

University of California, San Francisco
CURRICULUM VITAE

Name: Matthew F Krummel, PhD

Position: Professor, Step 2
Pathology
School of Medicine

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EDUCATION

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|-------------|--|------------------|-------------------------------|
| 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

| | | | |
|----------------|---|-----------------------------|---------------------------------------|
| 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 - present | 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 |

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|-------------|---|-----------------------------|--------------|
| 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

| | |
|------|--|
| 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 |

PROFESSIONAL ACTIVITIES

CLINICAL

N/A

SUMMARY OF CLINICAL ACTIVITIES

N/A

PROFESSIONAL ORGANIZATIONS

Memberships

- 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

| | | |
|----------------|--|--|
| 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, Nature Cell Biology, PNAS, Journal of Immunology, Trends in Molecular Medicine, Traffic, Current Issues in Molecular Biology, Blood |

INVITED PRESENTATIONS

INTERNATIONAL

| | | |
|------|---|---------------------------------|
| 2014 | European Respiratory Society, Estoril Portugal | Invited Speaker |
| 2013 | International Congress of Immunology, Milan Italy | Session Chair |
| 2013 | University of Lausanne, Immunology Seminar Series | Invited Speaker |
| 2013 | World Immune Regulation Meeting, Davos, Switzerland | Invited Speaker |
| 2012 | Japanese Society of Immunology, Kobe, Japan | Invited Speaker |
| 2012 | "Cell Migration in Biology and Medicine", Kyushu University, Fukuoka, Japan | Invited Speaker |
| 2011 | 1st Annual Postech Conference on Bio-Imaging, Pohang, Korea | Invited Speaker |
| 2011 | Weatherall Institute of Immunology, Oxford University, England | Interviewee and Invited Speaker |
| 2009 | Saarland University Immunology Seminar Series, Homburg Germany | Invited Speaker |
| 2009 | Institut Curie, Immunology Series, Paris | Invited Speaker |
| 2009 | British Society of Immunology: Imaging the Immune System, York England | Invited Speaker |
| 2009 | Institut Pasteur, Immunology Series. Paris, France | Invited Speaker |
| 2008 | Institut Necker, Immunology Series. Paris, France | Invited Speaker |
| 2008 | RAMIC (Spanish Motility Consortium Meeting), Madrid, Spain | Invited Speaker |

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| 2008 | Foundation Dreyfus: 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 |

NATIONAL

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|------|--|-----------------|
| 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 |

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

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| 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 |

REGIONAL AND OTHER INVITED PRESENTATIONS

| | | |
|------|--|-------------------------------|
| 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, | Invited Speaker |

Stanford CA

UNIVERSITY AND PUBLIC SERVICE

UNIVERSITY SERVICE

UCSF CAMPUS-WIDE

| | | |
|----------------|--|------------------------------|
| 2013 - 2013 | UCSF/UCB Annual Immunology Retreat | Organizer |
| 2012 - present | UCSF ETAC Technology Committee | Member |
| 2013 - 2013 | UCSF Immunology Retreat | Organizer |
| 2012 - 2012 | 'Imaging Cancer' Workshop | Organizer |
| 2011 - 2011 | UCSF BMS Retreat | Organizer/Chair |
| 2009 - present | RAP (formerly REAC) Review Committee | Member |
| 2009 - present | Sandler Postdoctoral Review Committee | Member |
| 2007 - present | Biological Imaging Development Center (BIDC) at UCSF | Founder and Faculty Director |
| 2006 - present | 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 - present | UCSF BMS Graduate advising (Chair 2005-2008) | Member and Chair |
| 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 |
| 2002 - 2009 | UCSF, BMS Graduate Admissions Committee | Member |

TEACHING AND MENTORING

TEACHING

FORMAL SCHEDULED CLASSES FOR UCSF STUDENTS

| Qtr | Academic Yr | Course Number and Title | Teaching Contribution | Units | Class Size |
|-----|-------------|-----------------------------------|-----------------------|-------|------------|
| F | 2001 - 2001 | BMS 255, Tissue and Organ Biology | Lab Leader, 1 | 1-5 | 20 |

| Qtr | Academic Yr | Course Number and Title | Teaching Contribution | Units | Class Size |
|-----|-------------|-----------------------------------|--|-------|------------|
| | | | class | | |
| F | 2001 - 2001 | BMS 225, Tissue and Organ Biology | Two Lectures: "Advanced Microscopy" | 1-5 | 25 |
| F | 2002 - 2002 | I3, Medical Student Immunology | Discussion Leader | 4 | 15 |
| F | 2002 - 2002 | BMS 260, Cell Biology | Discussion Leader | 4 | 8 |
| F | 2002 - 2002 | BMS 225, Tissue and Organ Biology | Lab Leader, 1 class | 1-5 | 20 |
| F | 2002 - 2002 | BMS 225, Tissue and Organ Biology | Two Lectures: "Advanced Microscopy" | 1-5 | 25 |
| S | 2003 - 2003 | BMS 204, Immunology | Discussion Leader | 4 | 8 |
| S | 2003 - 2003 | BMS 209, Advanced Immunology | Course Organizer (w/ Frances Brodsky) | 5 | 10 |
| S | 2003 - 2003 | BMS 225, Tissue and Organ Biology | Lab Leader, 1 class | 1-5 | 20 |
| F | 2003 - 2003 | 13, Medical Student Immunology | Discussion Leader | 4 | 15 |
| F | 2003 - 2003 | BMS 204, Immunology | Discussion Leader | 4 | 10 |
| F | 2003 - 2003 | BMS 260, Cell Biology | Discussion Leader | 4 | 8 |
| F | 2003 - 2003 | BMS 225, Tissue and Organ Biology | Two Lectures: "Advanced Microscopy" | 1-5 | 25 |
| S | 2004 - 2004 | BMS 225, Tissue and Organ Biology | Lecture: "Advanced Microscopy" | 1-5 | 15 |
| S | 2004 - 2004 | BMS 265, Macromolecules | Lecture: "Receptor-Ligand Interactions" | 1-5 | 15 |
| F | 2004 - 2004 | 13, Medical Student Immunology | Discussion Leader | 4 | 15 |
| F | 2004 - 2004 | BMS 260, Cell Biology | Discussion Leader | 4 | 8 |
| F | 2004 - 2004 | BMS 225, Tissue and Organ Biology | Two Lectures: "Advanced Microscopy" | 1-5 | 25 |
| S | 2005 - 2005 | BMS 265, Macromolecules | Lecture: "Receptor-Ligand Interactions" | 1-5 | 25 |
| F | 2005 - 2005 | 13, Medical Student Immunology | Discussion Leader | 4 | 15 |
| F | 2005 - 2005 | BMS 260, Cell Biology | Discussion co-Leader | 4 | 8 |
| F | 2005 - 2005 | BMS 225, Tissue and Organ Biology | Two Lectures: | 1-5 | 25 |

| Qtr | Academic Yr | Course Number and Title | Teaching Contribution | Units | Class Size |
|-----|-------------|-----------------------------------|--|-------|------------|
| | | | "Advanced Microscopy" | | |
| S | 2006 - 2006 | BMS 225A | Lecture "Peripheral Lymphoid Organs" | 1-5 | 25 |
| S | 2006 - 2006 | BMS 225, Tissue and Organ Biology | Two Lectures: "Advanced Microscopy" | 1-5 | 25 |
| S | 2006 - 2006 | BMS 265, Macromolecules | Lecture: "Receptor-Ligand Interactions" | 1-5 | 25 |
| F | 2006 - 2006 | BMS 260, Cell Biology | Discussion co-Leader | 1-5 | 48 |
| F | 2006 - 2006 | BMS 225, Tissue and Organ Biology | Two Lectures: "Advanced Microscopy" | 1-5 | 25 |
| F | 2006 - 2006 | 13, Medical Student Immunology | Discussion Leader | 4 | 15 |
| S | 2007 - 2007 | BMS 225A | Lecture "Peripheral Lymphoid Organs" | 1-5 | 25 |
| S | 2007 - 2007 | BMS 225, Tissue and Organ Biology | One Lecture: "Advanced Microscopy" | 1-5 | 25 |
| S | 2007 - 2007 | BMS 265, Macromolecules | Lecture: "Receptor-Ligand Interactions" | 1-5 | 25 |
| F | 2007 - 2007 | BMS 260, Cell Biology | Discussion co-Leader | 1-5 | 48 |
| F | 2007 - 2007 | BMS 225, Tissue and Organ Biology | Two Lectures: "Advanced Microscopy" | 1-5 | 25 |
| F | 2007 - 2007 | 13, Medical Student Immunology | Discussion Leader | 4 | 15 |
| S | 2008 - 2008 | BMS 225A | Lecture "Peripheral Lymphoid Organs" | 1-5 | 25 |
| S | 2008 - 2008 | BMS 225, Tissue and Organ Biology | Two Lectures: "Advanced Microscopy" | 1-5 | 25 |
| F | 2008 - 2008 | BMS 225, Tissue and Organ Biology | Two Lectures: "Advanced Microscopy" | 1-5 | 25 |
| F | 2009 - 2009 | 13, Medical Student Immunology | Discussion Leader | 4 | 15 |
| F | 2009 - 2009 | BMS 225, Tissue and Organ Biology | Two Lectures: "Advanced Microscopy" | 1-5 | 25 |

| Qtr | Academic Yr | Course Number and Title | Teaching Contribution | Units | Class Size |
|-----|-------------|--------------------------------|-----------------------|-------|------------|
| F | 2010 - 2010 | 13, Medical Student Immunology | Discussion Leader | 4 | 15 |
| F | 2010 - 2010 | BMS 260, Cell Biology | Discussion co-Leader | 1-5 | 48 |
| F | 2010 - 2010 | BMS225 | Lecturer | 4 | 30 |
| F | 2011 - 2011 | I3, Medical Student Immunology | Discussion Leader | 4 | 12 |
| F | 2011 - 2011 | BM225 | Lecturer | 4 | 12 |

POSTGRADUATE AND OTHER COURSES

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|----------------|--|-----------|
| 2013 - present | Argentinian Course in Immunology | Lecturer |
| 2011 - present | Cold Spring Harbor Summer Course:Quantitative Imaging: From Cells to Molecules | Lecturer |
| 2006 - present | UCSF BMS Program: NSF fellowship writing lecture and mentoring | Organizer |

INFORMAL TEACHING

2002 - 2011 30 hours per week supervising thesis work and postdoctoral training for approximately 8 individuals. This includes practical lab training as well as one-on-one discussions of data and lab meetings

TEACHING NARRATIVE

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

1.) Course Director: Together with Frances Brodsky, I organized and led an advanced seminar course (Advanced Immunology, BMS 209, 2003) on the topic of Cell Biology of Leukocyte Interfaces . This entailed putting together a syllabus and reading list and supervising the students in their presentations of research papers on relevant topics.

2.) Discussion Leader: For many of the past 12 years, I have acted as a discussion leader for graduate level Cell Biology and Immunology courses (BMS 260 and 204 respectively). For these courses, I led students in weekly 2-hour discussions of research literature. For Cell Biology, this also entailed meeting with students individually to discuss their end-of-quarter grant-proposals, holding an oral-exam on these proposals, and grading their written work.

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

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

5. Recurring Lectures for Incoming Graduate Students: Since 2006, I have organized a lecture and mentoring program for incoming graduate students to help them assemble and write their NSF fellowship proposals. This includes an introductory lecture on 'How to Write a Fundable Grant' and follow-up meetings with volunteer graduate students and faculty to help students fine-tune their work. Beyond the one-day course and mentoring, we provide faculty and student-led mentoring throughout the submission process. This produced a record 14 awardees in 2012 and 12 in 2013.

MENTORING

PREDOCTORAL STUDENTS SUPERVISED OR MENTORED

| Dates | Name | Program or School | Role | Current Position |
|----------------|-------------------|------------------------|--------------------|---|
| 2002 - present | Aaron Tooley | BMS Program | PhD Advisor | Industry |
| 2003 - 2007 | Rachel Friedman | BMS Program | PhD Advisor | Assistant Professor, University of Colorado, Denver |
| 2004 - 2004 | Eric Wright | Wayne State University | Summer SRTP Mentor | Undergraduate, Wayne State |
| 2005 - 2011 | Julia Gilden | BMS Program | PhD Advisor | Postdoctoral Fellow, University of Wisconsin |
| 2007 - 2012 | Emily Thornton | BMS Program | PhD Advisor | Graduate Student, UCSF |
| 2011 - present | Miranda Broz | BMS Program | PhD Advisor | Graduate Student, UCSF |
| 2012 - present | Adriana Mujal | BMS Program | PhD Advisor | Graduate Student, UCSF |
| 2012 - 2014 | Erin Oswald | BMS Program | PhD Advisor | Graduate Student, UCSF |
| 2013 - present | Mikhail Binnewies | BMS Program | PhD Advisor | Graduate Student, UCSF |

POSTDOCTORAL FELLOWS AND RESIDENTS DIRECTLY SUPERVISED OR MENTORED

| Dates | Name | Fellow | Faculty Role | Current Position |
|-------------|------------------------------|--------------------------|----------------------|---|
| 2001 - 2003 | Judie Boisvert, PhD | Post-Doctoral Researcher | Research Supervision | Consultant |
| 2002 - 2011 | Jordan Jacobelli, PhD | Post-Doctoral Researcher | Research Supervision | Assistant Professor, University of Colorado |
| 2004 - 2006 | Maria-Cristina Moldovan, PhD | Post-Doctoral Researcher | Research Supervision | Scientist, Medarex |

| Dates | Name | Fellow | Faculty Role | Current Position |
|----------------|-------------------------|--------------------------|----------------------|---|
| 2004 - 2006 | Sumone Chakravarti, PhD | Post-Doctoral Researcher | Research Supervision | Senior Fellow, Melbourne Australia |
| 2004 - 2006 | Catherine Sabatos, PhD | Post-Doctoral Researcher | Research Supervision | Lecturer, University of Bristol, UK |
| 2006 - 2008 | Junsang Doh | Post-Doctoral Researcher | Research Supervision | Associate Professor, POSTECH, Korea |
| 2006 - 2011 | John Engelhardt | Post-Doctoral Researcher | Research Supervision | Scientist, Bristol-Myers Squibb |
| 2006 - present | Peter Beemiller | Post-Doctoral Researcher | Research Supervision | Post-Doctoral Researcher |
| 2007 - 2011 | Rachel Friedman | Post-Doctoral Researcher | Research Supervision | Assistant Professor, University of Colorado |
| 2008 - 2011 | Yi-Chun Maria Chen | Post-Doctoral Researcher | Research Supervision | Post-Doctoral Fellow, Genentech |
| 2008 - present | Audrey Gerard | Post-Doctoral Researcher | Research Supervision | Post-Doctoral Researcher |
| 2010 - 2012 | Adriaan Bins | Post-Doctoral Researcher | Research Supervision | Post-Doctoral Researcher |
| 2010 - 2014 | Debasish Sen | Post-Doctoral Researcher | Research Supervision | Post-Doctoral Scholar, Stanford University School of Medicine |
| 2010 - 2015 | Bijan Boldajipour | Post-Doctoral Researcher | Research Supervision | Senior Scientist, Pfizer |
| 2011 - present | Mark Headley | Post-Doctoral Researcher | Research Supervision | Post-Doctoral Researcher |
| 2011 - 2014 | Efrat Lelkes | Clinical Fellow | Research Supervision | Assistant Adjunct Professor, UCSF |
| 2013 - present | Edward Roberts | Post-Doctoral Researcher | Research Supervision | Post-Doctoral Researcher |
| 2013 - present | Stephen Jones | Post-Doctoral Researcher | Research Supervision | Post-Doctoral Researcher |
| 2015 - present | En Cai | Post-Doctoral Researcher | Research Supervision | Post-Doctoral Researcher |

FACULTY MENTORING

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

TEACHING AND MENTORING AWARDS AND NOMINATIONS

2013 Pediatrics FLAG Mentorship Award, University of California, San Francisco

SUMMARY OF TEACHING AND MENTORING HOURS

| | |
|-------------|---|
| 2001 - 2002 | 8 total hours of teaching (including preparation) Formal class or course teaching hours: 2 hours Informal class or course teaching hours: 2 hours Mentoring hours: 400 hours Total hours: 412 hours |
| 2002 - 2003 | 75 total hours of teaching (including preparation) Formal class or course teaching hours: 45 hours Informal class or course teaching hours: 10 hours Mentoring hours: 960 hours Total hours: 1090 hours |
| 2003 - 2004 | 50 total hours of teaching (including preparation) Formal class or course teaching hours: 22 hours Informal class or course teaching hours: 10 hours Mentoring hours: 960 hours Total hours: 1042 hours |
| 2004 - 2005 | 50 total hours of teaching (including preparation) Formal class or course teaching hours: 22 hours Informal class or course teaching hours: 0 hours Mentoring hours: 960 hours Total hours: 1042 hours |
| 2005 - 2006 | 50 total hours of teaching (including preparation) Formal class or course teaching hours: 22 hours Informal class or course teaching hours: 10 hours Mentoring hours: 960 hours Total hours: 1042 hours |
| 2006 - 2007 | 50 total hours of teaching (including preparation) Formal class or course teaching hours: 22 hours Informal class or course teaching hours: 10 hours Mentoring hours: 960 hours |

| | |
|----------------|---|
| | Total hours: 1042 hours |
| 2007 - 2008 | 50 total hours of teaching (including preparation) Formal class or course teaching hours: 22 hours Informal class or course teaching hours: 10 hours Mentoring hours: 960 hours Total hours: 1042 hours |
| 2008 - 2009 | 50 total hours of teaching (including preparation) Formal class or course teaching hours: 5 hours Informal class or course teaching hours: 10 hours Mentoring hours: 960 hours Total hours: 1025 hours |
| 2009 - 2010 | 50 total hours of teaching (including preparation) Formal class or course teaching hours: 5 hours Informal class or course teaching hours: 10 hours Mentoring hours: 960 hours Total hours: 1025 hours |
| 2010 - 2011 | 50 total hours of teaching (including preparation) Formal class or course teaching hours: 5 hours Informal class or course teaching hours: 8 hours Mentoring hours: 960 hours Total: 1023 hours |
| 2011 - present | Total anticipated hours of teaching: 1075 hours |

RESEARCH AND CREATIVE ACTIVITIES

RESEARCH AWARDS

CURRENT

| | |
|---|-------------------------|
| R01 AI52116 (PI) | 01/15/2008 - 12/31/2017 |
| NIH | \$250,000 direct/yr1 |
| Cytoskeletal Regulation of T cell Motility and Synaptic Signaling | |
| PO1 HL024136 (P2 PI) | 05/01/2010 - 03/31/2016 |
| NIH/NHLBI | \$243,616 direct/yr1 |

Evolving Microenvironments in Airway Inflammation

| | |
|--|---|
| PO1 HL024136-CoreB (Co-PI) NIH/NHLBI Core B: This core supports the basic activities of the PPG | 05/01/2010 - 03/31/2016 \$122,016 direct/yr1 |
| U54 CA163123-01 (Coussens, Krummel, Van't Veer: multi-PI) (PI (MPI)) NIH/NCI Leukocyte Biomarkers for Predicting Human Breast Cancer Outcome | 09/01/2011 - 08/30/2016 \$258,900 direct/yr1 |
| 1U01HL111054-01 (Chapman, Chuang, Krummel, multi-PI) (co-PI) (co PI) NHLBI Epithelial Progenitor Cells in Lung Repair and Regeneration | 12/01/2011 - 11/30/2016 \$90,000 (subcontract) direct/yr1 |
| 2U19A1077439-06 (Project 3 Leader) NIH/NIAID Program: IL-13 and IL-17 Dynamics in the Asthmatic Airway Project 3: Dynamic Imaging of IL13/IL17 Immune Infiltrates in Asthma | 04/01/2008 - 03/31/2018 \$1,086,097/yr Project 3: \$289,263/yr direct/yr1 |
| -Miller I Class 1886 (PI) UCSF REAC AWARD – A Shared Cutting-Edge Selective Plane Illumination Microscope | 01/01/2015 - 12/31/2015 \$35,000 total |
| <u>PAST</u> | |
| (PI) Diabetes Center Imaging Molecular Events in Lymph Nodes During T cell Activation | 05/01/2002 - 04/30/2004 \$25,000 direct/yr1 |
| (PI) Sandler Opportunity Fund Image Based Screening | 06/01/2002 - 05/31/2004 \$150,000 total |
| (PI) Stewart Trust | 05/01/2004 - 04/30/2005 \$50,000 direct/yr1 |

2-Photon Imaging of Immune Tumor Surveillance

| | |
|---|-------------------------|
| (PI) | 10/01/2003 - 09/30/2006 |
| Dana Foundation | \$33,000 direct/yr1 |
| Imaging T cell based Tumor Surveillance | |
| R21 (PI) | 03/01/2005 - 02/28/2007 |
| NIH | \$125,000 direct/yr1 |
| Image-Based Analysis of Tolerance-Induction Mechanisms | \$100,000 total |
| (PI) | 03/09/2005 - 03/10/2006 |
| Sandler Integrative Research Fund | |
| Biophysical Analysis of Immune-Cell Surface | \$355,000 total |
| (PI) | 03/01/2007 - 02/28/2010 |
| Juvenile Diabetes Research Foundation | \$150,000 direct/yr1 |
| Visualizing Feedback Loops in Type I Diabetes | |
| (Co-Investigator) | 06/01/2004 - 05/30/2009 |
| NIH/Mouse Models Consortium | \$65,000 direct/yr1 |
| Immune Enhancement and Therapy of Cancer | |
| (PI) | 08/01/2004 - 02/28/2009 |
| CRI/Young Investigator | \$50,000 direct/yr1 |
| Synapse and Migratory Dynamics of Lymphocytes in the Tumor Microenvironment | |
| (PI) | 03/01/2008 - 02/28/2010 |
| NIH/R21 | \$150,000 direct/yr1 |
| New Models for Molecular-Level Imaging of Cell Signaling in vivo | \$125,000 total |
| (PI) | 07/01/2005 - 06/30/2010 |
| Leukemia and Lymphoma Foundation Scholar Award | \$100,000 direct/yr1 |
| Tumor Suppressors in T cell Synapse Formation and Signaling | |
| () | 07/01/2009 - 06/30/2012 |
| American Asthma Foundation | \$150,000 direct/yr1 |
| Directing Antigens to Specific APC and T cell Subsets in the Lung | |
| 1S10RR029266-01 (PI) | 06/05/2011 - 06/04/2013 |

| | | |
|---|-------------------------|--|
| NIH/NCRR | | |
| Multiphoton Instrumentation for Translational Assays from Human Tissue Biopsies | | \$635,523 total |
| 1R21CA167601 (PI) | 04/01/2012 - 03/31/2014 | |
| NIH/NCI | | \$150,000 direct/yr1 |
| Defining the First Hours of Lung metastasis using Intravital Live-Imaging | | \$275,000 total |
| 1U01CA141451 (PI) | 09/01/2009 - 08/31/2014 | |
| NIH | | \$317,206 direct+indirect+consortia costs direct/yr1 |
| Collaborative Innate-Adaptive Immune Regulation of Tumor Progression | | |
| R01 AI52116 (PI) | 01/15/2008 - 12/31/2017 | |
| NIH | | \$250,000 direct/yr1 |
| Myosin Motors in T cell Synapse Formation and Activation | | |

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. PMID: 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 exacerbated clinical 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 threshold 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. PMID: 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. PMID: 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. PMID: PMC3057888.
29. 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.
30. Tang, Q and **Krummel M.F.** 2006 Imaging the function of regulatory T cells in vivo. *Curr Opin Immunol.* **18(4)**:496-502
31. 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.
32. **Krummel MF** and Macara I. 2006. T cell Polarity PARTita: maintenance and modulation of directionality in T lymphocytes *Nature Immunology.* **7**, 1143-49.
33. **Krummel, M.F.** 2007. Immunological Synapses: breaking up may be good to do. *Cell.* **129**, 653-655.
34. **Krummel, M.F.** 2007. Testing the Organization of the Immunological Synapse. *Curr Opin Immunol.* **19(4)**:460-2. PMID: PMC2039889.
35. 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.
36. 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

37. 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. PMID: PMC2532844.
38. 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. PMID: PMC2657555.
39. 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. PMID: PMC2562195.
40. 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. PMID: PMC3777658
41. 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.
42. 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.
43. 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. PMID: PMC3057894.
44. 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. PMID: PMC2778301.
45. **Krummel, M.F.**, Cahalan, M.D. 2010. The Immunological Synapse: a Dynamic Platform for Local Signaling. *J Clin Immunol.* **30(3)**:364-72. PMID: PMC2874029.
46. 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.
47. 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.
48. Gilden J., **Krummel M.F.** 2010. Control of cortical rigidity by the cytoskeleton: Emerging roles for septins. *Cytoskeleton (Hoboken)*. **67(8)**:477-86. PMID: PMC2906656.
49. **Krummel, M.F.** 2010. Illuminating emergent activity in the immune system by real-time imaging. *Nature Immunol.* **11(7)**:554-7.
50. 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. PMID: PMC2943564.

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

52. 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. PMID: PMC2964228.

53. 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. PMID: PMC2989766.

54. 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. PMID: PMC3076005.

55. 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. PMID: PMC3215700.

56. 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. PMID: PMC3255977.

57. 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. PMID: PMC3311997.

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

59. 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. PMID: PMC3371730.

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

61. 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. PMID: PMC3509168.

62. 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. PMID: PMC3576928.

63. 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. PMID: 23539221.
64. 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. PMID: 23962671.
65. 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. PMID: 23777879.
66. 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. PMID: 23795960.
67. 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. PMID: 23831008.
68. 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 $\gamma\delta$ T Cells. 2014 Mar 20;40(3):414-24. doi: 10.1016/j.immuni.2014.02.003. Epub 2014 Mar 13. PMID: 24019510.
69. **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.
70. 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. PMID: 24078867.
71. 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. PMID: 24076593.
72. 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. PMID: 24119593.
73. 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].

74. 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. PMID: PMC4124173.
75. 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. PMID: PMC4092148.
76. 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.** 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. PMID: PMC4119593.
77. 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]. PMID: PMC4208278.
78. 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. PMID: PMC4254577.
79. 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].
80. 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. PMID: PMC4212493.
81. 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. PMID: PMC4282963.
82. 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. PMID: PMC4366375.
83. 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. PMID: PMC4391275.
84. 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. PMID: PMC4390519.

PATENTS ISSUED OR PENDING (ALLOWED)

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

OTHER CREATIVE ACTIVITIES

1. Amateur Ballistics and Pyrotechnics

RESEARCH PROGRAM

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.

SIGNIFICANT PUBLICATIONS

1. 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.

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.

2. 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.

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

3. 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.

PI: In this work, we used a novel set of live-imaging approaches to define how antigens and antigen presenting cells are loaded in the alveoli of the lung and proceed upwards to airways where they present and form motile synapses (see Beemiller et al 2012) with T cells.

4. 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.

PI: In this work, we generated a new model for breast cancer in mice and used it to study synaptic presentation of tumor antigens to T cells in the tumor microenvironment. This has highlighted a novel population of cells and a dynamic that we are currently targeting to alter the balance of immunity in tumors.

5. 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.

PI: In this work, we showed that T cell receptors could be tracked, in real time, in living tissues and organs. The results provide strong support for both motile and stable synapses.