University of California, San Francisco

CURRICULUM VITAE

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Position: Professor, Step 4
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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

2020	Dial Fellow	Emerson Collective
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

2021	Institute of Pharmacology and Structural Biology, Toulousse France, Virtual	Invited Speaker
2020	Kennedy Institute of Rheumatology, University of Oxford, Virtual	Invited Speaker
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, Mexica	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 Marseile/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 Lausaanne, 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

2021	Allen Institute for Immunology Scientific Advisory Board Meeting, Virtual	Invited Speaker
2021	AACR National Conference, Virtual	Invited Speaker
2021	The Intratumoral Immune Response, Tucson Symposium, Virtual	Invited Speaker
2021	Immunology and Molecular Pathogenesis Seminar, Emory University, Virtual	Invited Speaker
2021	Arthur L Irving Family Foundation Cancer Immunology Symposium, Virtual	Invited Speaker
2021	Tumor Metabolism and the Microenvironment, Keystone Symposia, Virtual	Invited Speaker
2020	Annual Amgen Postdoc Conference, Virtual	Invited Speaker
2020	Starr Cancer Consortium, Virtual	Invited Speaker
2020	Institute for Immunology Seminar, University of California, Irvine, Virtual	Invited Speaker
2020	Gilead Sciences Seminar, Virtual	Invited Speaker
2020	NCI Immuno-Oncology Models Workshop, Virtual	Invited Speaker
2020	Immuno-Skamania Summit, Virtual	Co-Organizer
2020	National Jewish Health, Virtual	Invited Speaker

2020	Allen Institute for Immunology Scientific Advisory Board Meeting, Virtual	Invited Speaker
2020	Fred Hutch Eco Seminar, Virtual	Invited Speaker
2020	Emerson Collective Health Summit, Virtual	Invited Speaker
2020	Parker Institute for Cancer Immunology Retreat, Lanai, HI	Invited Speaker
2020	Masonic Cancer Center's Seminar Series, University of Minnesota, Minneapolis, MN	Invited Speaker
2020	Mount Sinai's Precision Immunology Institute (PRIISM) Meeting, NYC, NY	Invited Speaker
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, Philadephia PA	Invited Speaker
2010	ASCB Annual Meeting, Speaker and Session Chair, Philadephia 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

2021	UCSF Pulmonary Research Conference, Virtual	Invited Speaker
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

Starting in 2016, I worked with a group of fellow mid-career colleagues to re-envision collaboration at UCSF, centered on the immune system. Together, we built a program, ImmunoX, upon an existing immunology program and have seen it incorporate and align the science of nearly 80 labs and serve as their home-base for science. I have led this initiative, by which we have raised substantial philanthropy, to integrate ongoing studies of the immune system in disease and we are building a large collaborative data-sharing platform. The latter is designed on my success ‘ Immunoprofiler’ project, which attracted substantial investment from 5 large pharma companies to collect a large dataset of immune states in cancer. I have recently led an offshoot initiative ‘ Immunoprofiler v2’ which focuses on autoimmunities and inflammation. All of these bring together multiple labs worth of science at UCSF and all have 'outreach' programs to the community. I Chair IMmmunoX, serve on it's ImmunoX Leadership committee and Chair it's Research committee which distributes roughly $3M per year in research funding amongst the over 90 faculty members of this research umbrella organization. We were also active in developing CoLabs (the Biological Imaging Development Center emerged from my lab in 2007 and parts of the model for data and resource sharing in CoLabs came from our Immunoprofiler project). I also continue to serve as a BMS advisor for incoming graduate students.

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 - 2015	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.) Discussion Leader: For most of the past 18 years, I have acted as a discussion leader for graduate level Cell Biology and/or Immunology courses (BMS 260 and 204 respectively). For cell biology, I lead students in weekly 2-hour discussions of research literature and meet with students individually to discuss their end-of-quarter grant-proposals, holding an oral-exam on these proposals, and grading their written work. For the Immunology course, I co-lead a 'flipped' classroom with Mark Anderson.

2.) 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, last fall (and upcoming this fall), I gave 2 lectures for the Cancer course (BMS230) on the

immunotherapy of cancer. I also gave two lectures per year in the past three years in the BMS260 cell biology course on the topic of 'imaging technology'. 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 to that which included lab sessions that introduce students to confocal and/or 2-photon microscopy and I continue to provide faculty oversight in microscopy training this via the Biological Imaging Development Center (BIDC).

3.) Medical School Immunology: Over most of my time at UCSF, I have led discussions for the Medical School Immunology I3 course and prologue. I plan to 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.

4. Recurring Lectures with/for 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 included 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

5.) Course Director: 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. currently work with my ImmunoX colleagues to develop an informal ‘ The Practice of Science’ series which has treated topics from Peer review to Writing papers and grants to interviewing and use of Social Media. I have also co-formed a Media outreach team with ImmunoX, making media (videos and print) to convey the value of science and this is in strong collaboration with a collection of graduate students and postdocs.

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

	Academic Yr	Course No. & Title	Teaching Contribution	School	Class Size
	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
	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

Dates	Name	Program or School	Mentor Type	Role	Current Position
2013 - 2018	Mikhail Binnewies	DSCB Program		PhD Advisor	Scientist, Pionyr Immunotherapeutics
2015 - present	Casey Beppler	BMS Program		PhD Advisor	Graduate Student, Krummel Lab
2021 - present	Zewen (Owen) Jiang	BMS Program		PhD Advisor	Graduate Student, Krummel Lab
2021 - present	Molly Bassette	BMS Program		PhD Advisor	Graduate Student, Krummel Lab

POSTDOCTORAL FELLOWS AND RESIDENTS MENTORED

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

Dates	Name	Fellow	Mentor Role	Faculty Role	Current Position
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
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

Dates	Name	Fellow	Mentor Role	Faculty Role	Current Position
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, FHCRC, Seattle
2011 - 2014	Efrat Lelkes	Clinical Fellow	Research/Scholarly Mentor,Project Mentor,Career Mentor	Research Supervision	Assistant Adjunct Professor, UCSF
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

Dates	Name	Fellow	Mentor Role	Faculty Role	Current Position
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
2018 - present	Nina Serwas	Post-Doctoral Researcher	Research/Scholarly Mentor,Project Mentor,Career Mentor	Research Supervision	Post-Doctoral Researcher
2018 - present	Arja Ray	Post-Doctoral Scholar	Research/Scholarly Mentor,Project Mentor,Career Mentor	Research Supervision	Post-Doctoral Researcher
2020 - present	Nicholas Kuhn	Post-Doctoral Scholar	Research/Scholarly Mentor,Project Mentor,Career Mentor	Research Supervision	Post-Doctoral Researcher
2020 - present	Kwok (Chris) Im	Post-Doctoral Scholar	Research/Scholarly Mentor,Project Mentor,Career Mentor	Research Supervision	Post-Doctoral Researcher

Dates	Name	Fellow	Mentor Role	Faculty Role	Current Position
2020 - 2021	Ryan Davis	Post-Doctoral Scholar	Research/Scholarly Mentor,Project Mentor,Career Mentor	Research Supervision	Post-Doctoral Researcher

FACULTY MENTORING

Dates	Name	Position while Mentored	Mentor Type	Mentoring Role	Current Position
2007 - 2008	Dr. Helene Bour-Jordan, Adjunct Faculty in the Diabetes Center	Junior-Faculty Mentor		Mentor	Consultant

RESEARCH AND CREATIVE ACTIVITIES

RESEARCH AND CREATIVE ACTIVITIES SUMMARY

My lab is focused on the spatio-temporal organization of the immune response. We utilize and develop light-based imaging technologies for these analyses. Much of this work has centered on uncovering the controls and organization of immunological synapses: structures which transiently form and permit cell-cell signaling and information exchange between immune cells and other immune cells. In the recent 5 years, we have developed a sub-specialty in the development of tools for subcellular-level imaging of tissues and organs in situ in order to discover how components of the immune system are working in situ.

RESEARCH AWARDS - CURRENT

1. R01 AI52116 PI 15 % effort Krummel (PI)
   NIH/NIAID 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.

2. 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.

3. 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.

4. Consortia of Pharma Companies	PI		Krummel (PI)
UCSF Immunoprofiler (immunoprofiler.org)		01/01/2020	12/31/2022

This is funding of consortia of laboratories,I nitiated 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.

5. 3U19AI077439-13S1	Co-PI		Erle, Krummel (PI)
NIH-NIAID		05/08/2022	03/31/2022
UCSF COVID-19 extended immunophenotyping studies			

The major goal of this emergency COVID-19 supplement is to apply key and cutting-edge immunophenotyping assays to patient samples derived from the Immunophenotyping assessment in a COVID-19 Cohort (IMPACC) study to understand the critical features that characterize hospitalized patients with COVID-19, a pandemic disease characterized by immune exacerbations of lung injury.

6. 3U19AI0774309-13S2	Co-PI		Erle, Krummel (PI)
NIH-NIAID		05/07/2020	03/31/2022
UCSF COVID-19 Immunophenotyping Clinical Study and Core Laboratories			

The major goal of this emergency COVID-19 supplement is to develop and particiate IMPACC multi-center longitudinal clincial study of hospitalized patients with COVID-19 and to immunophenotype participants using shared immunological methods that will be designed and carried out by core laboratories at UCSF and at other participating institution.

7. R01 AI052116 PI Krummel (PI)
NIH/NIAID 05/27/2020 12/31/2021
COVID19 Admin Supplement to Rapidly Translate Immunobiology for Patient Belief
This project will utilize a deep knowledge of T cell-myeloid biology to identify and rank immunotherapeutics that will be clinically useful to modulate the severity of catastrophic lung damage int he context of SARS-CoV-2.

8. PI Krummel (PI)
Eli Lilly & Company 11/01/2020 10/31/2025
UCSF Immunoprofiler II $ 8,491,094 total
This is funding of consortia of laboratories, 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.

9. R35CA242447 Co-PI Weaver, Krummel (PI)
NIH/NCI 09/01/2020 08/31/2027
Tissue mechanics reprograms the tissue to malignancy and metastasis $ 6,728,880 total
The major goals of this project to identify conserved mechanical reinforcement circuits that drive malignant transformation and progression focusing on inflammation and mitochondrial stress.

RESEARCH AWARDS - PAST

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

2. PI
Sandler Opportunity Fund 06/01/2002 05/31/2004
Image Based Screening $ 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 Supressors 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 (Coussens, Krummel, Van't Veer: multi-PI)	PI (MPI)	10 % effort	Coussens (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 (Chapman, Chuang, Krummel, multi-PI) (co-PI)	co PI	5 % effort	Chapman (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
	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

26. 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.

27. 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.

28.	PI		Krummel (PI)
UCSF ImmunoX		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 profilesm generated under immunoprofiler.org.

29.	PI		Krummel (PI)

Parker Institute	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.

PEER REVIEWED PUBLICATIONS

1. Krummel, M.F. and Allison, J.P. 1995. CD28 and CTLA-4 deliver opposing signals which regulate the response of T cells to stimulation. Journal of Experimental Medicine. 182, 459-465.
2. Allison, J.P. and Krummel, M.F. 1995. The yin and yang of T cell costimulation. Science. 270,932-933.
3. Krummel, M.F., Sullivan, T.J. and Allison, J.P. 1995. Superantigen responses and costimulation: CD28 and CTLA-4 have opposing effects on T cell expansion In Vitro and In Vivo. Int.Immunol. 8, 101-105.
4. Krummel, M. and Allison, J.P. "B7 mediated costimulation of T cells: CTLA-4 can deliver inhibitory signals." 1995 In Genetic models of immune and inflammatory diseases, Abbas, A.K. and Flavell, R.A. eds. Springer Verlag: New York.
5. Chambers, C.A., Krummel, M.F., Boitel, B., Hurwitz, A., Sullivan, T.J., Fournier, S., Cassell, D., Brunner, M. and Allison, J.P. 1996. The role of CTLA-4 in the regulation and initiation of T cell responses. Immunological Reviews. 153, 27-46.
6. Leach, D.R., Krummel, M.F. and Allison, J.P. 1996. Enhancement of antitumor immunity by CTLA-4 blockade. Science. 271, 1734-1736.
7. Krummel, M.F. and Allison, J.P. 1996. CTLA-4 engagement inhibits IL-2 accumulation and cell cycle progression upon activation of resting T cells. Journal of Experimental Medicine. 183, 2533-2540. PMCID: PMC2192613.
8. Winkel, K.D., Kronin, V., Krummel, M.F. and Shortman, K. 1997. The nature of the signals regulating CD8 T cell proliferative responses to CD8a+ or CD8a- dendritic cells. European Journal of Immunology. 27, 3350-3359.
9. Hurwitz, A.A., Sullivan, T.J., Krummel, M.F., Sobel, R.A. and Allison, J.P. 1997. Specific blockade of CTLA-4/B7 interactions results in exacerbatedclinical and histological disease in an actively-induced model of experimental allergic encephalomyelitis. J. Neuroimmunology. 73, 57-62.
10. Allison, J.P., Chambers, C., Hurwitz, A., Sullivan, T., Boitel, B. Fournier, S. Brunner, M., Krummel, M.F. 1998. A Role for CTLA-4-mediated inhibitory signals in peripheral T cell tolerance? Novartis Foundation Symposium. 215, 98-102.
11. Allison, J., Stephens, L., Kay, T.W., Kurts, C., Heath, W.R., Miller, J.F. and Krummel, M.F. 1998. The threshhold for autoimmune T cell killing is influenced by B7.1. European Journal of Immunology. 28, 949-960.

12. Kurts, C., Carbone, F.R., Krummel, M.F., Miller, J.F.A.P. and Heath, W.R. 1998.Signalling through CD30 protects against autoimmune diabetes mediated by CD8 T cells. Nature. 398, 341-4.

13. Krummel, M.F., Heath, W.R. and Allison, J. 1999. Differential coupling of second signals for cytotoxicity and proliferation in CD8+ T cell effectors: Amplification of the lytic potential by B7. J. Immunol. 163, 2999-3006.

14. Davis,M.M., Wlfing,C., Krummel, M.F., Savage,P., Xu,J., and Chieh,H-Y. 2000. "Visualizing T cell activation." In Signaling & Gene Expression in the Immune System. Cold Spring Harbor Symposia on Quantitative Biology, Volume LXIV.

15. Krummel, M.F., Wlfing,C., Sumen, C., and Davis, M.M. 2000. Thirty six views of T cell recognition. In Phil. Trans. R. Soc. Lond. 355, 1071-1076. PMCID: PMC1692810.

16. Krummel, M.F., Sjaastad, M.D., Wlfing, C., and Davis, M.M. 2000. Differential clustering of CD4 and CD3z during T cell recognition. Science. 289, 1349-1352.

17. Krummel, M.F. and Davis, M.M. 2002 Dynamics of the Immunological Synapse: Finding, Establishing and Solidifying a Connection. Curr. Op. Immunol. 14:66-74.

18. Richie, L.I., P.J.R. Ebert, Wu, L.C., Krummel, M.F., Owen, J.J.T. , and Davis, M.M. 2002 Imaging synapse formation during thymocyte selection: inability of CD3z to form a stable central accumulation during negative selection. Immunity. 16:595-606.

19. Moss,W.C., Irvine,D.C, Davis,M.M., and Krummel, M.F. 2002. Quantifying Signaling-Induced Reorientation of Cell Membrane and TCRs During Immunological Synapse Formation. PNAS. 99 15024-15029

20. Ehrlich,L.I., Ebert, P.J.R. Krummel, M.F., Weiss,A. and Davis, M.M. 2002. Dynamics of p56lck translocation to the T cell immunological synapse following agonist and antagonist stimulation. Immunity. 17 809-822.

21. Andres,P.G., Howland,K.C., Dresnek,D. Edmondson, S., Abbas,A.K., and Krummel, M.F. 2004. CD28 signals in the immature immunological synapse. J. Immunol.

22. Jacobelli, J. Chmura, S.A., Buxton,D.B., Davis , M.M. and Krummel, M. F. 2004. Class II Myosin Heavy Chain 2A/MyH9 Is Involved in the T Cell Stop Signal but is not Required for Synapse Formation. Nature Immunology.

23. Jacobelli, J., Andres, P.G., Boisvert, J., and Krummel, M.F. 2004. New Views of the Immunological Synapse: Variations in Assembly and Function. Curr Opin Immunol 16, 345-52

24. Boisvert, J., Edmondson, S. and Krummel, M.F. 2004. Immunological Synapse Formation Licenses CD40-CD40L Accumulations at T-APC Contact Sites. J. Immunol. 173, 3647-3652.

25. Tooley,A.J., Jacobelli, J., Moldovan, M-C., Douglas, A., and Krummel, M.F. 2005. T cell Synapse Assembly: Proteins, Motors and the Underlying Cell Biology. Seminars in Immunology, 17, 65-75.

26. Okada, T. Miller, M.J., Parker, I., Krummel, M.F., O Garra,A. Cahalan,M.D., Cyster, J.G. 2005. Antigen-engaged B cells undergo directional migration to the T cell zone and form motile conjugates with helper T cells. PLOS Biology 3 1-13. PMCID: PMC1088276.

27. Friedman, R.S., Jacobelli, J., Krummel, M.F. 2005. Mechanisms of T cell Motility and Arrest: Deciphering the Relationship between Intra- and Extracellular determinants. Seminars in Immunology, 17, 387-99.

28. Tang, Q., Adams, J.Y., Tooley, A.J., Bi, M., Serra, P., Santamaria, P., Krummel, M.F.* and Bluestone, J.A.* (*co-senior authors) 2006. Visualizing regulatory T cell control of autoimmune response in NOD diabetic mice. Nature Immunology, 7, 83-92. PMCID: PMC3057888.

29. Krummel MF, Macara I. Maintenance and modulation of T cell polarity. Nat Immunol. 2006 Nov; 7(11):1143-9. PMID: 17053799

30. Moldovan MC, Sabbagh L, Breton G, Sekaly RP and Krummel MF*. (*co-last authors) 2006. Triggering of T cell activation via CD4 dimers. J Immunol. 176(9):5438-45.

31. Tang, Q and Krummel M.F. 2006 Imaging the function of regulatory T cells in vivo. Curr Opin Immunol. 18(4):496-502

32. Friedman, R.S. Jacobelli, J, and Krummel, M.F. 2006. Surface-bound Chemokines Capture and Prime T cells For Synapse Formation. Nature Immunology 7, 1101-8.

33. Krummel MF and Macara I. 2006. T cell Polarity PARtita: maintenance and modulation of directionality in T lymphocytes Nature Immunology. 7, 1143-49.

34. Krummel, M.F. 2007. Immunological Synapses: breaking up may be good to do. Cell. 129, 653-655.

35. Krummel, M.F. 2007. Testing the Organization of the Immunological Synapse. Curr Opin Immunol. 19(4):460-2. PMCID: PMC2039889.

36. Engelhardt, J.J., **Krummel, M.F.** 2008. The importance of prolonged binding to antigen-presenting cells for T cell fate decisions. Immunity. 28(2):143-5.

37. Sabatos, C.A., Doh, J. Chakravarti, S. Friedman, R.S., Pandurangi, P.G., Tooley, A.J. Krummel, M.F. A Synaptic Basis for Paracrine Interleukin-2 Signaling in Activating T cells. Immunity. 29(3): 238-248. Epub 2008 Jul 31. PMCID: PMC4466225.

38. Gardner, J.M., DeVoss. J.J., Friedman, R.S., Wong, D.J., Tan, Y.X., Johannes, K.P., Su, M.A. Chang, H.Y., Krummel, M.F., Anderson, M.S. 2008. Deletional Tolerance Mediated by Extrathymic Aire-Expressing Cells. Science. 321(5890): 843-7. PMCID: PMC2532844.

39. Mamchak, A.A., Sullivan,B.M., Hou,B., Lee,L.M., Gilden,J.K., Krummel, M.F. Locksley,R.M, DeFranco,A.L.. 2008. Normal development and activation but altered cytokine production of Fyn-deficient CD4+ T cells. Journal of Immunology. 181: 5374-85. PMCID: PMC2657555.

40. Egeblad, M., Ewald, A. J., Askautrud, H. A., Truitt, M. L., Welm, B. E., Bainbridge, E., Peeters, G., Krummel, M. F., Werb, Z. 2008. Visualizing stromal cell dynamics in different tumor microenvironments by spinning disk confocal microscopy. Dis. Model. Mech., 1 155-167. PMCID: PMC2562195.

41. Tooley, A.J., Gilden, J., Jacobelli, J., Trimble, W, Kinoshita, M. and Krummel, M.F. 2009. Amoeboid T lymphocytes require the septin cytoskeleton for cortical integrity and persistent motility. Nature Cell Biology. Jan;11(1):17-26. Epub 2008 Nov 30. PMCID: PMC3777658

42. Jacobelli,J., Bennett, F.C., Pandurangi, P. and Krummel, M.F. 2009. Myosin-IIA and ICAM-1 Regulate the Interchange between Two Distinct Modes of T cell Migration J. Immunol. 82: 2041-50.

43. Bullen, A., Friedman, R.S., Krummel, M.F. 2009. Two-photon imaging of the immune system: A custom technology platform for high-speed, multi-color tissue imaging of immune responses. Current Topics in Microbiology and Immunology. 334:1-29.

44. Melli, K., Friedman, R.S., Finger, E.B., Miao, G. Szot, G.L. Krummel, M.F. and Tang Q. 2009. Amplification of autoimmune response through induction of dendritic cell maturation in inflamed tissues. J. Immunol. 182: 2590-600. PMCID: PMC3057894.

45. Fife BT, Eagar TN, Pauken KE, Wu J., Obu T, Tang, Q, Azuma M, Krummel, MF, Bluestone JA. 2009. Interactions between PD-1 and PD-L1 promote tolerance by blocking the TCR induced stop signal. Nature Immunology. 10(11):1185-92. Epub 2009 Sep 27. PMCID: PMC2778301.

46. Krummel, M.F., Cahalan, M.D. 2010. The Immunological Synapse: a Dynamic Platform for Local Signaling. J Clin Immunol. 30(3):364-72. PMCID: PMC2874029.

47. Krummel MF. Illuminating emergent activity in the immune system by real-time imaging. Nat Immunol. 2010 Jul; 11(7):554-7. PMID: 20562836

48. Doh, J. and Krummel M.F. Immunological Synapses within Context: Patterns of Cell-Cell Communication and their Application in T-T Interactions. 2010. Current Topics in Microbiology and Immunology. 340:25-50.

49. Doh, J., Kim, M., and Krummel, M.F. 2010. Cell-laden microwells for the study of multicellularity in lymphocyte fate decisions. Biomaterials. 12: 3422-8.

50. Gilden J., Krummel M.F. 2010. Control of cortical rigidity by the cytoskeleton: Emerging roles for septins. Cytoskeleton (Hoboken). **67(8)**:477-86. PMCID: PMC2906656.

51. Krummel, M.F. 2010. Illuminating emergent activity in the immune system by real-time imaging. Nature Immunol. 11(7):554-7.

52. Jacobelli, J., Friedman, R.S., Conti, M.A., Lennon-Dumenil, A.-M., Piel, M., Sorensen, C.M., Adelstein, R.S., Krummel, M.F. 2010. Confinement-optimized three-dimensional T cell amoeboid motility is modulated via myosin IIA-regulated adhesions. Nat Immunol. 11, 953-961. PMCID: PMC2943564.

53. Beemiller, P., Krummel, M.F. 2010. Mediation of T-Cell Activation by Actin Meshworks. Cold Spring Harb Perspect Biol. 2(9):a002444. PMCID: PMC2926748.

54. Katzman, S.D., O'Gorman, W.E., Villarino, A.V., Gallo, E., Friedman, R.S., **Krummel, M.F.**, Nolan, G.P., Abbas, A.K. 2010 Oct 4. Duration of antigen receptor signaling determines T-cell tolerance or activation. Proc Natl Acad Sci. **107(42)**:18085-90. PMCID: PMC2964228.

55. Friedman, R.S., Beemiller, P., Sorensen, C.M., Jacobelli, J., **Krummel, M.F.** 2010 Nov 1. Real-time analysis of T cell receptors in naive cells in vitro and in vivo reveals flexibility in synapse and signaling dynamics. J Exp Med. 11(10):953-61. PMCID: PMC2989766.

56. Looney, M.R., Thornton, E.E., Sen, D., Lamm, W.J., Glenny, R.W., **Krummel, M.F**. 2010. Stabilized imaging of immune surveillance in the mouse lung. Nat Methods. 8(1):91-6. PMCID: PMC3076005.

57. Khan, O., Headley, M., Gerard, A., Wei, W., Liu, L., **Krummel, M.F.** 2011. Regulation of T Cell Priming by Lymphoid Stroma. PLoS ONE **6(11)**: e26138. doi:10.1371/journal.pone.0026138. PMCID: PMC3215700.

58. Gilden, J.K., Peck, S., Chen, Y.C.M., **Krummel, M.F.** 2012. The septin cytoskeleton facilitates membrane retraction during motility and blebbing. J Cell Biol. Jan 9;**196(1)**:103-14. PMCID: PMC3255977.

59. Engelhardt, J.J., Boldajipour, B., Beemiller, P., Pandurangi, P., Sorensen, C., Werb, Z., Egeblad, M., **Krummel, M.F.** 2012. Marginating Dendritic Cells of the Tumor Microenvironment Cross-Present Tumor Antigens and Stably Engage Tumor-Specific T Cells. Cancer Cell **21**, March 20; 402-417. PMCID: PMC3311997.

60. Thornton, E.E., **Krummel, M.F.**, Looney, M.R. 2012. Live Imaging of the Lung. Curr Protoc Cytom. Apr;Chapter 12:Unit12.28.

61. Thornton, E.E., Looney M.R., Bose, O,. Sen, D., Sheppard, D., Locksley, R., Huang, X., **Krummel, M.F.** 2012. Spatiotemporally Separated Antigen Uptake by Alveolar Dendritic Cells and Airway Presentation to T Cells in the Lung. J Exp Med., **209(6)**:1183-99. PMCID: PMC3371730.

62. 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. PMCID: PMC3902181.

63. Zhang, Y., Chen, Y.C., **Krummel, M.F.**, Rosen, S.D. 2012. Autotaxin through Lysophosphatidic Acid Stimulates Polarization, Motility, and Transendothelial Migration of Naive T Cells. J Immunol. 2012 Oct 15;189(8):3914-24. doi: 10.4049/jimmunol.1201604. Epub 2012 Sep 7. PMCID: PMC3509168.

64. Cheng, L.E., Hartmann, K., Roers, A., **Krummel, M.F.**, Locksley, R.M. 2013. Perivascular Mast Cells Dynamically Probe Cutaneous Blood Vessels to Capture Immunoglobulin E. Immunity. Jan 24;38(1):166-75. doi: 10.1016/j.immuni.2012.09.022. Epub 2013 Jan 3. PMCID: PMC3576928.

65. Gérard, A., Beemiller, P., Friedman, R.S., Jacobelli, J., **Krummel, M.F**. 2013. Evolving immune circuits are generated by flexible, motile, and sequential immunological synapses. Immunol Rev. 2013 Jan;251(1):80-96. doi: 10.1111/imr.12021. PMCID: PMC3539221.

66. 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 Apr;14(4):356-63. doi: 10.1038/ni.2547. Epub 2013 Mar 10. PMCID: PMC3962671.

67. Jacobelli, J., Estin Matthews, M., Chen, S., **Krummel, M.F.** 2013. Activated T Cell Trans-Endothelial Migration Relies on Myosin-IIA Contractility for Squeezing the Cell Nucleus through Endothelial Cell Barriers. PLoS One. 2013 Sep 19;8(9):e75151. doi: 10.1371/journal.pone.0075151. PMCID: PMC3777879.

68. Nussbaum, J.C., Van Dyken, S.J., von Moltke, J., Cheng, L.E., Mohapatra, A., Molofsky, A.B., Thornton, E.E., **Krummel, M.F.**, Chawla, A., Liang, H.E., Locksley, R.M. 2013. Type 2 innate lymphoid cells control eosinophil homeostasis. Nature. 2013 Oct 10;502(7470):245-248. doi: 10.1038/nature12526. Epub 2013 Sep 15. PMCID: PMC3795960.

69. Beemiller P., **Krummel M.F.** 2013. Regulation of T-cell receptor signaling by the actin cytoskeleton and poroelastic cytoplasm. Immunol Rev. 2013 Nov;256(1):148-59. doi: 10.1111/imr.12120. PMCID: PMC3831008.

70. Van Dyken, S.J., Mohapatra, A., Nussbaum, J.C., Molofsky, A.B., Thornton, E.E., Ziegler, S.F., McKenzie, A.N., **Krummel, M.F.**, Liang, H.E., Locksley, R.M. 2014. Chitin Activates Parallel Immune Modules that Direct Distinct Inflammatory Responses via Innate Lymphoid Type 2 and γδ T Cells. 2014 Mar 20;40(3):414-24. doi: 10.1016/j.immuni.2014.02.003. Epub 2014 Mar 13. PMCID: PMC4019510.

71. Krummel MF, Friedman RS, Jacobelli J. Modes and mechanisms of T cell motility: roles for confinement and Myosin-IIA. Curr Opin Cell Biol. 2014 Oct; 30:9-16. PMID: 24905977. PMCID: PMC4178009

72. Gérard A, Patino-Lopez G, Beemiller P, Nambiar R, Ben-Aissa K, Liu Y, Totah FJ, Tyska MJ, Shaw S, Krummel MF. Detection of rare antigen-presenting cells through T cell-intrinsic meandering motility, mediated by Myo1g. Cell. 2014 Jul 31; 158(3):492-505. PMID: 25083865. PMCID: PMC4119593

73. **Krummel, M.F.**, Friedman, R.S., Jacobelli, J. Modes and mechanisms of T cell motility: roles for confinement and Myosin-IIA. Curr Opin Cell Biol. 2014. 30:9-16. PMID: 24905977.

74. Broz ML, Binnewies M, Boldajipour B, Nelson AE, Pollack JL, Erle DJ, Barczak A, Rosenblum MD, Daud A, Barber DL, Amigorena S, Van't Veer LJ, Sperling AI, Wolf DM, Krummel MF. Dissecting the tumor myeloid compartment reveals rare activating antigen-presenting cells critical for T cell immunity. Cancer Cell. 2014 Nov 10; 26(5):638-52. PMID: 25446897. PMCID: PMC4254577

75. Friedman, R.S., Lindsay, R.S., Lilly, J.K., Nguyen, V., Sorensen, C.M., Jacobelli, J., **Krummel, M.F.** An evolving autoimmune microenvironment regulates the quality of effector T cell restimulation and function. Proc Natl Acad Sci U S A. 2014 Jun 24;111(25):9223-8. doi: 10.1073/pnas.1322193111. Epub 2014 Jun 10. PMCID: PMC4078867.

76. Patnode, M.L., Bando, J.K., **Krummel, M.F.**, Locksley, R.M., Rosen, S.D. 2014. Leukotriene B4 amplifies eosinophil accumulation in response to nematodes. J Exp Med. 2014 Jun 30;211(7):1281-8. doi: 10.1084/jem.20132336. Epub 2014 Jun 2. PMCID: PMC4076593.

77. Gérard, A., Patino-Lopez, G., Beemiller,P., Nambiar,R., Ben-Aissa, K., Liu,Y., Totah, F.Tyska, M., Shaw, S., **Krummel, M.F.** 2014. 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.

78. Corbin, K., Pinkard, H., Peck, S., Beemiller, P., **Krummel, M.F.** 2014. Assessing and benchmarking multiphoton microscopes for biologists. Methods Cell Biol. 2014;123:135-51. doi: 10.1016/B978-0-12-420138-5.00008-2. PMID: 24974026 [PubMed - in process].

79. Lelkes, E., Headley, M.B., Thornton, E.E., Looney, M.R., **Krummel, M.F.** 2014. The spatiotemporal cellular dynamics of lung immunity. Trends Immunol. 2014 Aug;35(8):379-386. doi: 10.1016/j.it.2014.05.005. Epub 2014 Jun 26. PMCID: PMC4124173.

80. Li, M., Wetzel-Strong, S.E., Hua, X., Tilley, S.L., Oswald, E., **Krummel, M.F.**, Caron, K.M. 2014. Deficiency of RAMP1 Attenuates Antigen-Induced Airway Hyperresponsiveness in Mice. PLoS One. 2014 Jul 10;9(7):e102356. doi: 10.1371/journal.pone.0102356. eCollection 2014. PMCID: PMC4092148.

81. Ortiz-Muñoz, G., Mallavia, B., Bins, A., Headley, M., **Krummel, M.F.**, Looney, M.R. Aspirin-triggered 15-epi-lipoxin A4 regulates neutrophil-platelet aggregation and attenuates acute lung injury in mice. Blood. 2014 Aug 20. pii: blood-2014-03-562876. [Epub ahead of print]. PMCID: PMC4208278.

82. Mujal, A.M., **Krummel, M.** The subtle hands of self-reactivity in peripheral T cells. Nat Immunol. 2014 Dec 18;16(1):10-1. doi: 10.1038/ni.3060. PMID: 25521673 [PubMed - in process].

83. Hogan, B.L., Barkauskas, C.E., Chapman, H.A., Epstein, J.A., Jain, R., Hsia, C.C., Niklason, L., Calle, E., Le, A., Randell, S.H., Rock, J., Snitow, M., **Krummel, M.**, Stripp, B.R., Vu, T., White, E.S., Whitsett, J.A., Morrisey, E.E. Repair and regeneration of the respiratory system: complexity, plasticity, and mechanisms of lung stem cell function. Cell Stem Cell. 2014 Aug 7;15(2):123-38. doi: 10.1016/j.stem.2014.07.012. PMCID: PMC4212493.

84. Lindsay, R.S., Corbin, K., Mahne, A., Levitt, B.E., Gebert, M.J., Wigton, E.J., Bradley, B.J., Haskins, K., Jacobelli, J., Tang, Q., **Krummel, M.F.**, Friedman, R.S. Antigen recognition in the islets changes with progression of autoimmune islet infiltration. J Immunol. 2015 Jan 15;194(2):522-30. doi: 10.4049/jimmunol.1400626. Epub 2014 Dec 10. PMCID: PMC4282963.

85. Bose, O., Baluk, P., Looney, M.R., Cheng, L.E., McDonald, D.M., Caughey, G.H., **Krummel, M.F.** Mast Cells Present Protrusions into Blood Vessels upon Tracheal Allergen Challenge in Mice. PLoS One. 2015 Mar 19;10(3):e0118513. doi: 10.1371/journal.pone.0118513. PMCID: PMC4366375.

86. Broz, M.L., **Krummel, M.F.** The Emerging Understanding of Myeloid Cells as Partners and Targets in Tumor Rejection. Cancer Immunol Res. 2015 Apr;3(4):313-319. PMCID: PMC4391275.

87. Hashimoto, M., Yanagisawa, H., Minagawa, S., Sen, D., Goodsell, A., Ma, R., Moermans, C., McKnelly, K.J., Baron, J.L., **Krummel, M.F.**, Nishimura, S.L. A Critical Role for Dendritic Cells in the Evolution of IL-1beta-Mediated Murine Airway Disease. J Immunol. 2015 Apr 15;194(8):3962-9. doi: 10.4049/jimmunol.1403043. Epub 2015 Mar 18. PMCID: PMC4390519.

88. Hashimoto, M., Yanagisawa, H., Minagawa, S., Sen, D., Ma, R., Murray, L.A., Tsui, P., Lou, J., Marks, J.D., Baron, J.L., **Krummel, M.F.**, Nishimura, S.L. TGF-β-Dependent Dendritic Cell Chemokinesis in Murine Models of Airway Disease. J Immunol. 2015 Aug 1;195(3):1182-90. doi: 10.4049/jimmunol.1500348. Epub 2015 Jun 24. PMCID: PMC4506848.

89. Plaks, V., Boldajipour, B., Linnemann, J.R., Nguyen, N.H., Kersten, K., Wolf, Y., Casbon, A.J., Kong, N., van den Bijgaart, R.J., Sheppard, D., Melton, A.C., **Krummel, M.F.**, Werb, Z. Adaptive Immune Regulation of Mammary Postnatal Organogenesis. Dev Cell. 2015 Sep 14;34(5):493-504. doi: 10.1016/j.devcel.2015.07.015. Epub 2015 Aug 27. PMCID: PMC4573906.

90. Mujal, A.M., Gilden, J.K., Gérard, A., Kinoshita, M., **Krummel, M.F.** A septin requirement differentiates autonomous and contact-facilitated T cell proliferation. Nat Immunol. 2016 Mar;17(3):315-22. doi: 10.1038/ni.3330. Epub 2015 Dec 21. PMCID: PMC4755847.

91. Krummel MF, Bartumeus F, Gérard A. T cell migration, search strategies and mechanisms. Nat Rev Immunol. 2016 03; 16(3):193-201. PMID: 26852928. PMCID: PMC4869523

92. Daud AI, Loo K, Pauli ML, Sanchez-Rodriguez R, Sandoval PM, Taravati K, Tsai K, Nosrati A, Nardo L, Alvarado MD, Algazi AP, Pampaloni MH, Lobach IV, Hwang J, Pierce RH, Gratz IK, Krummel MF, Rosenblum MD. Tumor immune profiling predicts response to anti-PD-1 therapy in human melanoma. J Clin Invest. 2016 09 01; 126(9):3447-52. PMID: 27525433. PMCID: PMC5004965

93. 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.

94. Pinkard H, Stuurman N, Corbin K, Vale R, Krummel MF. Micro-Magellan: open-source, sample-adaptive, acquisition software for optical microscopy. Nat Methods. 2016 09 29; 13(10):807-809. PMID: 27684577. PMCID: PMC5100821

95. Pinkard, H., Corbin, K., **Krummel, M.F.** Spatiotemporal Rank Filtering Improves Image Quality Compared to Frame Averaging in 2-Photon Laser Scanning Microscopy.PLoS One. 2016 Mar 3;11(3):e0150430. doi: 10.1371/journal.pone.0150430. eCollection 2016. PMCID: PMC4777388.

96. Jones, L.M., Broz, M.L., Ranger, J.J., Ozcelik, J., Ahn, R., Zuo, D., Ursini-Siegel, J., Hallett, M.T., **Krummel, M.**, Muller, W.J. STAT3 Establishes an Immunosuppressive Microenvironment during the Early Stages of Breast Carcinogenesis to Promote Tumor Growth and Metastasis. Cancer Res. 2016 Mar 15;76(6):1416-28. doi: 10.1158/0008-5472.CAN-15-2770. Epub 2015 Dec 30. PMID: 26719528.

97. Roberts, E.W., Broz, M.L, Binnewies, M., Bogunovic, D., Bhardwaj, N., **Krummel, M.F.** Critical Role for CD103+ /CD141+ Dendritic Cells Bearing CCR7 for Tumor Antigen Trafficking and Priming of T Cell Immunity in Melanoma.Cancer Cell 2016. 30, S1535-6108

98. Daud, A.I., Loo, K., Pauli, M.L., Sanchez-Rodriguez, R., Sandoval, P.M., Taravati, K., Tsai, K., Nosrati, A., Nardo, L., Alvarado, M.D., Algazi, A.P., Pampaloni, M.H., Lobach, I.V., Hwang, J., Pierce, R.H., Gratz, I.K., **Krummel, M.F.**, Rosenblum, M.D. Tumor immune profiling predicts response to anti-PD-1 therapy in human melanoma. J Clin Invest. 2016 Sep 1;126(9):3447-52. doi: 10.1172/JCI87324. PMCID: PMC5004965.

99. Thanabalasuriar, A., Neupane, A.S., Wang, J., **Krummel, M.F.**, Kubes, P. iNKT Cell Emigration out of the Lung Vasculature Requires Neutrophils and Monocyte-Derived Dendritic Cells in Inflammation. Cell Rep. 2016 Sep 20;16(12):3260-72. doi: 10.1016/j.celrep.2016.07.052. PMID: 27653688.

100. Pinkard, H., Stuurman, N., Corbin, K., Vale, R., **Krummel, M.F.** Micro-Magellan: open-source, sample-adaptive, acquisition software for optical microscopy. Nat Methods. 2016 Sep 29;13(10):807-809. doi: 10.1038/nmeth.3991. No abstract available. PMCID: PMC5100821.

101. Loyher, P.L., Rochefort, J., Baudesson de Chanville, C., Hamon, P., Lescaille, G., Bertolus, C., Guillot-Delost, M., **Krummel, M.F.**, Lemoine, F.M., Combadière, C., Boissonnas, A.. CCR2 influences T regulatory cell migration to tumors and serves as a biomarker of cyclophosphamide sensitivity. Cancer Res. 2016 Sep 28. pii: canres.0984.2016. PMID: 27680685.

102. Chong, S.Z., Evrard, M., Devi, S., Chen, J., Lim, J.Y., See, P., Zhang, Y., Adrover, J.M., Lee, B., Tan, L., Li, J.L., Liong, K.H., Phua, C., Balachander, A., Boey, A., Liebl, D., Tan, S.M., Chan, J.K., Balabanian, K., Harris, J.E., Bianchini, M., Weber, C., Duchene, J., Lum, J., Poidinger, M., Chen, Q., Rénia, L., Wang, C.I., Larbi, A., Randolph, G.J., Weninger, W.,

Looney, M.R., **Krummel, M.F.**, Biswas, S.K., Ginhoux, F., Hidalgo, A., Bachelerie, F., Ng, L.G. CXCR4 identifies transitional bone marrow premonocytes that replenish the mature monocyte pool for peripheral responses. J Exp Med. 2016 Oct 17;213(11):2293-2314. PMCID: PMC5068243.

103. Sen, D., Jones, S.M., Oswald, E.M., Pinkard, H., Corbin, K., **Krummel, M.F.** Tracking the Spatial and Functional Gradient of Monocyte-To-Macrophage Differentiation in Inflamed Lung. PLoS One. 2016 Oct 18;11(10):e0165064. doi: 10.1371/journal.pone.0165064. PMID: 27755611.

104. Starobinets, H., Ye, J., Broz, M., Barry, K., Goldsmith, J., Marsh, T., Rostker, F., **Krummel, M.**, Debnath, J. Antitumor adaptive immunity remains intact following inhibition of autophagy and antimalarial treatment. J Clin Invest. 2016 Oct 24. pii: 85705. doi: 10.1172/JCI85705. [Epub ahead of print]. PMID: 27775547.

105. Boldajipour, B., Nelson, A., **Krummel, M.F.** Tumor-infiltrating lymphocytes are dynamically desensitized to antigen but are maintained by homeostatic cytokine. JCI Insight. 2016 Dec 8;1(20):e89289. PMCID: PMC5135268.

106. Wong, P.T., Roberts, E.W., Tang, S., Mukherjee, J., Cannon, J., Nip, A.J., Corbin, K., **Krummel, M.F.**, Choi, S.K. Control of an Unusual Photo-Claisen Rearrangement in Coumarin Caged Tamoxifen through an Extended Spacer. JACS Chem Biol. 2017 Feb 17. doi: 10.1021/acschembio.6b00999. [Epub ahead of print]. PMID: 28191924.

107. Loo K, Tsai KK, Mahuron K, Liu J, Pauli ML, Sandoval PM, Nosrati A, Lee J, Chen L, Hwang J, Levine LS, **Krummel MF**, Algazi AP, Pampaloni M, Alvarado MD, Rosenblum MD, Daud AI. Partially exhausted tumor-infiltrating lymphocytes predict response to combination immunotherapy. JCI Insight. 2017 07 20; 2(14). PMID: 28724802. PMCID: PMC5518562

108. Lefrançais, E., Ortiz-Muñoz, G., Caudrillier, A., Mallavia, B., Liu, F., Sayah, D.M., Thornton, E.E., Headley, M.B., David, T., Coughlin, S.R., **Krummel, M.F.**, Leavitt, A.D., Passegué, E., Looney, M.R. The lung is a site of platelet biogenesis and a reservoir for haematopoietic progenitors. Nature. 2017 Apr 6;544(7648):105-109. doi: 10.1038/nature21706. Epub 2017 Mar 22. PMID: 28329764.

109. Tumeh, P.C., Hellmann, M.D., Hamid, O., Tsai, K.K., Loo, K.L., Gubens, M.A., Rosenblum, M., Harview, C.L., Taube, J.M., Handle,y N., Khurana, N., Nosrati, A., Krummel, **M.F.**, et al. Liver Metastasis and Treatment Outcome with Anti-PD-1 Monoclonal Antibody in Patients with Melanoma and NSCLC.Cancer Immunol Res. 2017 May;5(5):417-424. doi: 10.1158/2326-6066.CIR-16-0325. Epub 2017 Apr 14. PMID: 28411193.

110. 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.

111. Yipp, B.G., Kim, J.H., Lima, R., Zbytnuik, L.D., Petri, B., Swanlund, N., Ho, M., Szeto, V.G., Tak, T., Koenderman, L., Pickkers, P., Tool, A.T.J., Kuijpers, T.W., van den Berg, T.K., Looney, M.R., **Krummel, M.F.**, Kubes, P. The Lung is a Host Defense Niche for Immediate Neutrophil-Mediated Vascular Protection. Sci Immunol. 2017 Apr 28;2(10). pii: eaam8929. doi: 10.1126/sciimmunol.aam8929. PMID: 28626833.

112. Loo, K., Tsai, K.K., Mahuron, K., Liu, J., Pauli, M.L., Sandoval, P.M., Nosrati, A., Lee, J., Chen, L., Hwang, J., Levine, L.S., **Krummel, M.F.**, Algazi, A.P., Alvarado, M.D.,

Rosenblum, M.D., Daud, A.I. Partially exhausted tumor-infiltrating lymphocytes predict response to combination immunotherapy. JCI Insight. 2017 Jul 20;2(14). pii: 93433. doi: 10.1172/jci.insight.93433. [Epub ahead of print].

113. de Mingo Pulido Á, Gardner A, Hiebler S, Soliman H, Rugo HS, **Krummel MF**, Coussens LM, Ruffell B. TIM-3 Regulates CD103+ Dendritic Cell Function and Response to Chemotherapy in Breast Cancer. Cancer Cell. 2018 01 08; 33(1):60-74.e6. PMID: 29316433. PMCID: PMC5764109

114. Hung LY, Oniskey TK, Sen D, **Krummel MF**, Vaughan AE, Cohen NA, Herbert DR. Trefoil Factor 2 Promotes Type 2 Immunity and Lung Repair through Intrinsic Roles in Hematopoietic and Nonhematopoietic Cells. Am J Pathol. 2018 May;188(5):1161-1170. doi: 10.1016/j.ajpath.2018.01.020. Epub 2018 Feb 16.

115. Binnewies M, Roberts EW, Kersten K, Chan V, Fearon DF, Merad M, Coussens LM, Gabrilovich DI, Ostrand-Rosenberg S, Hedrick CC, Vonderheide RH, Pittet MJ, Jain RK, Zou W, Howcroft TK, Woodhouse EC, Weinberg RA, **Krummel MF**. Understanding the tumor immune microenvironment (TIME) for effective therapy. Nat Med. 2018 May;24(5):541-550. doi: 10.1038/s41591-018-0014-x. Epub 2018 Apr 23. Review.

116. Bąbała N, Bovens A, de Vries E, Iglesias-Guimarais V, Ahrends T, **Krummel MF**, Borst J, Bins AD. Subcellular Localization of Antigen in Keratinocytes Dictates Delivery of CD4+ T-cell Help for the CTL Response upon Therapeutic DNA Vaccination into the Skin. Cancer Immunol Res. 2018 Jul;6(7):835-847. doi: 10.1158/2326-6066.CIR-17-0408. Epub 2018 May 15. PMID: 29764836

117. Barry KC, Hsu J, Broz ML, Cueto FJ, Binnewies M, Combes AJ, Nelson AE, Loo K, Kumar R, Rosenblum MD, Alvarado MD, Wolf DM, Bogunovic D, Bhardwaj N, Daud AI, Ha PK, Ryan WR, Pollack JL, Samad B, Asthana S, Chan V, **Krummel MF**. A natural killer-dendritic cell axis defines checkpoint therapy-responsive tumor microenvironments. Nat Med. 2018 Aug;24(8):1178-1191. doi: 10.1038/s41591-018-0085-8. Epub 2018 Jun 25. PMID: 29942093

118. **Krummel MF**, Mahale JN, Uhl LFK, Hardison EA, Mujal AM, Mazet JM, Weber RJ, Gartner ZJ, Gérard A. Paracrine costimulation of IFN-? signaling by integrins modulates CD8 T cell differentiation. Proc Natl Acad Sci U S A. 2018 Nov 06; 115(45):11585-11590. PMID: 30348790. PMCID: PMC6233119

119. Hung LY, Sen D, Oniskey TK, Katzen J, Cohen NA, Vaughan AE, Nieves W, Urisman A, Beers MF, **Krummel MF**, Herbert DR. Macrophages promote epithelial proliferation following infectious and non-infectious lung injury through a Trefoil factor 2-dependent mechanism. Mucosal Immunol. 2019 Jan; 12(1):64-76. PMID: 30337651. PMCID: PMC6301101

120. 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

121. Dahlgren MW, Jones SW, Cautivo KM, Dubinin A, Ortiz-Carpena JF, Farhat S, Yu KS, Lee K, Wang C, Molofsky AV, Tward AD, **Krummel MF**, Peng T, Molofsky AB. Adventitial Stromal Cells Define Group 2 Innate Lymphoid Cell Tissue Niches. Immunity. 2019 Feb 15. pii: S1074-7613(19)30047-0. doi: 10.1016/j.immuni.2019.02.002. [Epub ahead of print] PMID: 30824323

122. Mujal AM, **Krummel MF.** Immunity as a continuum of archetypes. Science. 2019 04 05; 364(6435):28-29. PMID: 30948539

123. Dodagatta-Marri E, Meyer DS, Reeves MQ, Paniagua R, To MD, Binnewies M, Broz ML, Mori H, Wu D, Adoumie M, Del Rosario R, Li O, Buchmann T, Liang B, Malato J, Arce Vargus F, Sheppard D, Hann BC, Mirza A, Quezada SA, Rosenblum MD, **Krummel MF**, Balmain A, Akhurst RJ. α-PD-1 therapy elevates Treg/Th balance and increases tumor cell pSmad3 that are both targeted by α-TGFβ antibody to promote durable rejection and immunity in squamous cell carcinomas. J Immunother Cancer. 2019 Mar 4;7(1):62. doi: 10.1186/s40425-018-0493-9. PMID: 30832732

124. Puttur F, Denney L, Gregory LG, Vuononvirta J, Oliver R, Entwistle LJ, Walker SA, Headley MB, McGhee EJ, Pease JE, **Krummel MF**, Carlin LM, Lloyd CM. Pulmonary environmental cues drive group 2 innate lymphoid cell dynamics in mice and humans. Sci Immunol. 2019 Jun 7;4(36). pii: eaav7638. doi: 10.1126/sciimmunol.aav7638. PMID: 31175176. PMCID: PMC6744282

125. Jahchan NS, Mujal AM, Pollack JL, Binnewies M, Sriram V, Reyno L, **Krummel MF**. Tuning the Tumor Myeloid Microenvironment to Fight Cancer. Front Immunol. 2019 Jul 25; 10:1611. doi: 10.3389/fimmu.2019.01611. eCollection 2019. Review. PMID: 31402908. PMCID: PMC6673698

126. Wculek SK, Cueto FJ, Mujal AM, Melero I, **Krummel MF**, Sancho D. Dendritic cells in cancer immunology and immunotherapy. Nat Rev Immunol. 2019 Aug 29. PMID: 31467405

127. **Krummel MF**, Blish C, Kuhns M, Cadwell K, Oberst A, Goldrath A, Ansel KM, Chi H, O'Connell R, Wherry EJ, Pepper M; Future Immunology Consortium. Universal Principled Review: A Community-Driven Method to Improve Peer Review. Cell. 2019 Dec 12;179(7):1441-1445. doi: 10.1016/j.cell.2019.11.029. PMID: 31835023.

128. Lowe MM, Boothby I, Clancy S, Ahn RS, Liao W, Nguyen DN, Schumann K, Marson A, Mahuron KM, Kingsbury GA, Liu Z, Munoz Sandoval P, Rodriguez RS, Pauli ML, Taravati K, Arron ST, Neuhaus IM, Harris HW, Kim EA, Shin US, **Krummel MF**, Daud A, Scharschmdit TC, Rosenblum MD. Regulatory T cells use arginase 2 to enhance their metabolic fitness in tissues. JCI Insight. 2019 Dec 19;4(24):e129756. doi: 10.1172/jci.insight.129756. PMID: 31852848

129. Thumkeo D, Katsura Y, Nishimura Y, Kanchanawong P, Tohyama K, Ishizaki T, Kitajima S, Takahashi C, Hirata T, Watanabe N, Krummel MF, Narumiya S. mDia1/3-dependent Actin Polymerization Spatiotemporally Controls LAT Phosphorylation by Zap70 at Immune Synapse. Sci Adv. 2020 Jan 1;6(1):eaay2432. doi: 10.1126/sciadv.aay2432. eCollection 2020 Jan. PMID: 31911947. PMCID: PMC6938706.

130. Crotty S, Blish C, Cadwell K, Chi H, Goldrath A, Green D, Kaech SM, Krummel MF, Pepper M, Rothlin CV, Wherry EJ, Once-a-Year Pledge Supporters. Reinvigorating NIH Grant Peer Review. Immunity 2020 Jan 14;52(1):1-3. doi: 10.1016/j.immuni.2019.12.016. PMID: 31940266.

131. Hu KH, **Krummel MF.** Carpet-bombing tumors with IFN-γ. Nat Cancer 1, 270–272. 2020 March. https://doi.org/10.1038/s43018-020-0042-6

132. Levine LS, Mahuron KM, Tsai KK, Wu C, Mattis DM, Pauli ML, Oglesby A, Lee JC, Spitzer MH, **Krummel MF**, Algazi AP, Rosenblum MD, Alvarado M, Daud AI. Tumor Immune Profiling-Based Neoadjuvant Immunotherapy for Locally Advanced Melanoma. Ann Surg Oncol. 2020 June 2. doi: 10.1245/s10434-020-08648-7. PMID: 32488521

133. Ruhland MK, Roberts EW, Cai E, Mujal AM, Marchuk K, Beppler C, Nam D, Serwas NK, Binnewies M, **Krummel MF**. Visualizing Synaptic Transfer of Tumor Antigens among Dendritic Cells. Cancer Cell. 2020 Jun 08. Volume 37, Issue 6, P786-799.E5. doi: 10.1016/j.ccell.2020.05.002.

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.

137. Argüello RJ, Combes AJ, Char R, Tabouret E, Gigan JP, Baaziz AI, Bousiquot E, Camosseto V, Samad B, Tsui J, Yan P, Bouissonneau S, Figarella-Branger D, Gatti E, **Krummel MF**, Pierre P. SCENITH: A Flow Cytometry-Based Method to Functionally Profile Energy Metabolism with Single-Cell Resolution. Cell Metabolism. 2020. Volume 32, Issue 6, Pages 1063-1075.e7. doi: 10.1016/j.cmet.2020.11.007.

138. Combes AJ, Courau T, Kuhn NF, Hu KH, Ray A, Chen WS, Chew NW, Cleary SJ, Kushnoor D, Reeder GC, Shen A, Tsui J, Hiam-Galvez KJ, Muñoz-Sandoval P, Zhu WS, Lee DS, Sun Y, You R, Magnen M, Rodriguez L, Im KW, Serwas NK, Leligdowicz A, Zamecnik CR, Loudermilk RP, Wilson MR, Ye CJ, Fragiadakis GK, Looney MR, Chan V, Ward A, Carrillo S; UCSF COMET Consortium, Matthay M, Erle DJ, Woodruff PG, Langelier C, Kangelaris K, Hendrickson CM, Calfee C, Rao AA, **Krummel MF**. Global absence and targeting of protective immune states in severe COVID-19. Nature. 2021 Jan 25. doi: 10.1038/s41586-021-03234-7. PMID: 33494096.

139. Chan V, Gherardini PF, **Krummel MF**, Fragiadakis GK. A "data sharing trust" model for rapid, collaborative science. Cell. 2021 Feb 4;184(3):566-570. doi: 10.1016/j.cell.2021.01.006. PMID: 33545032

140. van der Wijst MGP, Vazquez SE, Hartoularos GC, Bastard P, Grant T, Bueno R, Lee DS, Greenland JR, Sun Y, Perez R, Ogorodnikov A, Ward A, Mann SA, Lynch KL, Yun C, Havlir DV, Chamie G, Marquez C, Greenhouse B, Lionakis MS, Norris PJ, Dumont LJ, Kelly K, Zhang P, Zhang Q, Gervais A, Voyer TL, Whatley A, Si Y, Byrne A, Combes AJ, Rao AA, Song YS; UCSF COMET consortium, Fragiadakis GK, Kangelaris K, Calfee CS, Erle DJ, Hendrickson C, **Krummel MF**, Woodruff PG, Langelier CR, Casanova JL, Derisi JL, Anderson MS, Ye CJ. Longitudinal single-cell epitope and RNA-sequencing reveals the immunological impact of type 1 interferon autoantibodies in critical COVID-19. bioRxiv. 2021 Mar 10:2021.03.09.434529. doi: 10.1101/2021.03.09.434529. Preprint. PMD: 33758859.

141. Seed RI, Kobayashi K, Ito S, Takasaka N, Cormier A, Jespersen JM, Publicover J, Trilok S, Combes AJ, Chew NW, Chapman J, **Krummel MF**, Lou J, Marks J, Cheng Y, Baron JL, Nishimura SL. A tumor-specific mechanism of T reg enrichment mediated by the integrin αvβ8. Sci Immunol. 2021 Mar 26;6(57):eabf0558. doi: 10.1126/sciimunol.abf0558. PMID: 33771888.

142. Pinkard H, Baghdassarian H, Mujal A, Roberts E, Hu KH, Friedman DH, Malenica I, Shagam T, Fries A, Corbin K, **Krummel MF**, Waller L. Learned adaptive multiphoton illumination microscopy for large-scale immune response imaging. Nat Commun. 2021 Mar 26; 12(1):1916. doi: 10.1038/s41467-021-22246-5. PMID: 33772022

143. Tsitsiklis A, Zha BS, Byrne A, Devoe C, Levan S, Rackaityte E, Sunshine S, Mick E, Ghale R, Jauregui A, Sarma A, Neff N, Serpa PH, Deiss TJ, Kistler A, Carrillo S, Ansel KM, Leligdowicz A, Christenson S, Jones N, Wu B, Darmanis S, Matthay MA, Lynch SV, DRisi JL; COMET Consortium+, Hendrickson CM, Kangelaris KN, **Krummel MF**, Woodruff PG, Erle DJ, Rosenberg O, Clafee CS, Langelier CR. Impaired antibacterial immune signaling and changes in the lung microbiome precede secondary bacterial pneumonia in COVID-19. medRxiv. 2021 Mar 26:2021.03.23.21253487. doi: 10.1101/2021.03.23.21253487. Preprint. PMID: 33791731

144. Cueto FJ, Del Fresno C, Brandi P, Combes AJ, Hernández-García E, Sánchez-Paulete AR, Enamorado M, Bromley CP, Gomez MJ, Conde-Garrosa R, Mañes S, Zelenay S, Melero I, Iborra S, **Krummel MF**, Ssancho D. DNGR-1 limits Flt3L-mediated antitumor immunity by restraining tumor-infiltrating type I conventional dendritic cells. J Immunother Cancer. 2021 May;9(5):e002054. doi: 10.1136/jitc-2020-002054. PMID: 33980589.

145. Pipathsouk A, Brunetti RM, Town JP, Graziano BR, Breuer A, Pellett PA, Marchuk K, Tran NT, **Krummel MF**, Stamou D, Weiner OD. The WAVE complex associates with sites of saddle membrane curvature. J Cell Biol. 2021 Aug 2; 220(8):e202003086. doi: 10.1083/jcb.202003086. Epub 2021 Jun 7. PMID: 34096965.

146. van der Wijst MGP, Vazquez SE, Hartoularos GC, Bastard P, Grant T, Bueno R, Lee DS, Greenland JR, Sun Y, Perez R, Ogorodnikov A, Ward A, Mann SA, Lynch KL, Yun C, Havlir DV, Chamie G, Marquez C, Greenhouse B, Lionakis MS, Norris PJ, Dumont LJ, Kelly K, Zhang P, Zhang Q, Gervais A, Le Voyer T, Whatley A, Si Y, Byrne A, Combes AJ, Rao AA, Song YS, Fragiadakis GK, Kangelaris K, Calfee CS, Erle DJ, Hendrickson C, **Krummel MF**, Woodruff PG, Langelier CR, Casanova JL, Derisi JL, Anderson MS, Ye CJ; UCSF COMET consortium. Type I interferon autoantibodies are associated with systemic immune alterations in patients with COVID-19. Sci Transl Med. 2021 Aug 24:eabh2624. doi: 10.1126/svitranslmed.abh2624. PMID: 34429372.

147. Sarma A, Christenson SA, Byrne A, Mick E, Pisco AO, DeVoe C, Deiss T, Ghale R, Zha BS, Tsitsiklis A, Jauregui A, Moazed F, Detweiler AM, Spottiswoode N, Sinha P, Neff N, Tan M, Serpa PH, Willmore A, Ansel KM, Wilson JG, Leligdowicz A, Siegel ER, Sirota M, DeRisi JL, Matthay MA; COMET Consortium, Hendrickson CM, Kangelaris KN, **Krummel MF**, Woodruff PG, Erle DJ, Calfee CS, Langelier CR. Tracheal aspirate RNA sequencing identifies distinct immunological features of COVID-19 ARDS. Nat Commun. 2021 Aug 26;12(1):5152. doi: 10.1038/s41467-021-25040-5. PMID: 34446707

148. Mehta P, Gouirand V, Boda DP, Zhang J, Gearty SV, Zirak B, Lowe MM, Clancy S, Boothby I, Mahuron KM, Fries A, **Krummel MF**, Mankoo P, Chang HW, Liu J, Moreau JM, Scharschmidt TC, Daud A, Kim E, Neuhaus IM, Harris HW, Liao W, Rosenblum MD. Layilin Anchors Regulatory T Cells in Skin. J Immunol. 2021 Sep1:ji2000970. doi: 10.4049/jimmunol.2000970. PMID 34470859

149. Weiner J, Suwalski P, Holtgrewe M, Rakitko A, Thibeault C, Müller M, Patriki D, Quedenau C, Krüger U, Ilinsky V, Popov I, Balnis J, Jaitovich A, Helbig ET, Lippert LJ, Stubbemann P, Real LM, Macías J, Pineda JA, Fernandez-Fuertes M, Wang X, Karadeniz Z, Saccomanno J, Doehn JM, Hübner RH, Hinzmann B, Salvo M, Blueher A, Siemann S, Jurisic S, Beer JH, Rutishauster J, Wiggli B, Schmid H, Danninger K, Binder R, Corman VM, Mühlemann

B, Rao AA, Fragiadakis GK, Mick E, Comet C, Calfee CS, Erle DJ, Hendrickson CM, Kangelaris KN, **Krummel MF**, Woodruff PG, Langelier CR, Venkataramani U, García F, Zyla J, Drosten C, Alice B, Jones TC, Suttorp N, Witzenrath M, Hippenstiel S, Zemojtl T, Skurk C, Wolfgang P, Borodina T, Pa-Covid SG, Ripke S, Sander LE, Beule D, Landmesser U, Guettouche T, Kurth F, Heidecker B. Increased risk of severe clinical course of COVID-19 incarriers of HLA-C*04:01. EClinicalMedicine. 2021 Sep 2:101099. doi: 10.1016/j.eclinm.2021.101099. PMID: 34490415. PMCID: PMC8410317.

150. You R, Artichoker J, Fries A, Edwards A, Combes AJ, Reeder G, Samad B, **Krummel MF**. Active surveillance characterizes human intratumoral T cell exhaustion. J Clin Invest. 2021 Sep 15;131(18):e144353. doi: 10.1172/JCI144353. doi: 10.1172/JCI144353. PMID: 34292884. PMCID: PMC8439597

151. Jiang H, Courau T, Borison J, Ritchie AJ, Mayer, AT, **Krummel MF**, Collission EA. Activating Immune Recognition in Pancreatic Ductal Adenocarcinoma via Autophagy Inhibition, MEK blockade and CD40 Agonism. Gastroenterology. 2021 Oct 7:S0016-5085(21)03618-0. doi: 10.1053/j.gastro.2021.09.066. PMID: 34627860

152. Im K, Combes AJ, Spitzer MH, Satpathy AT, **Krummel MF**. Archetypes of checkpoint-responsive immunity. Trends Immunol. 2021 Oct 9:S1471-4906(21)00183-6. doi: 10.1016/j.it.2021.09.007. PMID: 34642094. Review

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.

2. 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.

3. 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 metastastic success.

4. 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)

5. 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.

6. 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 intraclonal 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. PMCID: 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 utlized 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. 2017
3. M.F. Krummel, and K.H. Hu, Single Cell Mapping and Transcriptome Analysis. Patent Pending

OTHER CREATIVE ACTIVITIES

1. Amateur Ballistics and Pyrotechnics