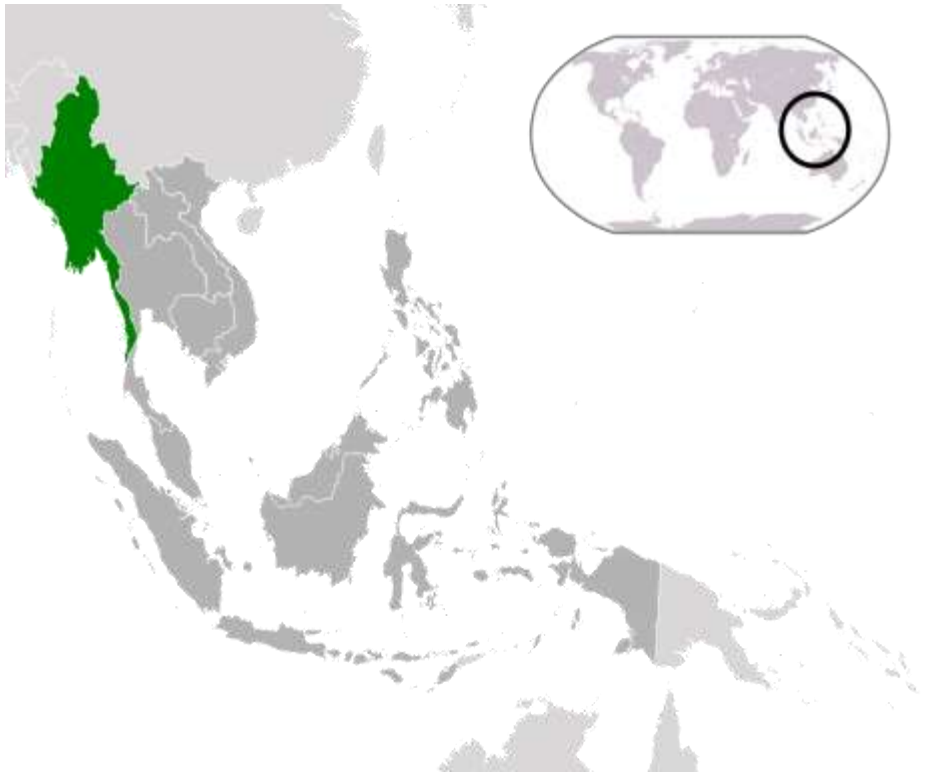
Faces of Cuban Science


adidas


adidas

Universidad de la Habana

Universidad de la Habana



Myanmar (Burma)


TAKE
CARE


๑๑

Islamic Republic of Iran


THE SONS OF ADAM
ARE ALL LIMBS OF
ONE ANOTHER
Rassam Arabzadeh
The Innovator of Persian Rugs


ریاست جمهوری
معاونت علمی فناوری
بنیاد نخبگان
مراسم سخنرانی پروفسور
پیتر آگرا
استاد دانشگاه و رییس مرکز تحقیقات
مالاریای دانشگاه جانز هاپکینز
برنده جایزه نوبل شیمی سال ۲۰۰۳
بنیاد نخبگان که الحمدلله
تلاش های خوبی دارد؛ همین
جور باید دنبال کند. ما بایستی
این جریان نوآور جامعه را که به
معنای واقعی کلمه مشغول
خلاقیت است تقویت کنیم.

ایران و امریکا راه پیشرفت مذاکرات را بررسی می کنند

تلاش برای گشودن گره‌های «فنی» مذاکرات

DPR Korea


ACING


조선민주주의인민공화국
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA
No. 99306142
이름 Name 아그레 피터 커틀랜드
사증종류 Type of visa 일반/왕복
성별 Sex 남
국적 Nationality 미국
생년월일 Brith date 1949. 01. 30
려권번호 Passport No 212358875
목적지 Destination 평양
동반자 Children
평양, 신의주, 두만강
1(일) 개월 Month
체류일수 Duration of stay 7 일간
베이징
날자 2009. 12. 09
풍인
수표

Pyongyang DPRK


백두의혁명정신

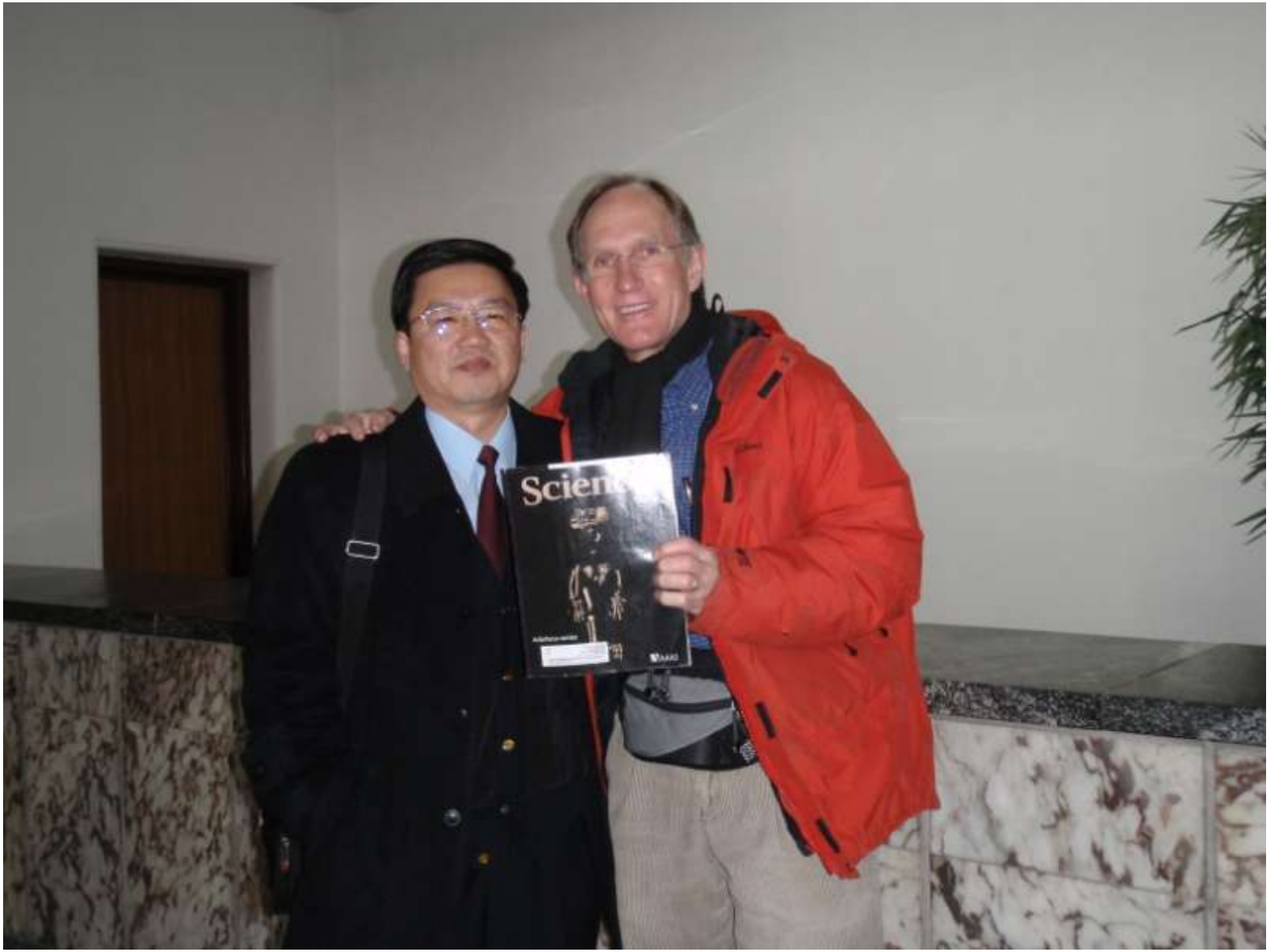
“Juche” – Korean self reliance

동무는
선군시대공로자들처럼살고있는가?

Kim Jong Il and Kim Il Song

US-DPRK Science Engagement Consortium


2001. 9. 19


Scien

Faces of North Korean Science

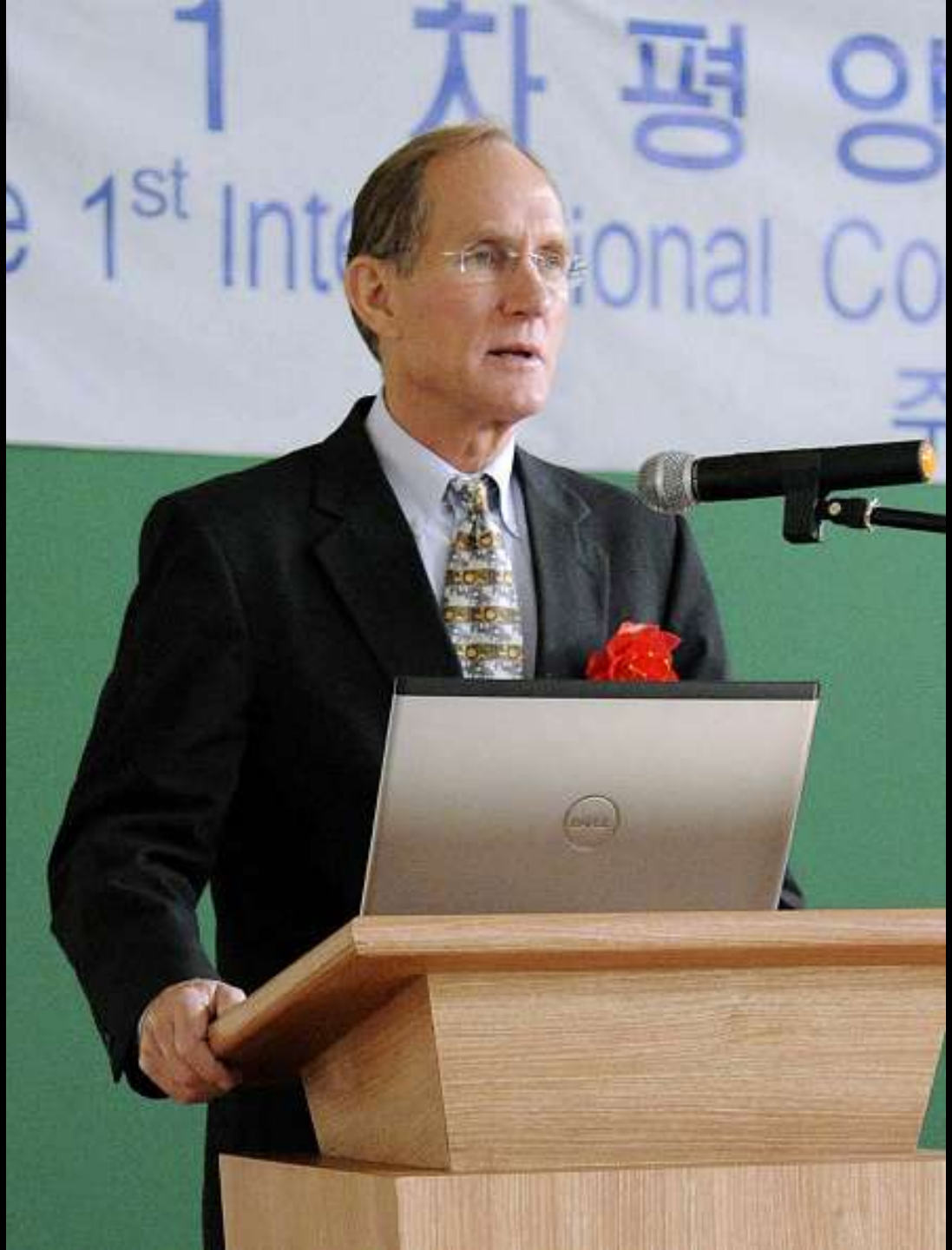
Faces of North Korean Science

Faces of North Korean Science

Faces of North Korean Science

Pyongyang University of Science and Technology

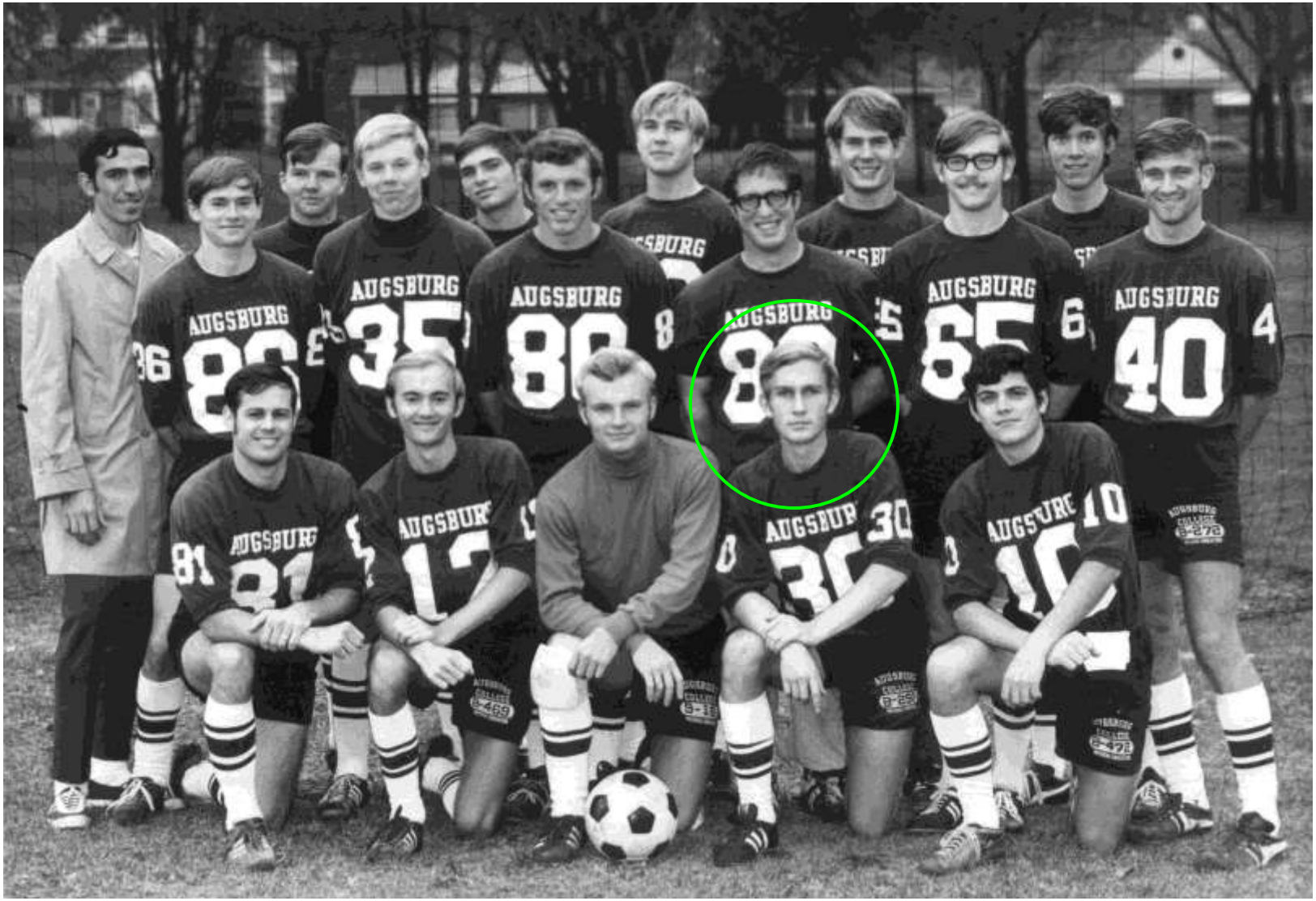

自动门


1 차 평 양
e 1st Inte ional Co

Wei Ji

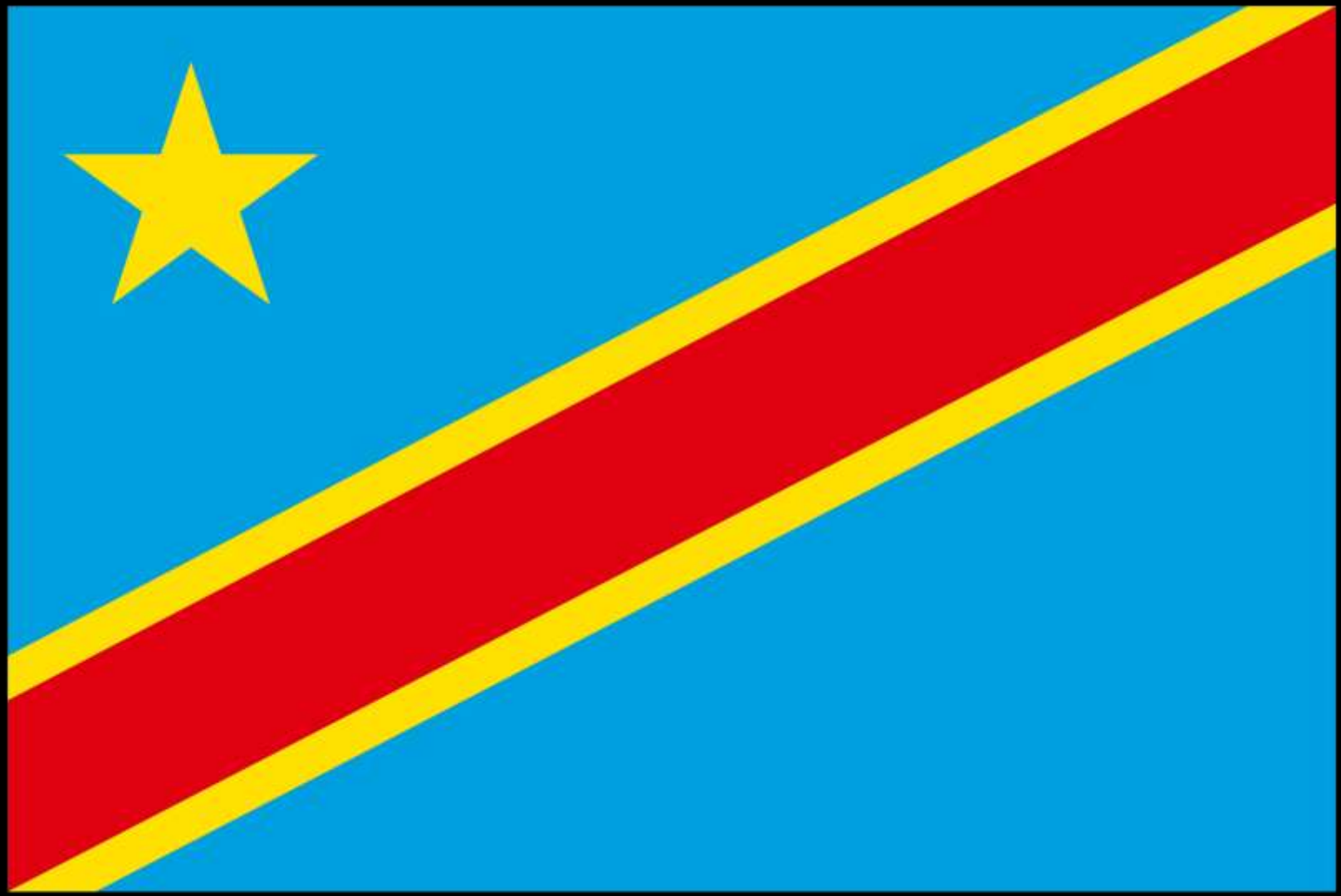
Mandarin for “crisis”

danger opportunity



Augsburg Men’s Soccer Team, 1969

Minnesotan Origins, 1965

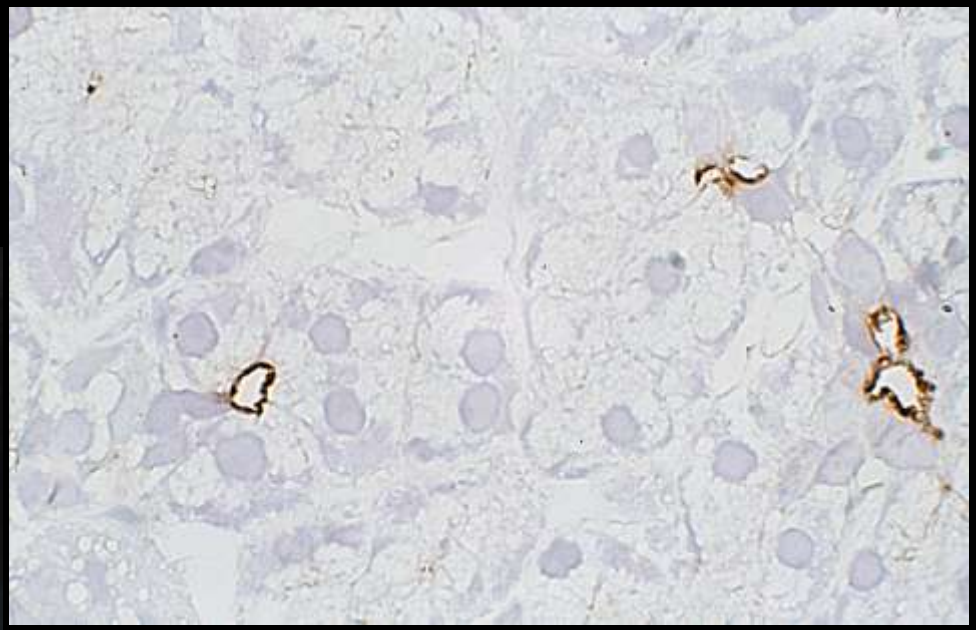


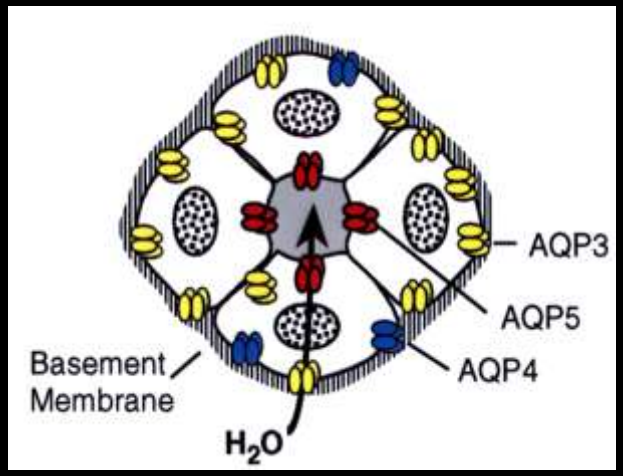
AQP5—Secretory glands

cDNA cloned from salivary gland
Lacrimal, submucosal, and
sweat glands

Type 1 pneumocytes

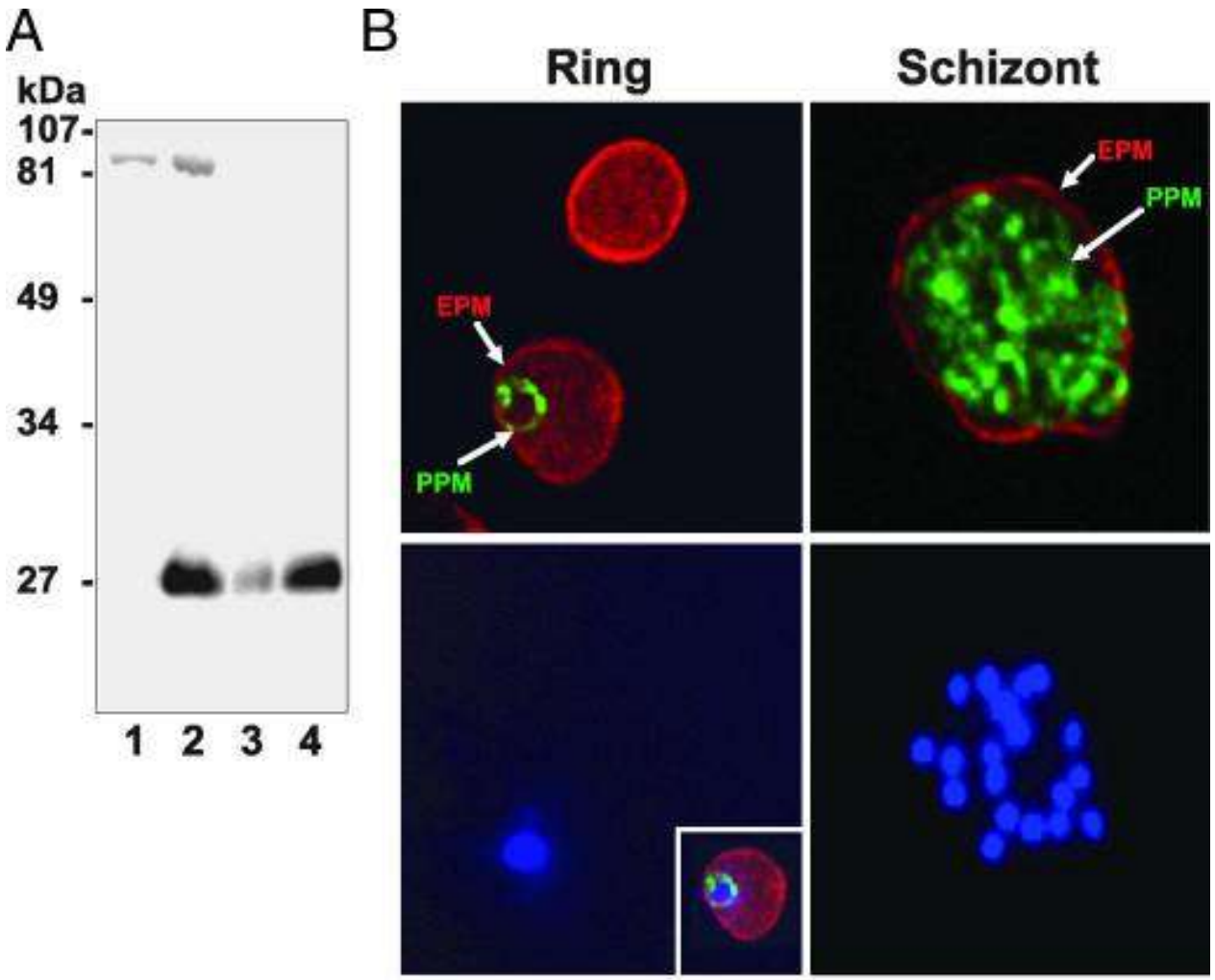
Raina *et al., J Biol Chem,* 1995





Nielsen *et al., Am J Physiol,* 1997

Aquaglyceroporin PbAQP increases malaria virulence



Promeneur, Liu *et al., Proc Natl Acad Sci,* 2007

Aquaporin water channels

Freely permeated by H_2O, not H_3O^+

Certain homologs permeated by
glycerol, nitrate, or arsenite

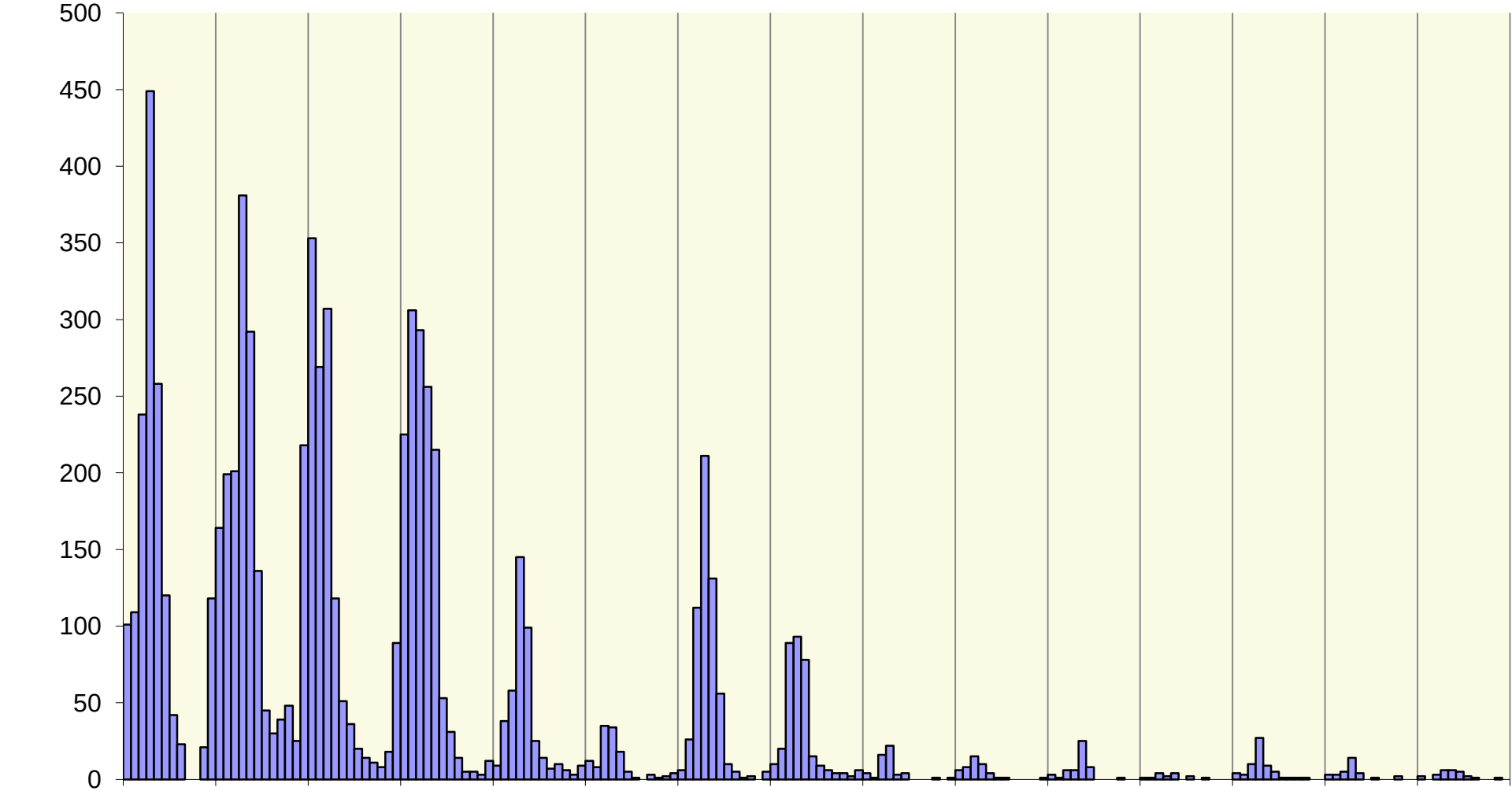
Structural models explain functions

Implicated in multiple clinical disorders
- Renal-vascular diseases
- Loss of vision
- Brain injury and edema
- Hyperthermia
- Starvation and obesity
- Malaria and infectious diseases
- Arsenic toxicity

Expressed throughout nature

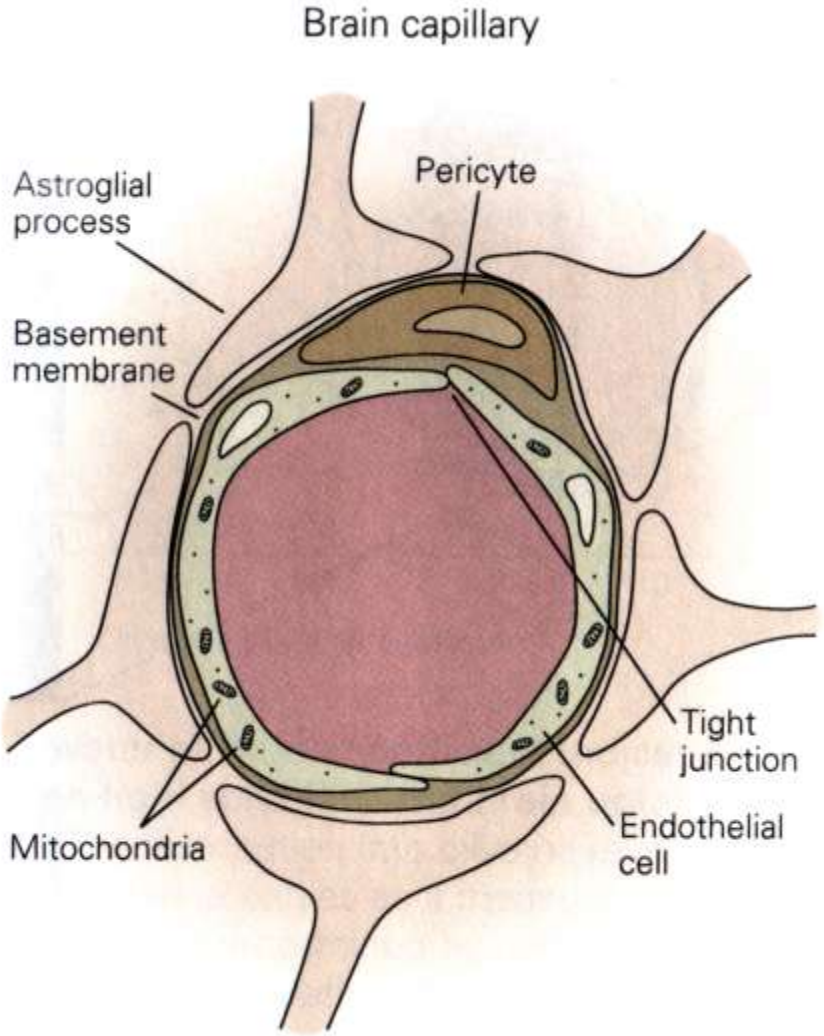
Child Malaria - Macha Hospital, Zambia

Annual Rainfall Deviation (mm)	-342	-186	35	-188	51	217	74	79	-104	115	-186	-75.4	-300



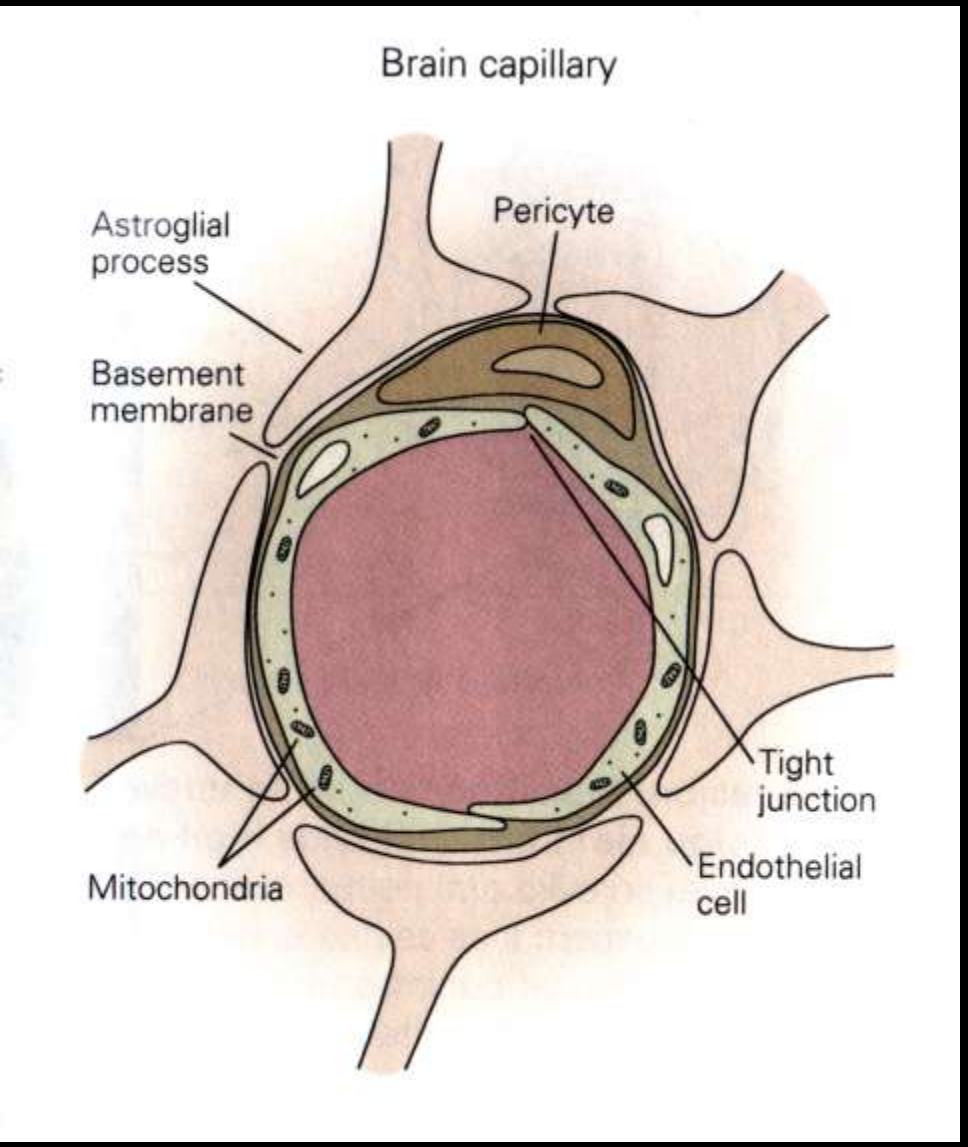
Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Malaria Cases	1479	1778	1294	1418	423	123	565	336	52	46	50	15	62	32	26
Malaria Deaths	106	65	32	34	18	6	24	24	2	2	5	1	3	2	1

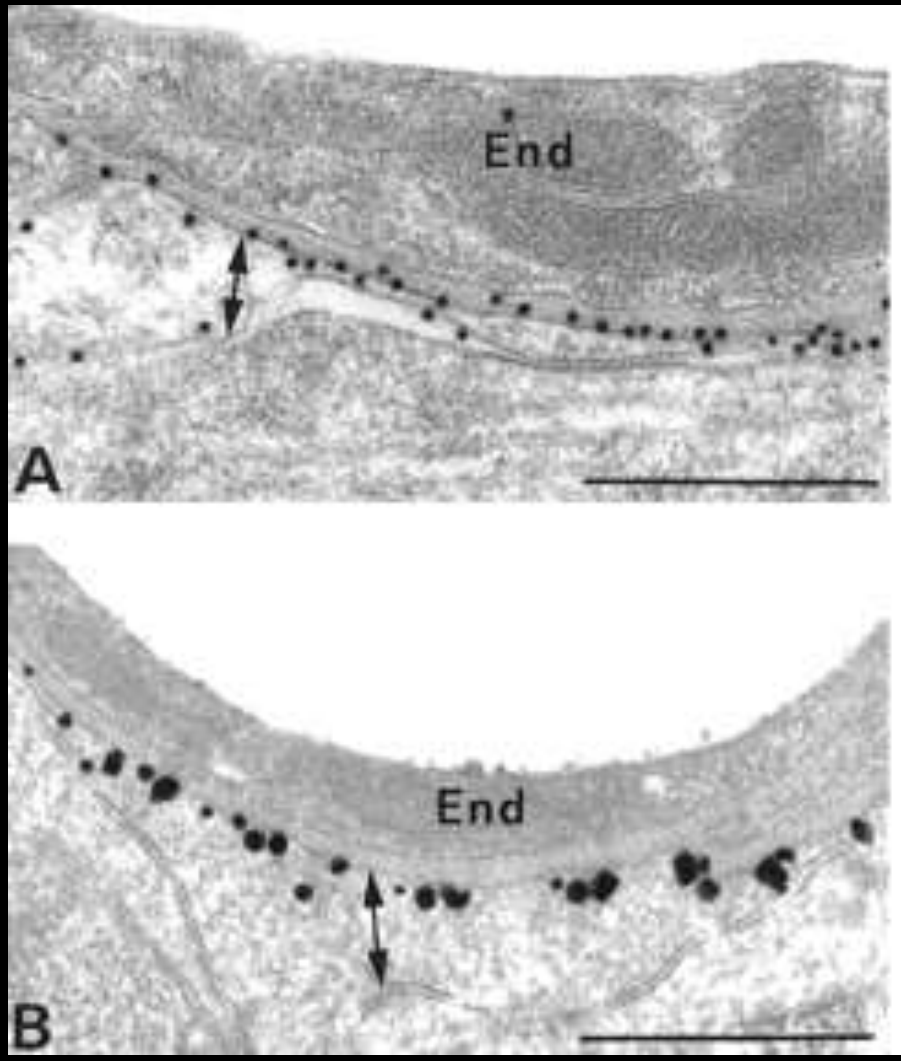
AQP4 water channel in brain



Nielsen *et al., J Neurosci* 1997

AQP4—Blood brain barrier
(with Ole Petter Ottersen, Oslo)

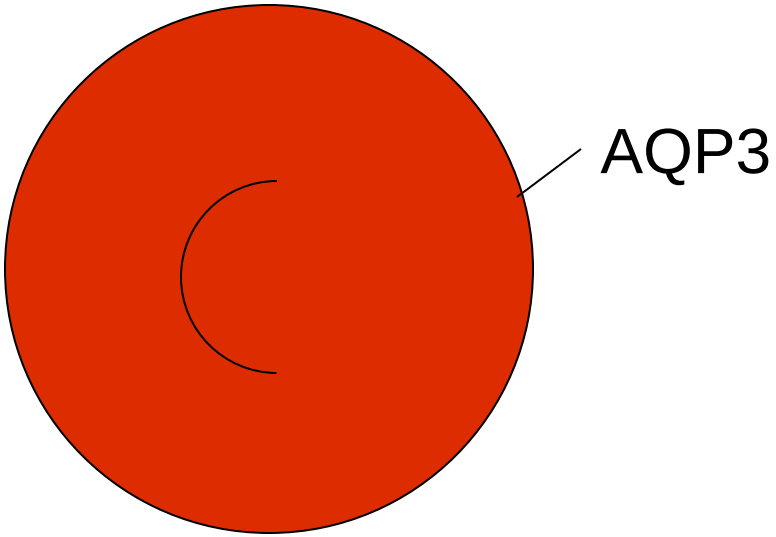




Nielsen *et al.*, *J Neurosci*, 1997
Nagelhus *et al.*, *J Neurosci*, 1998

Aquaglyceroporin—AQP3 in red cells

Pathway for glycerol transport
Site of high frequency GIL antigen
AQP3-null humans

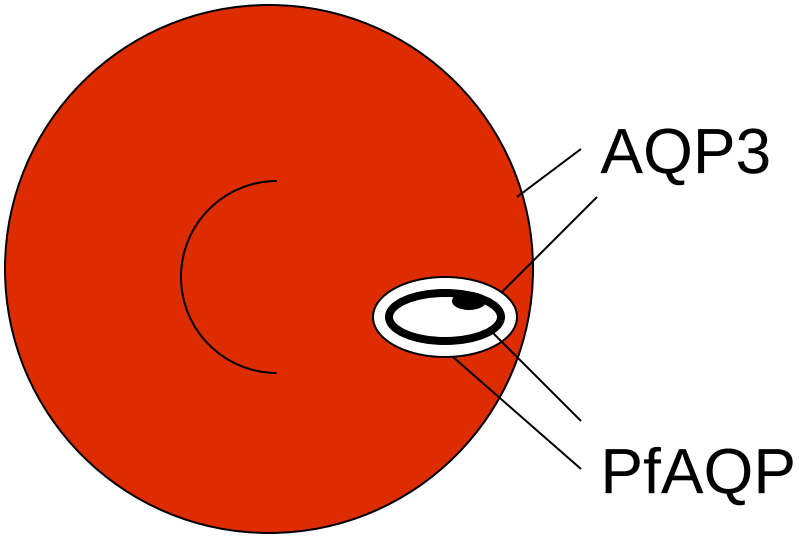


Roudier *et al., J Biol Chem,* 2002a,b

Aquaglyceroporins in malaria

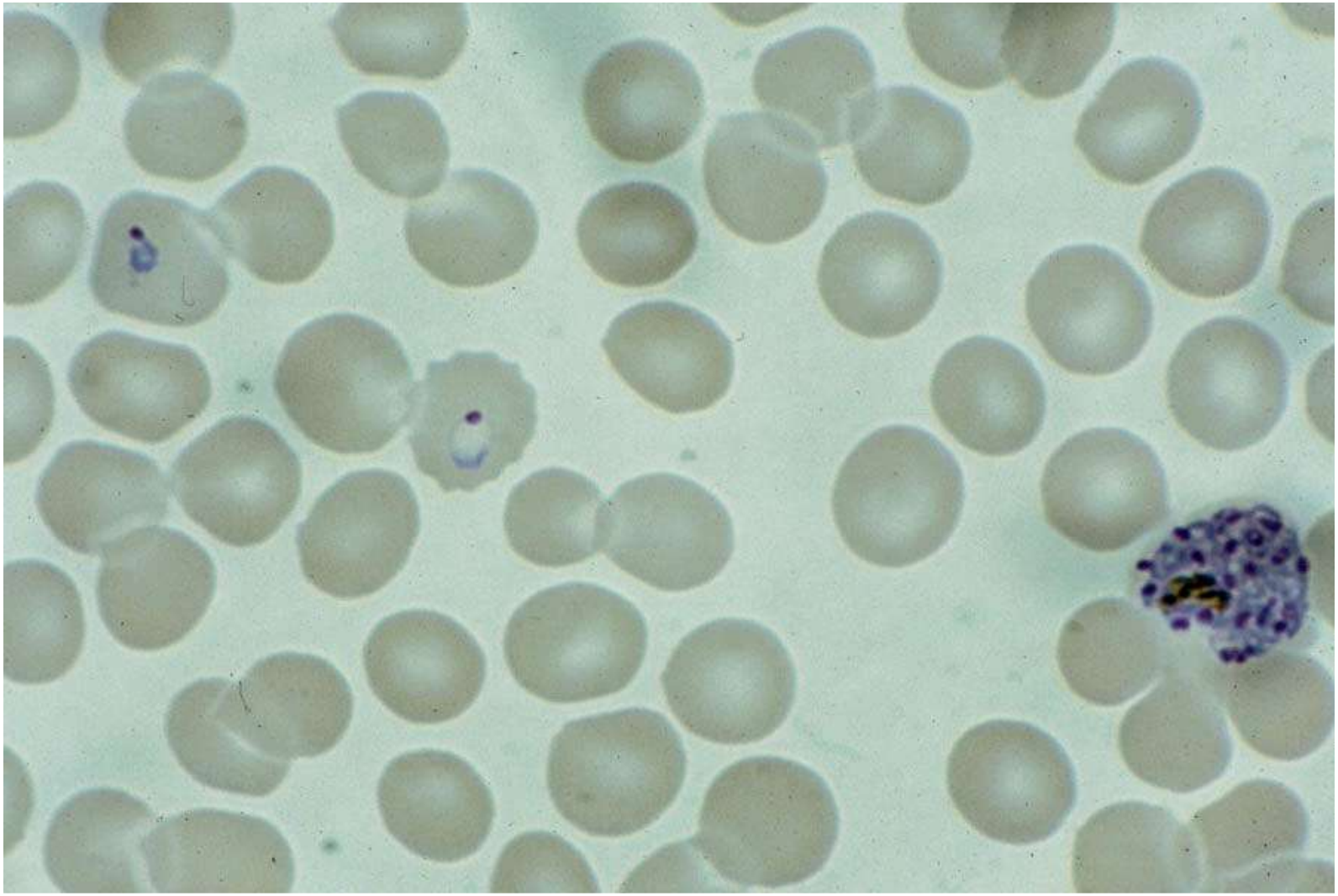
Pathway for glycerol transport

PM, PVM, PPM



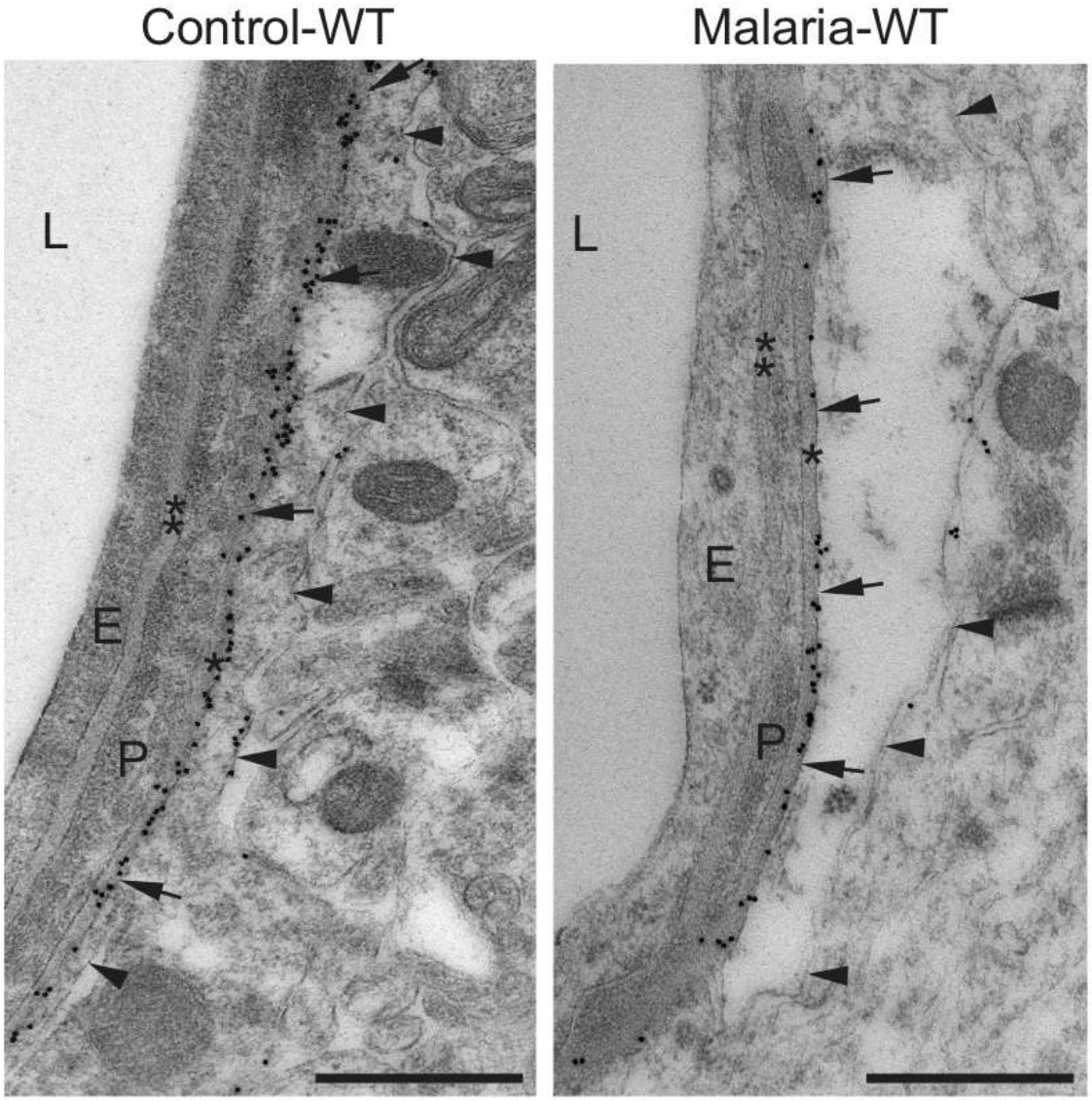
Hansen *et al., J Biol Chem,* 2002
Beitz, Pavlovic-Djuranovic *et al., Proc Natl Acad Sci,* 2004
Promeneur, Liu *et al., Proc Natl Acad Sci,* 2007

Plasmodium infected red blood cells

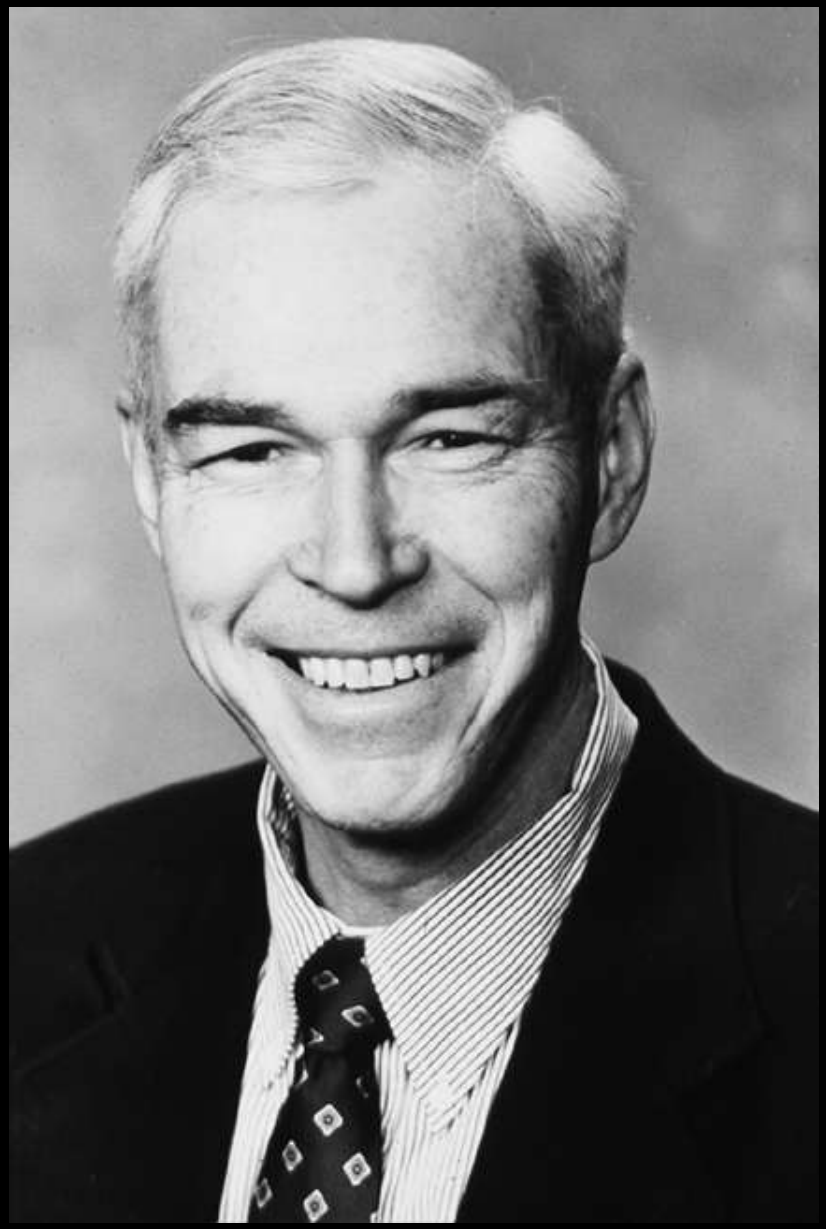


Anopheles gambiae

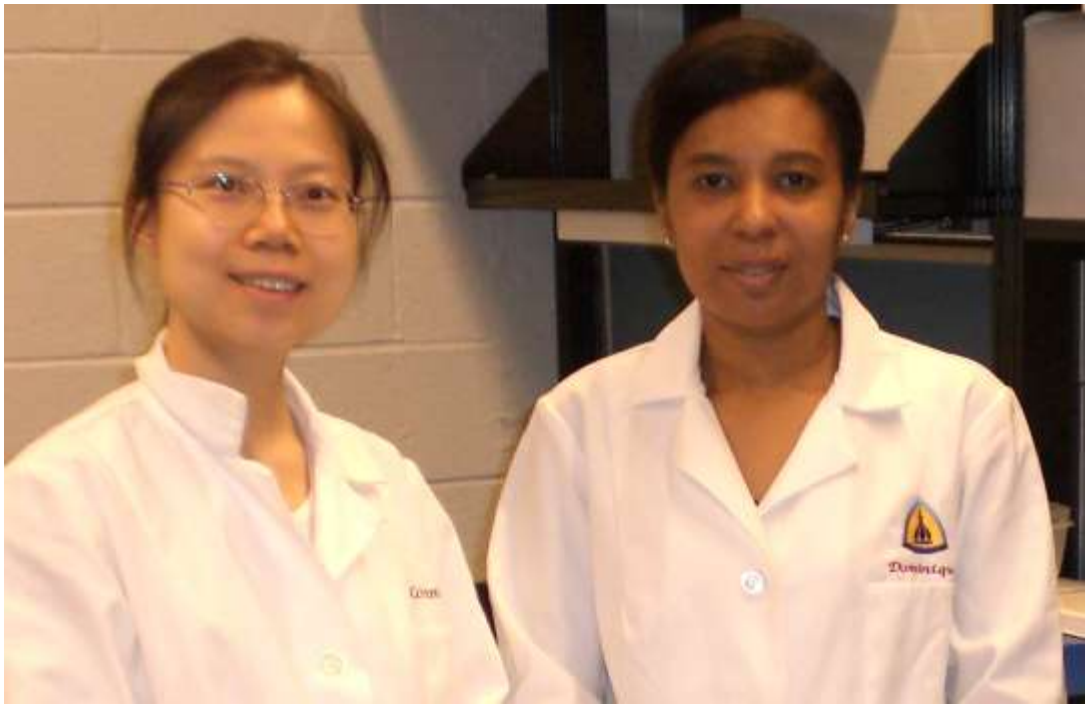
Aquaporin-4 in murine cerebral malaria



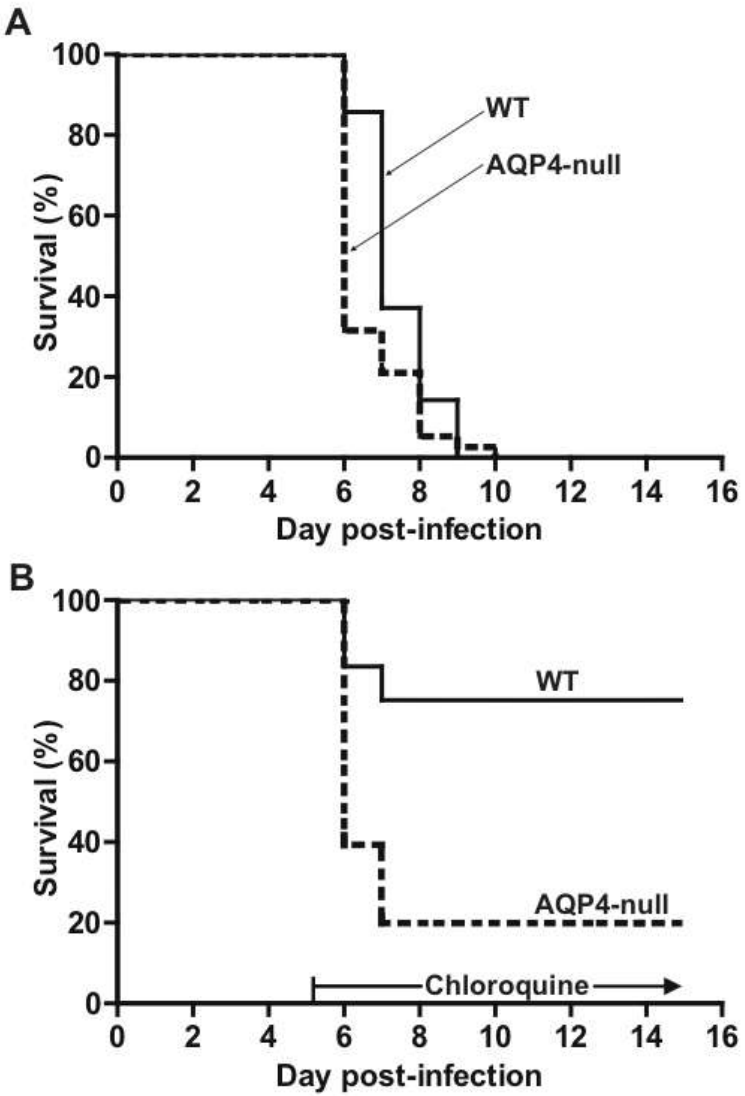
Promeneur *et al., Proc Natl Acad Sci,* 2013



John C. Parker, M.D. 1935-1993

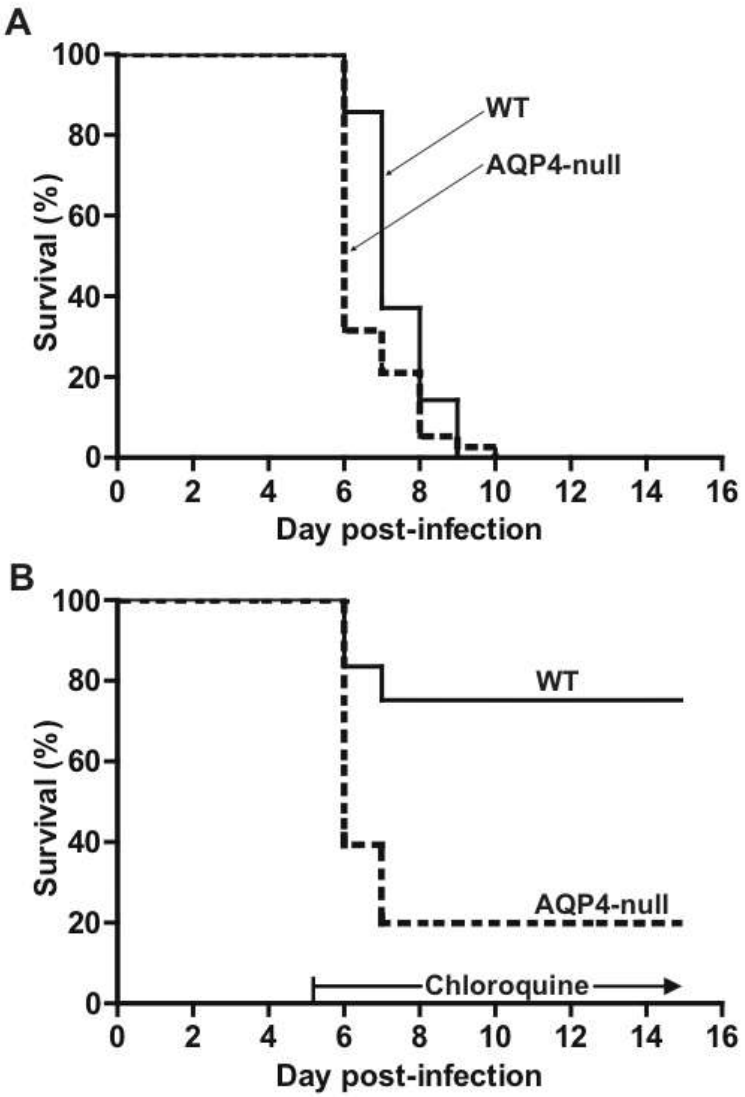


Aquaporin-4 in murine cerebral malaria



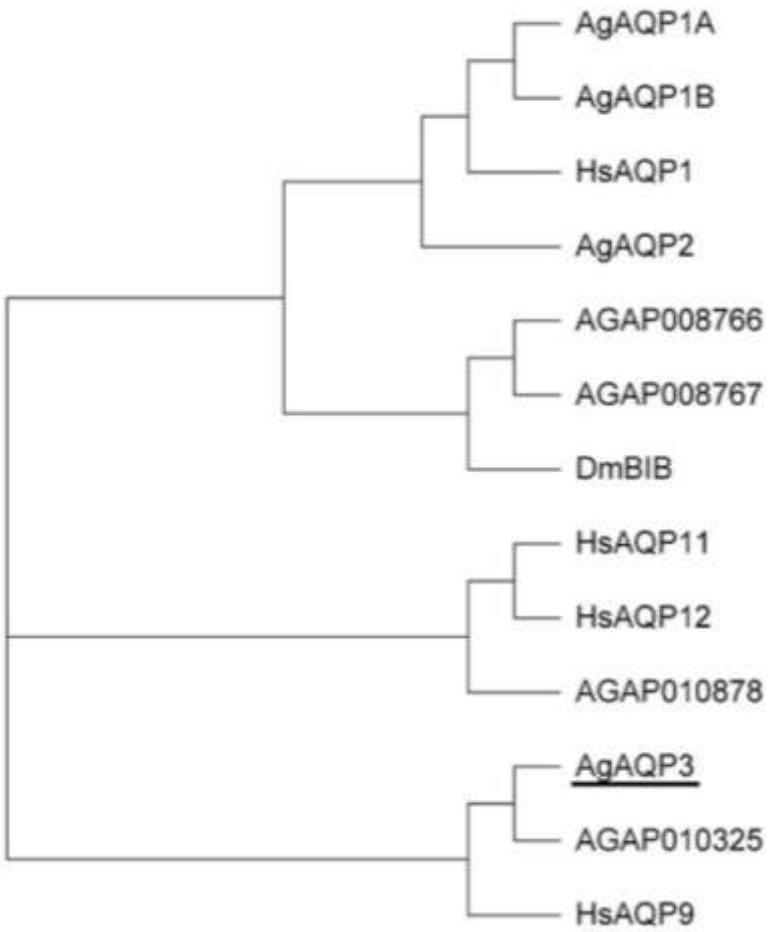
Promeneur *et al., Proc Natl Acad Sci,* 2013

Aquaporin-4 in murine cerebral malaria



Promeneur *et al., Proc Natl Acad Sci,* 2013

Aquaporins in *Anopheles gambiae*



water transport

uncertain

incompletely defined

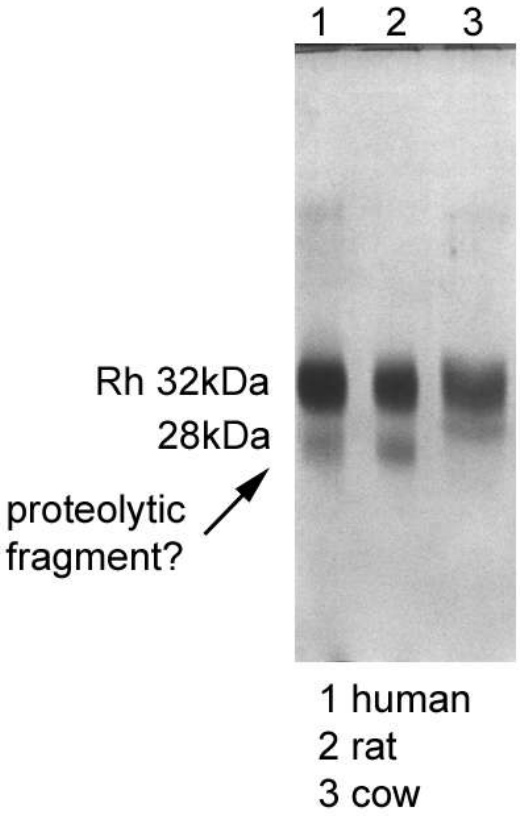
water + glycerol transport

Liu *et al., Proc Natl Acad Sci,* 2011
Tsujimoto *et al., PLoS One,* 2013
Liu *et al., Biol Cell,* 2016

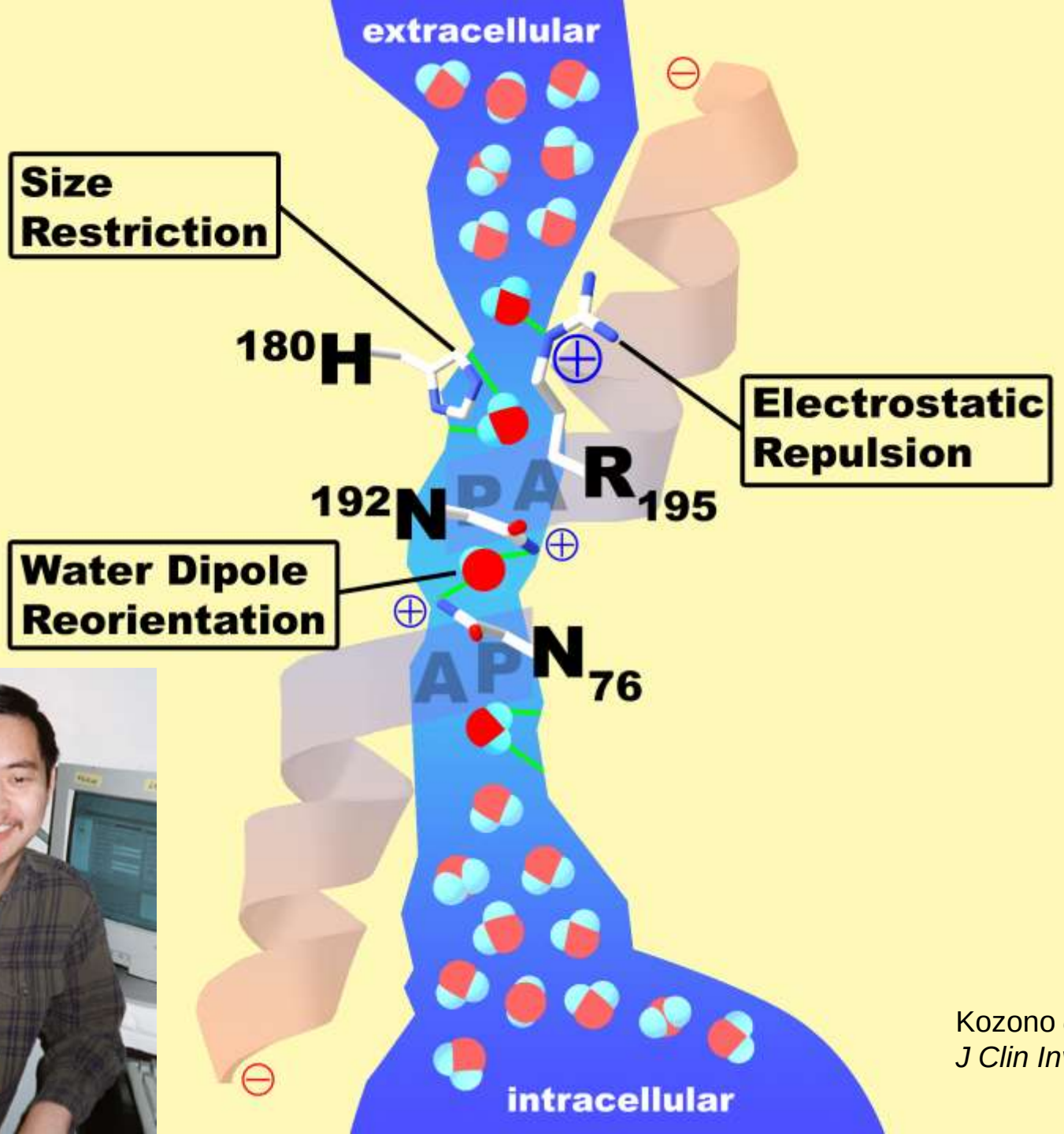
Discovery of Aquaporin-1

A serendipitous observation

Contaminant in 32 kDa
Rh preparations

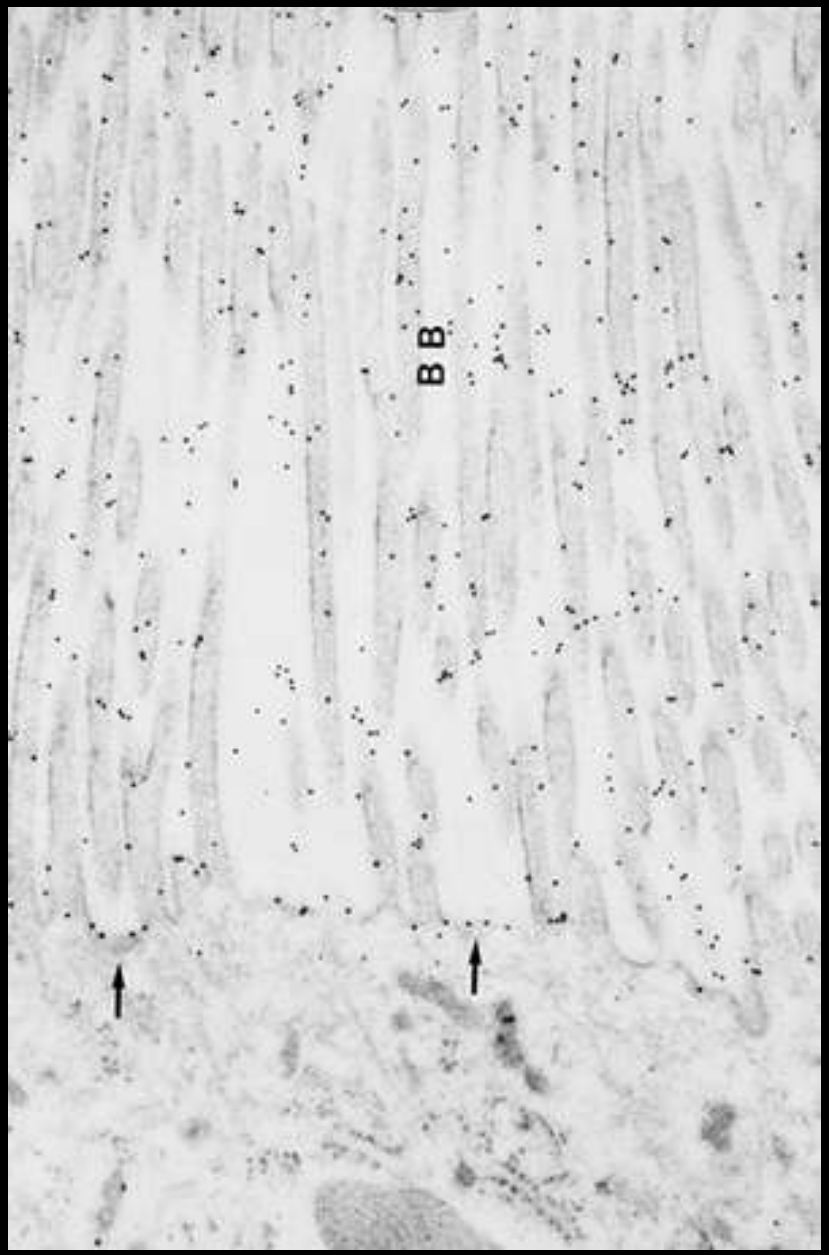


Denker *et al., J Biol Chem,* 1988



Kozono *et al.*,
J Clin Invest, 2002

AQP1 in proximal nephron

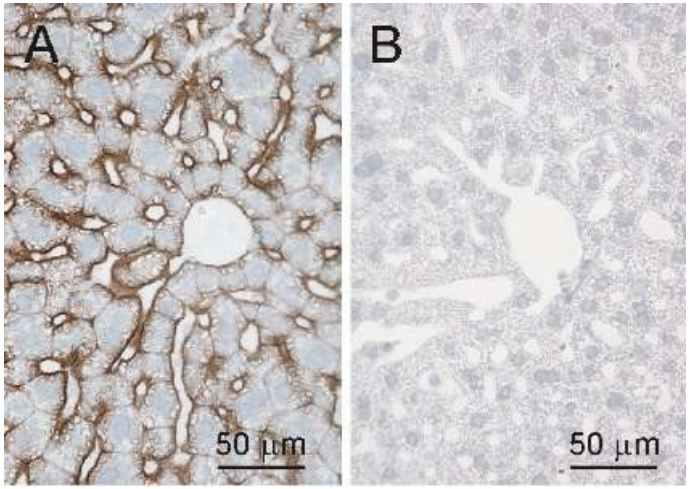


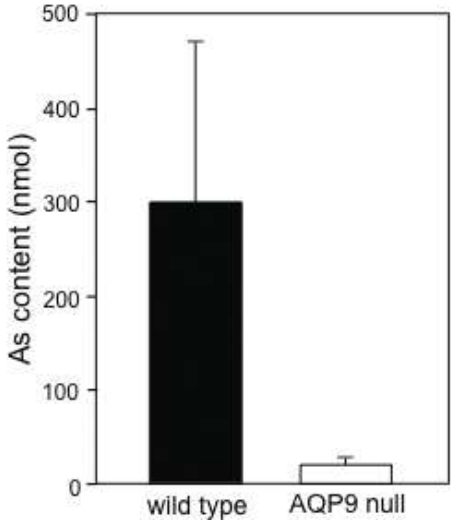
BB, apical brush border

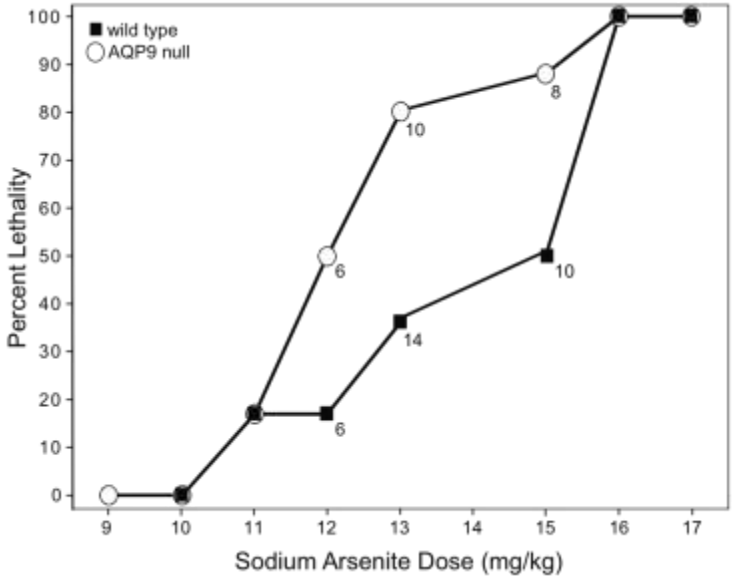
arrows, endocytic invaginations

Nielsen *et al.*, *J Cell Biol*, 1993

Arsenic toxicity in aquaglyceroporin-9 null mice

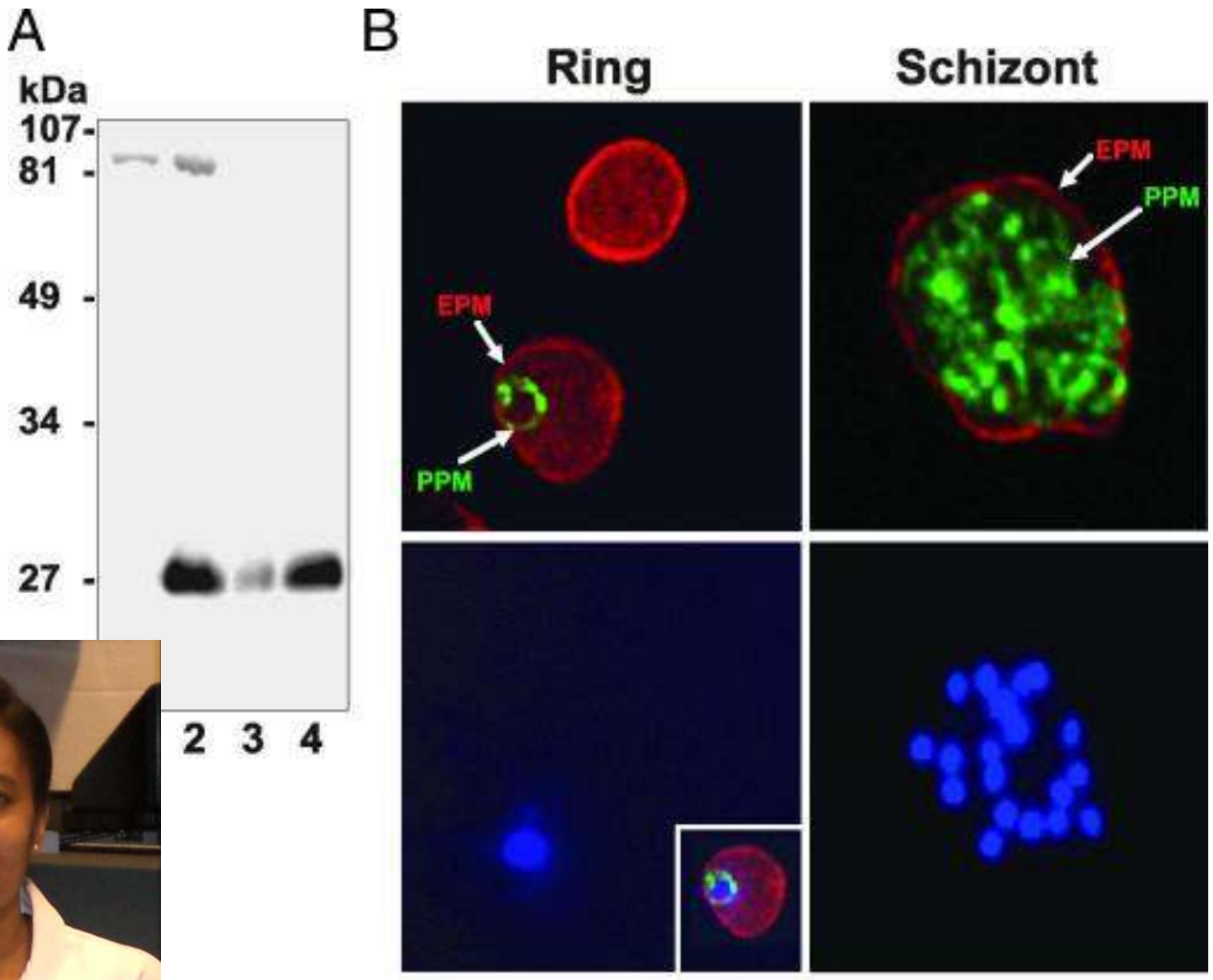






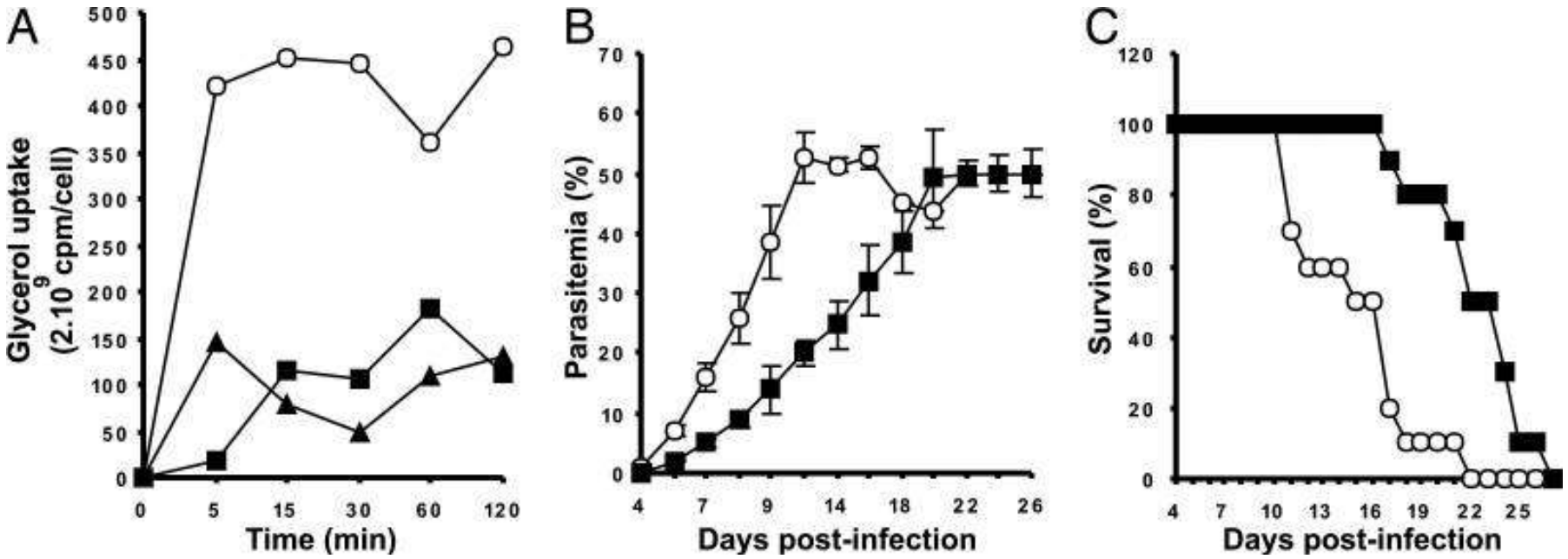
Carbrey *et al., Proc Natl Acad Sci,* 2009

Aquaglyceroporin PbAQP increases malaria virulence



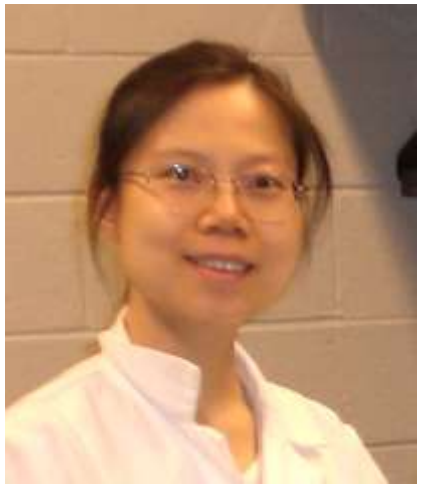
Promeneur *et al., Proc Natl Acad Sci,* 2007

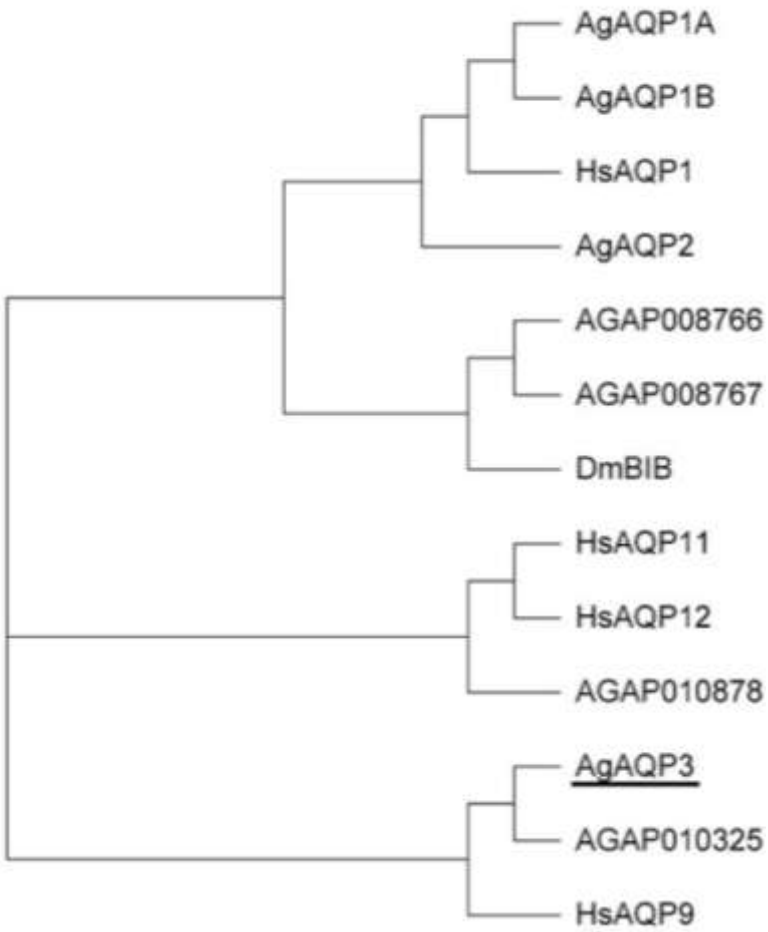
Aquaglyceroporin PbAQP increases malaria virulence



Promeneur, Liu *et al., Proc Natl Acad Sci,* 2007
Liu, Promeneur *et al., Proc Natl Acad Sci,* 2007

Aquaporins in *Anopheles gambiae*





water transport

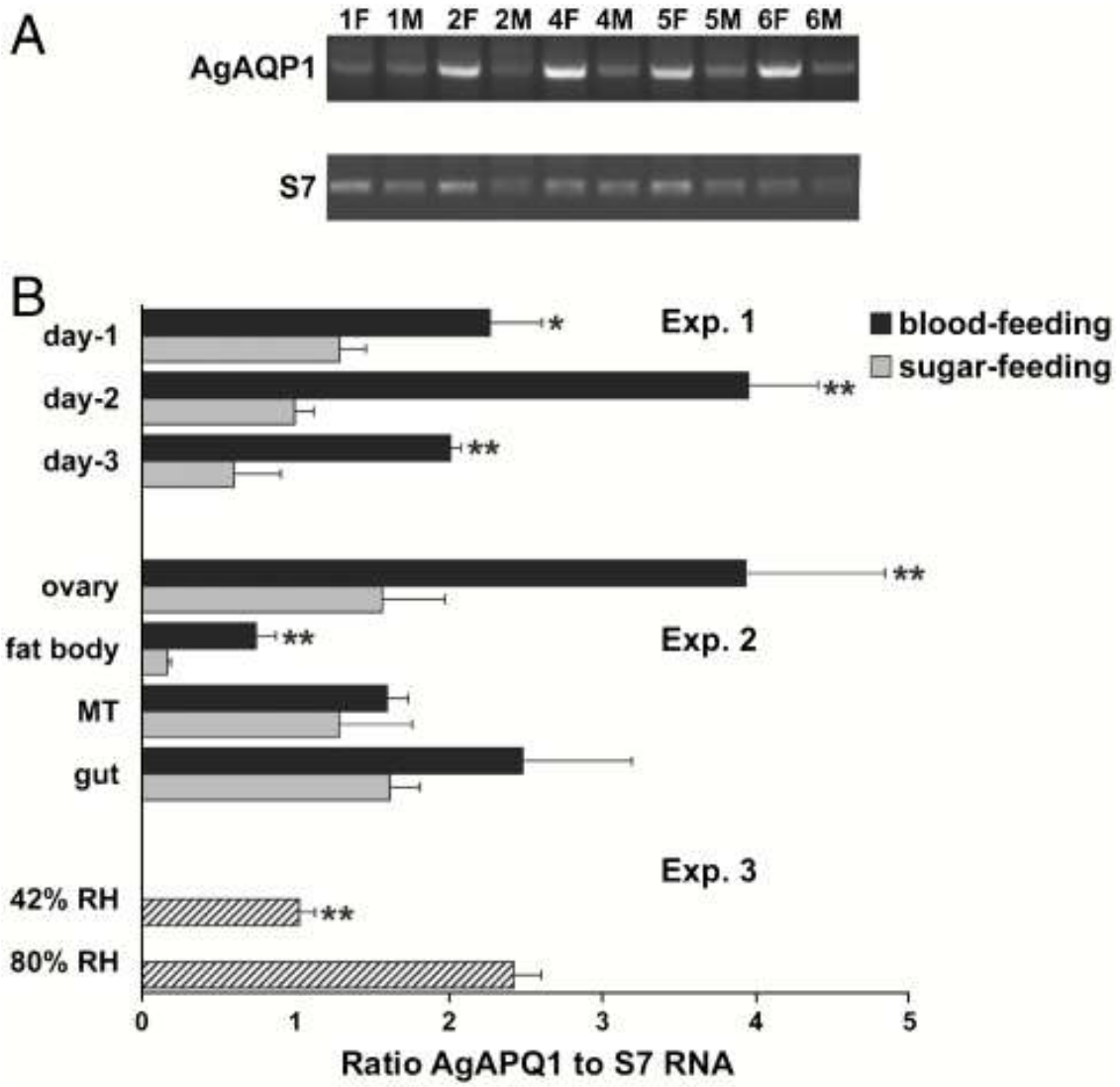
uncertain

incompletely defined

water + glycerol transport

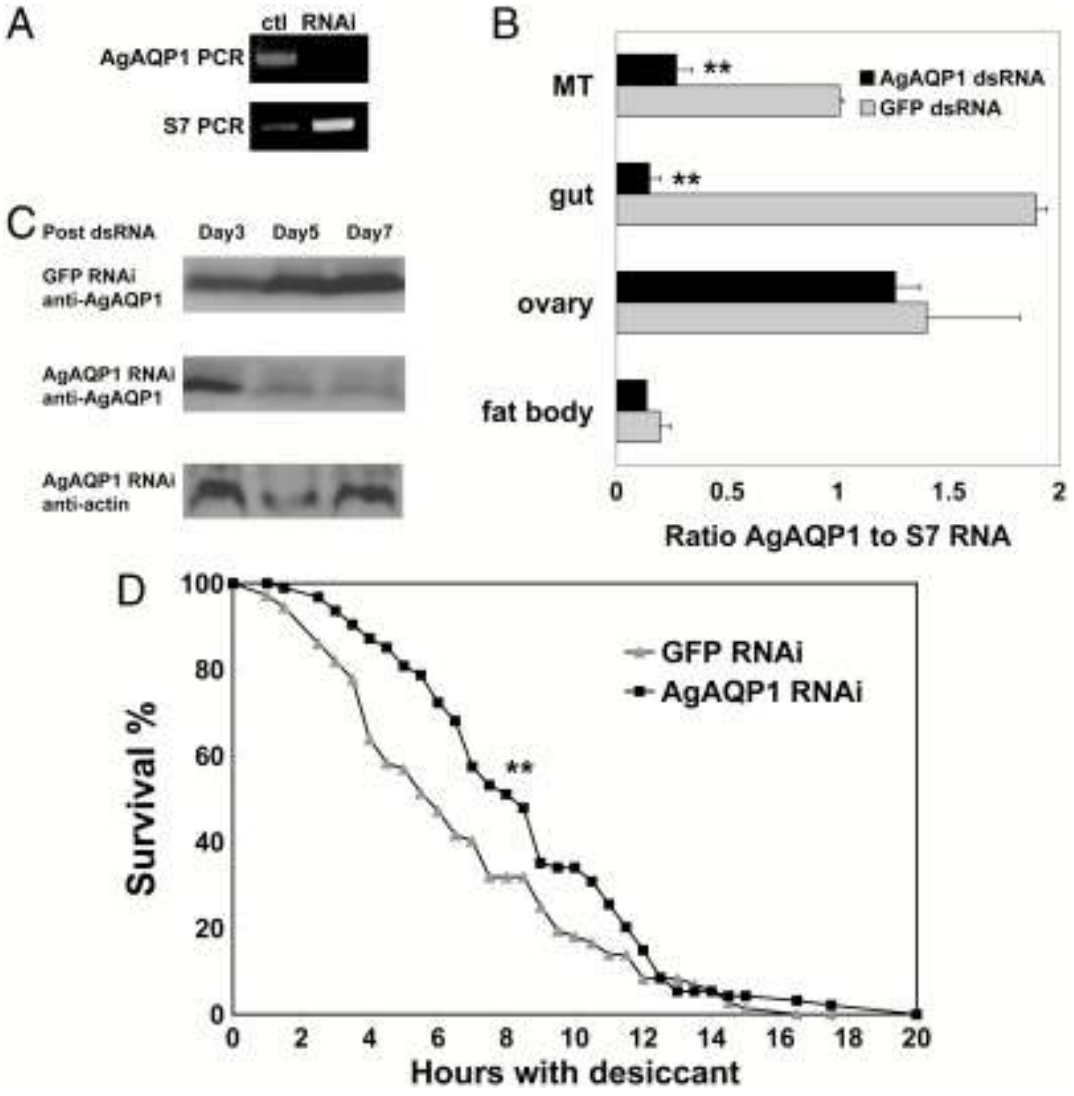
Liu *et al., Proc Natl Acad Sci,* 2011
Tsujimoto *et al., PLoS One,* 2013
Liu *et al., Biol Cell,* 2016

AgAQP1 – blood feeding and humidity



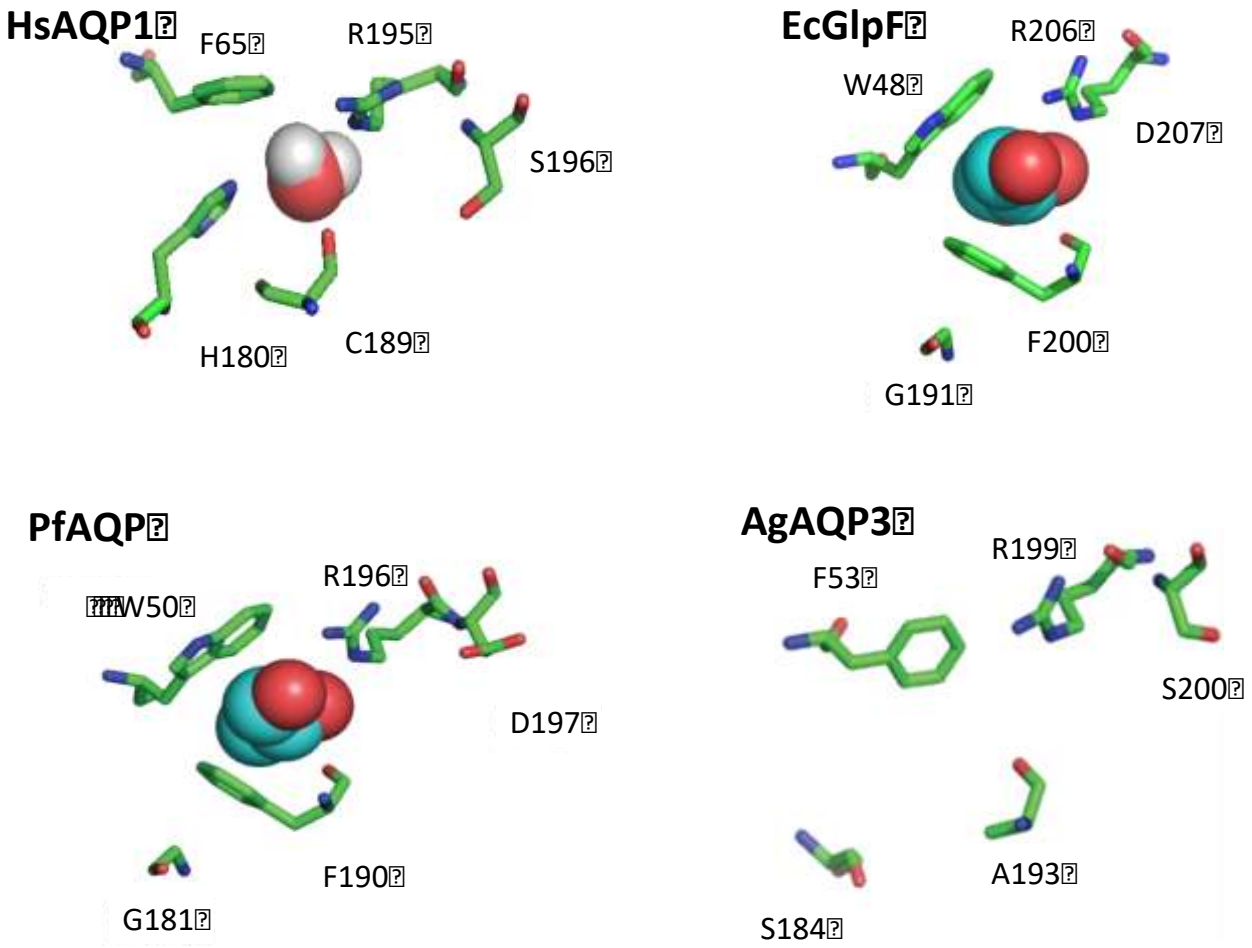
Liu *et al., Proc Natl Acad Sci,* 2011

AgAQP1 – dessication sensitivity



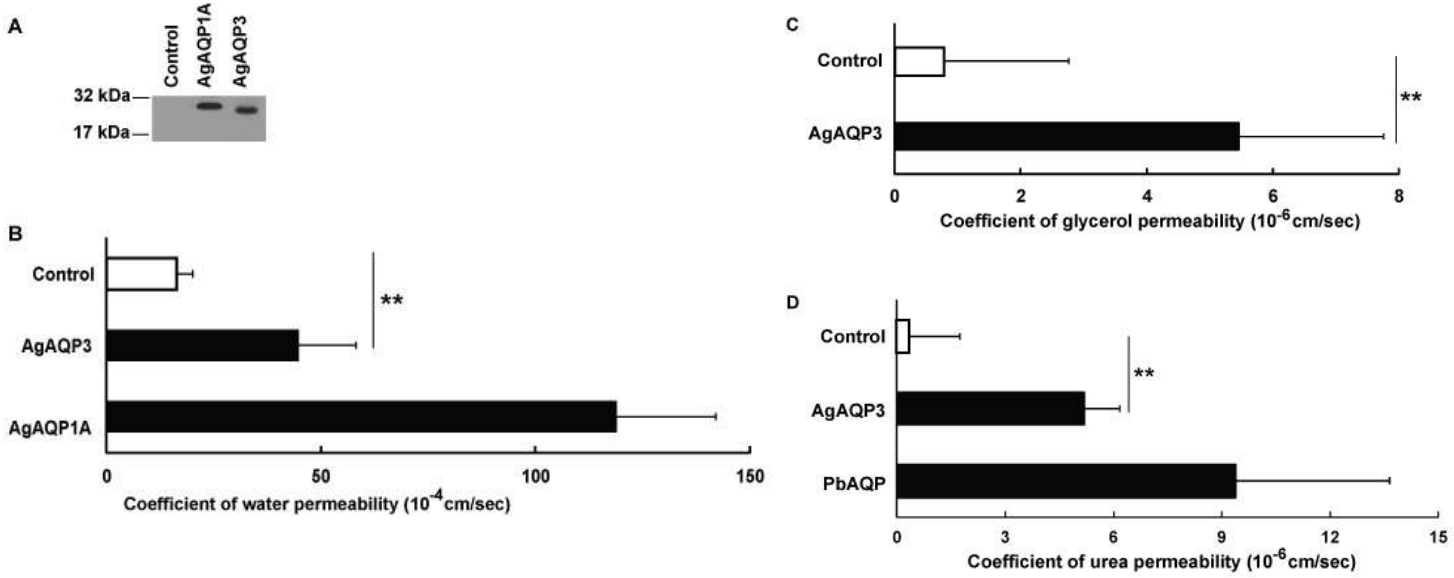
Liu *et al., Proc Natl Acad Sci,* 2011

AgAQP3 – atypical pore lining residues



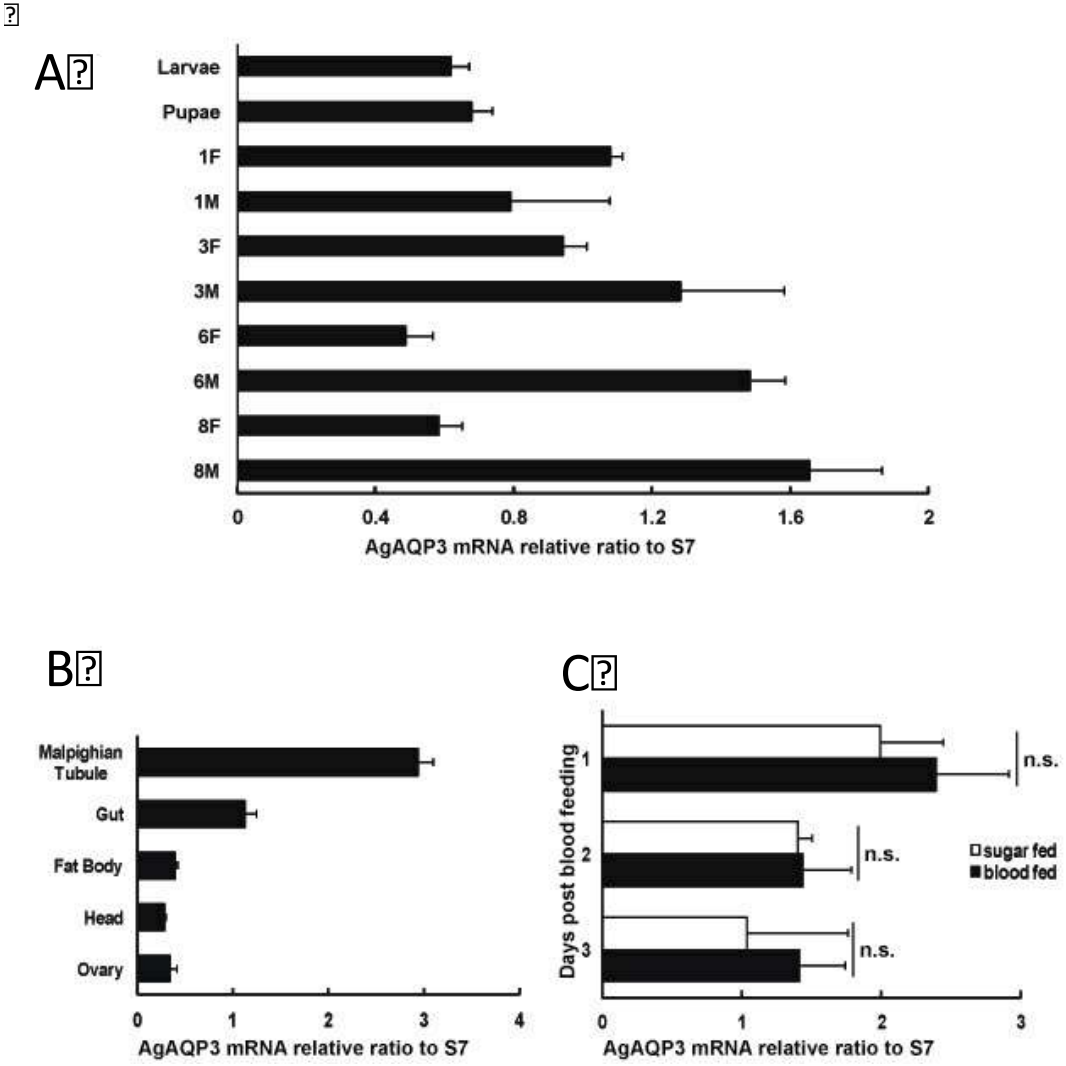
Liu *et al.*, *Biol Cell,* 2016

AgAQP3 – water + glycerol transport



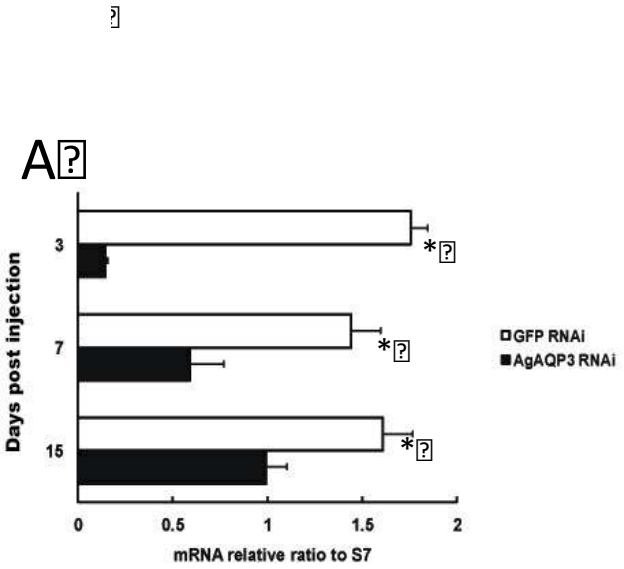
Liu *et al., Biol Cell,* 2016

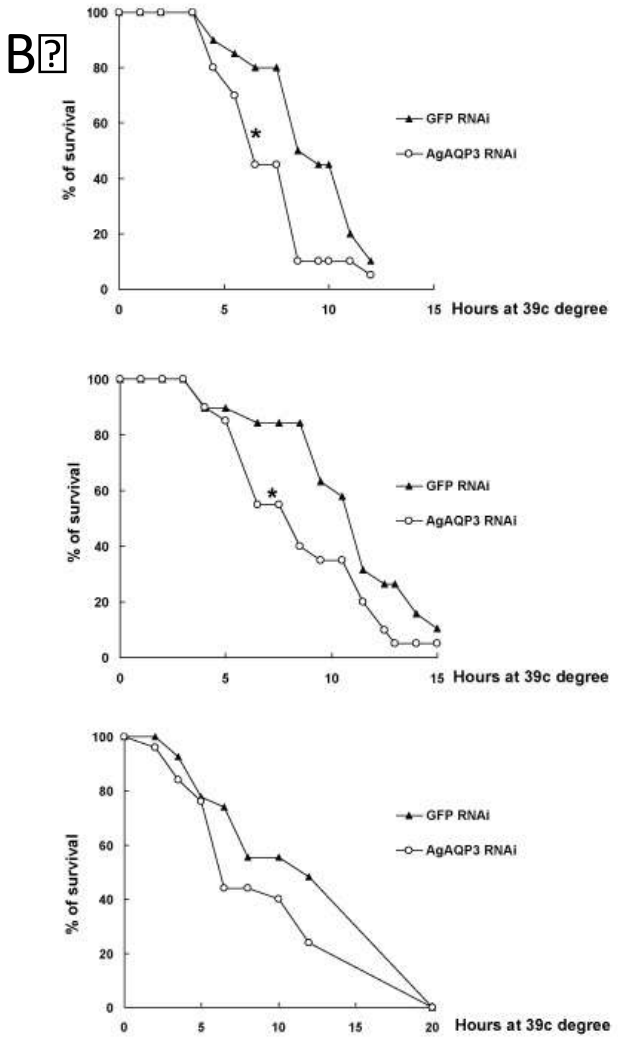
AgAQP3 – expression patterns



Liu *et al., Biol Cell,* 2016

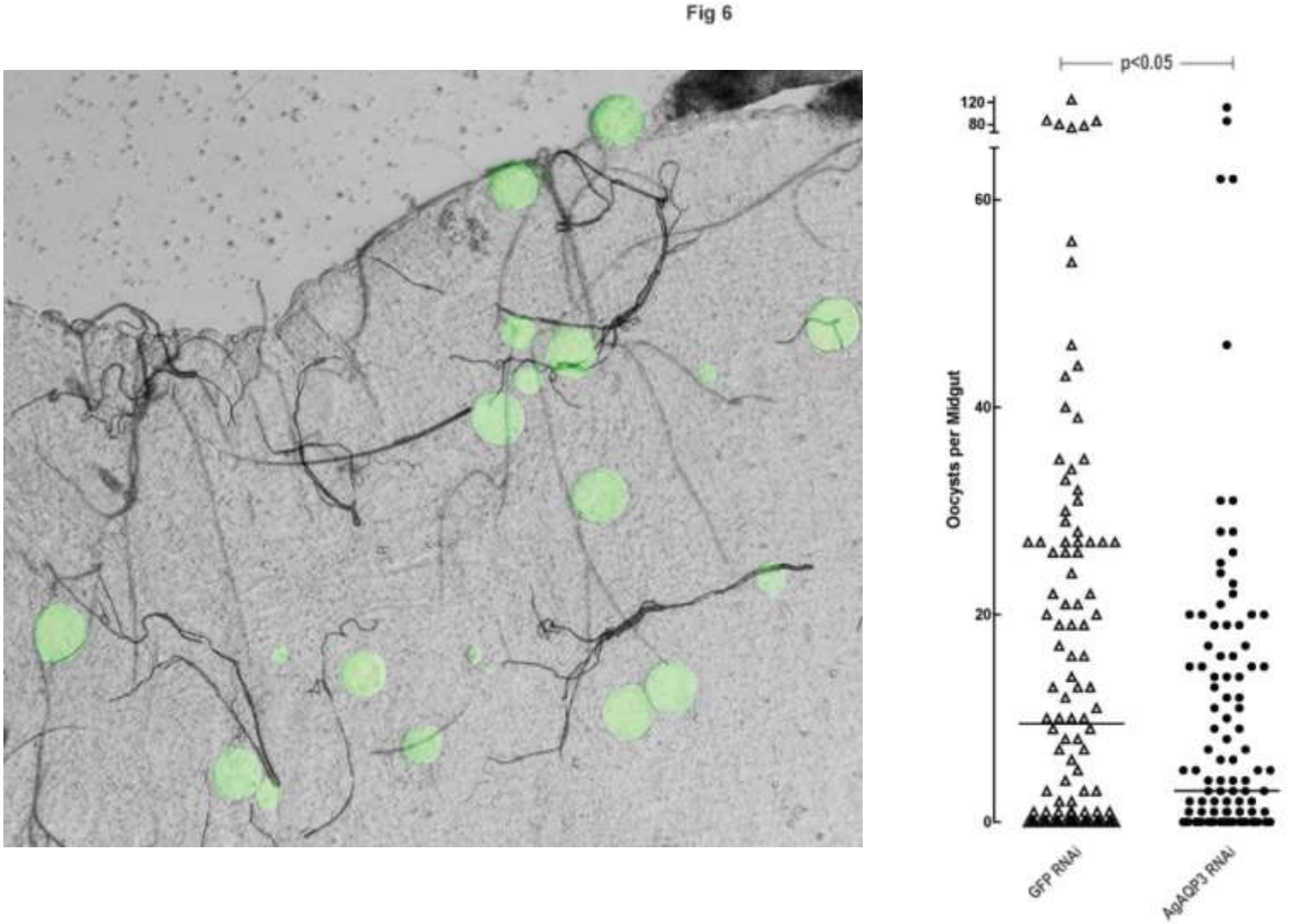
AgAQP3 – dessication resistance





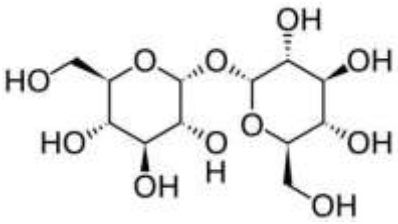
Liu *et al., Biol Cell,* 2016

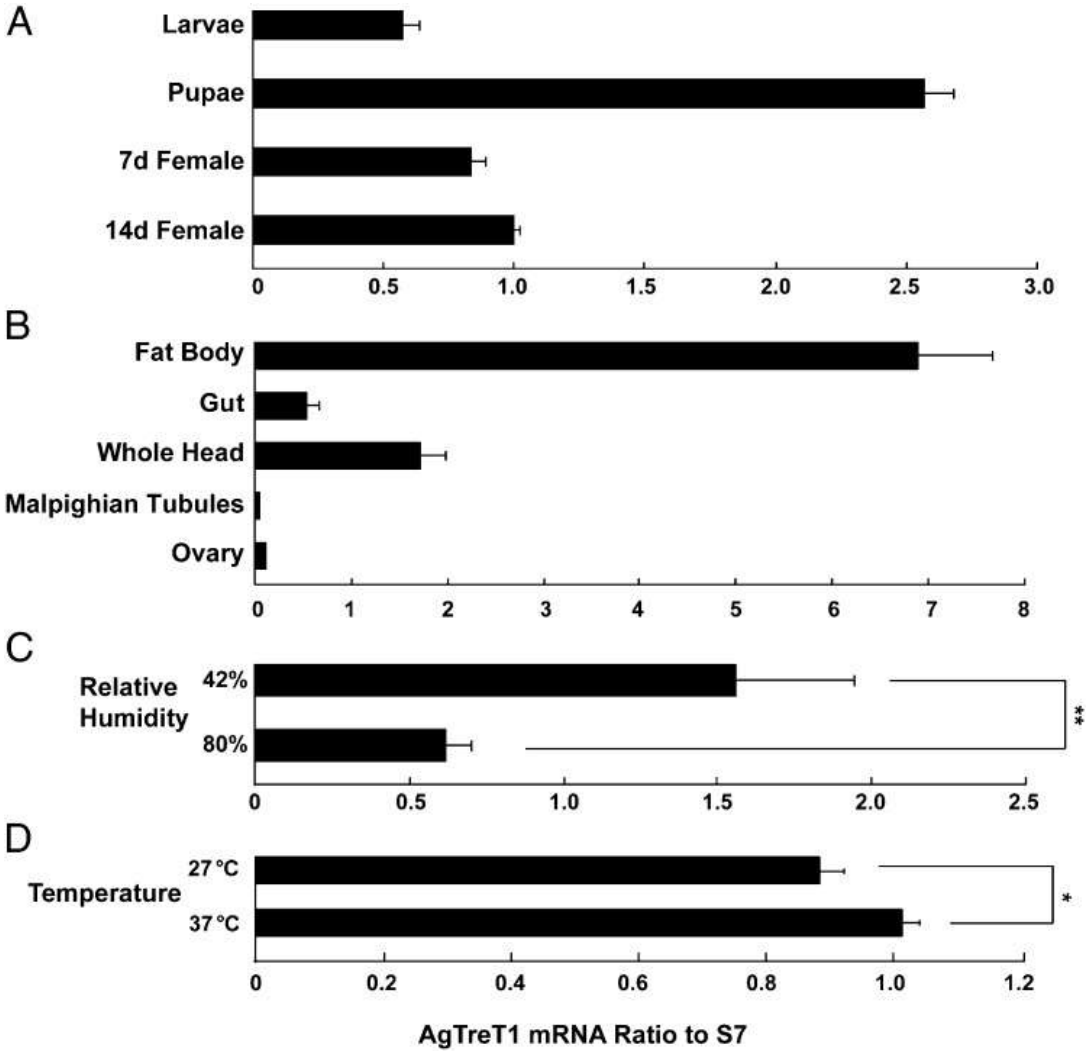
AgAQP3 – midgut malaria invasion



Liu *et al., Biol Cell,* 2016

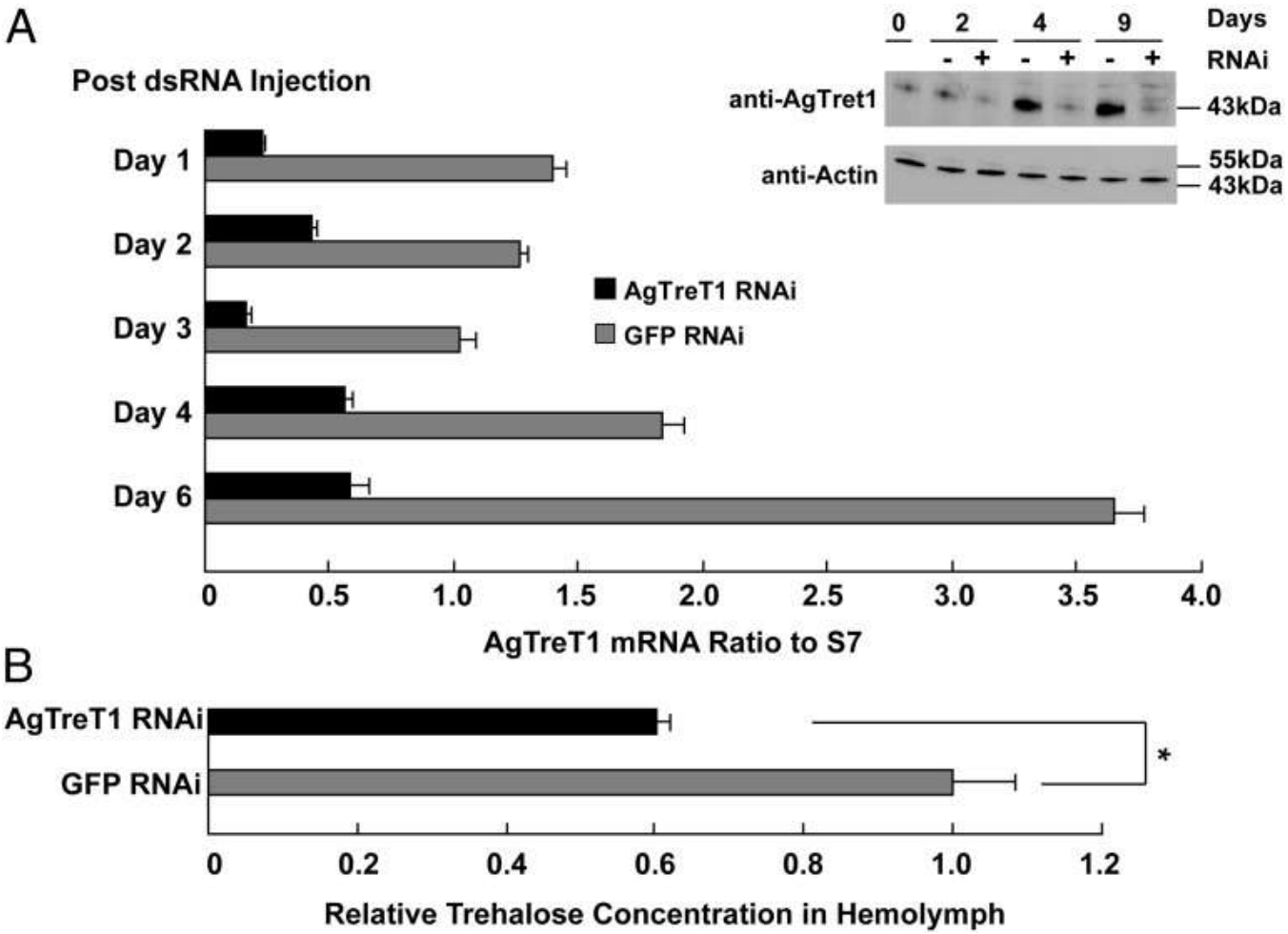
AgTreT1 – trehalose transporter





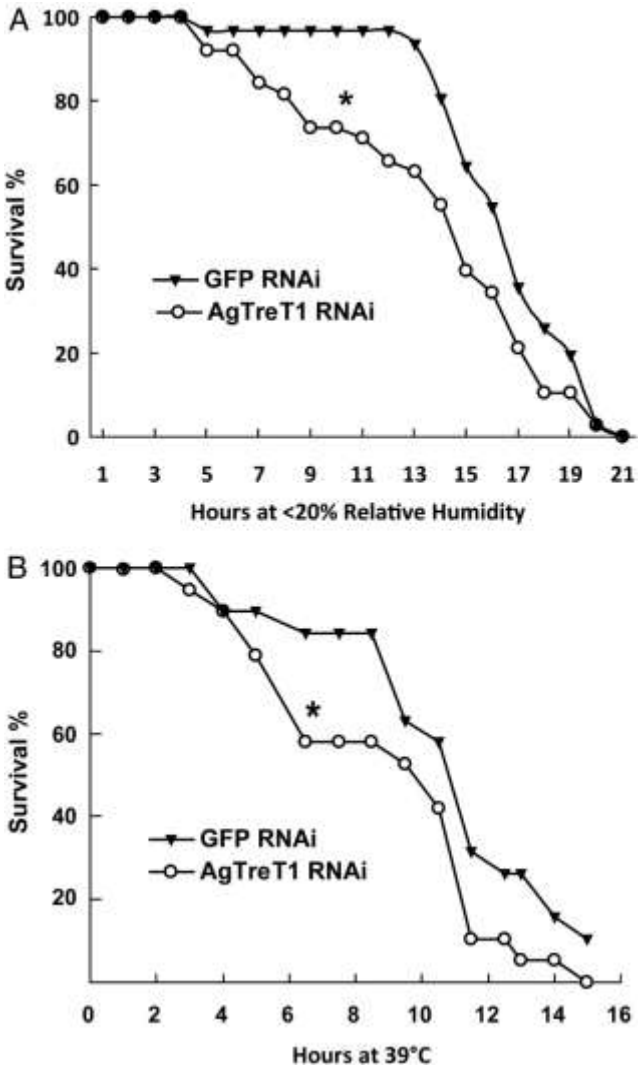
Liu *et al., Proc Natl Acad Sci,* 2013

AgTreT1 – trehalose transporter



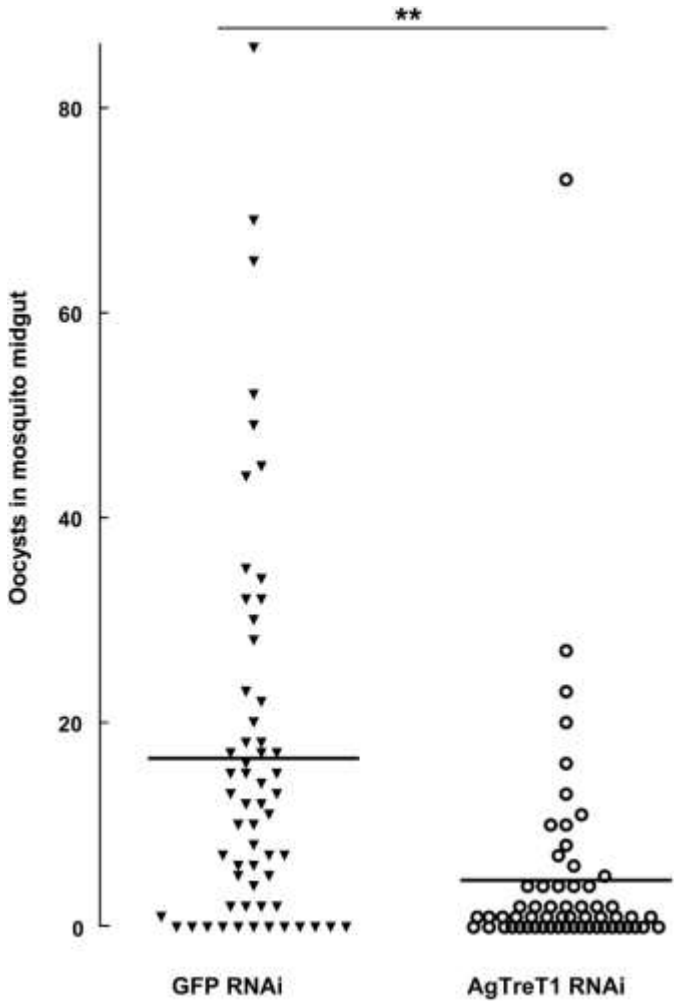
Liu *et al., Proc Natl Acad Sci,* 2013

AgTreT1 – dessication and heat resistance



Liu *et al., Proc Natl Acad Sci,* 2013

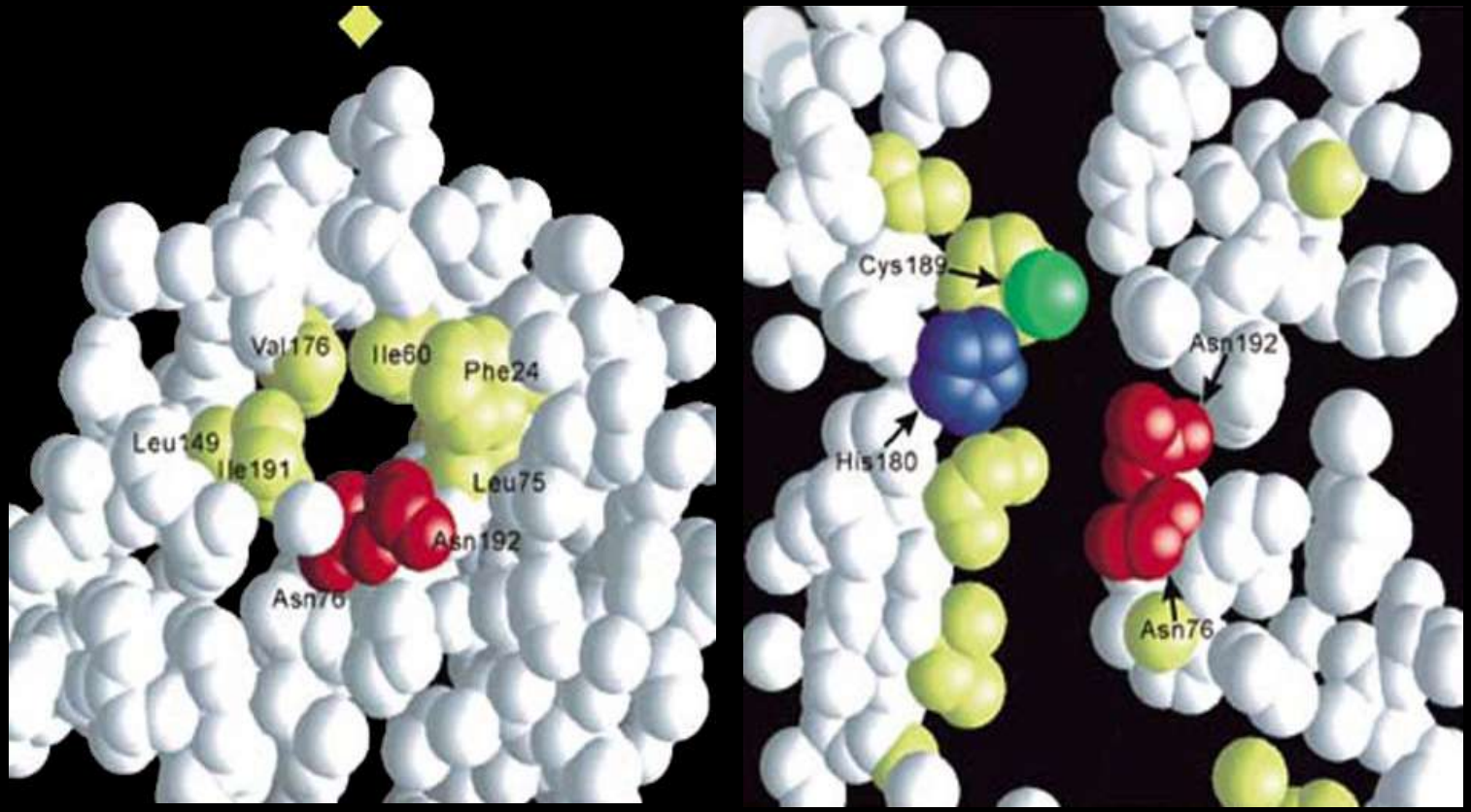
AgTreT1 – midgut malaria invasion



Liu *et al., Proc Natl Acad Sci,* 2013

Structure of AQP1

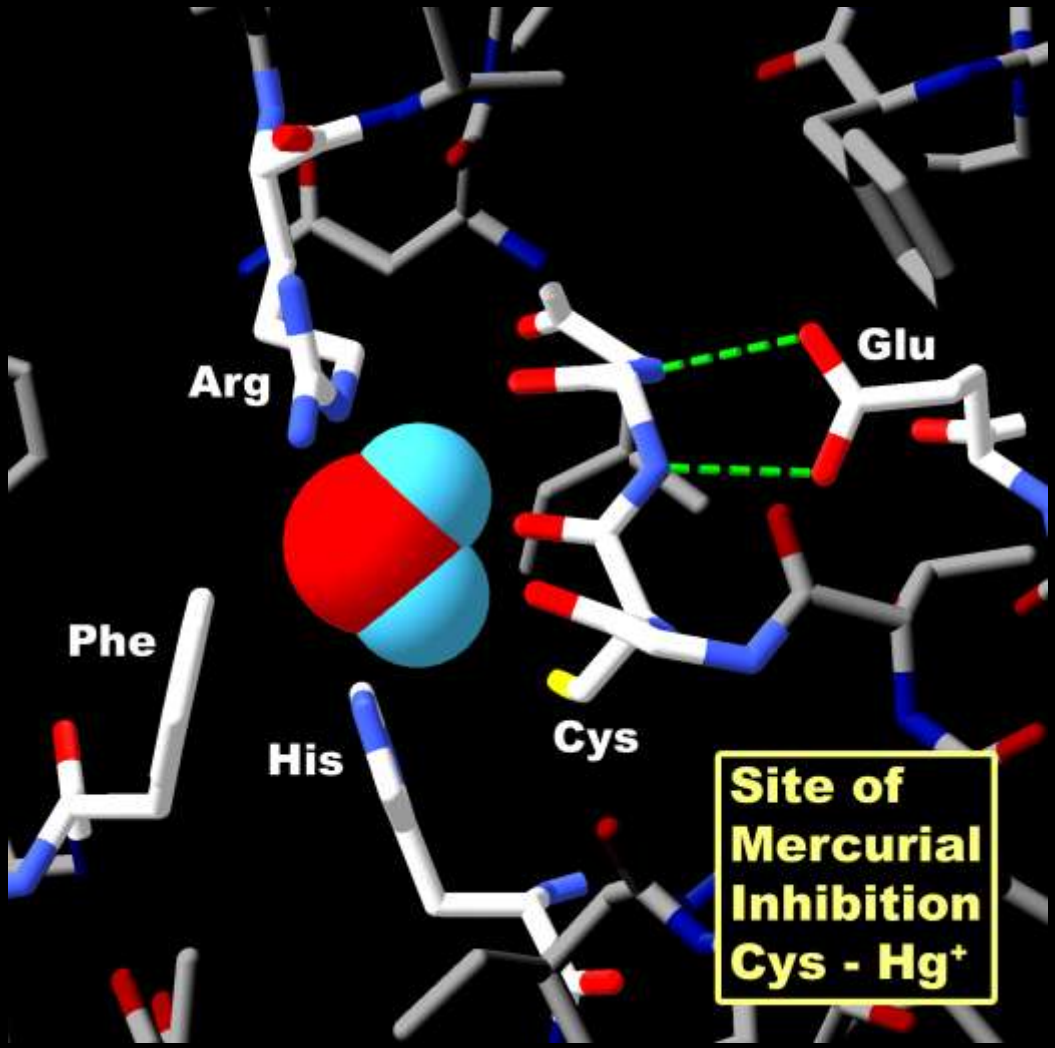
Membrane crystallography (with Y. Fujiyoshi, Kyoto and A. Engel, Basel)



Walz *et al., J Biol Chem,* 1994; *EMBO J,* 1994; *Nature Struct Biol,* 1995; *J Mol Biol,* 1996; *Nature* 1997; Mitsuoka *et al., J Struct Biol,* 1999; Murata *et al., Nature,* 2000

Structure of AQP1

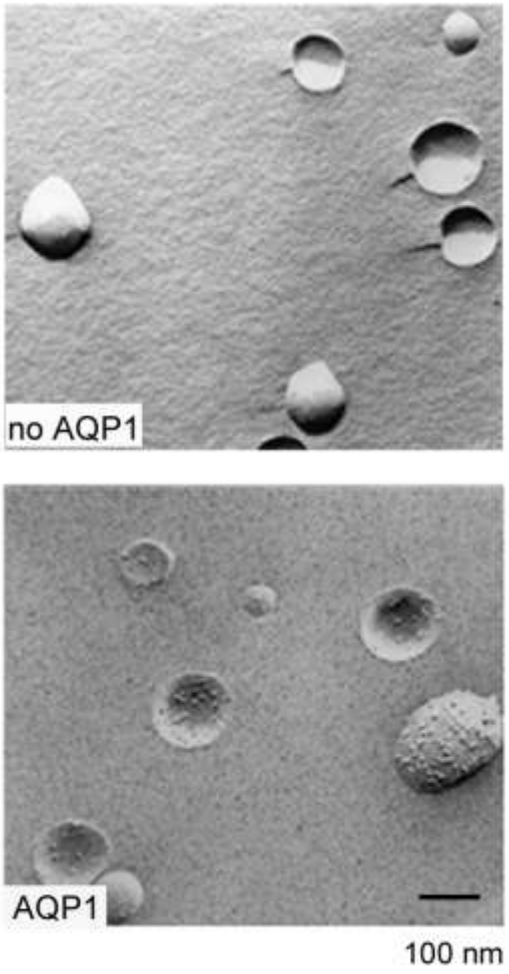
Hg^{++} inhibitory site



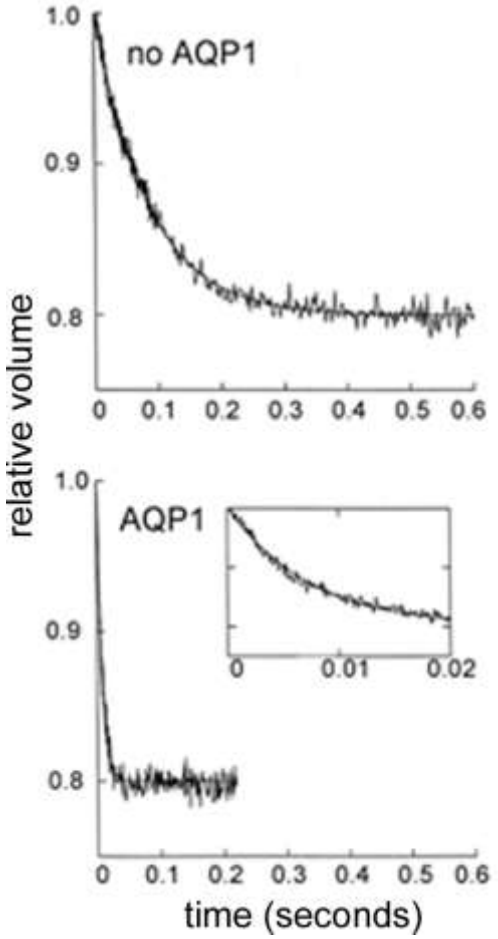
Verification of AQP1 function

Functional reconstitution

Reconstituted membranes



Stopped-flow water permeability



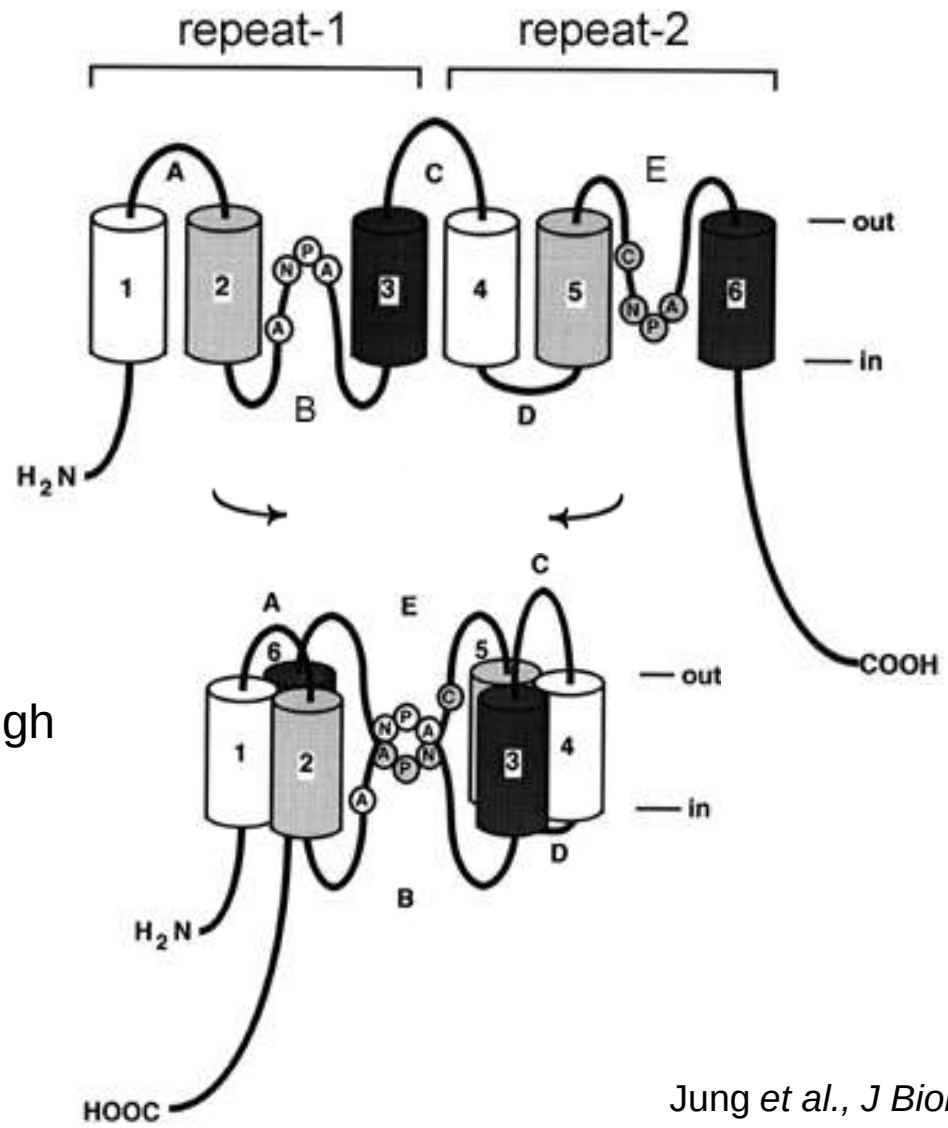
Zeidel *et al., Biochemistry* 1992, 1994

Structure of AQP1

The Hourglass Model

Tandem repeats oriented at 180˚

Aqueous pore through each subunit

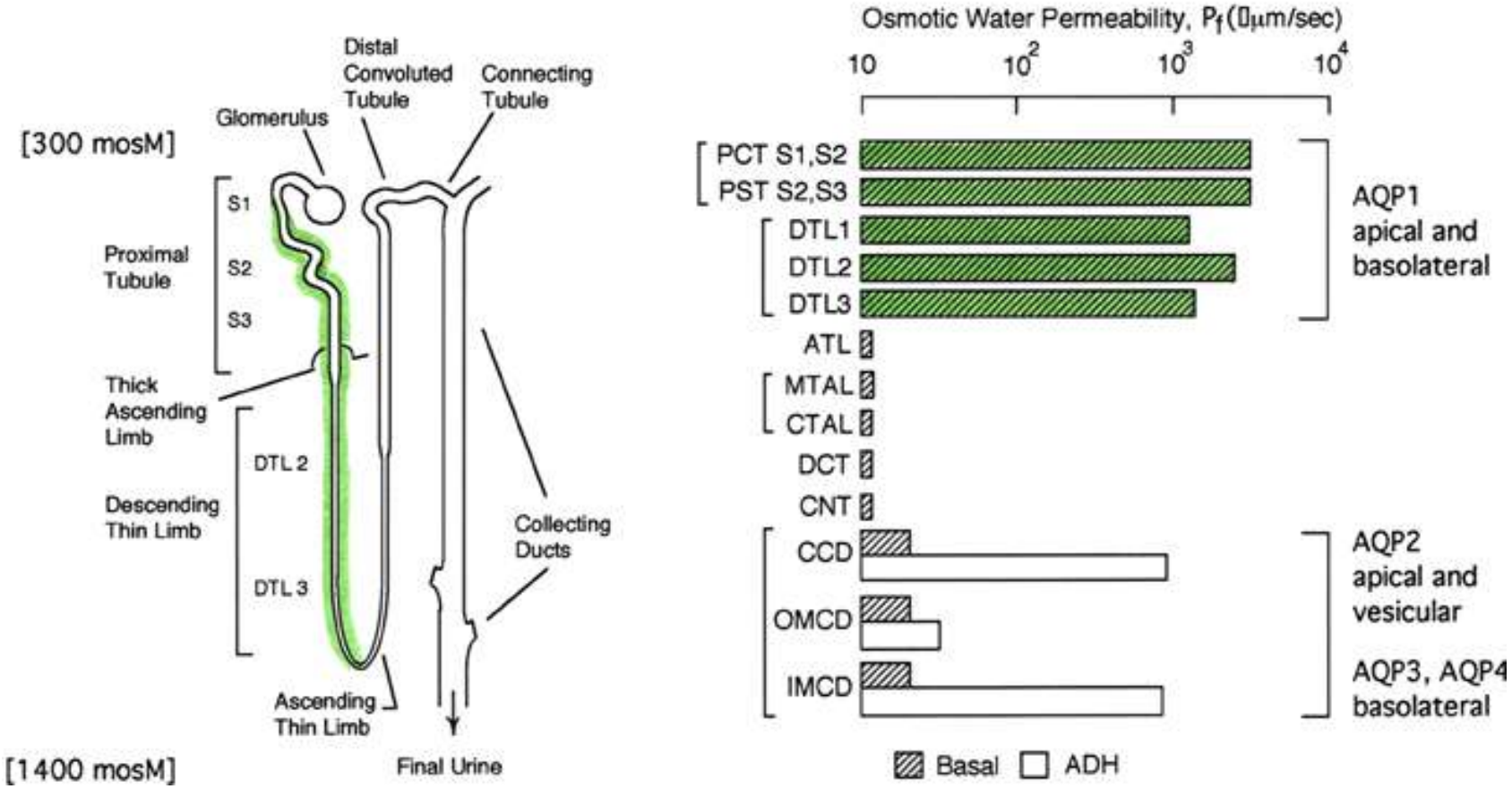


Jung *et al., J Biol Chem,* 1994

Localization of AQP1 in kidney

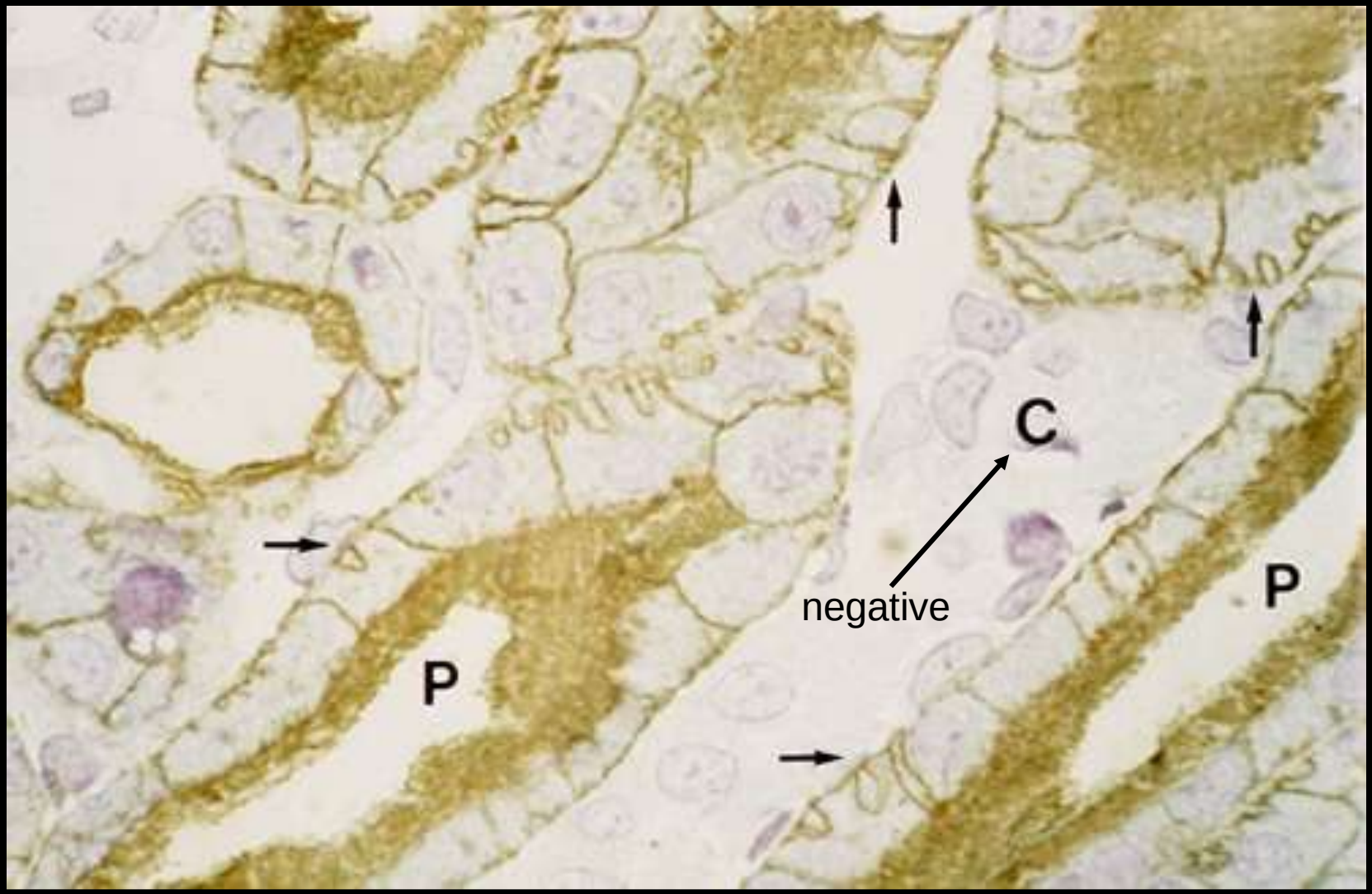
(with Søren Nielsen, Aarhus)

Aquaporin distribution—Renal water permeability



Nielsen *et al.*, *J Cell Biol,*1993

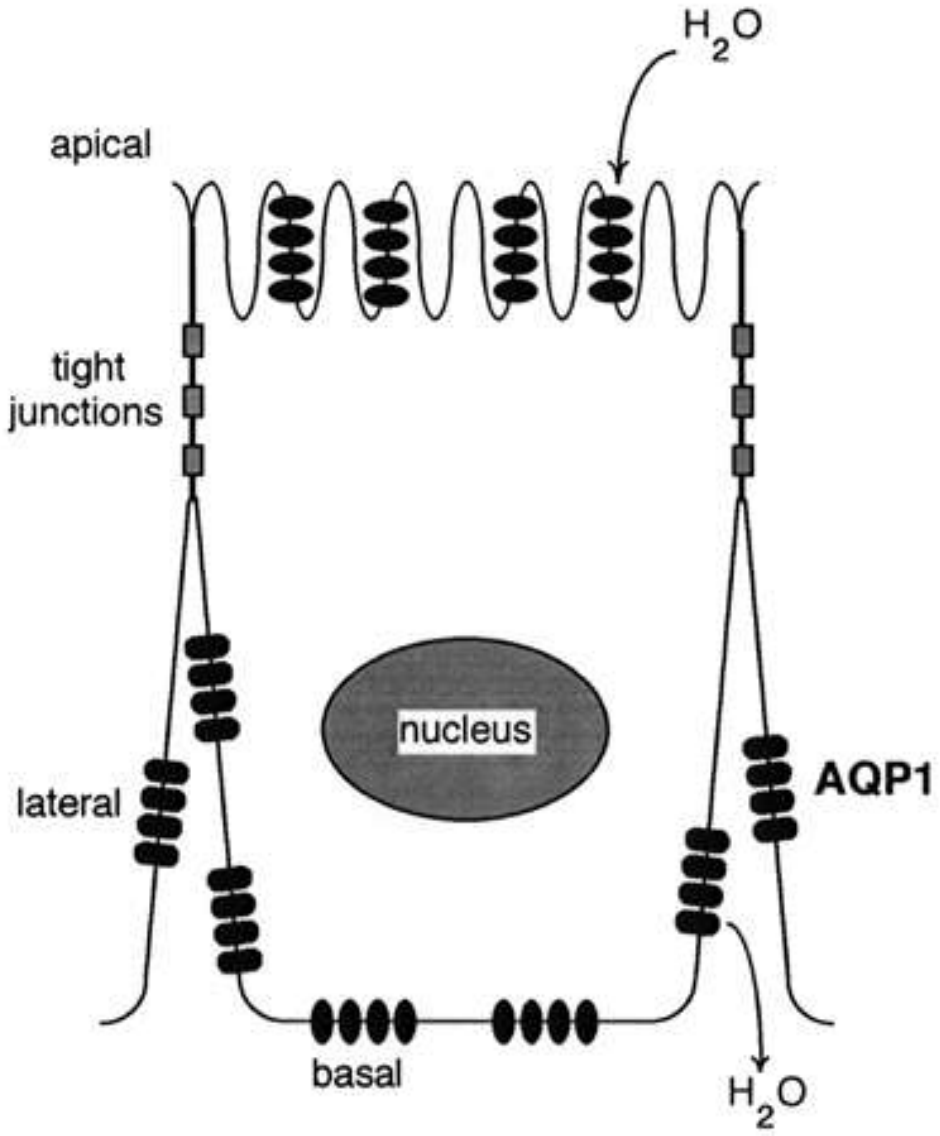
AQP1 in proximal nephron



P, proximal tubule lumen C, collecting duct

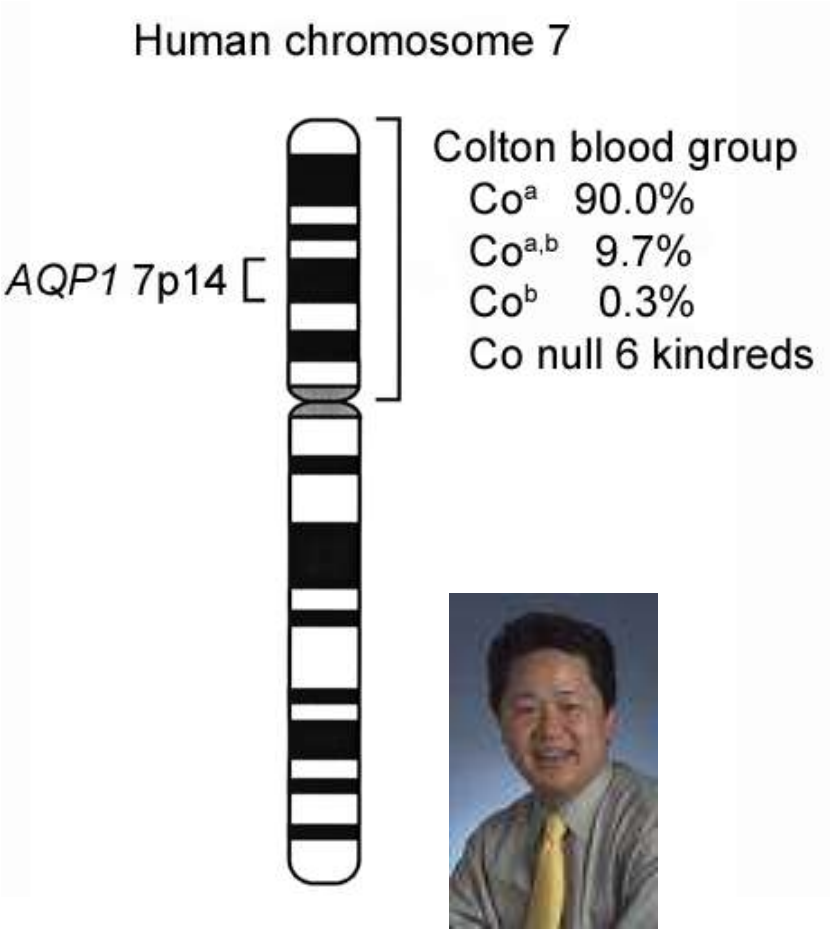
Nielsen *et al., J Cell Biol,* 1993

AQP1-mediated constitutive transcellular water movements



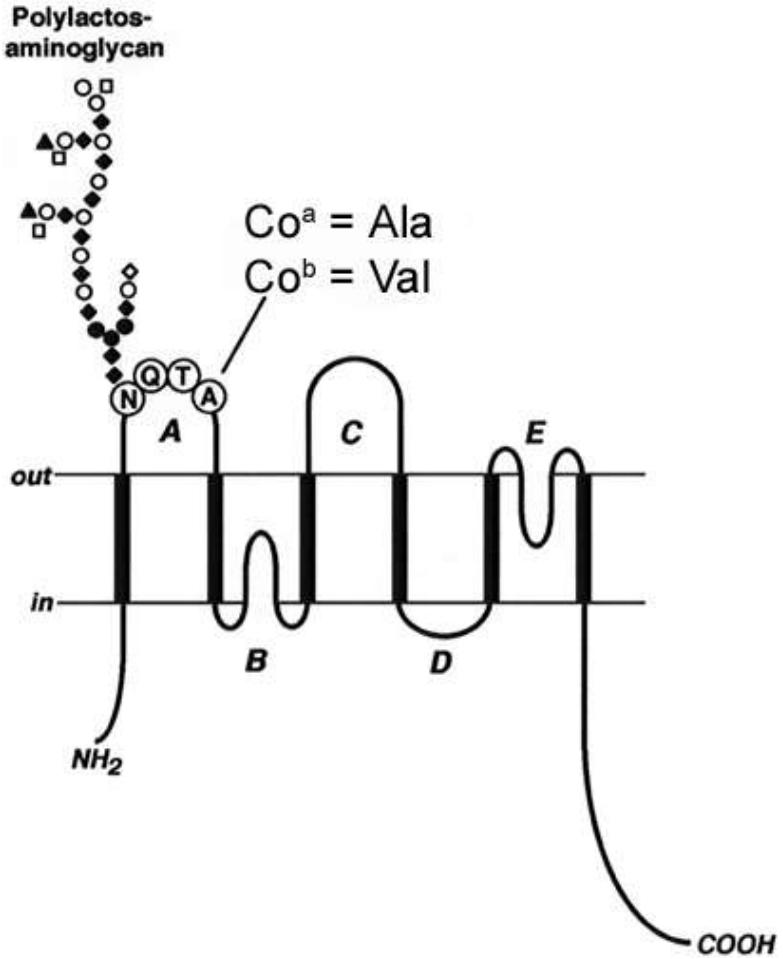
AQP1 and the Colton antigen

Coincidental chromosomal locus



Moon *et al., J Biol Chem,*1993

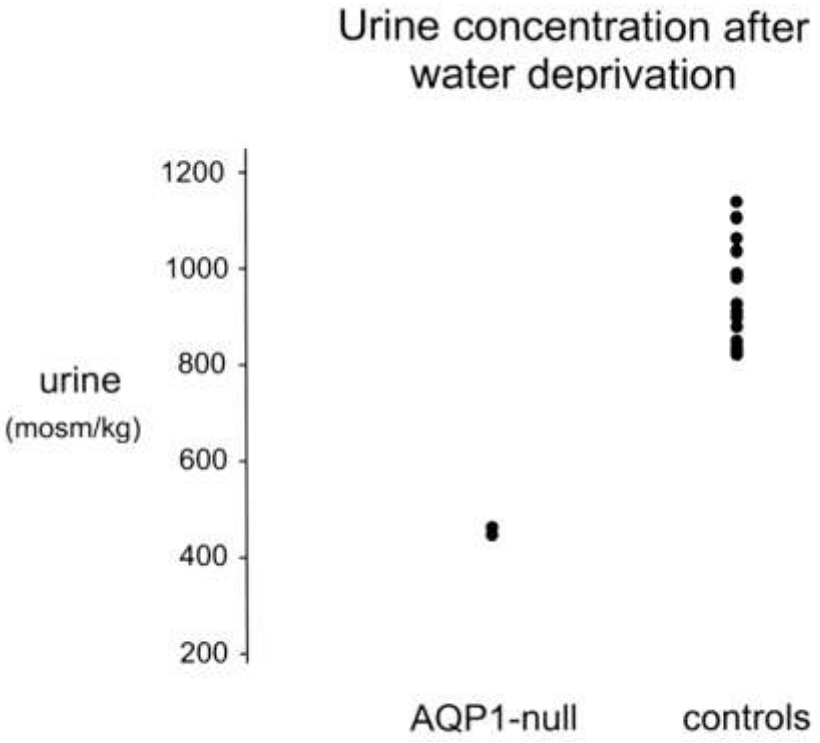
Surface polymorphism



Smith *et al., J Clin Invest,*1994

AQP1 null humans—Renal concentration defect

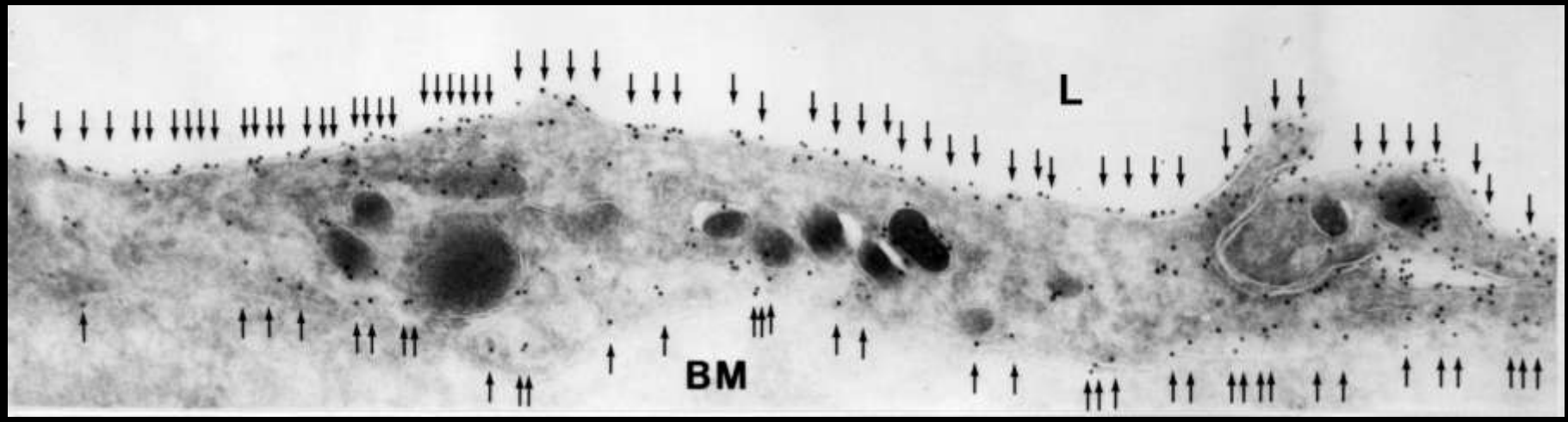
(Landon King and Mike Choi, JHMI)



Dx—Mild Nephrogenic Diabetes Insipidus

King *et al., New Engl J Med, 2001*

AQP1 in human capillary endothelium

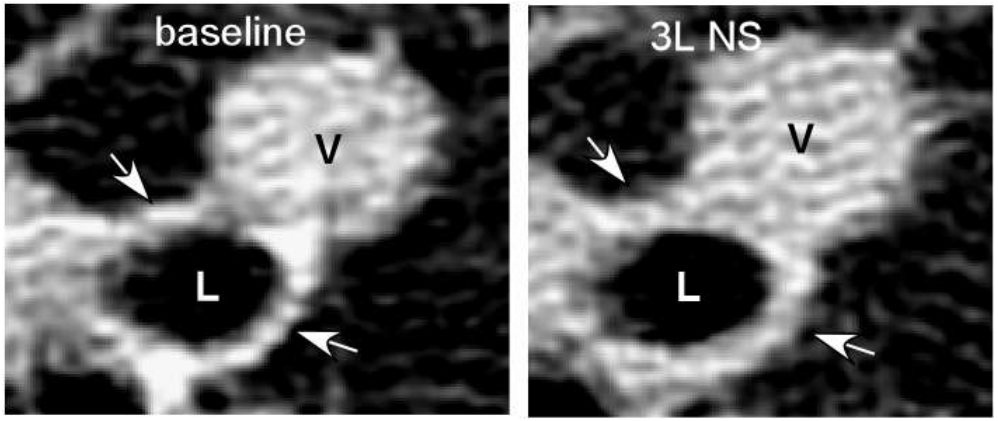


King *et al., Proc Natl Acad Sci,* 2002

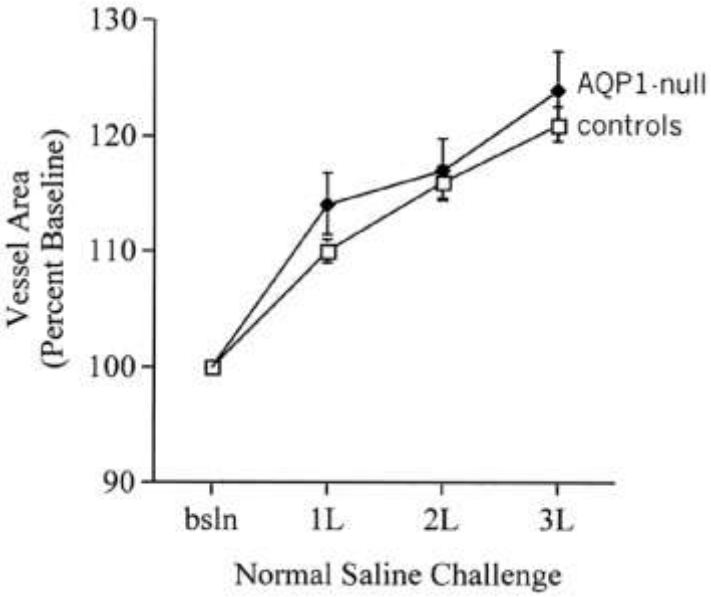
AQP1 null humans

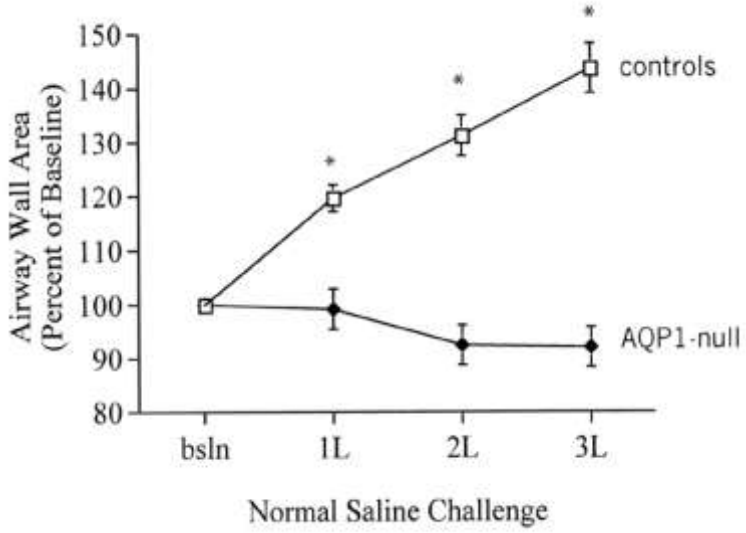
Pulmonary capillary defect

Johns Hopkins Hospital inpatient study
Baseline—High resolution CT scan of lung
Rapid—Saline infusion, 3 x 1 liter
Repeat—HRCT scans after each liter
Measure—Bronchiolar (1-5 mm) wall thickness



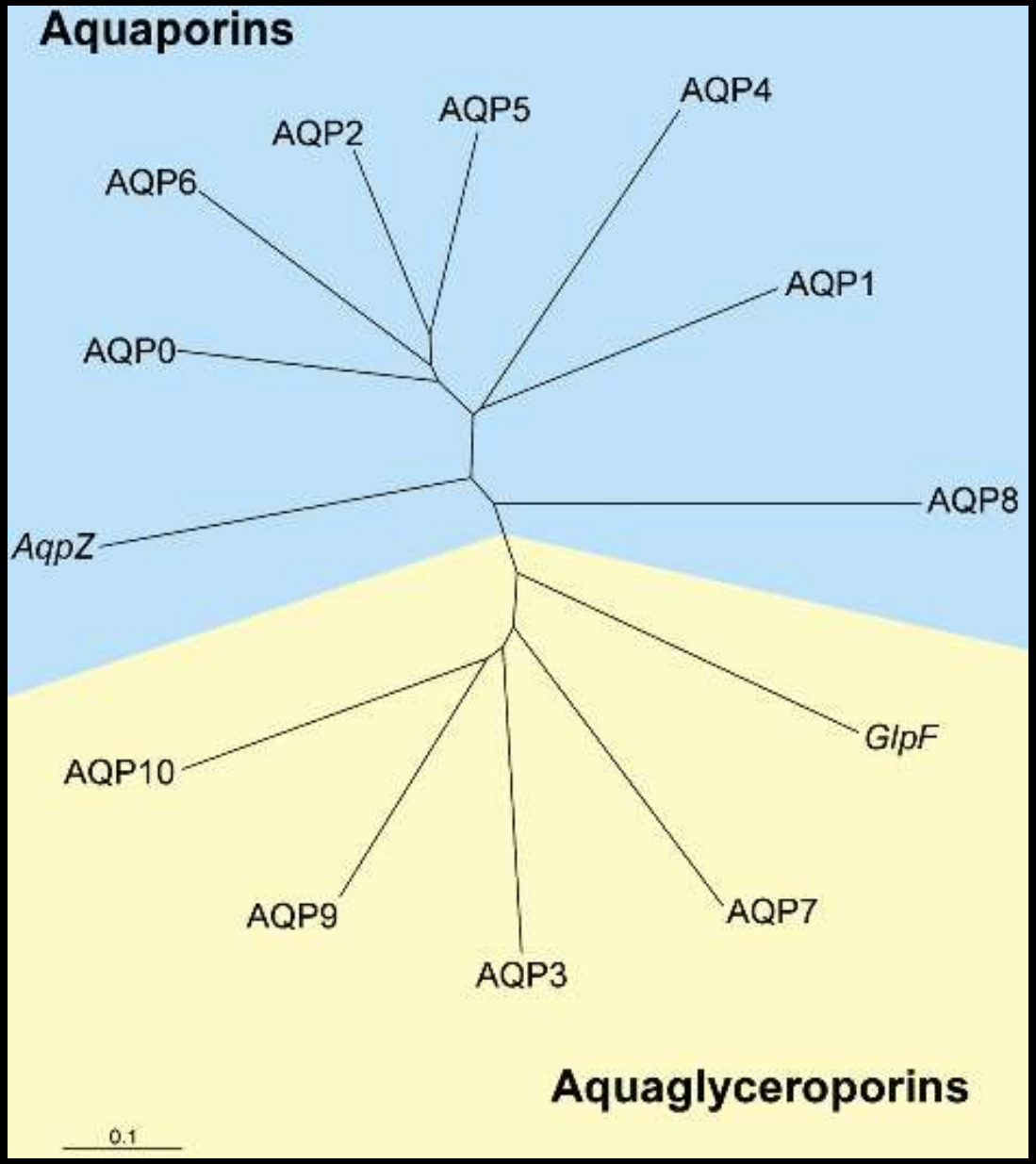
Dx—Decreased vascular water permeability





King *et al., Proc Natl Acad Sci,* 2002

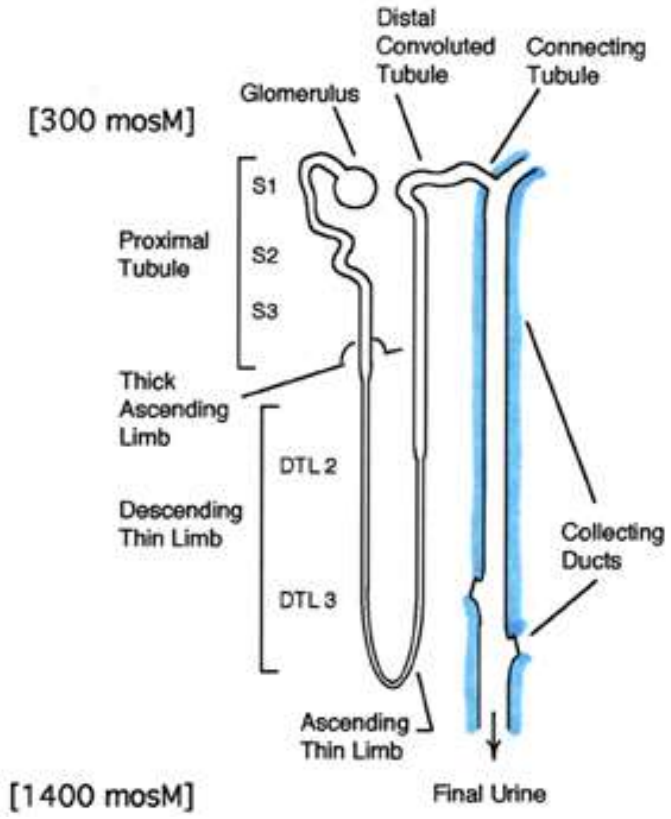
Human Aquaporin Repertoire



AQP2—A regulated water channel

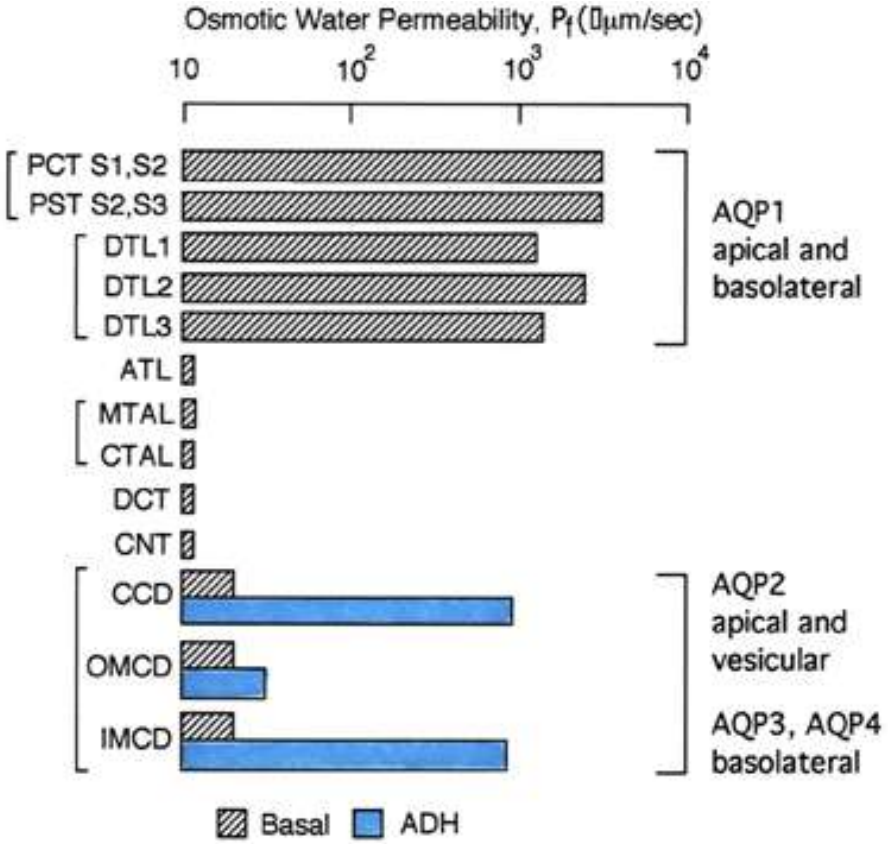
cDNA cloned by homology

(Fushimi *et al., Nature,* 1993)



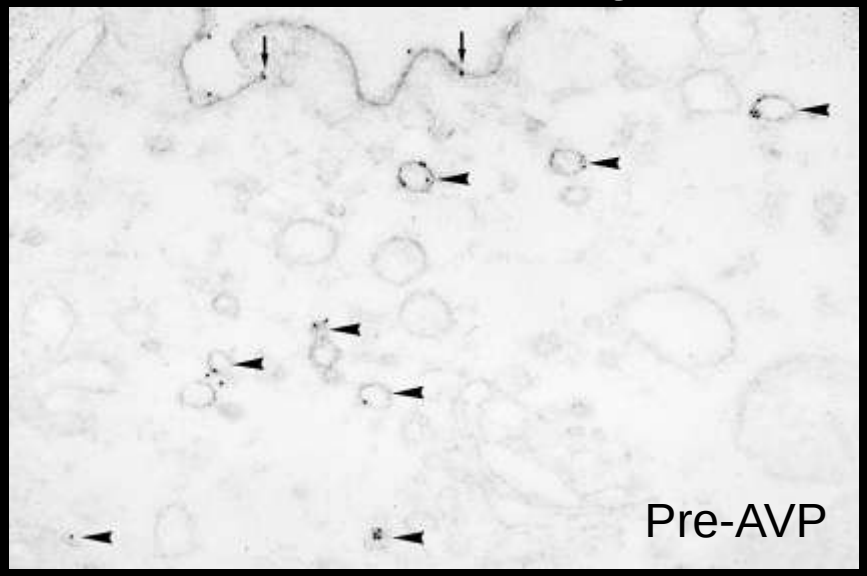
AQP2 localization in kidney

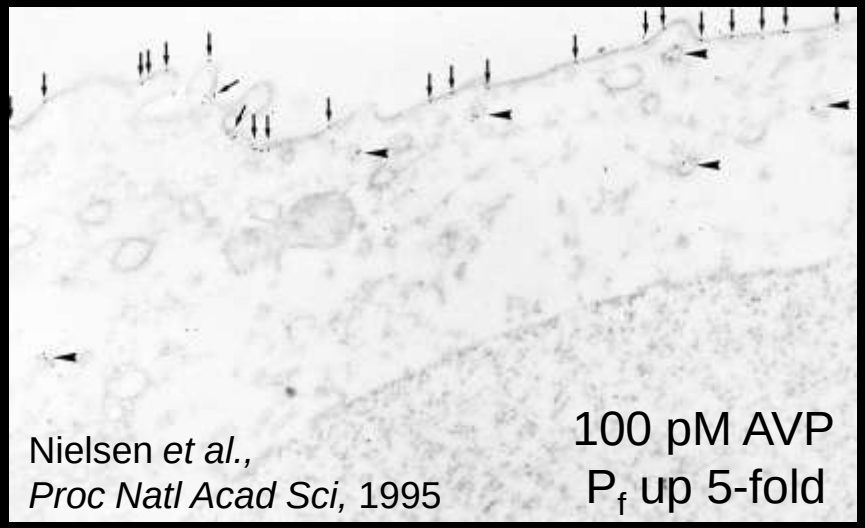
(Nielsen *et al., Proc Natl Acad Sci,* 1993)

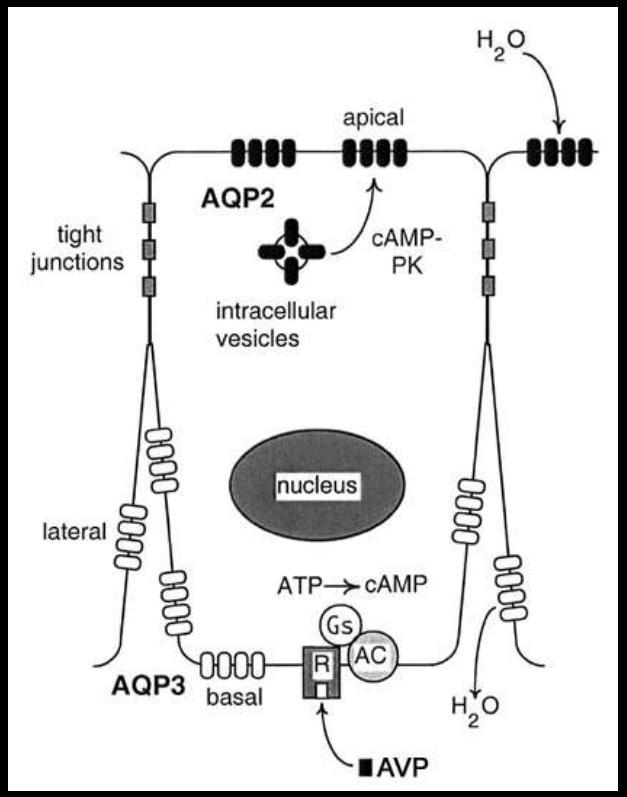


AQP2—Acute regulation by AVP

Isolated renal collecting ducts







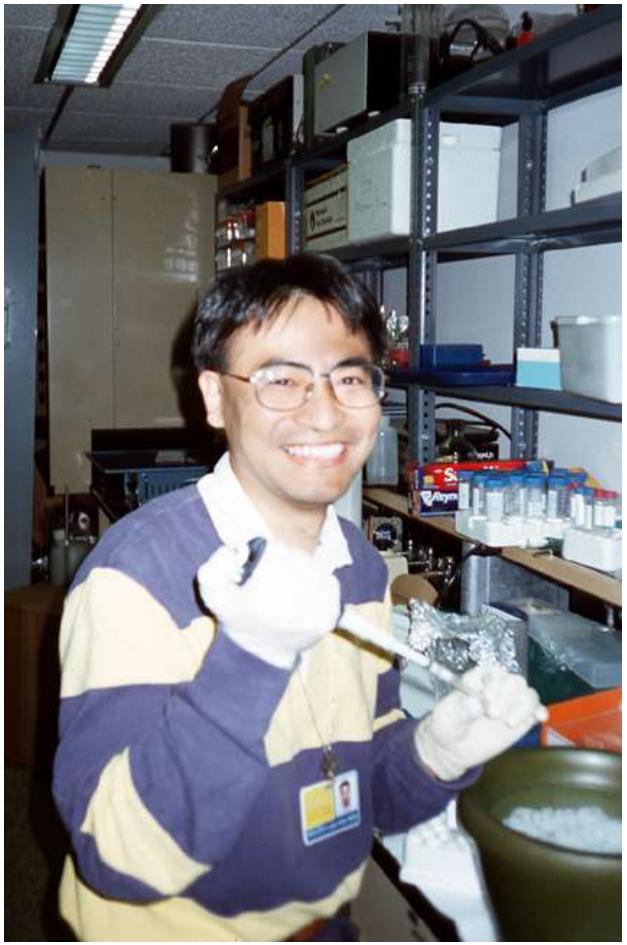
Inherited defects (rare)

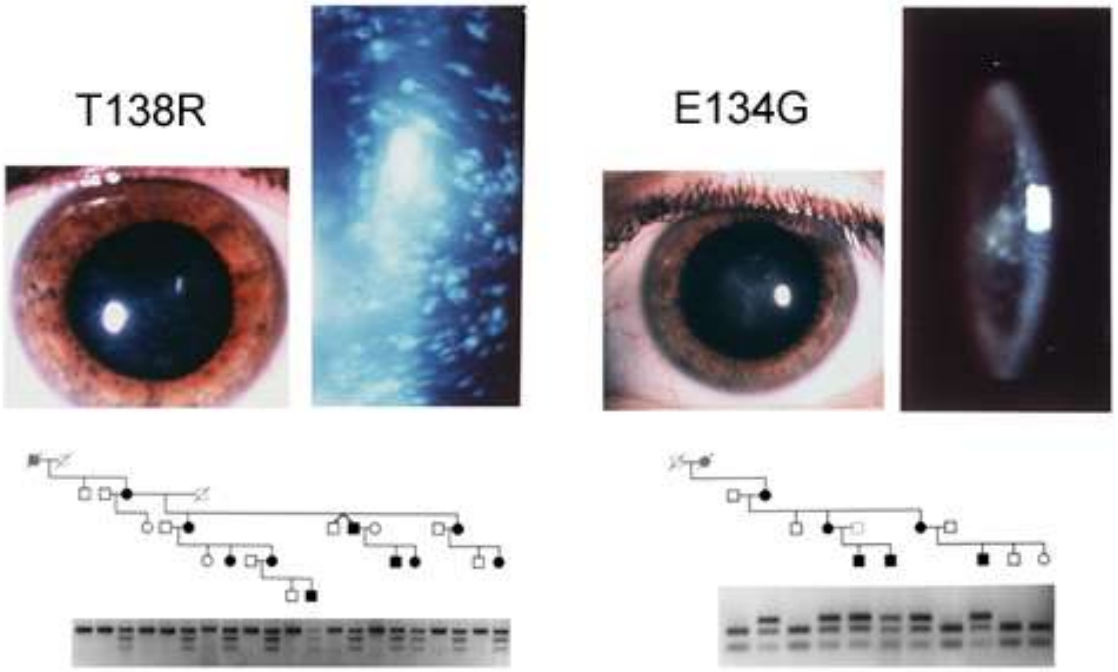
- Nephrogenic DI (severe)

Acquired defects (very common)

- Overexpression—Fluid retention
- Underexpression—Enuresis

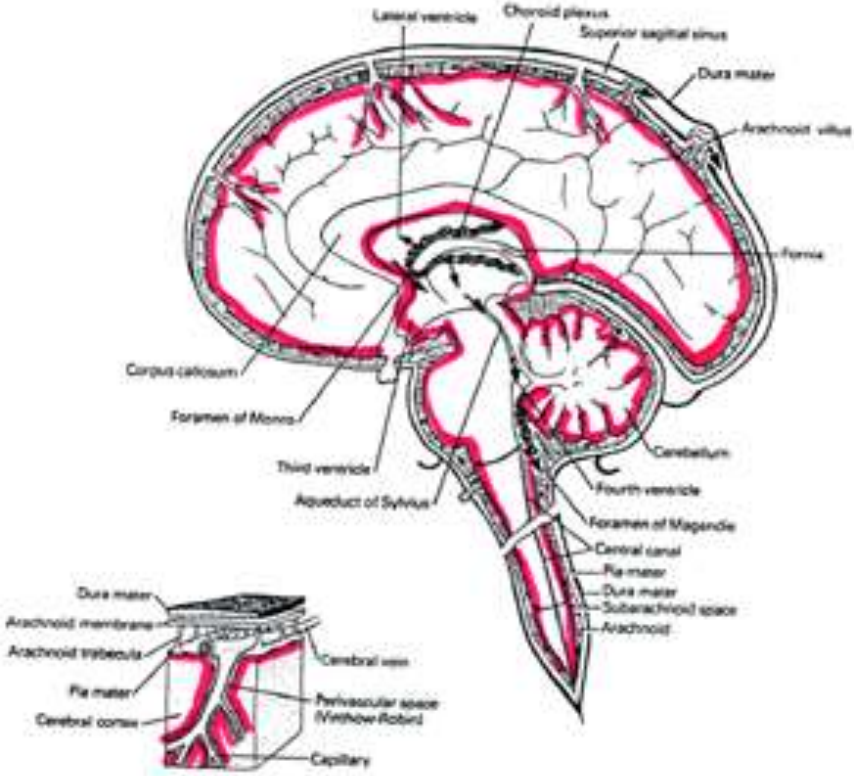
AQP0 and congenital cataracts





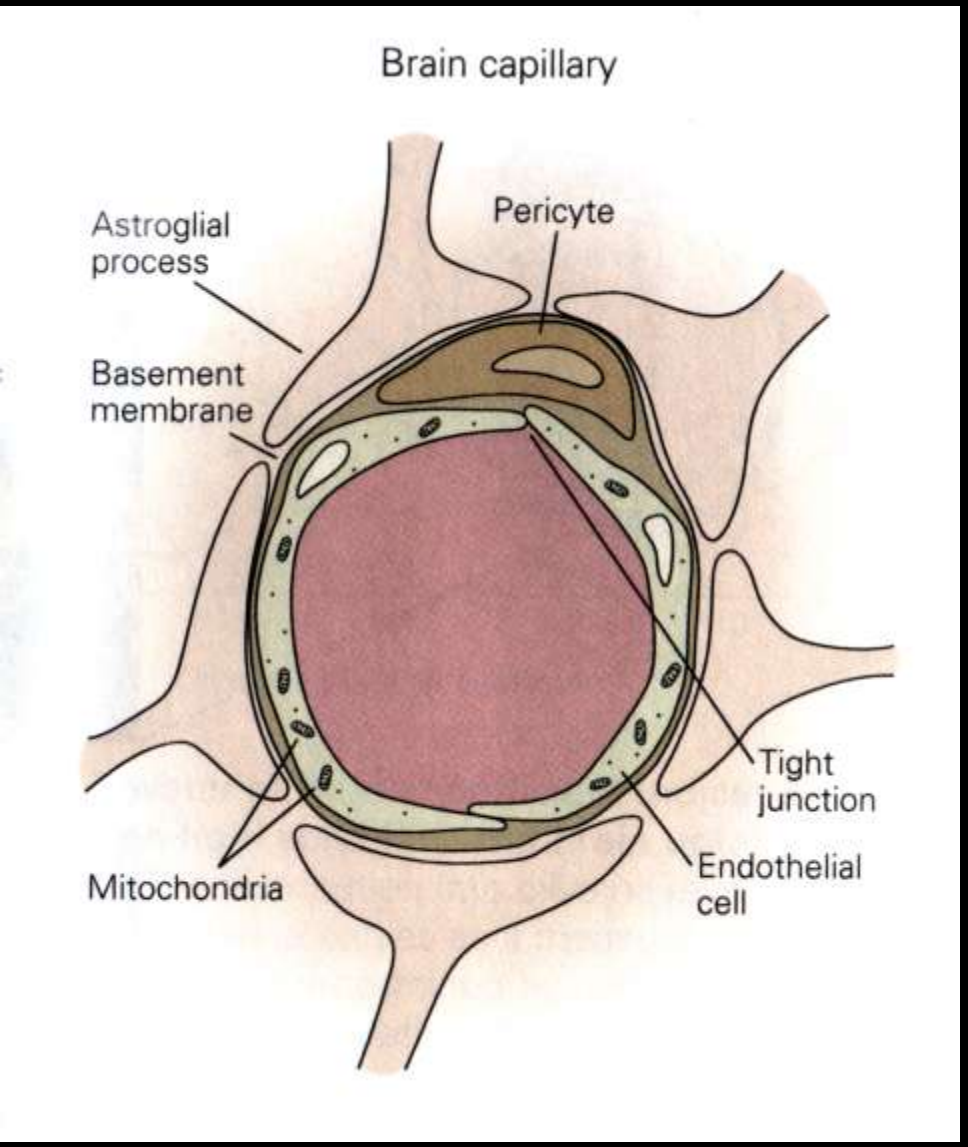
Francis *et al., Human Mol Genetics* 2000

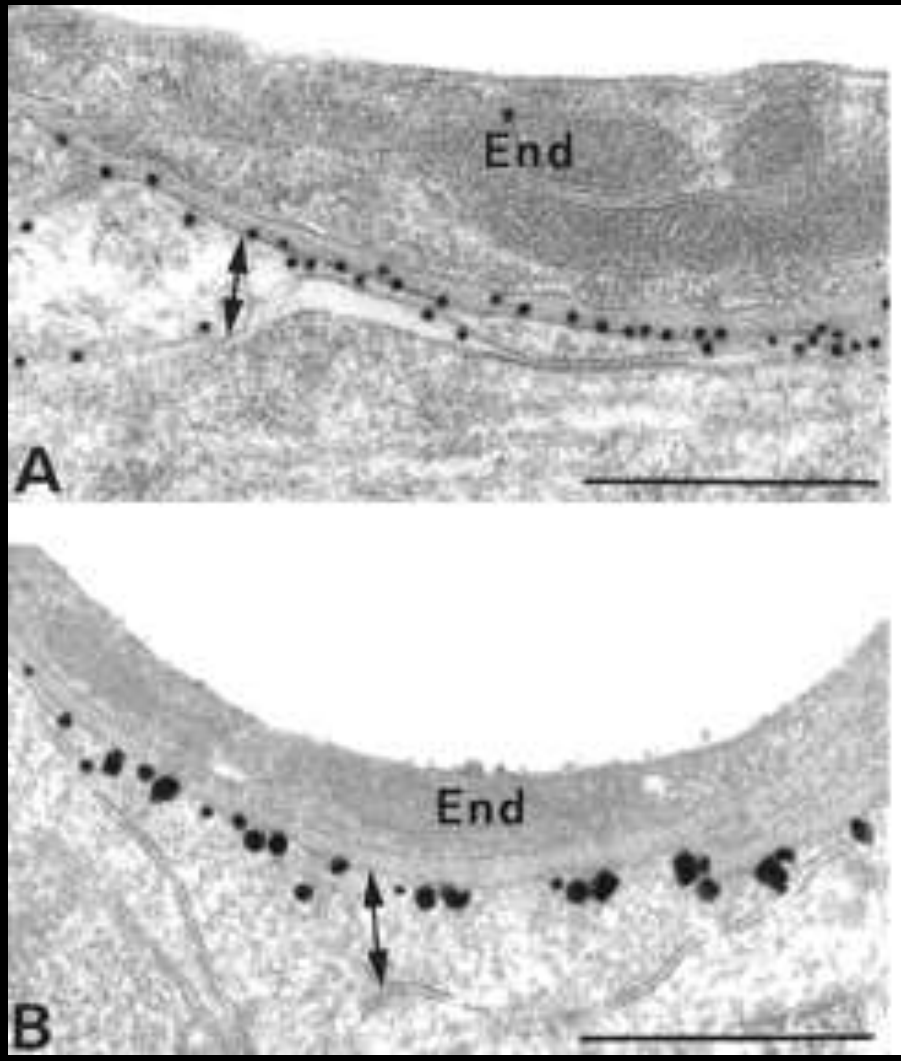
AQP4 water channel in brain



Nielsen *et al., J Neurosci* 1997

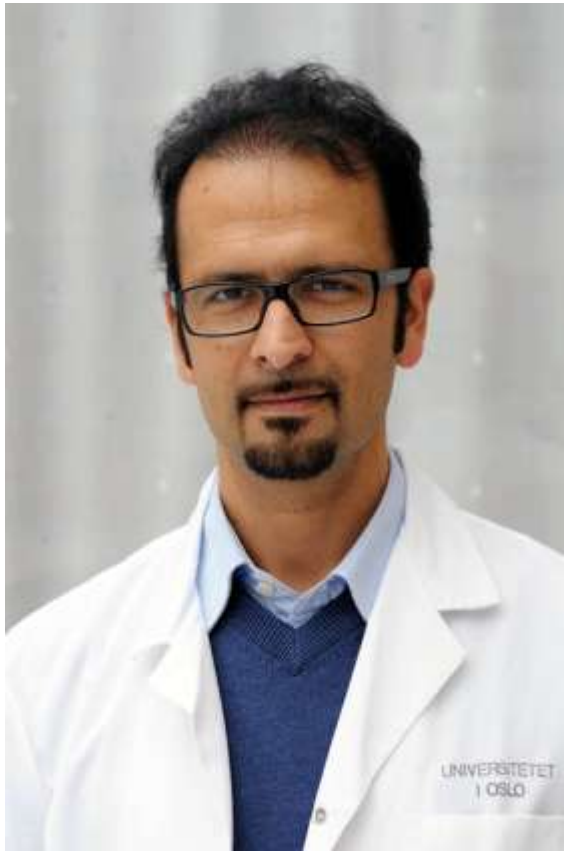
AQP4—Blood brain barrier
(with Ole Petter Ottersen, Oslo)





Nielsen *et al.*, *J Neurosci*, 1997
Nagelhus *et al.*, *J Neurosci*, 1998

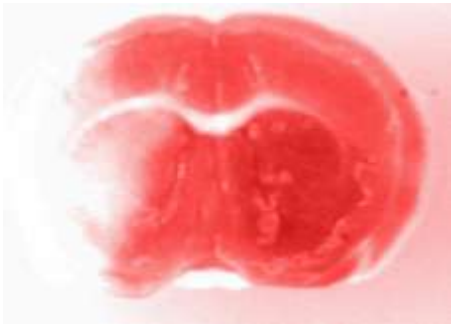
AQP4—accelerated brain damage

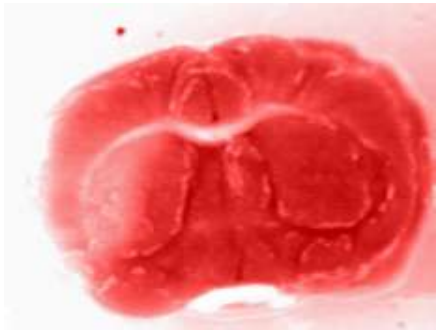


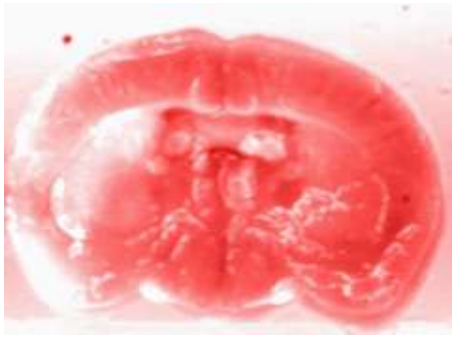
Amiry-Moghaddam *et al.,*
Proc Natl Acad Sci 2003

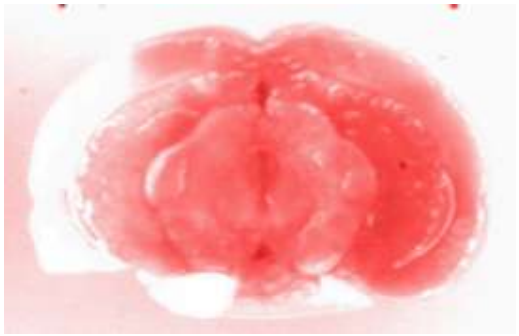
Normal Mouse

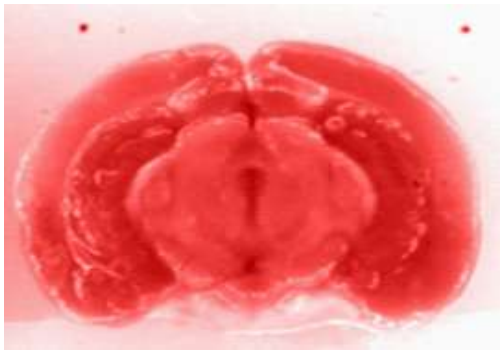
Mutant Mouse

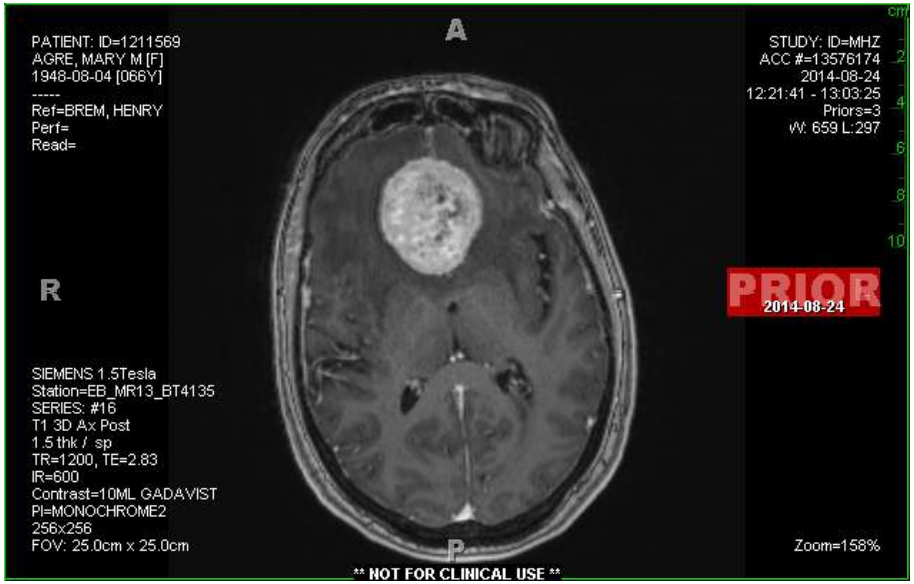











PATIENT: ID=1211569
AGRE, MARY M [F]
1948-08-04 [066Y]

Ref=BREM, HENRY
Perf=
Read=
STUDY: ID=MHZ
ACC #=13576174
2014-08-24
12:21:41 - 13:03:25
Priors=3
W: 659 L:297
A
R
P
PRIOR
2014-08-24
SIEMENS 1.5Tesla
Station=EB_MR13_BT4135
SERIES: #16
T1 3D Ax Post
1.5 thk / sp
TR=1200, TE=2.83
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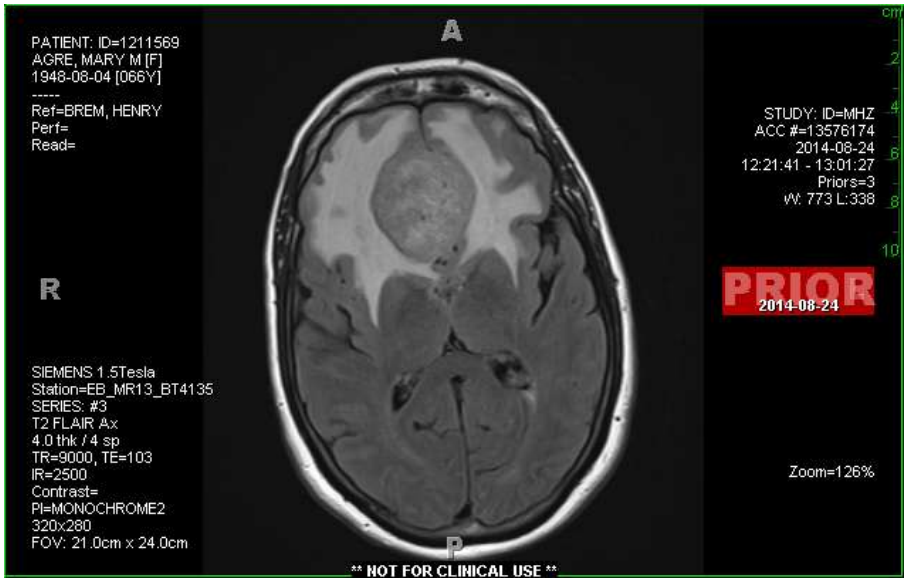
256x256
FOV: 25.0cm x 25.0cm
Zoom=158%
** NOT FOR CLINICAL USE **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AGRE, MARY M [F]
1948-08-04 [066Y]

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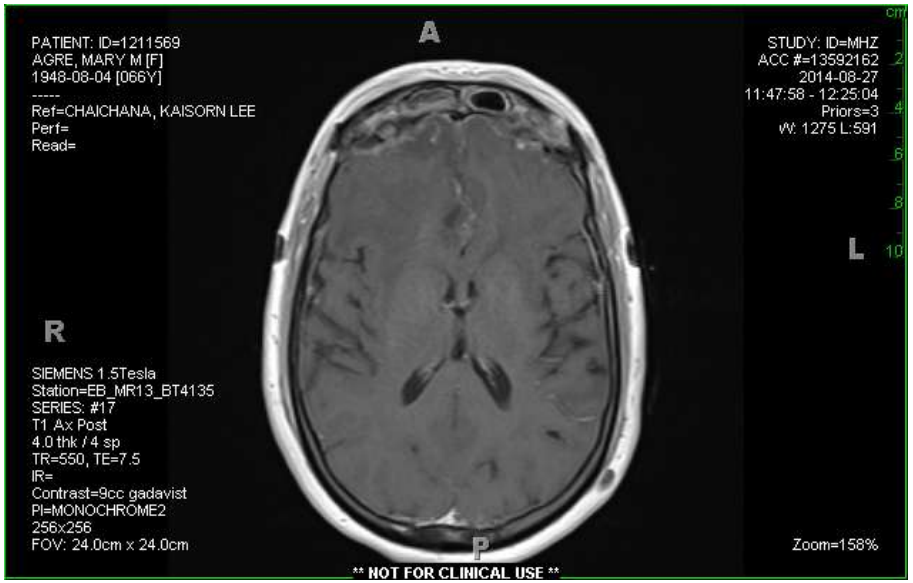
** NOT FOR CLINICAL USE **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AGRE, MARY M [F]
1948-08-04 [066Y]

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Perf=
Read=
STUDY: ID=MHZ
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2014-08-27
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A
R
L
P
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Station=EB_MR13_BT4135
SERIES: #17
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4.0 thk / 4 sp
TR=550, TE=7.5
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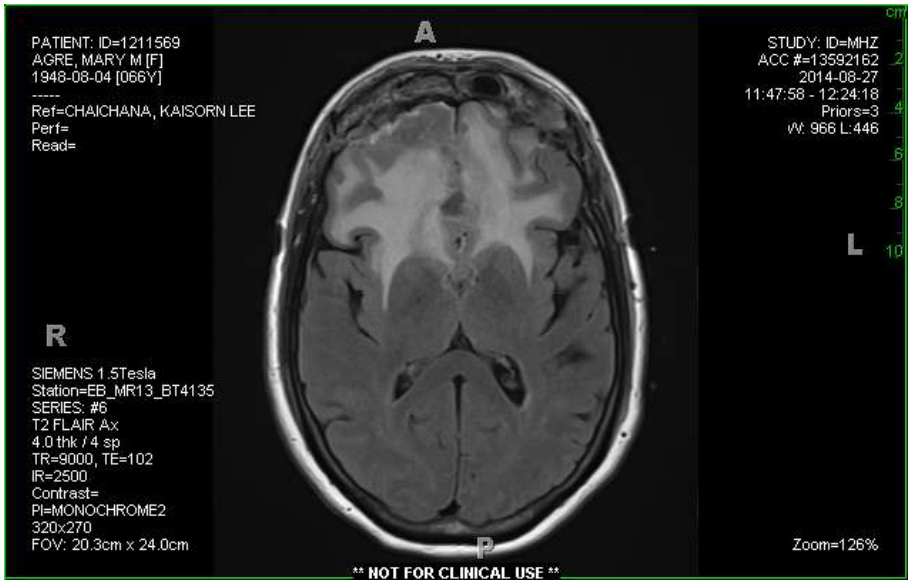
FOV: 24.0cm x 24.0cm
Zoom=158%
** NOT FOR CLINICAL USE **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AGRE, MARY M [F]
1948-08-04 [066Y]

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A
R
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SERIES: #6
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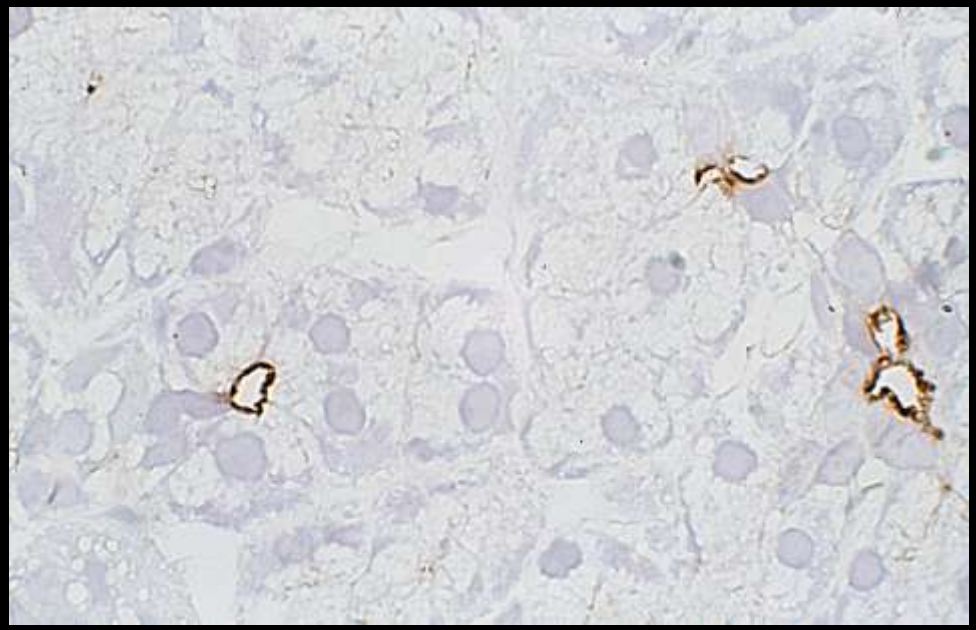
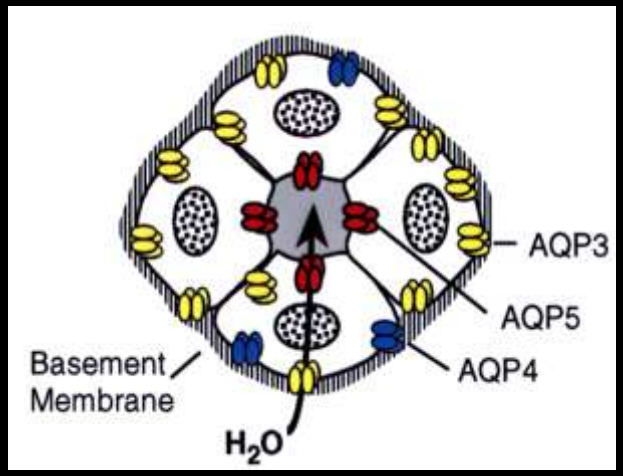
4.0 thk / 4 sp
TR=9000, TE=102
IR=2500
Contrast=
PI=MONOCHROME2
320x270
FOV: 20.3cm x 24.0cm
Zoom=126%
** NOT FOR CLINICAL USE **

AQP5—Secretory glands

cDNA cloned from salivary gland
Lacrimal, submucosal, and
sweat glands



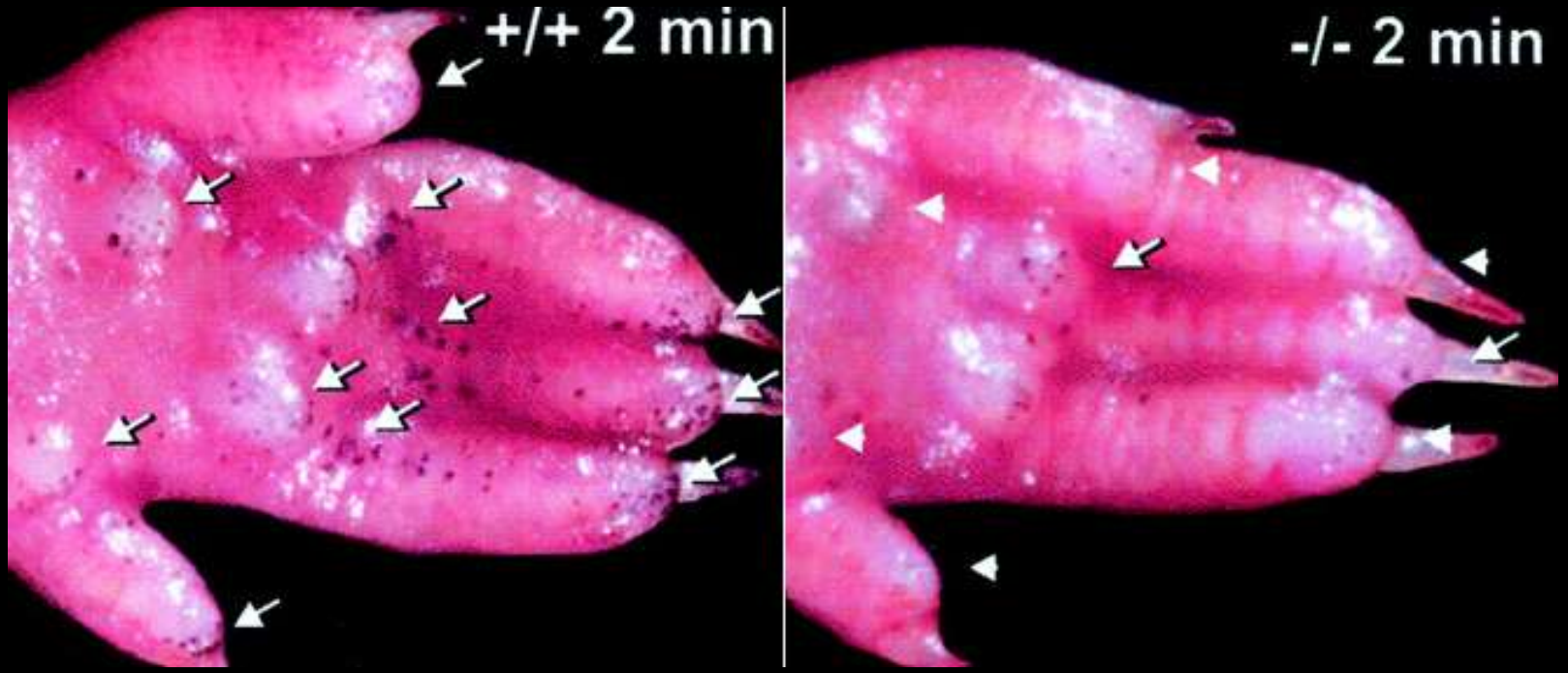


Raina *et al., J Biol Chem,* 1995

Nielsen *et al., Am J Physiol,* 1997

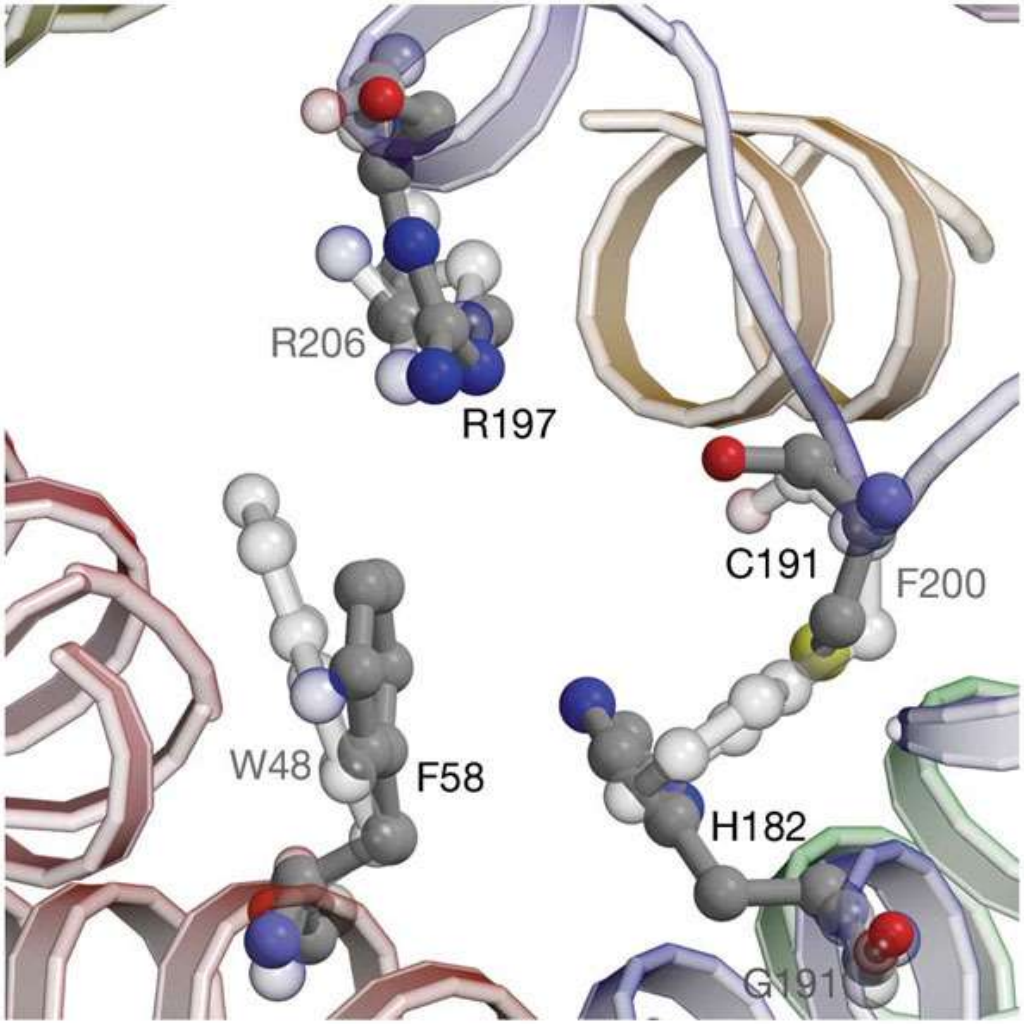
AQP5—Secretory glands

Pilocarpine induced sweat gland function—Wild type vs. AQP5 null mice



Nejsum *et al., Proc Natl Acad Sci,* 2002

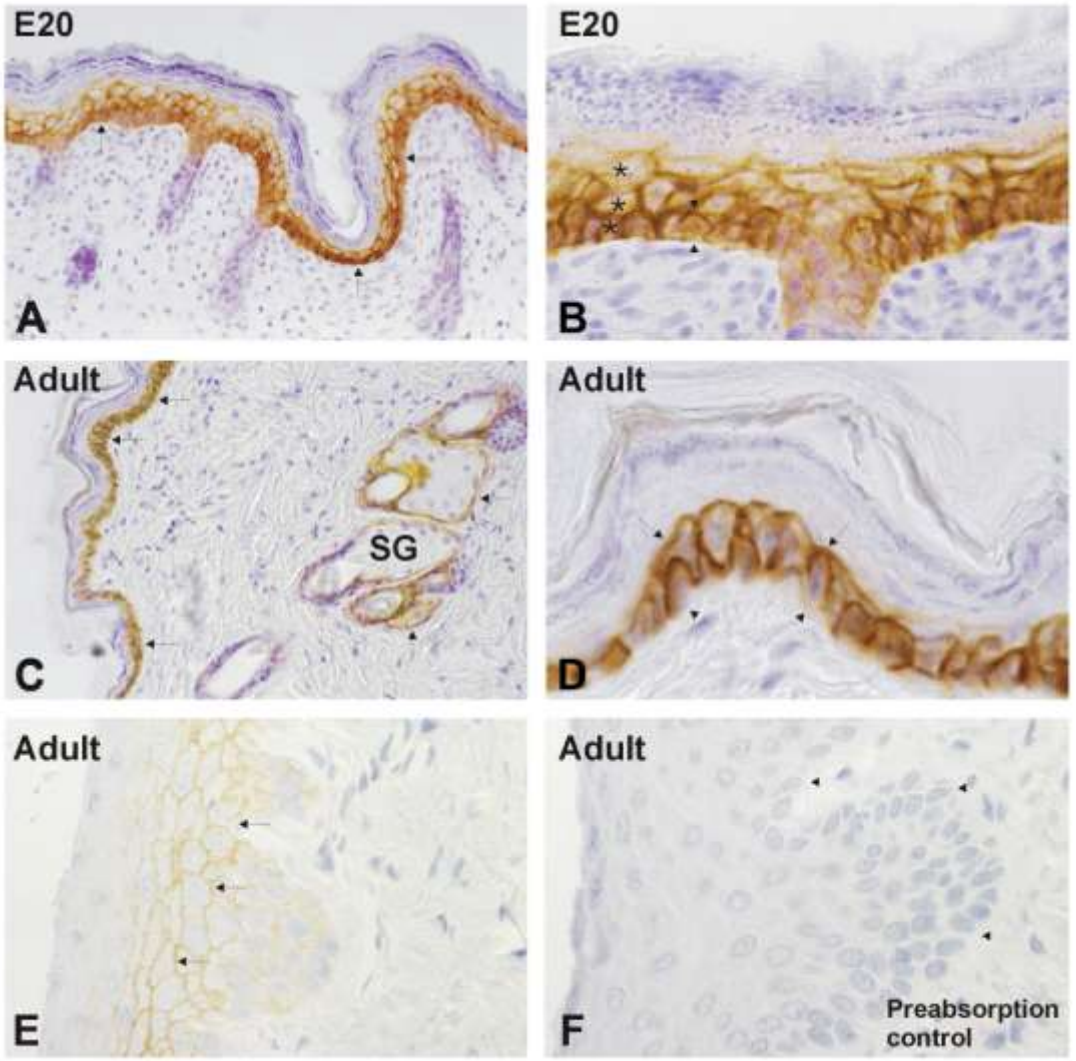
Pore diameters AQP1 vs GlpF



Sui *et al., Nature,* 2001

Aquaglyceroporin—AQP3 in skin

Expression in wound healing and aging



Johan Ågren,
unpublished

Jamais votre peau n'a été aussi belle.

HYDRACTION

La déshydratation se ressent mais surtout elle se voit : teint terne, ridules de déshydratation,...
Pour en finir, Dior crée HYDRACTION, un soin hydratant* innovant aux résultats spectaculaires !

Hydratation Profonde : irriguée** grâce à la technologie Aquaporine exclusive, votre peau retrouve un confort extrême et longue durée.

Hydratation Visible : désaltérée grâce au complexe Aquacapt™, votre peau renaît, belle et pulpeuse.

Des résultats spectaculaires :

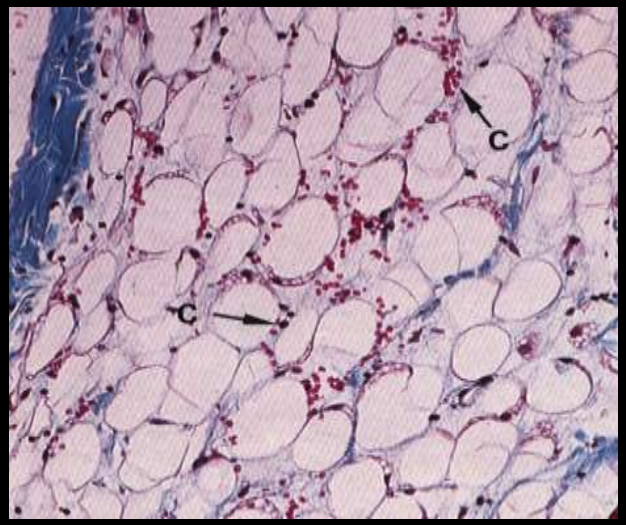
71% des femmes se trouvent plus belles après application d'HYDRACTION***

Les travaux liés à l'exceptionnelle découverte du rôle des aquaporines en général ont été récompensés par le Prix Nobel de Chimie en 2003.

AQP7 and 9—Glycerol metabolism

AQP7 in adipose tissue
- Glycerol + water permeation
- Suppressed by insulin

AQP9 in liver
- Glycerol, water, urea permeation
- Increased by fasting or diabetes



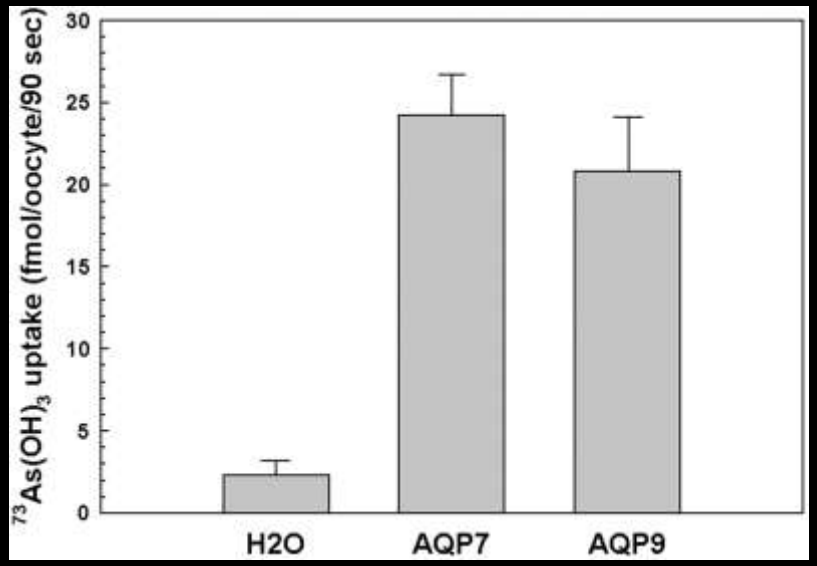
Kishida *et al., J Biol Chem,* 2000
Kuriyama *et al., Diabetes,* 2002

Starvation—AQP7 release
AQP9 facilitate

AQP7 and 9—Heavy metal transport

(with Barry Rosen, Wayne State)

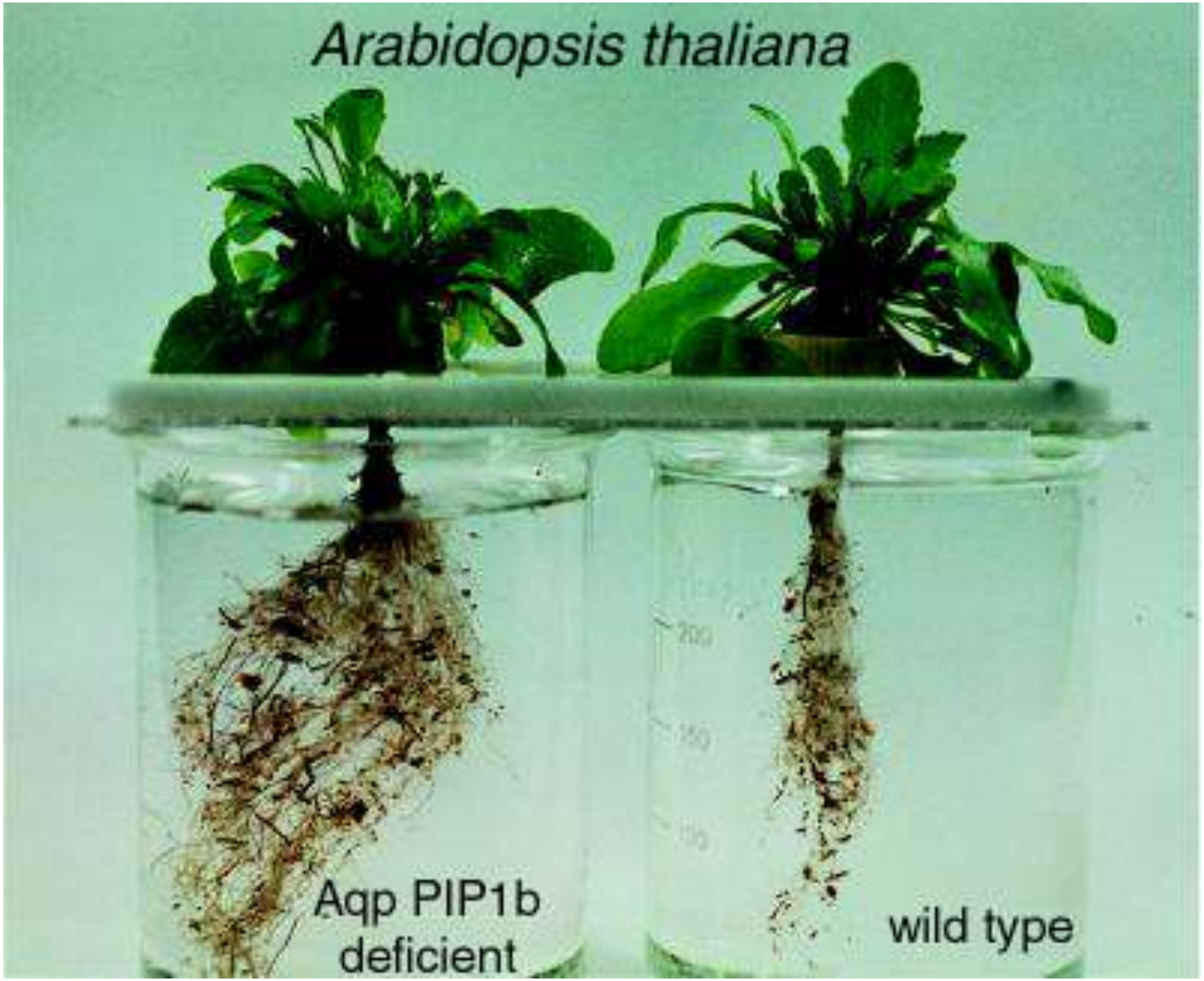
Arsenite—transported by AQP7 and by AQP9.



Liu *et al., Proc Natl Acad Sci,* 2002

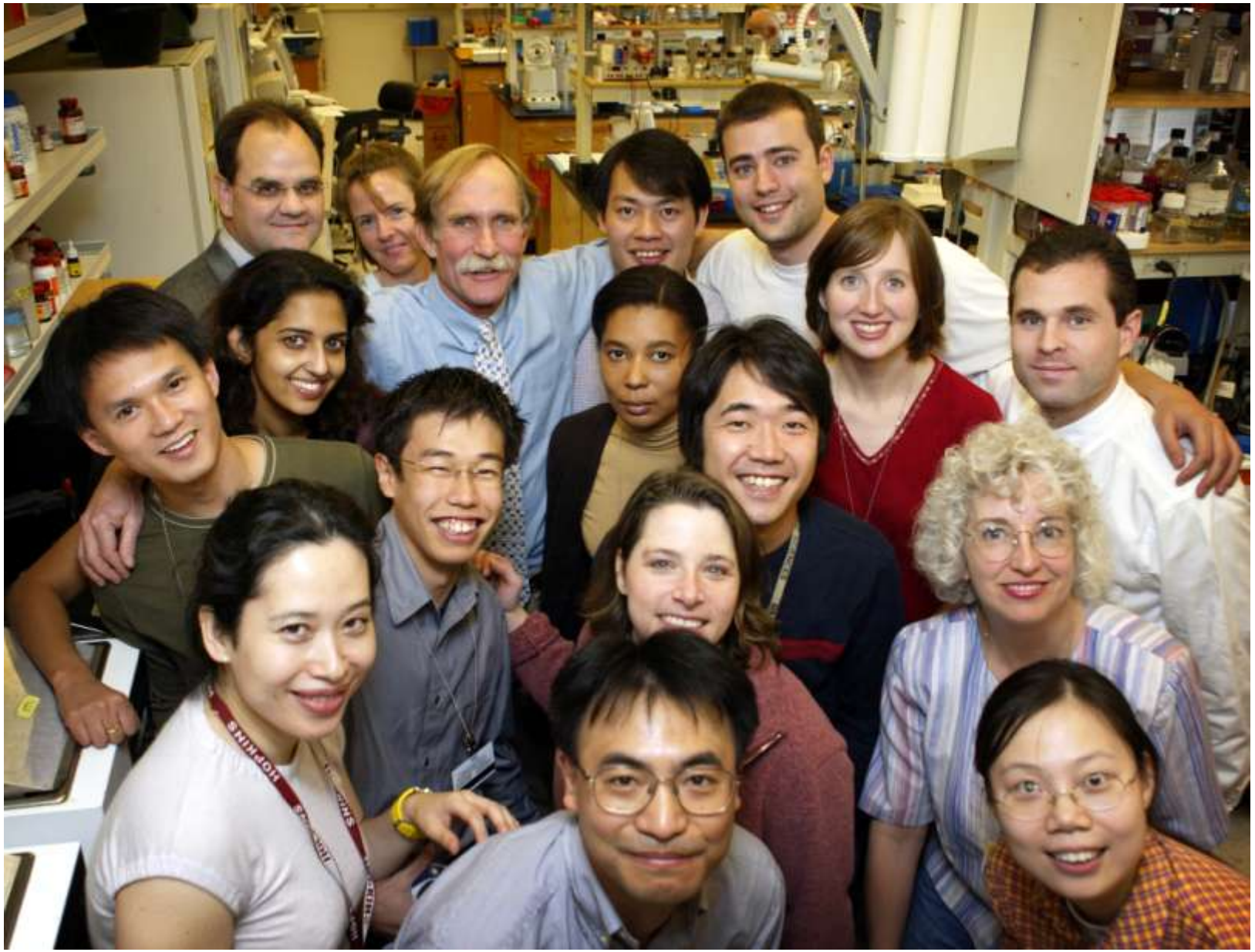
$As(OH)_3$ uncharged at pH 7.
Predictor of epidemic arsenic poisoning hepatotoxicity?

.



Kaldenhof *et al., Plant J* 1998

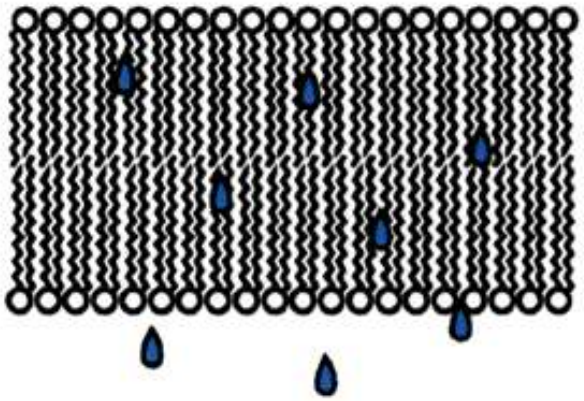
8 October 2003




WELLS
Discount
LIQUORS
PARKING
CONGRATS
DR AGRE

Transmembrane water permeability—Current view

Bilayer Diffusion



All biological membranes

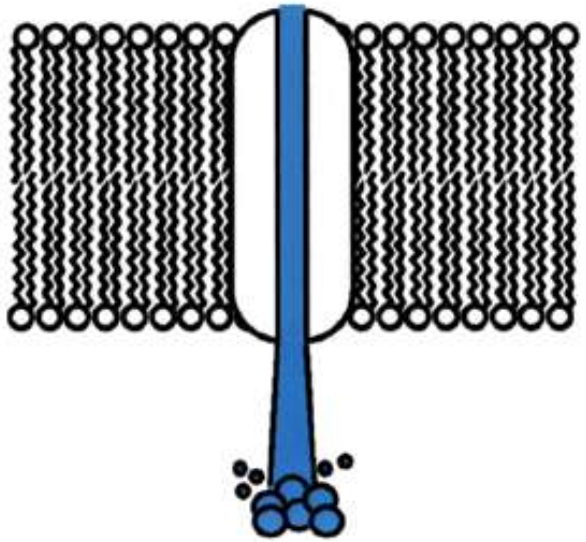
Low capacity

Bi-directional

No known inhibitors

E_a ~10 kcal/mol

Aquaporin Water Channels



Renal tubules, secretory glands, red cells

High capacity for H_2O, not H_3O^+

Directed by osmotic gradients

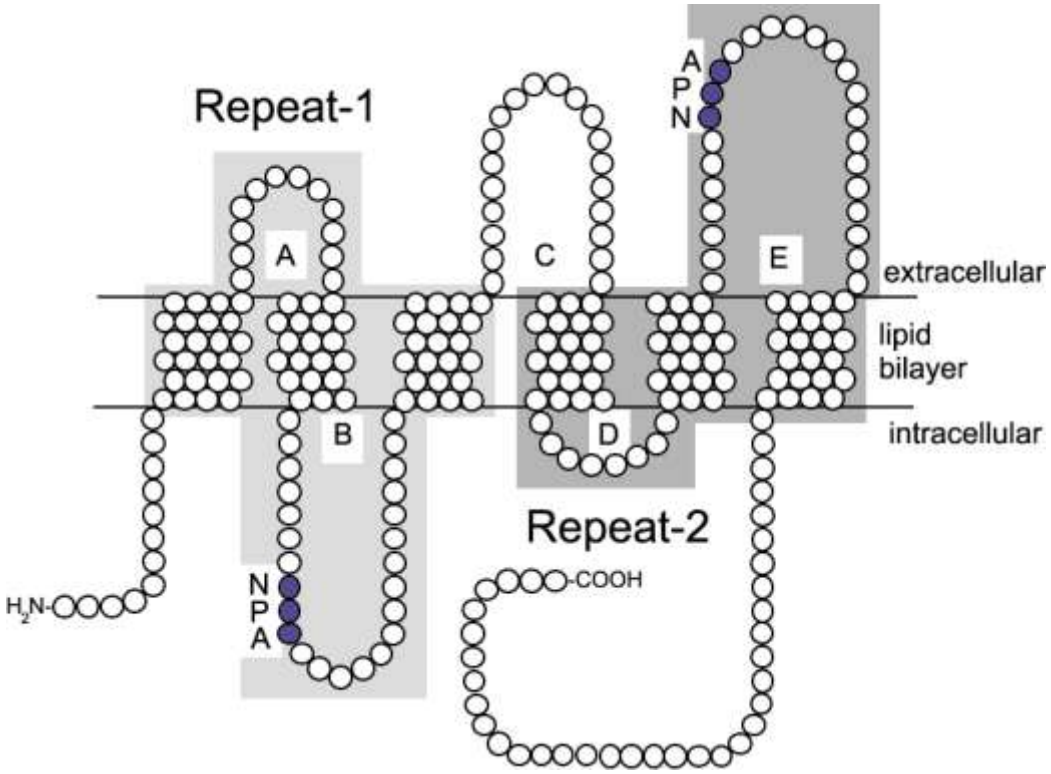
Reversibly inhibited by Hg^{++}

E_a <5 kcal/mol

Discovery of Aquaporin-1
Molecular cloning

28 kDa polypeptide (269 aa)

Internal tandem repeat



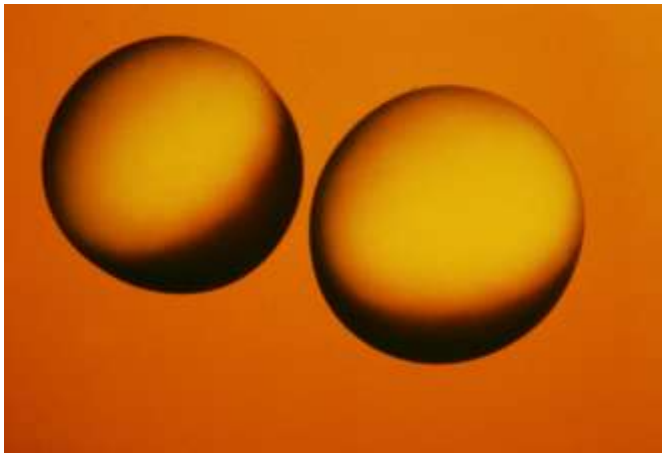
Recognition of homologs

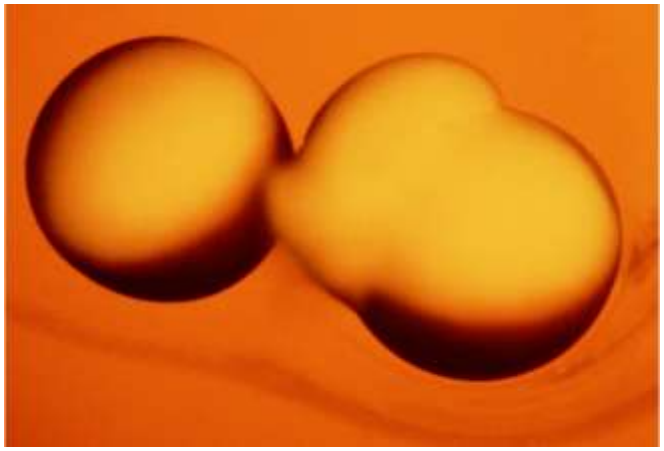
- Bovine lens—MIP
- Drosophila brain—Bib
- E. coli—GlpF
- Plants—Nod, TIP, TUR, TobRB47

Preston & Agre, *Proc Natl Acad Sci,* 1991

Discovery of Aquaporin-1

Functional expression (with Wm. Guggino, JHMI)





Hypo-osmolar swelling
Hg^{++} inhibited, no currents

Preston *et al., Science* 1992

EN MEMORIA DE LA COLABORACION CIENTIFICA ENTRE EL MEDICO CUBANO CARLOS J. FINLAY Y JESSE W. LAZEAR, DE LA UNIVERSIDAD JOHNS HOPKINS, EN LOS EXPERIMENTOS PARA COMPROBAR LAS TEORIAS ORIGINALES DE FINLAY SOBRE EL AGENTE TRANSMISOR DE LA FIEBRE AMARILLA. SUS RESULTADOS ABRIERON EL CAMINO PARA ELIMINAR ESE AZOTE DE LOS TROPICOS. EN ARAS DE ESE PROPOSITO, LAZEAR OFRENDO SU VIDA.

LA HABANA, FEBRERO DE 2015. AÑO DEL CENTENARIO DEL DECESO DE CARLOS J. FINLAY.

THE HEALTH ADVISORY BOARD FROM THE JOHNS HOPKINS BLOOMBERG SCHOOL OF PUBLIC HEALTH, BALTIMORE, MARYLAND, USA.

LA ACADEMIA DE CIENCIAS DE CUBA.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