

University of California, San Francisco
CURRICULUM VITAE

Name: Matthew F Krummel, PhD

Position: Professor, Step 4
Pathology
School of Medicine

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EDUCATION

1989 - 1995	University of California at Berkeley, Department of Molecular and Cell Biology	Ph.D.	Immunology
1985 - 1989	University of Illinois, School of Liberal Arts and Sciences	B.S.	Honors Biology and Chemistry.
1987 - 1988	University College, London, England	Exchange Student	Department of Chemistry
1980 - 1985	University of Illinois High School, Urbana, Illinois		

PRINCIPAL POSITIONS HELD

2018 - present	University of California at San Francisco	Co-Founder and Inaugural Chair	ImmunoX Initiative
2015 - 2016	Mediterranean Institute for Advanced Studies, Aix-Marseille University, France	Visiting Sabbatical Scholar	
2012 - present	University of California at San Francisco	Professor	Department of Pathology
2008 - 2009	Institut Curie. Paris, France	Visiting Sabbatical Scholar	Cancer

2006 - present	University of California at San Francisco	Faculty Director	Biological Imaging Development Center
2006 - 2011	University of California at San Francisco	Associate Professor	Department of Pathology
2001 - 2006	University of California at San Francisco	Assistant Professor	Department of Pathology
1997 - 2001	Beckman Institute, Stanford University. Advisor: Dr. Mark M. Davis	Postdoctoral Fellow	HHMI
1996 - 1997	Walter and Eliza Hall Institute, Melbourne Australia. Advisors: Dr. Bill Heath and Dr. Ken Shortman	Postdoctoral Fellow	Dendritic Cell Biology
1995 - 1996	UC Berkeley. Advisor: Dr. James P. Allison	Postdoctoral Fellow	MCB
1989 - 1995	UC Berkeley. Advisor: Dr. James Allison	Graduate Research Assistant	MCB
1988 - 1988	UGM, Institut Pasteur. Advisors: Dr. Julian Davies and Dr. Tom Holt	Stagiare (Technician)	UGM
1987 - 1987	UTHSC Dallas. Advisor: Dr. Flora Katz	HHMI Summer Fellow	Neurobiology

HONORS AND AWARDS

2016	Robert E. Smith Endowed Chair in Experimental Pathology
2013	Pediatrics FLAG Mentorship Award, University of California, San Francisco
2009	Fellow of the American Asthma Foundation
2005	Leukemia and Lymphoma Foundation, Career Award
2004	Cancer Research Institute, Investigator Award
1997	NRSA Postdoctoral Fellowship, National Institutes of Health
1996	Postdoctoral Fellowship, Juvenile Diabetes Foundation International

- 1989 Luce scholars competition finalist, Henry Luce Foundation
- 1986 James scholar, University of Illinois
- 1985 Illinois State Scholar, National Merit scholar, Westinghouse Science Award

KEYWORDS/AREAS OF INTEREST

Immunity, Tolerance, Cell-Cell Interactions, T cell synapse, Cell motility, Multicellular systems
Tumor Immunology, Immune regulation, Immunotherapy
Lung Immunity, asthma, lung metastasis

CLINICAL ACTIVITIES

CLINICAL ACTIVITIES SUMMARY

N/A

PROFESSIONAL ACTIVITIES

MEMBERSHIPS

- 2016 - present Member of the European Academy for Tumor Immunology (EATI)
- 2009 - present Biophysical Society
- 2003 - present American Association of Investigative Pathology
- 1997 - present American Association of Immunologists
- 1991 - present American Association for the Advancement of Science

SERVICE TO PROFESSIONAL ORGANIZATIONS

- | | | |
|----------------|--|--|
| 2014 - present | Cancer Research UK | Referee |
| 2008 - present | European Research Council | Referee |
| 2004 - present | US-Israeli Binational Science Foundation | Ad hoc reviewer |
| 2003 - present | Wellcome Trust | Ad hoc reviewer |
| 2002 - present | NIH: CMIA (formerly Aly), TTT | Ad hoc member of study sections |
| 2008 - 2009 | NIAID | Member: Board of Scientific Counselors |

SERVICE TO PROFESSIONAL PUBLICATIONS

- 2005 - present Associate Editor, Immunity
- 2005 - 2012 Section Editor, Biology Image Library

2001 - present Reviewer: Science, Nature, Cell, Nature Immunology, Immunity, JEM, JCB, JCI, Nature Cell Biology, Nature Medicine, Nature Methods, Nature Protocols, Science Immunology, PNAS, Journal of Immunology, Trends in Molecular Medicine, Traffic, Current Issues in Molecular Biology, Blood.

INVITED PRESENTATIONS - INTERNATIONAL

2019	Centuri Scientific Meeting, Self-Organization in Multicellular Systems, Corsica, France	Invited Speaker
2019	EMDS Annual Conference, The Mononuclear phagocyte system in development, immunity and cancer, Marseille, France	Invited Speaker
2019	QIMR International Immunotherapy Conference, Brisbane, Australia	Invited Speaker
2019	World Immune Regulation Meeting, Davos, Switzerland	Invited Speaker
2019	Scandinavian Society for Immunology, Annual Meeting & Spring School of Immunology, Geilo, Norway	Invited Speaker
2018	EMBO Lymphocyte Antigen Receptor Signaling, Siena, Italy	Invited Speaker
2018	Cambridge Immunology Forum -- "Cancer Immunology", Cambridge, UK	Invited Speaker
2018	BIRS Quantitative Analysis of Immune Cell Migration and Spatial Processes in Health and Disease, Oaxaca, Mexico	Invited Speaker
2018	Barcelona BioMed Conference on Mechanisms of Metastasis	Invited Speaker
2017	Donnelly Seminar Series, University of Toronto, Canada	Invited Speaker
2017	World Immune Regulation Meeting, Davos, Switzerland	Invited Speaker
2016	CRI-CIMT-EATI-AACR International Cancer Immunotherapy Meeting, NYC, NY	Session Chair and Speaker
2016	Imaging the Immune System, Weizmann Institute, Israel	Keynote Speaker
2016	EMBO: Lymphocyte Signaling, Siena Italy	Invited Speaker
2016	Immunology Seminar Series, Universidad de Madrid	Invited Speaker
2016	German Cell Biology Society Annual Meeting, Munich, Germany	Invited Speaker
2016	Keystone Meeting on Tumor Vaccines, Whistler BC, Canada	Invited Speaker
2016	Immunology Seminar Series, Curie Institute, Paris, France	Invited Speaker
2015	French Dendritic Cell Club, Annual Meeting	Invited Speaker

2015	Microscience Microscopy Congress, Imaging the Immune System Seminar, Manchester UK	Invited Speaker
2015	Kennedy Institute of Rheumatology, Seminar Series, Oxford University	Invited Speaker
2015	"Unanswered Questions in Cancer and the Immune System" Cancer Research UK Annual Meeting, Cambridge UK	Invited Speaker
2015	Universite de Marseille/INSERM, Luminy. Immunology Seminar Series	Invited Speaker
2014	European Respiratory Society, Estoril Portugal	Invited Speaker
2013	International Congress of Immunology, Milan Italy	Session Chair
2013	University of Lausanne, Immunology Seminar Series	Invited Speaker
2013	World Immune Regulation Meeting, Davos, Switzerland	Invited Speaker
2012	Japanese Society of Immunology, Kobe, Japan	Invited Speaker
2012	"Cell Migration in Biology and Medicine", Kyushu University, Fukuoka, Japan	Invited Speaker
2011	1st Annual Postech Conference on Bio-Imaging, Pohang, Korea	Invited Speaker
2011	Weatherall Institute of Immunology, Oxford University, England	Interviewee and Invited Speaker
2009	Saarland University Immunology Seminar Series, Homburg Germany	Invited Speaker
2009	Institut Curie, Immunology Series, Paris	Invited Speaker
2009	British Society of Immunology: Imaging the Immune System, York England	Invited Speaker
2009	Institut Pasteur, Immunology Series. Paris, France	Invited Speaker
2008	Institut Necker, Immunology Series. Paris, France	Invited Speaker
2008	RAMIC (Spanish Motility Consortium Meeting), Madrid, Spain	Invited Speaker
2008	Foundation Dreyfeus: Cellular Motility and the Cytoskeleton, Paris France	Invited Speaker
2007	Institut Curie, Paris	Invited Speaker
2007	Signaling in the Immune and Nervous System, Ulm Germany	Invited Speaker
2007	Canadian Transplantation Society, Halifax NS	Invited Speaker
2007	2nd International Septin Meeting, Monte Verita Switzerland	Invited Speaker

2007	University of British Columbia, Vancouver	Invited Speaker
2007	Plenary Lecture, Netherlands Society of Immunology, Luntern	Invited Speaker
2007	University of Utrecht, Netherlands	Invited Speaker
2006	Institut Curie, Paris France	Invited Speaker
2006	Cancer Research UK, London	Invited Speaker
2005	Gordon Conference: Immunobiology and Immunochemistry, Oxford, England	Invited Speaker
2004	International Congress of Immunology, Montreal, Canada	Invited Speaker
2001	International Congress of Immunology, Stockholm, Sweden	Invited Speaker

INVITED PRESENTATIONS - NATIONAL

2019	SITC Annual Meeting, National Harbor, MD	Co-Chair and Invited Speaker
2019	NCI, Cancer and Inflammation: From Micro to Macro, Bethesda, MD	Invited Speaker
2019	Allen Institute for Immunology Scientific Advisory Board Meeting, Seattle WA	Invited Speaker
2019	The Jackson Laboratory, Annual Short Course on Experimental Models of Human Cancer, Bar Harbor, ME	Invited Speaker
2019	Immuno-Skamania Summit, Stevenson, WA	Co-Organizer
2019	Cancer Target Discovery and Development Network, Annual Face-to-Face Meeting, Portland, OR	Invited Speaker
2019	AAI, Major Symposium at Immunology 2019, San Diego, CA	Invited Speaker
2019	Woods Hole Immunoparasitology Meeting, Woods Hole, MA	Invited Speaker
2019	Keystone Symposia, Uncovering Mechanisms of Immune-Based Therapy in Cancer and Autoimmunity, Breckenridge, CO	Invited Speaker
2019	Keystone Symposia on Molecular and Cellular Biology, Santa Fe NM	Invited Speaker
2019	KI/MIT Immune Engineering Symposium, Boston MA	Invited Speaker
2019	Midwinter Conference of Immunology, Pacific Grove CA	Invited Speaker
2018	AACR Special Conference on Tumor Immunology and Immunotherapy, Miami FL	Invited Speaker

2018	FASEB - Immunoreceptors & Immunotherapy, Snowmass, CO	Invited Speaker
2018	Dana-Farber Cancer Institute Immune Imaging Symposium, Boston MA	Invited Speaker
2018	Parker Institute of Cancer Immunotherapy, Symposium, Rochester NY	Invited Speaker
2018	National Cancer Institute, Innovative Molecular Analysis Technologies Principal Investigators Meeting, Rockville MD	Invited Speaker
2018	Starr Cancer Consortium, MSKCC, New York NY	Invited Speaker
2018	PNW Tumor Microenvironment Symposium, Portland OR	Invited Speaker
2018	Immunology Inflammation Infectious Disease Symposium, Salt Lake City UT	Invited Speaker
2018	Keystone Symposium Myeloid Cells, Keystone CO	Invited Speaker
2018	Parker Institute of Cancer Immunotherapy, Spring Retreat, Honolulu HI	Invited Speaker
2018	AACR Annual Meeting 2018, Chicago IL	Invited Speaker
2018	Keystone Symposium Lymphocytes in Cancer, Keystone CO	Invited Speaker
2018	FOCIS - SITC Course on Cancer & Immunotherapy, San Francisco CA	Invited Speaker
2018	Allen Institute Immunology Workshop, San Diego CA	Invited Speaker
2018	Midwinter Conference of Immunologists, Asilomar, CA	Organizer and Invited Speaker
2017	AARC Tumor Immunology and Immunotherapy, Boston MA	Invited Speaker and Session Chair
2017	Sun Valley Conference, Sun Valley ID	Invited Speaker
2017	Cancer Cell Meeting on Tumors, San Diego CA	Invited Speaker
2017	Merck Research Labs, Immunology Seminar Series, Boston MA	Invited Speaker
2017	Memorial Sloane Kettering Cancer Center, Immunology Seminar Series, Rockville Centre NY	Invited Speaker
2017	Midwinter Conference of Immunologists, Asilomar CA	Invited Speaker
2017	NCI Special Meeting on the Tumor Immune Microenvironment, Fredrick MD	Organizer and Speaker
2017	Cell Plasticity within Tumor Microenviornment, Keystone MT	Invited Speaker

2015	University of Washington, Seattle, Immunology Seminar Series	Invited Speaker
2015	Yale University Immunology Seminar Series	Invited Speaker
2015	Parker Institute for Cancer Immunotherapy, Kickoff workshop, NYC	Invited Speaker
2015	University of North Carolina, Epithelial Cell Biology Seminar Series	Invited Speaker
2015	UC Santa Cruz, BME Seminar Series	Invited Speaker
2015	AACR National Meeting, Major Symposium Innate and Adaptive Immunity in Cancer, Philadelphia	Invited Speaker
2014	UT Austin Immunology Seminar Series	Invited Speaker
2014	UC Berkeley, Immunology seminar series	Invited Speaker
2014	Medical College of Wisconsin, Student-sponsored seminar series	Invited Speaker
2014	University of Chicago, Immunology Seminar Series	Invited Speaker
2014	Cold Spring Harbor, Banbury Symposium on Immunity and Cancer	Invited Speaker
2014	MD Anderson Cancer Center	Invited Speaker
2014	University of Arizona IMB Symposium	Invited Speaker
2014	Washington University, St. Louis Department of Immunology and Cancer Center Seminar Series	Invited Speaker
2014	Systems Approaches in Immunology Conference, Santa Fe NM	Invited Speaker
2013	Fall Seminar Series, University of Massachusetts	Invited Speaker
2013	AACDRC Annual Meeting, Bethesda, Maryland	Invited Speaker
2013	University of California, Irvine	Invited Speaker
2013	Harvard/Mass General Hospital Immunology Seminar Series	Invited Speaker
2013	Harvard/Mass General Hospital Pulmonary Ground Rounds	Invited Speaker
2013	AACR Special Meeting on Metastasis, San Diego	Invited Speaker
2012	Kavila Institute of Theoretical Physics, UCSB	Invited Speaker
2012	Stanford University, Immunology Seminar Series	Invited Speaker
2012	American Thoracic Society Annual Meeting, San Francisco	Invited Speaker

2012	American Asthma Foundation Annual Meeting, San Francisco	Invited Speaker
2012	Immunology Seminar Series, Genentech, San Francisco	Invited Speaker
2012	Immunology Seminar Series, Scripps Research Institute	Invited Speaker
2011	Gordon Research Conferences: Lung Development, Injury & Repair	Invited Speaker
2011	La Jolla Institute of Allergy and Immunology, San Diego CA	Invited Speaker
2011	FASEB Summer Conferences: Signal Transduction in the Immune System	Invited Speaker
2011	American Asthma Foundation, San Francisco CA	Invited Speaker
2011	American Academy of Allergy, Asthma and Immunology, San Francisco CA	Invited Speaker
2011	NCI Seminar Series, NCI Frederick MD	Invited Speaker
2011	Immunology Seminar Series, Memorial Sloan Kettering, New York NY	Invited Speaker
2011	NCI Mouse Models Consortium Meeting, South San Francisco CA	Invited Speaker
2010	Kimmel Cancer Center, Seminar Series, Philadelphia PA	Invited Speaker
2010	ASCB Annual Meeting, Speaker and Session Chair, Philadelphia PA	Invited Speaker
2010	University of Minnesota, Immunology Seminar Series, Minneapolis MN	Invited Speaker
2010	Cancer Research Institute, Annual Meeting, New York NY	Invited Speaker
2010	American Association of Immunology Annual Meeting, Baltimore MD	Invited Speaker
2010	Keystone Symposia: Lymphocyte Activation and Gene Expression, Breckenridge CO	Invited Speaker
2010	University of Washington Seattle, Immunology Seminar Series, Seattle WA	Invited Speaker
2010	Midwinter Conference of Immunologists, Asilomar CA	Invited Speaker
2010	Mouse Models of Human Cancer Consortium, San Francisco CA	Invited Speaker
2009	UNC, Pharmacology Series, Chapel Hill NC	Invited Speaker
2009	Gordon Conference: Integrin, Fibronectins and Related Molecules, Ventura, CA	Invited Speaker

2008	IPSEN Foundation: Cell Shape and Polarity, Chicago IL	Invited Speaker
2008	New York University Immunology Seminar Series, New York NY	Invited Speaker
2008	NIH/NIAID Immunology Lecture Series, Bethesda MD	Invited Speaker
2008	University of Pennsylvania, Immunology Group, Philadelphia PA	Invited Speaker
2007	Keystone Conference "Imaging the Immune Response", Keystone CO	Invited Speaker
2007	Gordon Conference "Gradient Sensing and Directed Cell Migration", Ventura CA	Invited Speaker
2006	UC Santa Cruz, Santa Cruz CA	Invited Speaker
2006	University of Virginia, Immunology Seminar Series	Invited Speaker
2006	FOCIS Meeting, San Francisco CA	Invited Speaker
2006	Harvard Medical School Immunology Seminar, Cambridge MA	Invited Speaker
2006	UMass Worcester Immunology Seminar, Worcester MA	Invited Speaker
2006	UC Irvine Immunology Seminar, Irvine, CA	Invited Speaker
2005	Washington University Immunology Seminar, St. Louis, MO	Invited Speaker
2005	HHMI: Imaging the Immune System, Chevy Chase MD	Invited Speaker
2005	University of Illinois at Urbana-Champaign Cell Biology Seminar Series	Invited Speaker
2004	American Society for Cell Biology Annual Meeting, Washington DC	Invited Speaker
2004	Antigen Presenting Workshop, Bar Harbor, Maine	Invited Speaker
2003	FASEB Summer Conference: ?Lymphocytes and the Immune System,? Tuscon, Arizona	Invited Speaker
2003	Keystone Symposia, "Lymphocyte Activation", Keystone CO	Invited Speaker
2003	NYU/Skirball Institute Immunology Seminar Series, New York NY	Invited Speaker

INVITED PRESENTATIONS - REGIONAL AND OTHER INVITED PRESENTATIONS

2018	FOCIS - SITC Course on Cancer Immunity and Immunotherapy	Invited Speaker
2015	2015 Cancer Center Symposium: Breakthroughs in Cancer Immunotherapy	Invited Speaker

2012	'Imaging Cancer' Workshop, UCSF, San Francisco CA	Invited Speaker and Organizer
2010	Stanford University Immunology Seminar Series	Invited Speaker
2010	UCSF Cancer, Immunity and Microenvironment Symposium, San Francisco CA	Invited Speaker
2004	Stanford University Immunology Seminar Series, Stanford CA	Invited Speaker

UNIVERSITY AND PUBLIC SERVICE

SERVICE ACTIVITIES SUMMARY

I continue to serve the BMS graduate program, serving as an adviser as well as leading the grant-writing workshop (which had a record 17 awards in 2013). I serve on the RAP technology committee and on multiple faculty search committees.

UCSF CAMPUSWIDE

2018 - present	UCSF ImmunoX Program	Chair, Member and Leadership Committee
2007 - present	Biological Imaging Development Center (BIDC) at UCSF	Founder and Faculty Director
2012 - present	UCSF ETAC Technology Committee	Member
2009 - present	RAP (formerly REAC) Review Committee	Member
2004 - present	UCSF BMS Graduate advising (Chair 2005-2008)	Member and Chair
2013 - 2013	UCSF/UCB Annual Immunology Retreat	Organizer
2013 - 2013	UCSF Immunology Retreat	Organizer
2012 - 2012	'Imaging Cancer' Workshop	Organizer
2011 - 2011	UCSF BMS Retreat	Organizer/Chair
2009 - 2010	Sandler Postdoctoral Review Committee	Member
2002 - 2009	UCSF, BMS Graduate Admissions Committee	Member
2006 - 2008	UCSF Department of Transplantation, Faculty Search Committee	Member
2005 - 2006	UCSF Immunology Retreat	Organizer/Chair
2004 - 2005	UCSF Department of Cell and Tissue Biology, Faculty Search Committee	Member
2004 - 2005	UCSF Department of Pathology, Faculty Search Committee	Member

2002 - 2005	UCSF, BMS Seminar Series Committee (Chair 2004-2005)	Member and Chair
2002 - 2005	UCSF Diabetes Center, Faculty Search Committee	Member
2003 - 2005	UCSF Sandler Asthma Center, Faculty Search Committee	Member

COMMUNITY AND PUBLIC SERVICE

2018 - 2018	The California Academy of Sciences: Brain & Body Nightlife	Event Participant (multiple years): Showcasing 'what is immunotherapy', cell imaging, & live tumor tissue
2017 - 2019	Bay Area Science Festival: Discovery Day	Event Participant: Showcasing cell sorting, immunology, imaging. This has become an annual educational outreach for my lab and ImmunoX

TEACHING AND MENTORING

TEACHING SUMMARY

Since joining the UCSF faculty, I have participated in graduate education at five levels:

1.) Course Director: Together with Frances Brodsky, I organized and led an advanced seminar course (Advanced Immunology, BMS 209, 2003) on the topic of Cell Biology of Leukocyte Interfaces . This entailed putting together a syllabus and reading list and supervising the students in their presentations of research papers on relevant topics. In 2009, I was (with Walter Finkbeiner) de facto course organizer for BMS225B, responsible for overall course organization and assembling and grading exams.

2.) Discussion Leader: For many of the past 18 years, I have acted as a discussion leader for graduate level Cell Biology and Immunology courses (BMS 260 and 204 respectively). For these courses, I led students in weekly 2-hour discussions of research literature. For Cell Biology, this also entailed meeting with students individually to discuss their end-of-quarter grant-proposals, holding an oral-exam on these proposals, and grading their written work.

3.) Team-Teaching : I have participated as a lecturer for various BMS and PIBS courses. This typically entails preparing a selection of lectures for team-taught courses. For example, in the recent quarter, I gave lectures for 225A on Advanced Microscopy and for the last few years I've taught a lecture on 2-photon microscopy for PIBS students and in the UCSF Imaging course. Other courses/topics over the past years have included BMS265: Receptor-Ligand Interactions and BMS225B: Lymph node development. In 2009, for BMS225a, we added a 'practical' section which includes lab sessions that introduce students to confocal and/or 2-photon

microscopy and I continue to oversee this via the Biological Imaging Development Center (BIDC), a facility that I oversee. For the past five years I have taught lectures in BMS230, the Cancer biology course--with a focus on cancer immunology and a cell biology course lecture focusing on advanced imaging.

4.) Medical School Immunology: Over most of my time at UCSF, I have led discussions for the Medical School Immunology I3 course and prologue. I will do so again this year. This entails leading students in presenting relevant primary literature relevant to topics covered in the lecture series. This has differed somewhat from 2.) above insofar as students typically are more interested in clinical relevance of basic science.

5. Recurring Lectures for Incoming Graduate Students: Between 2006 and 2016, I organized a lecture and mentoring program for incoming graduate students to help them assemble and write their NSF fellowship proposals. This includes an introductory lecture on 'How to Write a Fundable Grant' and follow-up meetings with volunteer graduate students and faculty to help students fine-tune their work. Beyond the one-day course and mentoring, we provide faculty and student-led mentoring throughout the submission process. This produced a record 14 awardees in 2012 and 12 in 2013. I am currently working with my ImmunoX colleagues to develop an informal 'Open Forum' series, focusing on 'The Practice of Science' which will treat topics from Peer review to Writing papers and grants to interviewing and use of Social Media.

FORMAL TEACHING

	Academic Yr	Course No. & Title	Teaching Contribution	School	Class Size
	2001 - 2003	BMS 225, Tissue and Organ Biology	Lab Leader, 1 class		20
	2002 - 2004	BMS 260, Cell Biology	Discussion Leader		8
	2003 - 2003	BMS 204, Immunology	Discussion Leader		8
	2003 - 2003	BMS 204, Immunology	Discussion Leader		10
	2003 - 2003	BMS 209, Advanced Immunology	Course Organizer (w/ Frances Brodsky)		10
	2004 - 2009	BMS 225, Tissue and Organ Biology	Lectures: "Advanced Microscopy"		25
	2005 - 2005	BMS 260, Cell Biology	Discussion co-Leader		8
	2004 - 2007	BMS 265, Macromolecules	Lecture: "Receptor-Ligand Interactions"		25
	2006 - 2008	BMS 225A	Lecture "Peripheral Lymphoid Organs"		25

	Academic Yr	Course No. & Title	Teaching Contribution	School	Class Size
	2006 - 2007	BMS 260, Cell Biology	Discussion co-Leader		48
	2006 - present	UCSF BMS Program: NSF fellowship writing lecture and mentoring	Organizer		
	2010 - 2010	BMS260, Cell Biology	Discussion co-Leader		48
	2010 - 2011	BMS 225	Lecturer		30
	2011 - 2014	Cold Spring Harbor Summer Course: Quantitative Imaging: From Cells to Molecules	Lecturer		
	2013 - present	BMS 225A, Investigating Human Biology and Disease	Lecturer/Organized Microscopy Hands-on Session		45
	2013 - 2013	Argentinian Course in Immunology	Lecturer		
	2014 - present	Prologue Small Group: Immunology	Lecturer		12
	2002 - present	I3, Medical Student Immunology	Discussion Leader		15
	2012 - present	BMS 230, Cancer Biology	Lecturer		10
	2014 - present	BMS 205, Advanced Immunology	Flip Classroom leader		15
	2015 - 2015	Dutch Society of Immunology, Course in Immunology	Lecturer		

INFORMAL TEACHING

2002 - present 30 hours per week supervising thesis work and postdoctoral training for 8-14 individuals. This includes practical lab training as well as one-on-one discussions of data and lab meetings

MENTORING SUMMARY

I continue to actively mentor between 8 and 10 graduate students and postdocs in my lab each year. One postdoc is currently entertaining an offer of a faculty position at Oxford University and my most recent graduate student has gone on to co-found a small biotech company.

PREDOCTORAL STUDENTS SUPERVISED OR MENTORED

Dates	Name	Program or School	Mentor Type	Role	Current Position
2002 - 2007	Aaron Tooley	BMS Program		PhD Advisor	Consultant
2003 - 2007	Rachel Friedman	BMS Program		PhD Advisor	Associate Professor, University of Colorado, Denver
2004 - 2004	Eric Wright	Wayne State University		Summer SRTP Mentor	Graduate, of Wayne State
2005 - 2011	Julia Gilden	BMS Program		PhD Advisor	Senior Scientist, Promega Corporation
2007 - 2012	Emily Thornton	BMS Program		PhD Advisor	Postdoctoral Fellow, Oxford University
2012 - 2014	Erin Oswald	BMS Program		PhD Advisor	RA, Regeneron Inc.
2011 - 2015	Miranda Broz	BMS Program		PhD Advisor	Scientist, Bristol-Meyers Squibb
2012 - 2018	Adriana Mujal	BMS Program		PhD Advisor	Postdoc, MSKCC
2013 - 2018	Mikhail Binnewies	DSCB Program		PhD Advisor	Scientist, Pionyr Immunotherapeutics
2015 - present	Casey Beppler	BMS Program		PhD Advisor	Graduate Student, Krummel Lab

POSTDOCTORAL FELLOWS AND RESIDENTS MENTORED

Dates	Name	Fellow	Mentor Role	Faculty Role	Current Position
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Dates	Name	Fellow	Mentor Role	Faculty Role	Current Position
2001 - 2003	Judie Boisvert, PhD	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Consultant
2002 - 2011	Jordan Jacobelli, PhD	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Associate Professor, University of Colorado
2004 - 2006	Maria-Cristina Moldovan, PhD	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Scientist, Medarex
2004 - 2006	Sumone Chakravarti, PhD	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Senior Fellow, Melbourne Australia
2004 - 2006	Catherine Sabatos, PhD	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Scientist, Novartis
2006 - 2008	Junsang Doh	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Associate Professor, POSTECH, Korea
2006 - 2011	John Engelhardt	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Scientist, Bristol-Myers Squibb
2006 - 2015	Peter Beemiller	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Scientist, Berkeley Lights

Dates	Name	Fellow	Mentor Role	Faculty Role	Current Position
2007 - 2011	Rachel Friedman	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Associate Professor, University of Colorado
2008 - 2011	Yi-Chun Maria Chen	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Post-Doctoral Fellow, Genentech
2008 - 2016	Audrey Gerard	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Faculty, Oxford University
2010 - 2012	Adriaan Bins	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Faculty, Netherlands Cancer Institute
2010 - 2014	Debasish Sen	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Scientist, Asterias Biotherapeutics
2010 - 2015	Bijan Boldajipour	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Senior Scientist, Pfizer
2011 - 2016	Mark Headley	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Assistant Professor, FHCR, Seattle
2011 - 2014	Efrat Lelkes	Clinical Fellow	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Assistant Adjunct Professor, UCSF

Dates	Name	Fellow	Mentor Role	Faculty Role	Current Position
2013 - 2017	Stephen Jones	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Post-Doctoral Researcher
2013 - 2019	Edward Roberts	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Faculty, CRUK, Glasgow
2015 - 2019	Kevin Barry	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Associate Professor, FHCRC, Seattle
2015 - 2021	En Cai	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Assistant Professor, Carnegie Mellon University
2016 - 2020	Megan Ruhland	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Oregon Health Sciences University
2016 - present	Kelly Kersten	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Post-Doctoral Researcher
2017 - present	Ran You	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Post-Doctoral Researcher
2017 - present	Kenneth Hu	Post-Doctoral Researcher	Research/Scholarly Mentor, Project Mentor, Career Mentor	Research Supervision	Post-Doctoral Researcher

NIH		01/01/2018	12/31/2022
Spatiotemporal Control of T Cell Synapse Stabilization and Signaling		\$ 300,000 direct/yr 1	\$ 1,250,000 total
The major goals of this project are to analyze MyoIIA regulation during T cell motility and synapse formation. This includes mutational analyses as well as generation and analyses of knockout animals.			
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2. 1R01AI114787-01A1	PI		Krummel (PI)
NIH/NIAID		7/1/2015	6/30/2020
Manipulating Collectivity and Niches for Developing CD8 Immunity		\$ 281,988 direct/yr 1	\$ 1,409,940 total
The goal of this project is to use advanced imaging methods to discover how we could take advantage of co-vaccination regimen to generate strong CD8 T cell immunity, systemically and in target tissue. This will have significant implications for protective immunizations to viruses.			
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3. 1R01CA197363	PI		Krummel (PI)
NIH/NCI		3/15/2017	2/28/2022
Anti-Tumor Mechanisms of Intratumoral Stimulatory Dendritic Cells		\$ 221,071 direct/yr 1	\$ 350,398 total
The goal of this project is to study the generation and function of rare stimulatory dendritic cell populations in mouse and human tumors, with emphasis on determining the flow of antigens from tumors towards pathways that stimulate T cells.			
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4. P30DK063720	Co-PI	5 % effort	German, Krummel (PI)
NIH		04/01/2019	03/31/2020
Core C Microscopy		\$ 1,048,985 direct/yr 1	\$ 1,662,641 total
The goal of the Center is to support a highly interactive team investigating Type 1 and Type 2 diabetes to advance the study and treatment of the disease. The Center encompasses a broad range of intellectual and research expertise from 21 departments and organized research units and four UCSF campuses focused on both basic and clinical research.			
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5. U01CA217864	co PI		Balmain, Krummel, Weiss (PI)
NIH/NCI		8/17/2017	7/31/2022
Integrating targeted and immunotherapy to treat genetically heterogeneous cancers		\$ 224,104 direct/yr 1	\$ 1,065,613 total

The goal of this project is to perform crispr screens in monocytes and T cells to identify genes associated with tumor entry and function in two distinct tumor types. Will use genetic or pharmacological perturbation of newly generated candidate genes involved in metabolic stress and ros-induced DNA damage to increase mutation load and antigen abundance in a tumor-specific manner, leading to improved responses to IMT. Will also exploit gene expression networks to identify druggable targets and pathways that augment immune responses.

6. Consortia of Pharma Companies	PI		Krummel (PI)
UCSF Immunoprofiler (immunoprofiler.org)		01/01/2015	12/31/2019

This is funding of consortia of laboratories, initiated by Krummel Lab, for a project designed to profile the immune composition, localization, and gene-expression of hundreds of human tumors from multiple cancer indications. Funds largely drive a UCSF campus-wide clinical project designed to generate a common database of immune profiles.

7. UCSF ImmunoX	PI		Krummel (PI)
		01/01/2019	12/31/2020

This program funds a comparative immunoprofiling project to compare mouse models of cancer against the common database of human immune profiles generated under immunoprofiler.org.

8. Parker Institute	PI		Krummel (PI)
		07/01/2018	06/30/2020

This program funds the development of a technology platform for spatial sequencing. Called ' ZipSeq' this platform permits the study of gene expression from single cells post live-imaging, with the ability to pinpoint which cells came from which regions.

RESEARCH AWARDS - PAST

1. Diabetes Center	PI		
Imaging Molecular Events in Lymph Nodes During T cell Activation		05/01/2002	04/30/2004
		\$ 25,000 direct/yr 1	

2. Sandler Opportunity Fund	PI		
Image Based Screening		06/01/2002	05/31/2004
			\$ 150,000 total

3.	PI		Krummel (PI)
	Stewart Trust	05/01/2004	04/30/2005
	2-Photon Imaging of Immune Tumor Surveillance	\$ 50,000 direct/yr 1	
4.	PI		Krummel (PI)
	Dana Foundation	10/01/2003	09/30/2006
	Imaging T cell based Tumor Surveillance	\$ 33,000 direct/yr 1	
5.	R21 PI		Krummel (PI)
	NIH	03/01/2005	02/28/2007
	Image-Based Analysis of Tolerance-Induction Mechanisms	\$ 125,000 direct/yr 1	\$ 100,000 total
6.	PI		Krummel (PI)
	Sandler Integrative Research Fund	03/09/2005	03/10/2006
	Biophysical Analysis of Immune-Cell Surface		\$ 355,000 total
7.	PI		Krummel (PI)
	Juvenile Diabetes Research Foundation	03/01/2007	02/28/2010
	Visualizing Feedback Loops in Type I Diabetes	\$ 150,000 direct/yr 1	
8.	Co-Investigator		Krummel (PI)
	NIH/Mouse Models Consortium	06/01/2004	05/30/2009
	Immune Enhancement and Therapy of Cancer	\$ 65,000 direct/yr 1	
9.	PI		Krummel (PI)
	CRI/Young Investigator	08/01/2004	02/28/2009

	Synapse and Migratory Dynamics of Lymphocytes in the Tumor Microenvironment	\$ 50,000 direct/yr 1	
10.	PI		Krummel (PI)
	NIH/R21	03/01/2008	02/28/2010
	New Models for Molecular-Level Imaging of Cell Signaling in vivo	\$ 150,000 direct/yr 1	\$ 125,000 total
11.	PI		Krummel (PI)
	Leukemia and Lymphoma Foundation Scholar Award	07/01/2005	06/30/2010
	Tumor Suppressors in T cell Synapse Formation and Signaling	\$ 100,000 direct/yr 1	
12.			Krummel (PI)
	American Asthma Foundation	07/01/2009	06/30/2012
	Directing Antigens to Specific APC and T cell Subsets in the Lung	\$ 150,000 direct/yr 1	
	The major goals of this project are to screen for conditions that bias antigens towards particular antigen presenting cell populations and then to read out, through imaging and functional assays, the resulting T cell responses with the aim of optimizing regulatory interaction pathways.		
13.	1S10RR029266-01 PI		Krummel (PI)
	NIH/NCRR	06/05/2011	06/04/2013
	Multiphoton Instrumentation for Translational Assays from Human Tissue Biopsies		\$ 635,523 total
	This equipment grant is to purchase a state-of-the art multiphoton microscope specifically configured and situated to accommodate a portfolio of translational imaging approaches and further dedicated to extension of two-photon technology to human biopsy tissues.		
14.	1R21CA167601 PI		Krummel (PI)
	NIH/NCI	04/01/2012	3/31/2014
	Defining the First Hours of Lung metastasis using Intravital Live-Imaging	\$ 150,000 direct/yr 1	\$ 275,000 total

This proposal will apply novel intravital imaging of the lung to define the first hours following the arrival of metastatic cells into the mouse lung. As we know very little about why metastatic tumor cells survive in this environment, this represents a major undertaking in determining how to decrease their success.

15. 1U01CA141451	PI		Krummel (PI)
NIH		09/01/2009	08/31/2014
Collaborative Innate-Adaptive Immune Regulation of Tumor Progression		\$ 317,206 direct+indirect+consortia costs direct/yr 1	

The major goals of this project are; Goal 1: Visualize the progression in crosstalk between the innate and adaptive immune response during tumor development using mouse models of luminal and basal breast cancer. Goal 2: Define the specific attractants that regulate immune cell-cell interactions in the tumor. Goal 3: Use mouse models to determine mechanisms of existing and putative immuno- and cytotoxic anti-cancer regimens and to design and test combinatorial therapies based upon this information.

16. R01 AI52116	PI		Krummel (PI)
NIH		01/15/2008	12/31/2017
Myosin Motors in T cell Synapse Formation and Activation		\$ 250,000 direct/yr 1	

The major goals of this project are to analyze MyoIIA regulation during T cell motility and synapse formation. This includes mutational analyses as well as generation and analyses of knockout animals.

17. PO1 HL024136	P2 PI		Caughey (PI)
NIH/NHLBI		05/01/2010	03/31/2014
Evolving Microenvironments in Airway Inflammation		\$ 243,616 direct/yr 1	

The aims of this proposal are to identify shifts in antigen-trafficking into APC, the temporal pairing of specific APC with T cell subsets, and the effects of Mycoplasma-mediated inflammation and mast-cell-mediated regulation upon T cell-APC pairing in lung microenvironments.

18. PO1 HL024136-CoreB	Co-PI		Caughey (PI)
NIH/NHLBI		05/01/2010	03/31/2014
Core B: This core supports the basic activities of the PPG		\$ 122,016 direct/yr 1	

19. U54 CA163123-01	PI (MPI)	10 % effort	Coussens (PI)
(Coussens, Krummel, Van't Veer: multi-PI)			
NIH/NCI		09/01/2011	08/30/2016
Leukocyte Biomarkers for Predicting Human Breast Cancer Outcome		\$ 258,900 direct/yr 1	\$ 1,294,500 total
The goal of this project is to identify predictive biomarkers in human breast cancer, using genomic profiling of mouse and human breast cancer infiltrates and correlated analyses of outcome.			
I wrote Proejct 1 and co-direct this together with Lisa Coussens.			
20. 1U01HL111054-01	co PI	5 % effort	Chapman (PI)
(Chapman, Chuang, Krummel, multi-PI) (co- PI)			
NHLBI		12/01/2011	11/30/2016
Epithelial Progenitor Cells in Lung Repair and Regeneration		\$ 90,000 (subcontract) direct/yr 1	\$ 450,000 total
This project will analyze the stem cells and events that take place during lung repair.			
21. 2U19A1077439-06	Project 3 Leader	15 % effort	Sheppard (PI)
NIH/NIAID		04/01/2008	03/31/2018
Program: IL-13 and IL-17 Dynamics in the Asthmatic Airway Project 3: Dynamic Imaging of IL13/IL17 Immune Infiltrates in Asthma		\$ 289,263 for P3 direct/yr 1	\$ 5,430,675 total
In conjunction with Projects 1 and 2, this project will directly analyze the unfolding of asthmatic responses in the context of the intact airway epithelium. It develops cutting-edge imaging technologies in mouse, applies them to human samples via the Clinical Subject and Biospecimen core and significantly develops reagents and methods that will advance our capacity to study living human biopsies at the subcellular level.			
I wrote Project 3 and direct the research in Project 3			
22. N/A	PI	0 % effort	Krummel (PI)
UCSF		01/01/2015	12/31/2015
REAC AWARD – A Shared Cutting-Edge Selective Plane Illumination Microscope (BIDC)		\$ 35,000 direct/yr 1	\$ 35,000 total
This grant partially funds the home-grown building of a SPIM microscope			
I wrote the grant together with the managing director of the Biological Imaging Development Center, Kaitlin Corbin			
23. N/A	PI	15 % effort	Krummel (PI)
Consortia of Pharma Companies (BMS, Amgen, Abbvie)		1/1/2015	6/1/2018

UCSF Immunoprofiler	\$ 1,670,00 direct/yr 1	\$ 6,940,709 total
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This consortia is designed to profile the composition, localization, and gene-expression of hundreds of human tumors from multiple indications

I organized the project, herded the other investigators, sought and secured the support and direct the program.

24. R21CA191428	PI		Krummel (PI)
NIH/NCI		1/1/2015	12/31/2016
Cutting Edge Lineage Tracking of Tumor-Educated Immune Cells		\$ 150,000 direct/yr 1	\$ 275,000 total

The goal of this project is to devise novel lineage-tracking tools, taking advantage of photoconvertable tamoxifen derivatives and high resolution intravital imaging.

25. R21 CA196468 01	PI	10 % effort	Krummel (PI)
NCI		9/1/2015	8/31/2018
LIVING TUMOR BIOPSIES TO INTERROGATE IMMUNE FUNCTION AND RESPONSE TO THERAPY		\$ 166,000 direct/yr 1	\$ 500,000 total

Here we seek to develop methodology to track immune populations in living biopsies.

I wrote the grant and direct the project

PEER REVIEWED PUBLICATIONS

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 134. Hu KH, Eichorst JP, McGinnis CS, Patterson DM, Chow ED, Kersten K, Jameson SC, Gartner ZJ, Rao AA, **Krummel MF**. ZipSeq: barcoding for real-time mapping of single cell transcriptomes. 2020 Jul 6. *Nat Methods*. doi:10.1038/s41592-020-0880-2.
 135. Bald T, **Krummel MF**, Smyth MJ, Barry KC. The NK cell-cancer cycle: advances and new challenges in NK cell-based immunotherapies. 2020 Jul 20. *Nat Immunol*. doi: 10.1038/s41590-020-0728-z.
 136. Freedman TS, Headley MB, Serwas N, Ruhland M, Castellanos CA, Combes AJ, **Krummel MF**. Lessons of COVID-19: A roadmap for post-pandemic science. *J Exp Med*. 2020 Sep 7;217(9):e20201276. doi: 10.1084/jem.20201276. PMID: 32735669.

SIGNIFICANT PUBLICATIONS

1. Binnewies M, Mujal AM, Pollack JL, Combes AJ, Hardison EA, Barry KC, Tsui J, Ruhland MK, Kersten K, Abushawish MA, Spasic M, Giurintano JP, Chan V, Daud AI, Ha P, Ye CJ, Roberts EW, Krummel MF. Unleashing Type-2 Dendritic Cells to Drive Protective Antitumor CD4+ T Cell Immunity. *Cell*. 2019 Apr 18; 177(3):556-571.e16. PMID: 30955881

PI: In this work, we showed how a dendritic cell subset, cDC2 can control CD4 T cell responses to tumors and showed that the conditioning of those cDC2 is under the control of regulatory T cells. This work, initiated in mice, also showed phenocopies of the predicted states in human cancer patients and showed corresponding changes in their prognosis, consistent with the mouse models.

- Cai, E., Marchuk, K., Beemiller, P., Beppler, C., Rubashkin, M.G., Weaver, V.M., Gérard, A., Liu, T.L., Chen, B.C., Betzig, E., Bartumeus, F., Krummel, M.F.. Visualizing dynamic microvillar search and stabilization during ligand detection by T cells. *Science*. 2017 May 12;356(6338). pii: eaal3118. doi: 10.1126/science.aal3118. PMID: 28495700.

PI: In this work, we used a novel set of live-imaging approaches that we developed in order to show the real-time mechanisms by which T cells ‘ search’ for antigens. The results provide the basis for the current understanding that T cells ‘ palpate’ opposing surfaces using microvilli and that TCR much accumulate there in order to solidify the contacts and enable signaling.

- Headley MB, Bins A, Nip A, Roberts EW, Looney MR, Gerard A, Krummel MF. Visualization of immediate immune responses to pioneer metastatic cells in the lung. *Nature*. 2016 Mar 24; 531(7595):513-7. PMID: 26982733. PMCID: PMC4892380

PI: In this work, we used a novel set of live-imaging approaches that we developed (see *Nature Methods* 2012) in order to track the first steps in tumor metastasis. The results provide the first evidence for seeding of the lung with tumor microparticles which pass into immune cells which, in turn, modulates metastatic success.

- Broz, M.L., Binnewies, M., Boldajipour, B., Nelson, A.E., Pollock, J.L., Erle, D.J., Barczak, A., Rosenblum, M.D., Daud, A., Barber, D.L., Amigorena, S., van’ t Veer, L.J., Sperling, A.I., Wolf, D.M., **Krummel, M.F.** 2014. Dissecting the Tumor Myeloid Compartment Reveals Rare Activating Antigen-Presenting Cells Critical for T Cell Immunity. *Cancer Cell*. 2014 Nov 10;26, 1– 15. PMCID: PMC4254577

PI: In this work we identified a key intratumoral immune cell type that is necessary for T cell responses to tumor and showed that its abundance predicts outcome in human cancer patients. This cell type is now extensively under study as a method to complement T cell immunotherapies. (see also *Cancer Cell* 2016)

- Gérard, A., Patino-Lopez, G., Beemiller, P., Nambiar, R., Ben-Aissa, K., Liu, Y., Totah, F.J., Tyska, M.J., Shaw, S., **Krummel, M.F.** Detection of Rare Antigen-Presenting Cells through T Cell-Intrinsic Meandering Motility, Mediated by Myo1g. *Cell*. 2014 Jul 31;158(3):492-505. DOI: 10.1016/j.cell.2014.05.044. PMCID: PMC4119593

PI: In this work, we identified a ‘ steering’ motor in cells that forces them to make periodic turns. We further go went on to use this as model to show how T cells efficiently scan tissues.

- Gérard, A., Khan, O., Beemiller, P., Oswald, E., Hu, J., Matloubian, M., **Krummel, M.F.** 2013. Secondary T cell-T cell synaptic interactions drive the differentiation of protective CD8+ T cells. *Nat Immunol*. 2013 Mar 10. doi: 10.1038/ni.2547. PMCID: PMC3962671

PI: In this work, we showed how T cells profit from intracloal interactions, mediated by hive-like clusters. This represents a previously unrecognized synaptic platform for molding the immune response.

7. Beemiller, P., Jacobelli, J., **Krummel, M.F.**, 2012. Integration of Signaling Microclusters Movement with Cellular Motility in Immunological Synapses. Nat Immunol. Jul 1. doi: 10.1038/ni.2364. PMID: PMC3902181

PI: In this work, we demonstrated the concurrence of signaling T cell receptor microclusters on the T cell surface and how this type of signaling can concur in time with ongoing motility as a transient synapse is formed. We also demonstrated how actin movements are utilized to coordinate these two seemingly-disparate activities.

PATENTS ISSUED OR PENDING

1. J.P. Allison, D.R. Leach, and M.F. Krummel. *Blockade of Lymphocyte Down-Regulation Associated with CTLA-4 Signaling*. US Patent 5,855,887, 5,811,097. 1998
2. M.F. Krummel, Miranda Broz, Denise Wolf, Mikhail Binnewiesand Josh Pollack. Modulation of stimulatory and non-stimulatory myeloid cells. US Patent 10,428,143 Licensed to Pionyr Immunotherapeutics.
3. M.F. Krummel, and K.H. Hu, Single Cell Mapping and Transcriptome Analysis. Patent Pending

OTHER CREATIVE ACTIVITIES

1. Amateur Ballistics and Pyrotechnics