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THE REGENTS OF THE UNIVERSITY OF CALIFORNIA and MICHAEL V. DRAKE

UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA

SOUTHERN DIVISION

AARON KHERIATY, M.D.,

Plaintiff,

v.

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA, a corporation, and MICHAEL V. DRAKE, in his official capacity as President of the UNIVERSITY OF CALIFORNIA,

Defendants.

Case No. 8:21-cv-01367-JVS-KES

DECLARATION OF SHANE CROTTY, PH.D. IN SUPPORT OF DEFENDANTS' OPPOSITION TO PLAINTIFF'S MOTION FOR PRELIMINARY INJUNCTION

Date: September 27, 2021
Time: 1:30 P.M.
Place: Courtroom 10 C
Judge: Hon. James V. Selna

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THE REGENTS OF THE UNIVERSITY OF CALIFORNIA AND MICHAEL V. DRAKE

I, Shane Crotty, Ph.D., declare as follows:

1. I provide this declaration in support of Defendants The Regents of the University of California ("UC") and President Michael V. Drake's ("Defendants") Opposition to Plaintiff's Motion for Preliminary Injunction. I base this declaration on my expertise as outlined below and facts within my personal knowledge, to which I could and would testify competently if called upon to do so.

Professional Background and Experience

2. I am a Professor at the Center for Infectious Disease and Vaccine Research at the La Jolla Institute for Immunology ("LJI"). I graduated from Massachusetts Institute of Technology ("MIT") and then obtained my Ph.D. in Molecular Biology and Biochemistry at the University of California, San Francisco ("UCSF") in 2001, where I studied RNA virus genetics (coronaviruses are RNA viruses). I carried out postdoctoral studies at Emory University, at the Emory Vaccine Center before starting my laboratory at the La Jolla Institute for Allergy & Immunology (now the La Jolla Institute for Immunology), in 2003, where I am now a full professor. I also hold an Adjunct Professor position in the University of California, San Diego School of Medicine, Department of Medicine, Division of Infectious Diseases and Global Health. I have given scientific seminars on vaccines, viruses, and immunology at Stanford, Harvard, Yale, UCSF, and dozens of other universities. I am internationally recognized as an expert in my field and have been a Highly Cited Researcher for five years running (2016-2020, Thompson Reuters ISI, Clarivate), ostensibly a tabulation of the top ~0.1% of immunologists in the world based on scientific publications. I recently earned the distinction of "World Expert" in vaccine research from Expertscape, ranking me in the top 0.1% of scholars publishing information about vaccines over the past ten years. I have published over 150 scientific papers in peer reviewed journals, on virology, immunology, and vaccines. I was a Pew Scholar in Biomedical Research ("BD"), received the 2012 American Association of Immunology BD Biosciences

Investigator Award for outstanding early-career research contributions to the field of Immunology, received the 2019 Cancer Research Institute's ("CRI") Fredrick W. Alt Award for New Discoveries in Immunology, and was elected a fellow of the American Association for the Advancement of Science ("AAAS") in 2019.

3. My 2020 COVID-19 immunology paper with Dr. Alessandro Sette at LJI, "Targets of T Cell Responses to SARS-CoV-2 Coronavirus in Humans with COVID-19 Disease and Unexposed Individuals," is the most widely recognized paper published in *Cell* [1]. My more recent study on COVID-19 immune memory, "Immunological memory to SARS-CoV-2 assessed for up to 8 months after infection," published this year in *Science*[2], is the largest study of antigen-specific adaptive immunity (CD4 T cells, CD8 T cells, antibodies, and memory B cells) for any viral infection, and has already been cited by hundreds of other scientific and medical studies.

4. At LJI, I lead a team that studies immunity against infectious diseases and how the immune system remembers infections and vaccines. The goal of my lab is to understand factors that cause the development of long-lasting antibody responses and to harness that knowledge for vaccine design. After working on an AIDS vaccine for several years in graduate school, I concluded that more information concerning immunology was required for vaccine development. My focus since that point has been to take the steps necessary to build the fundamental immunology knowledge needed for rational vaccine design. The Crotty Lab focuses on understanding the cellular and genetic mechanisms regulating long-term, high quality, antibody responses, and is considered one of the top labs in the world on these topics.

5. The Crotty Lab, with Dr. Alessandro Sette, made some of the most impactful immunological findings on COVID-19 and immunity in 2020 and 2021. One of the reasons the Crotty Lab studies natural immunity to COVID-19 is the evidence from many labs that antibody responses in natural immunity are

concerningly low. Our paper "Targets of T Cell Responses to SARS-CoV-2 Coronavirus in Humans with COVID-19 Disease and Unexposed Individuals" in *Cell* is widely recognized as a key paper for understanding immune responses and immunity to COVID-19[1], and has been referenced by close to 2,000 other scientific papers in the past year. The Crotty Lab has published 16 immunology papers on COVID-19 and COVID-19 vaccines in highly respected journals, such as *Science* and *Cell*, and the Crotty Lab is recognized worldwide for COVID-19 immunology research. Most recently, the Crotty Lab, with colleagues at LJI, was the first to show that T cell memory to the Moderna mRNA COVID-19 vaccine is quite robust for over six months[3].

6. Attached hereto as **Exhibit A** and incorporated by reference to this declaration is a copy of my curriculum vitae.

7. My opinions are based on my professional training, experience and expertise. I do not offer any legal opinion, nor do I intend to interpret the legal terms of UC's COVID-19 vaccination policy.

COVID-19 Disease Severity

8. COVID-19 can be a serious disease for any age adult, young or old. COVID-19 has caused over 600,000 deaths in the USA. The majority of those deaths have been in older adults. While that mortality has been extraordinary, COVID-19 disease burden in the USA is much greater than mortality alone. There have been over 2 million hospitalized cases of COVID-19 in the USA, and most likely the actual number is over 6 million hospitalized cases of COVID-19 in the USA[4]. Half of those hospitalizations have been in people under the age of 65, and half of those have been in people under the age of 50. Regarding younger adults, over 117,000 Americans ages 18-29 years old have been hospitalized with COVID-19 in the past 12 months (https://covid.cdc.gov/covid-data-tracker/#new-hospital-admissions).

COVID-19 Vaccine Safety

9. COVID-19 vaccines have impressive safety records and are highly efficacious, including for previously infected individuals.

10. The three COVID-19 vaccines that are authorized by the U.S. Food and Drug Administration ("FDA") for Emergency Use Authorization ("EUA") in the USA have impressive safety records.

11. As a consequence of needing vaccine efficacy data quickly, the COVID-19 vaccine trials have been some of the largest vaccine trials ever, and consequentially have some of the most robust safety data collection of any vaccine trials ever in America. Between the Pfizer ("BioNTech"), Moderna, and Johnson & Johnson ("J&J") COVID-19 vaccine clinical trials, over 55,000 people were vaccinated and tracked for safety. Including the placebo control groups, that amounts to over 110,000 people. This represents safety data for 90,000 vaccine doses. That is much larger than most clinical trials, and most safety data sets for drug trials. If the international COVID-19 vaccine clinical trials for Pfizer, Moderna, and J&J are also included, those numbers are substantially higher. Furthermore, the Moderna and Pfizer and J&J COVID-19 vaccine clinical trials were some of the most inclusive vaccine trials ever, with good representation of different ages, both sexes, and multiple racial and ethnic groups.

12. The published COVID-19 vaccine safety data in peer reviewed medical journals has been outstanding, with the Pfizer, J&J, and Moderna vaccines showing excellent safety profiles [5–9]. It is worth noting that safety does not mean zero reactogenicity, which means that the vaccine will cause a reaction in the body. Reactogenicity is a normal expected immunological process for vaccines. Vaccines work by training/teaching the immune system to recognize the Spike protein, and some local reactogenicity (i.e., 'side effects' or inflammation) or systemic effects (e.g., mild fever) are a common sign that the immune system is doing its job and learning to recognize the target. Such reactogenicity is normal for vaccines and

self-resolves in a few days as the immune system goes through its learning process. The safety profiles of the Moderna and Pfizer COVID-19 vaccines have been similar to the profiles of the FDA-approved and licensed Shingles vaccine, Shingrix, which has impressive safety records, and is a widely used vaccine.

13. The safety data in vaccine clinical trials are a very robust data set. They are only visible to an independent safety monitoring committee during the clinical trial, not the companies. Each vaccine trial has its own safety monitoring board. The comparable safety profiles of the Moderna and Pfizer mRNA vaccines in independent clinical trials serves as even more robust evidence of the safety of each of those similar COVID-19 mRNA vaccines. Those data were used for the initial vaccine EUA filings [10–12], and the FDA concluded that the vaccines were safe, resulting in rapid EUA approval. The Centers for Disease Control and Prevention ("CDC") Advisory Committee on Immunization Practices ("ACIP") also concluded that the Pfizer and Moderna vaccines are safe.

14. Subsequent to the EUA filings, the Phase 3 COVID-19 vaccine trials have continued to collect safety data for 6 months. Both Pfizer and Moderna have reported excellent 6-month safety profiles. Reactogenicity data were collected for almost 10,000 vaccinated people in the Pfizer trial [13], with the same conclusions as the earlier findings [9]. For full safety data, from the Pfizer six-month preprint (the official name of the Pfizer COVID-19 vaccine is BNT162b2): "Cumulative safety follow-up was available up to 6 months post-dose 2 from combined blinded and open-label periods for 12,006 participants originally randomized to BNT162b2. The longer follow-up for this report, including open-label observation of original BNT162b2 recipients and placebo recipients who received BNT162b2 after unblinding, revealed no new safety signals" [13]. These are the data submitted to the FDA for full vaccine approval (it is standard practice to require 6 months of safety data).

15. FDA approval of COVID-19 vaccines: The FDA has reviewed the

Pfizer COVID-19 vaccine safety and efficacy data now and awarded full approval to the vaccine. The Moderna COVID-19 vaccine safety data and efficacy data and documentation have been submitted to the FDA for full vaccine approval, along with the publicly available data. The Moderna vaccine clinical trial started after the Pfizer trial, and so is on a slightly later timetable.

16. COVID-19 vaccine safety data includes previously infected individuals.

17. The Pfizer COVID-19 vaccine Phase 1-3 clinical trial did not exclude previously infected people. 364 participants in the clinical trial had evidence of previous SARS-CoV-2 infection, and the vaccine was safe in those individuals. This includes participants ages 16 and older. From the full 6-month clinical trial data [13]: "Participants with or without evidence of prior SARS-CoV-2 infection reported local reactions with similar frequency and of similar severity. No Grade 4 local reactions were reported." And "Systemic reactogenicity was similar in those with and without evidence of prior SARS-CoV-2 infection." In addition, there are multiple medical studies independent of the Pfizer vaccine trial that have also shown that the Pfizer vaccine is safe in people with previous cases of COVID-19, in published peer-reviewed studies [14–16].

18. The Moderna clinical trials did not exclude people with previous SARS-CoV-2 exposure. 343 people were enrolled who had previous COVID-19, and vaccine safety was equal in those people compared to the COVID negative participants (~15,000) [6]. In addition, studies independent of the Moderna vaccine trial have also shown that the Moderna vaccine is safe in people with previous cases of COVID-19, in published peer-reviewed research [14].

19. Studies show that the one-dose J&J (Janssen) COVID-19 vaccine is also safe for people who have been previously infected with SARS-CoV-2 [8].

COVID-19 Vaccine Efficacy

20. The COVID-19 vaccines are incredibly effective. The Pfizer,

Moderna, and J&J vaccines all provide very high protection against COVID-19 hospitalizations and deaths. The Pfizer and Moderna mRNA vaccines also have provided exceptional protection against symptomatic COVID-19 cases, asymptomatic cases, and transmission. The vaccines are also highly efficacious against variants, particularly variants of concern. This success is due to the broad immune response elicited by the mRNA vaccines.

21. Pfizer and Moderna vaccines have both proven to be ~95% protective against symptomatic COVID-19 in clinical trials[6,9]. Those protection results have been confirmed in "real world" studies outside of clinical trials [17–20]. Six month vaccine efficacy data are now available from the Pfizer and Moderna clinical trials in the USA, with the Pfizer vaccine showing an overall efficacy over six months in the USA of 91%[13], and the Moderna vaccine showing an overall efficacy over six months in the USA of 93%.

22. These mRNA vaccines have shown outstanding efficacy against variants of concern. Protection against Alpha (B.1.1.7, the "UK variant) is almost identically good to protection against the original strain [10,17,18,20]. Protection against Delta has also proven to be high, with 88% protection against symptomatic COVID-19 [21], and very high protection against hospitalizations[22] in a large UK study. A second large UK study using independent approaches (384,543 people undergoing regular testing), found 86% protection against Delta variant COVID-19 with a viral test Ct < 30 (as a molecular surrogate of cases that were likely to be symptomatic and potentially transmissible). Corroborating evidence has come from Canada [23], and the USA, where the vast majority of Delta infections are in unvaccinated individuals, and almost all of the COVID-19 hospitalizations in May through July were of unvaccinated or partially vaccinated individuals [24].

23. Immune protection is provided by several different parts of the adaptive immune system [25]. The Pfizer and Moderna vaccines elicit neutralizing antibody responses [5,26,27], but also CD4 T cells, CD8 T cells, and memory B cells

[3,28–35]. This breadth of immune response provides several independent lines of defense against SARS-CoV-2 [36]. Importantly, these different parts of the immune system also are particularly good at stopping variants, as variants have an easier time "escaping" antibody by viral mutation, but it is extremely unlikely the virus can escape T cells or memory B cells, because of the ways they recognize the virus [25,35,37].

24. The Vaccine Adverse Event Reporting System (VAERS) database is sometimes used as evidence of lack of COVID-19 vaccine safety; the VAERS database cannot be used in that way. A fuller explanation is provided below.

Hybrid Immunity and Natural Immunity

25. Individuals previously infected with SARS-CoV-2 who get vaccinated generate a potent "hybrid immunity," which is more potent than that obtained by other vaccinated individuals and more potent than natural immunity.

Hybrid Immunity

26. Individuals previously infected with SARS-CoV-2 who get vaccinated with one dose of a COVID-19 mRNA vaccine (Moderna or Pfizer) rapidly make a neutralizing antibody response 10 to 100 times higher than that of people with no previous exposure to the virus. This has been clearly and consistently recorded in a series of high-profile scientific papers, in peer reviewed journals, by multiple independent research groups, and covering all four major types of immune memory: neutralizing antibodies, CD4 T cells, CD8 T cells, and memory B cells [14,29–32,38–41]. Notably, the hybrid immunity recognizes variants far better than natural immunity, as published in *Science* [32,42]. I reviewed this overall immunity topic in a June 2021 article titled "Hybrid Immunity" in *Science*.[36]

Natural Immunity and Delta Variant

27. While hybrid immunity is quite broad against variants[29,32,35,41,42], natural immunity can be narrow against variants and of uncertain protective capacity. Antibodies generated by mRNA COVID-19 vaccines outperform natural

immunity for potency against variants [43–47]. Additionally, one of the main concerns early on about natural immunity against COVID-19 was that antibody levels after COVID-19 were relatively low. Indeed, for COVID-19, the mRNA vaccines consistently generate higher antibody levels than natural immunity[5,26,48].

28. The best study of natural immunity against a variant with substantial antibody escape mutations was an important scientific study from Brazil on the Gamma variant (aka P.1 or Manaus variant) [49]. The Gamma wave in Manaus, Brazil caused a high number of deaths [50]. In the immunity study in Manaus, Brazil, many individuals previously infected with SARS-CoV-2 were subsequently infected with the Gamma variant, showing a substantial loss of natural immunity against reinfection with Gamma [49]. (Notably, the Gamma variant is one of the few variants circulating in the United States during 2021 at a frequency > 1%.)

University of California's COVID-19 Vaccine policy

29. I have reviewed the University of California's COVID-19 vaccination policy requiring that, with limited exceptions, students and employees must be vaccinated against COVID-19 as a condition of their physical access to campus facilities, issued on July 29, 2021. I am fully supportive of the University of California policy.

Rebuttals to Plaintiff's Evidence

30. The rebuttals below are to specific points made by Plaintiff in his brief and supporting papers. The rebuttals focus on two main scientific and medical topics that are central to Plaintiff's arguments and complaints: 1) COVID-19 vaccine safety, and 2) COVID-19 vaccine efficacy (benefit), particularly for persons previously infected with SARS-CoV-2. In brief, in contrast to the claims made by the Plaintiff, COVID-19 vaccines actually have impressive benefits in persons previously infected with SARS-CoV-2, and there is extensive safety data showing that COVID-19 vaccines are safe in persons previously infected with SARS-CoV-2.

Rebuttal to Plaintiff's Statements Regarding Safety of the COVID-19 Vaccines Currently Available in the United States

31. Plaintiff presents three lines of relevant evidence pertaining to his claims regarding COVID-19 vaccine safety: 1) COVID-19 vaccine clinical trials; 2) VAERS database; and 3) "real world" studies of COVID-19 vaccine safety. These three areas of COVID-19 vaccine safety are each addressed in turn below.

1. Rebuttal to Plaintiff's Statements Regarding Vaccine Safety and COVID-19 Vaccine Clinical Trials

32. Plaintiff claims, "Relevant to this case, the clinical trials for the Covid vaccines which received Emergency Use Authorization deliberately excluded Covid-recovered patients." As described above, in actuality, the Pfizer, Moderna, and J&J clinical trials in the USA all included SARS-CoV-2 infected individuals. Those data are all public, and have been published in peer-reviewed scientific papers in major journals, and have been an important dataset for demonstrating safety of the vaccines in previously SARS-CoV-2 infected individuals. The details were described above in "COVID-19 Vaccine Safety". The FDA also considered those data when it awarded the Pfizer COVID-19 vaccine full approval this month.

2. Rebuttal to Plaintiff's Statements Regarding Vaccine Safety and VAERS

33. Plaintiff states that there are a "growing number of reported serious harms as a consequence of receiving the Covid-19 vaccine after a SARS-CoV-2 infection," and refers to VAERS as the primary source of information. Plaintiff refers to VAERS and makes conclusions from VAERS as evidence that the COVID-19 vaccines may cause injury. However, VAERS data alone cannot determine if a vaccine caused a reported adverse event.

34. VAERS is an open system, to which anyone can report adverse events, including false or fake adverse events. This is well known, and it is even stated on the VAERS database web page that the information in VAERS is unverified. (See https://www.cdc.gov/vaccinesafety/ensuringsafety/monitoring/vaers/index.html.)

35. VAERS was started with a noble purpose of allowing people to self-report vaccine adverse events. In recent years, sadly, VAERS has been rendered almost useless. A simple, now famous, example of this is the Incredible Hulk, where someone added a COVID-19 vaccine adverse event report to the VAERS database, stating that the vaccine had made them turn green and angry. That report could be viewed by anyone who searched the database (https://twitter.com/PolitiFact/status/1369735306816159747). The report has since been removed by the submitter, as they only did it for demonstration purposes. Others recognized the potential to corrupt the VAERS database in 2020 with fake reports, and they have submitted numerous such reports. Many impossible events are in the database, and it takes the CDC a great deal of time to remove individual fake reports. This past month, at some point, it appeared that there were over 1,000 fake "vaccine related deaths" reports being added to VAERS every day.

36. The unreliability of the reports in VAERS is one reason that the Phase 3 clinical trials, with independent data and safety monitoring boards and tracking of confirmed vaccinations, are so important. Those clinical trials have shown the vaccines to be safe, as described above.

3. Rebuttal to Plaintiff's Statements Regarding Vaccine Safety and "Real World Study Safety Data"

37. "Real world" studies are another way to collect data on vaccines outside of clinical trials. Plaintiff asserts that two studies support his argument that there is a "significantly increased risk of adverse reactions to the vaccine among those previously infected." Declaration of Plaintiff in Support of Motion for Preliminary Injunction, ¶ 29. The first study ("Mathioudakis et al.") was simply an online Google Form survey, which is a type of online survey heavily biased for responders with complaints. The second ("Raw et al.") is a preprint reporting a study of people with or without previous COVID-19, examining adverse events in persons receiving the Pfizer/BioNTech COVID-19 mRNA vaccine (known as

BNT162b2) [51]. The study observed the same types of symptoms in both groups after vaccination. While some symptoms were slightly more vigorous in persons with confirmed previous COVID-19, no different or new symptoms were observed. In the Raw et al. study[51], among people with confirmed previous COVID-19 (the "Sensitivity Analysis Subset"), only two symptoms were statistically more vigorous. Overall, the results in the Raw et al. preprint are consistent with (a) the Pfizer clinical trial, (b) the Moderna clinical trial, and (c) peer-reviewed published studies of COVID-19 vaccination of previous COVID-19 cases, addressed in turn below.

38. (a) As described in the "COVID-19 Vaccine Safety" section above, the Pfizer COVID-19 vaccine safety was tracked in many individuals who had evidence of previous SARS-CoV-2 infection and the vaccine was safe in those individuals. Of note, the Raw et al. preprint study only followed people receiving the first dose of the Pfizer vaccine, resulting in an incomplete comparison. The Pfizer vaccine clinical trial tracked vaccine safety after both doses, and reported similar responses overall, but distributed differently between the two immunizations[13]: "Systemic reactogenicity was similar in those with and without evidence of prior SARS-CoV-2 infection, although BNT162b2 recipients with evidence of prior infection reported systemic events more often post-dose 1, and those without evidence reported systemic events more often post-dose 2." This makes sense immunologically.

39. (b) As described in the "COVID-19 Vaccine Safety" section above, the Moderna COVID-19 vaccine trial also did not exclude participants with previous SARS-CoV-2 infections. The Moderna vaccine was safe in people with previous SARS-CoV-2 infections. Notably, in contrast to the Raw et al. study, the Moderna and Pfizer clinical trials were placebo controlled, double blind studies. This is particularly important when assessing side effects, as even subjects in the placebo control group will report a variety of side effects. That is one well known version

of the "placebo effect". Thus, much more weight is placed on safety data from Phase 1-3 vaccine clinical trial data because of the placebo controlled blinded design, as well as their use of independent data and safety monitoring boards.

40. (c) There are three peer-reviewed published studies of COVID-19 vaccination of previous COVID-19 cases [14–16], analogous in design to the Raw et al. preprint, except these studies also directly assess successful immune responses to the COVID-19 vaccine, as described in paragraph 26, the Hybrid Immunity section above. These three papers are published in highly respected scientific journals, and they all report that vaccines are safe in persons with previous SARS-CoV-2 infection history [14–16]. Persons with previous SARS-CoV-2 infections exhibited the same types of reactogenicity as seen in vaccinated persons with no previous infection history, demonstrating safety consistent with the Pfizer and Moderna clinical trials. Indeed, two of the studies report the same findings as the Pfizer clinical trial described above; the symptoms had a reversed distribution between the first and second vaccination for the two groups, but an overall comparable amount of reactogenicity[15,16]. And, as discussed in paragraph 26, the Hybrid Immunity section, persons with previous SARS-CoV-2 infections who get vaccinated have impressively broad and more potent immunity.

41. Overall, across two Phase 3 clinical trials and three additional independent "real world" studies, the Pfizer and Moderna vaccines have been shown to be safe in persons with previous SARS-CoV-2.

Rebuttal of Plaintiff's Claims Regarding COVID-19 Vaccine Efficacy (i.e., Benefit)

42. Plaintiff makes a series of claims that the COVID-19 vaccine has no benefit in people with previous SARS-CoV-2 exposure. For example, Plaintiff claims: "But jabbing students who are already immune contributes nothing whatsoever to campus safety. All that it does, medically speaking, is create danger." Declaration of Plaintiff in Support of Motion for Preliminary Injunction, ¶ 28. As

addressed above, COVID-19 vaccines are safe for people who have been previously infected with SARS-CoV-2. Below I address the topic of the benefits of the vaccine for people who have been previously infected with SARS-CoV-2.

43. Persons with previous SARS-CoV-2 infection who get vaccinated make outstanding immune responses to the COVID-19 vaccines, as described above in paragraph 26, the section on "Hybrid Immunity". The antibody responses by such persons are both larger and of higher quality than in individuals previously infected with SARS-CoV-2 or vaccinated individuals who have not previously had COVID-19, resulting in 10 to 100 times better neutralizing antibodies.

44. New studies are now available that demonstrate that individuals previously infected with SARS-CoV-2 who go on to get a COVID-19 vaccine (people with "hybrid immunity") have enhanced protective immunity against COVID-19 [52–54]. Based on these studies, persons who have been previously infected with SARS-CoV-2 who get vaccinated are even more protected against the Delta variant than are persons who are vaccinated but have not been infected, who are in turn better protected than persons who have been previously infected withSARS-CoV-2 [52], i.e. hybrid immunity > vaccine immunity > natural immunity alone. These findings are supported by a large longitudinal study in the UK of over 300,000 people [52]. A Kentucky study compared immunity between persons with previous SARS-CoV-2 infection who got vaccinated (hybrid immunity) compared with those who had only been previously infected with SARS-CoV-2 (natural immunity alone), and observed significantly better protection from COVID-19 in persons with hybrid immunity[53]. This is consistent with the findings in the UK study. In sum, the scientific and medical data on COVID-19 vaccine immunology and protective immunity, including against the Delta variant, indicate that getting vaccinated confers benefits to both persons who have previously had COVID-19 and to persons who have never been infected. Previously infected individuals gain better protection (hybrid immunity), so there is no reason for a COVID-19 vaccine

policy to treat previously infected individuals differently than individuals who have never been infected.

Rebuttal to Plaintiff's Statements Regarding Disease Transmission

45. Plaintiff portrays COVID-19 vaccines as useless for prevention of disease transmission on UC campuses, stating that "…the vaccines, according to the CDC, do not prevent infection and viral transmission." Declaration of Plaintiff in Support of Motion for Preliminary Injunction, ¶ 36. This is a mischaracterization of the CDC's statement, and a basic misunderstanding of the science of COVID-19 vaccines and SARS-CoV-2 transmission. The CDC statement describes a change in SARS-CoV-2, and a resultant change in the protection by the vaccines. The vaccines were incredibly effective at stopping the Alpha wave in the USA in early 2021, and the data indicated that essentially no SARS-CoV-2 transmissions were occurring from vaccinated individuals; hence the CDC recommended not requiring masks for vaccinated individuals. However, the emergence of Delta variant required a re-evaluation of that policy. Delta variant is much more transmissible than the original SARS-CoV-2 strain or any previous SARS-CoV-2 variant (the R0 increasing from ~2 to ~6.5, which is probably unprecedented for a virus), and examples of SARS-CoV-2 Delta variant transmission by vaccinated individuals were observed. Thus, at least some transmissions started occurring from vaccinated individuals, and the CDC felt it was important to communicate this change. However, it was based on very preliminary data (which can be acceptable in times of crisis). The reality is that vaccination does an important and impressive job reducing transmission. The vast majority of SARS-CoV-2 transmission in the USA is by unvaccinated individuals.

46. How often do vaccinated individuals transmit SARS-CoV-2 Delta variant compared to unvaccinated individuals? 93% fewer transmissions is a conservative estimate (14-times fewer transmissions). There are at least 86% fewer transmissions of SARS-CoV-2 by vaccinated individuals (7-times fewer), because

vaccinated individuals get fewer SARS-CoV-2 Delta infections. Every infection prevented is a transmission source prevented. More specifically, vaccinated individuals get 7-times fewer SARS-CoV-2 Delta variant infections of sufficient viral load for transmission, based on either symptomatic disease or viral RNA load < 30 Ct, using the data from two large studies [21,52]. In addition, the total amount of Delta virus over time in a vaccinated individual versus an unvaccinated individual is different. Studies show that viral replication is controlled much faster in vaccinated individuals based on viral RNA measurements[55], and thus vaccinated individuals are likely only capable of transmitting Delta variant for a much shorter window of time. Lastly, viral RNA measurements (by RT-PCR, the Ct values often reported as "viral load") are a helpful surrogate marker of viral loads but do not directly measure infectious virus. A study of actual infectious virus isolation found that vaccinated persons were significantly less likely than unvaccinated persons to shed infectious virus, even where the viral RNA levels are equal[56]. Thus, overall, a conservative estimate is that vaccinated individuals likely have a 93% reduction in transmissions, based on 7-times fewer infections and a 50% shorter window of time for transmission.

47. In conclusion, regarding the two major scientific and medical topics of interest: COVID-19 vaccine efficacy (benefit) and safety, COVID-19 vaccines have impressive benefits in persons previously infected with SARS-CoV-2, and there is extensive safety data showing that COVID-19 vaccines are safe in persons previously infected with SARS-CoV-2.

Rebuttal of Plaintiff's Claims Regarding Reinfection and Viral Transmission

48. Can someone with natural immunity transmit virus after reinfection? Based on currently available data, this likely happens in some cases. The clearest case study of this phenomenon was published in *Clinical Infectious Diseases*[57], a well-respected scientific journal, in a situation with a reinfected healthcare worker (HCW1): "It seems likely that HCW1 played a role in the spread of this outbreak as

she provides the only link between some of the patients.… HCW1's nasopharyngeal swabs contained replicating virus but no neutralizing antibodies, which suggests the reinfecting virus was fully capable of onward transmission." The frequency of viral transmission to others by persons with reinfections is an area of scientific uncertainty, in large part because it is difficult to study because it is resource intensive. But there is some evidence it occurs. The most extensive epidemiological evidence at a population level was the devastating P.1 (Gamma) variant SARS-CoV-2 epidemic in Brazil [49,58], where 76% of the population had evidence of natural immunity (previous infection) [58], and yet the city of Manaus still experienced a subsequent massive outbreak of Gamma variant, consistent with extensive viral transmission upon reinfections [49]. Lastly, more broadly, many scientists think that reinfections with other coronaviruses result in transmissions ("common cold coronaviruses"), and thus it is plausible the biology of SARS-CoV-2 is similar [59]. In sum, it is plausible that persons with reinfections transmit virus, and because of the current scientific uncertainty on this topic, it is most appropriate to take the conservative scientific position that reinfections do result in meaningful numbers of transmissions.

Rebuttal of Plaintiff's Characterization of the Overall Quality of Natural Immunity

49. A recent preprint that has received a lot of attention claims that natural immunity is vastly superior to vaccine immunity[60]. While that preprint captured many headlines because of its claims, there are other scientific studies that have not come to the same conclusion. "Real world" immunity studies are challenging to control for "confounders", which are properties such as differences in test-seeking behaviors that can lead to erroneous conclusions. In contrast, a large, prospective, longitudinal study in the UK of over 300,000 people with regular testing was done in such a way that the conclusions have higher confidence compared to a variety of other studies[52]. The regular testing component (over two million SARS-CoV-2 tests

in the study) and the randomization component eliminate concerns found with other study designs (confounders)[52]. In the large UK study, one of many findings was that mRNA COVID-19 vaccine immunity was somewhat better than natural immunity, including against Delta[52]. This is not an area with a final scientific answer and clear scientific consensus. Confidence in vaccine efficacy conclusions from Phase 3 vaccine clinical trials is higher than for observational studies of natural immunity because of inherent constraints of study design, such as the important roles of placebo controls and being blinded to vaccination status, which controls for important behavioral differences.

Rebuttal of Plaintiff's Characterization of Two Additional Topics

50. Rebuttal of two additional topics are addressed below: COVID-19 disease severity, and analogy of vaccines to other safety measures.

51. Plaintiff only portrays COVID-19 disease burden in terms of deaths in America. COVID-19 has caused over 600,000 deaths in the USA, but it has also caused millions of hospitalizations. Over 117,000 Americans ages 18-29 years old have been hospitalized with COVID-19 in the past 12 months. That does not include the disease burden of long COVID-19, which also occurs in a significant fraction of non-hospitalized COVID-19 cases.

52. Plaintiff attempts to draw parallels between vaccine safety policies and transportation safety policies, using vehicle speed limits as the analogy. However, seat belts are the proper analogy between cars and vaccines, not speed limits. We don't tell people they can't drive their car, we tell people they need to drive their car with a seatbelt on. Vaccine mandates do not tell people they can't go to work, they tell people they need to be vaccinated to go to work. Seatbelts are required for all as a simple, and very successful, safety measure. Vaccines required for all is also a simple and successful measure.

I declare under penalty of perjury under the laws of the United States of

America that the foregoing is true and correct.

Executed this _2nd__ day of September 2021 at La Jolla, California.

Shane Crotty, Ph.D.

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53. Cavanaugh AM, Spicer KB, Thoroughman D, Glick C, Winter K. Reduced Risk of Reinfection with SARS-CoV-2 After COVID-19 Vaccination — Kentucky, May–June 2021. Mmwr Morbidity Mortal Wkly Rep. 2021;70(32):1081–1083. PMCID: PMC8360277

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EXHIBIT A

Shane Crotty

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Center for Infectious Disease and Vaccine Research
La Jolla Institute for Immunology (LJI)
9420 Athena Circle, La Jolla, CA 92037
https://www.lji.org/faculty-research/labs/crotty/#overview

EDUCATION

1996 B.S. Degree in Biology, Massachusetts Institute of Technology, GPA 5.0/5.0
1996 B.S. Degree in Writing, Massachusetts Institute of Technology
2001 Ph.D. in Biochemistry and Molecular Biology, University of California, San Francisco (UCSF)
Advisor: Prof. Raul Andino, UCSF Department of Microbiology and Immunology
Thesis: "Poliovirus is (still) not dead: Vaccine vectors, antiviral drugs, and unexpected mutants"

HONORS & AWARDS

1991 National Science Foundation (NSF) Young Scholar
1995 Congressional Goldwater National Scholar for Excellence in Science and Mathematics
1995 Irwin Sizer Award for Education Innovation at MIT
1995 MIT Burchard Scholar for Excellence in Humanities
1996 MIT Ned Holt Prize for Excellence in Scholarship and Service
1996 NSF Predoctoral Fellowship Finalist
1996-2001 Howard Hughes Medical Institute Doctoral Fellow
2002-2003 Cancer Research Institute Postdoctoral Fellowship
2007 American Association of Immunologists (AAI) Pfizer-Showell Junior Faculty Award
2004-2008 Cancer Research Institute Young Investigator Award
2005-2009 Pew Scholar in the Biomedical Sciences
2012-present Visiting Associate Professor / Professor, Graduate School of Medicine, Chiba University
2011 University of Iowa. Immunology Graduate Program, Graduate Students Annual Invited Speaker
2011 Wake Forest University School of Medicine. Immunology Graduate Program. Graduate Students Invited Speaker.
2011 Australian Society of Immunology, Visiting Speaker
2012 American Association of Immunologists (AAI) BD Biosciences Investigator Award for outstanding, early-career research contributions to the field of Immunology
2012 John Hopkins University, Immunology program. Graduate Students Invited speaker.
2012 University of Chicago Committee on Immunology (COI) Graduate Students Annual Invited speaker.
2014 UAB Medical School. Inaugural John Volanakis Immunology Lecturer, Graduate Student invited lecturer.
2015 University of Oklahoma Health Sciences Center. The UOHSC graduate student nominated Annual Distinguished Speaker.
2016 University of Minnesota, Microbiology and Immunology (MICaB) Program. Graduate students Annual invited speaker.
2016 Thompson Reuters ISI, Web of Science, Highly Cited Researcher. Ostensibly a tabulation of the most influential ~125 immunologists in the world during the period 2004-2014, based on high impact papers.
2017 Thompson Reuters ISI, Web of Science, Highly Cited Researcher. Ostensibly a tabulation of the most influential ~125 immunologists in the world during the period 2005-2015, based on high impact papers.
2018 UCSF Immunology Postdoctoral Fellows invited speaker.

2018 Stanford University Immunology Graduate Students invited speaker.
2018 Singapore Immunology Network (SIgN), A*STAR. Inaugural graduate student invited speaker.
2018 University of Chicago Committee on Immunology (COI) Graduate Student body invited speaker.
2018 Thompson Reuters ISI, Web of Science, Highly Cited Researcher. Ostensibly a tabulation of the most influential ~140 immunologists in the world during the period 2006-2016 based on high impact papers published during that period.
2019 Best of Immunity 2018 (Abbott et al. *Immunity* 2018. Top research article of 2018)
2019 Cancer Research Institute's (CRI) Fredrick W. Alt Award for New Discoveries in Immunology
2019 Web of Science, Highly Cited Researcher. Clarivate. Top 0.1% of researchers during the period 2007-2017 based on high impact papers published during that period.
2019 Elected Fellow. American Association for the Advancement of Science (AAAS).
2020 Web of Science, Highly Cited Researcher. Clarivate. Top 0.1% of immunologists during the period 2008-2018 based on high impact papers published during that period.
2020 Altmetric. #1 top ranked paper ever in *Cell*. Grifoni et al., 2020
2020 Altmetric. #1 top ranked paper ever in *Nature Reviews Immunology*. Sette and Crotty 2020
2020- World Health Organization (WHO) Working Group on COVID-19 Assays
2020 *Nature* top 10 COVID papers of 2020. Dan et al. COVID-19 immune memory.
2021 NIH MERIT Award
2021 University of Wisconsin, Cellular and Molecular Pathology Student Choice Seminar
2021 > 1,000,000 YouTube views

RESEARCH APPOINTMENTS

1991-1992 Laboratories of Frederick Crescitelli and William MacFarland, UCLA Biology Dept. and USC Marine Biology Laboratory. *NSF Young Scholar*
1993-1994 Laboratory of Leonard Lerman, MIT Biology. *Undergraduate researcher*
1995-1996 Laboratory of Leonard Guarente, MIT Biology. *Undergraduate researcher, Research Technician*
1997-2001 Laboratory of Raul Andino, UCSF Microbiology and Immunology. *PhD student*
2001-2003 Laboratory of Rafi Ahmed, Emory University Microbiology and Immunology. *Postdoctoral research fellow*
2003-2008 Assistant Professor, La Jolla Institute of Allergy and Immunology (LIAI/LJI)
2004-2009 Adjunct Assistant Professor, Infectious Diseases Division, Department of Medicine, UCSD School of Medicine
2009-2012 Associate Professor with Tenure, La Jolla Institute of Allergy and Immunology (LJI)
2010-2016 Adjunct Associate Professor, Infectious Diseases Division, Department of Medicine, UCSD School of Medicine
2015 Adjunct Professor, Immunology and Microbial Science, The Scripps Research Institute (TSRI)
2016- Adjunct Professor, Division of Infectious Diseases and Global Public Health, Department of Medicine, UCSD School of Medicine
2013- Full Professor, La Jolla Institute of Allergy and Immunology (LJI) (January 1, 2013). Now La Jolla Institute for Immunology (LJI)

OTHER PROFESSIONAL EXPERIENCE

2005-2010 LIAI Institutional Review Board (IRB) Vice Chair.
2006- LIAI/LJI Normal Human Blood Donor Program (NBDP) founder and faculty liaison
2007 NIH NIAID Special Emphasis Panel Study Section
2008 NIH NIAID IHD Immunity and Host Defense Study Section, ad hoc reviewer
2008 NIH NIAID Special Emphasis Panel Study Section
2008 NIH NIAID IHD Immunity and Host Defense Study Section, ad hoc reviewer
2009 NIH NIAID IHD Immunity and Host Defense Study Section, ad hoc reviewer
2009 NIH NIAID IHD Immunity and Host Defense Study Section, ad hoc reviewer
2010-2014 NIH Study Section Standing Member appointment, Immunity and Host Defense (IHD)

2012-2015	American Association of Immunologist (AAI) Program Committee
2014-2019	NIH NIAID Scripps Center for HIV/AIDS Vaccine Immunology & Immunogen Discovery (CHAVI-ID) Scientific Leadership Group
2016	Conference Organizer (w/Shannon Turley), Asilomar 55th Midwinter Immunology Conference
2016	Conference Organizer (w/Carola Vinuesa), Inaugural Keystone Conference on 'T Follicular Helper Cells (Tfh) and Germinal Centers'. The conference received a 97% positive rating by attendees.
2016-2020	Asilomar Midwinter Conference Council
2016-	UCSD Biomedical Sciences Graduate Program (BMS), Immunology Track Chair, LJI
2017	NIH NIAID ZRG1 IMM Study Section
2018	NIH NIAID ZRG Special Emphasis Panel, Study Section reviewer
2018	2019 Michelson Prizes, Scientific Advisory Panel
2019	NIH Director's New Innovator Award (DP2), Distinguished Editor/Reviewer Study Section Panel
2019-	Human Vaccines Project, Scientific Leadership Group
2019	NIH AIDS Vaccine Research Subcommittee (AVRS) ad hoc member
2019	NIH NIAID CCHI IOF Review Panel
2020	NIH NIAID Immunity and Host Defense Study Section, ad hoc reviewer
2022	NIH NIAID Immunity and Host Defense Study Section, Winter, ad hoc reviewer

Total NIH grant review panels participated to date (2020): 23

PUBLICATIONS

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Google Scholar: Shane Crotty
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NCBI: https://www.ncbi.nlm.nih.gov/myncbi/shane.crotty.1/bibliography/public/

BOOKS

Shane Crotty. ***Ahead of the Curve: David Baltimore's Life in Science***. (April 2001) 272 pgs. University of California Press. (Paperback, Spring 2003)

Reviewed in: *Nature, Wall Street Journal, Washington Post, Nature Medicine, JAMA, Publishers Weekly, Library Journal, New Scientist, Discover, American Scientist.*

ARTICLES

1. Colin A. Smith, Shane Crotty, Yoko Harada, Alan D. Frankel. "Altering the context of an RNA bulge switches the binding specificities of two viral Tat proteins". **Biochemistry**. 1998;37:10808-14.

2. Luis J. Sigal, Shane Crotty, Raul Andino, Kenneth Rock. "Cytotoxic T-cell immunity to virus-infected non-haematopoietic cells requires presentation of exogenous antigen". **Nature.** 1999;398:77-80.
   - News and Views. "Accessory to murder." *Nature* 398:26-27
   - Selected for *Nature* "Best of 1999" collection

3. Shane Crotty, Barbara Lohman, Fabien Lu, Shenbei Tang, Chris Miller, Raul Andino. "Mucosal immunization of cynomolgus macaques with two serotypes of live poliovirus vectors expressing simian immunodeficiency virus (SIV) antigens: Stimulation of humoral, mucosal, and cellular immunity". **Journal of Virology** 1999;73:9485-95. PMC112983

4. David W. Gohara, Shane Crotty, Jamie J. Arnold, Joshua Yoder, Raul Andino, Craig E. Cameron. "Poliovirus RNA-dependent RNA polymerase ($3D^{pol}$): structural, biochemical and biological analysis of conserved structural motifs A and B". **J. Biological Chemistry.** 2000;275:25523-32.

5. Shane Crotty, David Maag, Jamie J. Arnold, Weidong Zhong, Johnson Y.N. Lau, Zhi Hong, Raul Andino, Craig E. Cameron. "The broad-spectrum antiviral ribonucleoside ribavirin is an RNA virus mutagen". **Nature Medicine.** 2000;6:1375-9.

6. Shane Crotty, Craig Cameron, Raul Andino. "RNA virus error catastrophe: direct molecular test by using ribavirin". **Proceedings of the National Academy of Sciences (PNAS)**. 2001;98:6895-900. PMC34449
(Editor's Choice: Highlights of the recent literature. "Genetic Meltdown." *Science* 292:1969)

7. Shane Crotty, Chris Miller, Barbara Lohman, Martha R. Neagu, Lara Compton, Ding Lu, Fabien Lu, Linda Fritts, Jeffrey D. Lifson, Raul Andino. "Protection from SIV vaginal challenge using Sabin poliovirus vectors". **Journal of Virology**. 2001;75:7435-52. PMC114979

8. Shane Crotty, Craig Cameron, Raul Andino. "Ribavirin's antiviral mechanism of action: Lethal Mutagenesis?" **Journal of Molecular Medicine**. 2002;80:86-95.

9 Shane Crotty, Laura Hix, Luis Sigal, Raul Andino. "Poliovirus pathogenesis in a new poliovirus receptor transgenic mouse model: age-dependent paralysis and a mucosal route of infection." **Journal of General Virology**. 2002;83:1707-20.

10. Shane Crotty, Raul Andino. "Implications of high RNA virus mutation rates: ribavirin and error catastrophe." **Microbes and Infection**. 2002;4:1301-7.

11. Shane Crotty, Ellen Kersh, Jennifer Cannons, Pamela Schwartzberg, Rafi Ahmed. "SAP is required for generating long-term humoral immunity". **Nature.** 2003;421:282-7.
(News and Views. "B cell memory: Sapping the T cell". *Nature Medicine* 9:164-166)

12. Shane Crotty, David Gohara, Devin K. Gilligan, Sveta Karelsky, Craig E. Cameron, Raul Andino. "Manganese-dependent polioviruses caused by mutations within the viral polymerase". **Journal of Virology**. 2003;77:5378-88. PMC153957

13. Shane Crotty, Phil Felgner, Huw Davies, John Glidewell, Luis Villarreal, Rafi Ahmed. "Cutting Edge: Long term B cell memory in humans after smallpox vaccination". **Journal of Immunology.** 2003;171:4969-73.

14. Shane Crotty, Raul Andino. "Poliovirus vaccine strains as mucosal vaccine vectors and their potential use to develop an AIDS vaccine". **Advanced Drug Delivery Reviews**. 2004;56(6):835-52.

15. Shane Crotty, Maria-Carla Saleh, Leonid Getlin, Oren Beske, Raul Andino. "Viral escape from a drug with a cellular protein target: Brefeldin A resistant poliovirus". **Journal of Virology**. 2004;78:3378-86.

16. Shane Crotty, Rachael Aubert, John Glidewell, Rafi Ahmed. "Tracking human antigen-specific memory B cells: A sensitive and generalized ELISPOT system". **Journal of Immunological Methods.** 2004;286:111-22.

17. Shane Crotty, Rafi Ahmed. "Immunological memory to infection". **Seminars in Immunology**. 2004;16:197-203.

18. Conrad P. Quinn, Peter M. Dull, Vera Semenova, Han Li, Shane Crotty, Thomas H. Taylor, Evelyn Steward-Clark, Karen Stamey, Dan Schmidt, Kelly W. Stinson, Alison E. Freeman, Cheryl Elie, S.K. Martin, Carolyn Green, Rachael D. Aubert, John Glidewell, Bradley A. Perkins, Rafi Ahmed, David S. Stephens. "Immune response to *Bacillus anthracis* Protective Antigen in patients with bioterrorism-related cutaneous and inhalation anthrax". **Journal of Infectious Diseases (JID)**. 2004;190:1228-36.

19. D. Huw Davies, Xiaowu Liang, Jenny E. Hernandez, Arlo Randall, Siddiqua Hirst, Yunxiang Mu, Kimberly M. Romero, Toai T. Nguyen, Mina Kalantari-Dehaghi, Shane Crotty, Pierre Baldi, Luis P. Villarreal, Philip L. Felgner.

"Profiling the humoral immune response to infection using proteome microarrays: High throughput vaccine and diagnostic antigen discovery". **Proceedings of the National Academy of Sciences (PNAS)**. 2005;102:547-52. PMC545576

20. Roland R. Regoes, Shane Crotty, Rustom Antia, Mark Tanaka. "Optimal replication of poliovirus within cells". **American Naturalist**. 2005;165:364-73.

21. D. Huw Davies, Megan M. McCausland, Conrad Valdez, Devan Huynh, Jenny E. Hernandez, Yunxiang Mu, Siddiqua Hirst, Luis Villarreal, Philip L. Felgner, Shane Crotty*. "Vaccinia virus H3L envelope protein is a major target of neutralizing antibodies in humans and elicits protection against lethal challenge in mice". **Journal of Virology.** 2005;79:11724-33. PMC1212608

22. D. B. Graham, Michael P. Bell, Megan M. McCausland, Catherine J. Huntoon, Jan van Deursen, William A. Faubion, Shane Crotty, David J. McKean. "Ly9 (CD229)-deficient mice exhibit T cell defects yet do not share several phenotypic characteristics associated with SLAM- and SAP-deficient mice". **Journal of Immunology.** 2006;176:291-300.

23. Shane Crotty*, Megan M. McCausland, Rachael D. Aubert, E. John Wherry, Rafi Ahmed. "Hypogammaglobulinemia and exacerbated CD8 T-cells-mediated immunopathology in SAP-deficient mice with chronic LCMV infection mimics human XLP disease". **Blood**. 2006;108:3085-93. *Corresponding author

24. Jennifer L. Cannons, Li J. Yu, Dragana Jankovic, Shane Crotty, Reiko Horai, Martha Kirby, Stacie Anderson, Allen W. Cheever, Alan Sher, Pamela L. Schwartzberg. "SAP regulates T cell–mediated help for humoral immunity by a mechanism distinct from cytokine regulation". **Journal of Experimental Medicine**. 2006;203:1551-65. PMC2118305

25. Ian Amanna, Mark Slifka, Shane Crotty*. "Immunity and immunological memory following smallpox vaccination". **Immunological Reviews**. 2006;211:320-37. *Corresponding author

26. Mette A. Ejrnaes, Christophe M. Filippi, M. M. Martinic, Eleanor M. Ling, Lisa M. Togher, Shane Crotty, Matthias G. von Herrath. "Resolution of a chronic viral infection following IL-10 receptor blockade". **Journal of Experimental Medicine**. 2006;203:2461-72. PMC2118120

27. Megan M. McCausland, Isharat Yusuf, Hung Tran, Nobuyuki Ono, Yusuke Yanagi, Shane Crotty*. "SAP regulation of follicular helper CD4 T cell development is independent of SLAM and Fyn kinase". **Journal of Immunology**. 2007 Jan 15;178:817-28. *Corresponding author.

28. Magdalini Moutaftsi, Huynh Hoa-Bui, Bjoern Peters, John Sidney, Shahram Salek-Ardakani, Carla Oseroff, Valerie Pasquetto, Shane Crotty, Mick Croft, Elliot Lefkowitz, Howard Grey, Alessandro Sette. "Vaccinia virus-specific CD4+ T cell responses target a set of antigens largely distinct from those targeted by CD8+ T cell responses". **Journal of Immunology**. 2007;178:6814-20.

29. D. Huw Davies, Douglas Molina, Jens Wrammert, Joe Miller, Siddiqua Hirst, Yunxiang Mu, Jozelyn Pablo, Berkay Unal, Rie Nakajima-Sasaki, Xiaowu Liang, Shane Crotty, Kevin Karem, Inger Damon, Rafi Ahmed, Luis Villarreal, Philip Felgner. "Proteome-wide analysis of the serological response to vaccinia and smallpox". **Proteomics.** 2007;7:1678-86.

30. Bianca Mothe, Barbara Stewart, Carla Oseroff, Huynh-Hoa Bui, Stephanie Stogiera, Zacarias Garcia, Courteney Dow, Maria Pilar Rodriguez-Carreno, Maya Kotturi, Valerie Pasquetto, Jason Botten, Shane Crotty, Edith Janssen, Michael Buchmeier, Alessandro Sette. "Chronic lymphocytic choriomeningitis virus infection actively down-regulates CD4+ T cell responses directed against a broad range of epitopes". **Journal of Immunology**. 2007;179:1058-67.

31. Kevin L. Karem, Mary Reynolds, Christine Hughes, Zach Braden, P. Nigam, Shane Crotty, John Glidewell, Rafi Ahmed, Rama Amara, Inger K. Damon. "Monkeypox-induced immunity and failure of childhood smallpox vaccination to provide complete protection". **Clinical and Vaccine Immunology**. 2007;14:1318-27. PMC2168110

32. Megan M. McCausland, Shane Crotty*. "Quantitative PCR (QPCR) technique for detecting lymphocytic choriomeningitis virus (LCMV) in vivo". **Journal of Virological Methods.** 2008;147:167-76. (Epub Aug 2007) PMC2330273. *Corresponding author.

33. Mohammed Rafii-El-idrissi Benhnia, Megan M. McCausland, Hua-Poo Su, Kavita Singh, Julia Hoffmann, D. Huw Davies, Philip L. Felgner, Steven Head, Alessandro Sette, David N. Garboczi, Shane Crotty*. "Redundancy and plasticity of neutralizing antibody responses are cornerstone attributes of the human immune response to the smallpox vaccine". **Journal of Virology**. 2008;82:3751-68. PMC2268460 *Corresponding author.

34. Alessandro Sette, Magdalini Moutaftsi, Juan Moyron-Quiroz, Megan M. McCausland, D. Huw Davies, Robert Johnston, Mohammed Rafii-El-idrissi Benhnia, Julia Hoffman, Hua-Poo Su, Kavita Singh, David N. Garboczi, Steven Head, Howard Grey, Philip L. Felgner, Shane Crotty*. "Selective $CD4^+$ T cell help for antibody responses to a large viral pathogen: deterministic linkage of specificities". **Immunity**. 2008; 28:847-58. PMC2504733 *Corresponding author.

35. Shahram Salek-Ardakani, Magdalini Moutaftsi, Shane Crotty, Alessandro Sette, Michael Croft. "OX40 drives protective vaccinia virus-specific CD8 T cells". **Journal of Immunology.** 2008**;** 181:7969-76. PMC2729132

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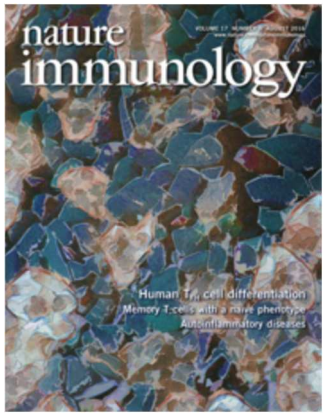

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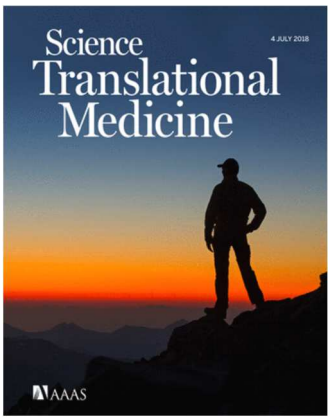

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- > 400 citations in less than a year

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148. Deli Huang, Robert K. Abbott, Colin Havenar-Daughton, Patrick D. Skog, Rita Al-Kolla, Bettina Groschel, Tanya R. Blane, Sergey Menis, Jenny Tuyet Tran, Theresa C. Thinnes, Sabrina A. Volpi, Mark Pintea, james E. Voss, Nicole Philps, Ryan Tingle, Alberto R. Rodriguez, Greg Martin, Sergey Kupryianov, William R. Schief, David Nemazee*, and Shane Crotty*. B cells expressing authentic naive human VRC01-class BCRs can be recruited to germinal centers and affinity mature in multiple independent mouse models. **Proceedings of the National Academy of Sciences**. 2020 Sep 15;117(37):22920-22931. PMC7502816 https://dx.doi.org/10.1073/pnas.2004489117 *Corresponding authors.

149. Carolyn Rydyznski Moderbacher, Sydney I. Ramirez, Jennifer M. Dan, Alba Grifoni, Kathryn M. Hastie, Daniela Weiskopf, Simon Belanger, Robert K. Abbott, Christina Kim, Jinyong Choi, Yu Kato, Eleanor G. Crotty, Cheryl Kim, Stephen A. Rawlings, Jose Mateus, Long Ping Victor Tse, April Frazier, Ralph Baric, Bjoern Peters, Jason Greenbaum, Erica Ollmann Saphire, Davey M. Smith, Alessandro Sette*, and Shane Crotty*. Antigen-specific adaptive immunity to SARS-CoV-2 in acute COVID-19 and associations with age and disease severity. **Cell**. 2020 Sept 16;S0092-8674(20)31235-6. PMC7494270 https://dx.doi.org/10.1016/j.cell.2020.09.038 *Corresponding authors.

- Science : https://www.sciencemag.org/news/2020/09/uncoordinated-immune-response-may-explain-why-covid-19-strikes-some-hard-particularly
- Reuters. T cell shortage linked to severe COVID-19 in elderly; antiseptic spray may limit virus spread

- Indianapolis TV. https://www.wishtv.com/news/medical/t-cells-take-lead-over-antibodies-against-covid-19-infection-new-study-suggests/
- San Diego 10 News. https://www.10news.com/news/coronavirus/why-do-older-people-fare-worse-against-covid-19-fewer-t-cells-according-to-new-study
- San Diego Union Tribune: https://www.sandiegouniontribune.com/business/biotech/story/2020-09-16/immune-system-fights-covid-19-best-when-it-fights-together-la-jolla-scientists-report
- Cell "Most Read" list
- Altmetric: 99th %ile (1,344)
- 365 citations in less than 10 months

150. Marc Lipsitch*, Yonatan H. Grad*, Alessandro Sette* and Shane Crotty*. Cross-reactive memory T cells and herd immunity to SARS-CoV-2. **Nature Reviews Immunology**. 2020 Oct 6;1-5. PMC7537578 *Corresponding authors.

- Altmetric = 941

151. Wang X, Ray R, Kratochvil S, Melzi E, Lin Y, Giguere S, Xu L, Warner J, Cheon D, Liguori A, Groschel B, Phelps N, Adachi Y, Tingle R, Wu L, Crotty S, Kirsch KH, Nair U, Schief WR, Batista FD. 2020. Multiplexed CRISPR/CAS9-mediated engineering of pre-clinical mouse models bearing native human B cell receptors. **Embo J** Jan 15;40(2):e105926. doi:10.15252/embj.2020105926. PMC7809789

152. Dan, J., Mateus, J., Kato, Y., Hastie, K., Faliti, C., Ramirez, S., Frazier, A., Yu, E., Grifoni, A., Rawlings, S., Peters, B., Krammer, F., Simon, V., Saphire, E., Smith, D., Weiskopf*, D., Sette, A.*, Shane Crotty*. (2020). Immunological memory to SARS-CoV-2 assessed for greater than six months after infection**. bioRxiv** . Version 1. Nov. 16, 2020. https://www.biorxiv.org/content/10.1101/2020.11.15.383323v1
Version 2. = Dan, J., Mateus, J., Kato, Y., Hastie, K., Ramirez, S., Frazier, A., Yu, E., Faliti, C., Grifoni, A., Haupt, S., Rawlings, S., Peters, B., Krammer, F., Simon, V., Saphire, E., Smith, D., Weiskopf*, D., Sette, A.*, Shane Crotty*. (2020). Immunological memory to SARS-CoV-2 assessed for up to eight months after infection. **bioRxiv**. Dec 18, 2020.
https://www.biorxiv.org/content/10.1101/2020.11.15.383323v2

- New York Times : Immunity to the Coronavirus May Last Years, New Data Hint https://www.nytimes.com/2020/11/17/health/coronavirus-immunity.html
- CNN, MSNBC, FOX, Reuters
- > 2 million Twitter views
- *Nature* news round up Nov 25, 2020
- Altmetric > 4,000
- *Nature* Top 10 COVID papers: The big COVID research papers of 2020. https://go.nature.com/3rqlCrc

153. Lee, J.H., Hu, J.K., Georgeson, E., Nakao, C., Groschel, B., Dileepan, T., Jenkins, M.K., Seumois, G., Vijayanand, P., Schief, W.R., Crotty, S*. (2021) Modulating the quantity of HIV Env-specific CD4 T cell help promotes rare B cell responses in germinal centers. **J Exp Med**. 2021 Feb 1;218(2):e20201254. doi:10.1084/jem.20201254. https://doi.org/10.1084/jem.20201254 . PMC7769167. *Corresponding author

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154. Wang, X., Ray, R., Kratochvil, S., Melzi, E., Lin, Y.C., Giguere, S., Xu, L., Warner, J., Cheon, D., Liguori, A., Groschel, B., Phelps, N., Adachi, Y., Tingle, R., Wu, L., Crotty, S., Kirsch, K.H., Nair, U., Schief, W.R., and Batista, F.D. Multiplexed CRISPR/CAS9-mediated engineering of pre-clinical mouse models bearing native human B cell receptors. **EMBO J**. Jan 15;40(2)e105926. doi: 10.15252/embj.2020105926. Epub 2020 Dec 1. PMC7809789

152. Dan, J., Mateus, J., Kato, Y., Hastie, K., Ramirez, S., Frazier, A., Yu, E., Faliti, C., Grifoni, A., Haupt, S., Rawlings, S., Peters, B., Krammer, F., Simon, V., Saphire, E., Smith, D., Weiskopf*, D., Sette, A.*, Shane Crotty*. (2020). Immunological memory to SARS-CoV-2 assessed for up to eight months after infection. **Science**. 2021 Feb

5:371(6529):eabf4063. doi: 10.1126/science.abf4063. https://science.sciencemag.org/content/371/6529/eabf4063 Epub 2021 Jan 6. PMC7919858 *Corresponding author

See above, plus:

- #7 all time highest Science paper Altmetric score for public attention.
- Altmetric 10,277
- 362 news outlets
- > 12,000 independent tweeters
- #101 all time highest Altmetric score (out of 18 million papers)
- > 580 research citations in less than 8 months (including preprint)

155. Antunes R da S, Pallikkuth S, Williams E, Esther DY, Mateus J, Quiambao L, Wang E, Rawlings SA, Stadlbauer D, Jiang K, Amanat F, Arnold D, Andrews D, Fuego I, Dan JM, Grifoni A, Weiskopf D, Krammer F, Crotty S, Hoffer ME, Pahwa SG, Sette A. Differential T cell reactivity to endemic coronaviruses and SARS-CoV-2 in community and health care workers. **J Infect Dis**. 2021. 224(1):jiab176-. PMID: 33822097

156. Tarke, A., Sidney, J., Kidd, C.K., Dan, J.M., Ramirez, S.I., Yu, E.D., Mateus, J., da Silva Antunes, R., Moore, E., Rubiro, P., Methot, N., Phillips, E., Mallal, S., Frazier, A., Rawlings, S.A., Greenbaum, J.A., Peters, B., Smith, D.M., Crotty, S., Weiskopf, D., Grifoni, A., Sette, A. (2021) Comprehensive analysis of T cell immunodominance and immunoprevalence of SARS-CoV-2 epitopes in COVID-19 cases. **Cell Rep Med.** 2021 Feb 16;2(2):100204. doi: 10.1016/j.xcrm.2021.100204. Epub 2021 Jan 26. PMC7837622

157. Sette A, Crotty S*. (2021) Adaptive immunity to SARS-CoV-2 and COVID-19. **Cell**. 2021 Feb 18;184(4):8611-880. doi: 10.1016/j.cell.2021.01.007. Epub 2021 Jan 12. https://doi.org/10.1016/j.cell.2021.01.007 PMC7803150. *Corresponding author

- Altmetric ~1,500 (99%ile)
- 144 research citations in less than 6 months

158. Choi, J.*, and Crotty, S*. Bcl6-mediated transcriptional regulation of follicular helper T cells (TFH). **Trends Immunol.** Apr;42(4):336-349. Epub 2021 Mar 1. PMC8021443 *Corresponding author

159. Masso-Silva, J.A., Moshensky, A., Lam, M.T.Y., Odish, M., Patel, A., Xu, L., Hansen, E., Trescott, S., Nguyen, C., Kim, R., Perofsky, K., Perera, S., Ma, L., Pham, J., Rolfsen, M., Olay, J., Shin, J., Dan, J.M., Abbott, R., Ramirez, S., Alexander, T.H., Lin, G.Y., Fuentes, A.L., Advani, I., Gunge, D., Pretorius, V., Malhotra, A., Sun, X., Duran, J., Hepokoski, M., Crotty, S., Coufal, N.G., Meier, A., and Crotty Alexander, L.E. Increased peripheral blood neutropil activation phenotypes and NETois in critically ill COVID-19 patients: a case series and review of the literature. **Clinical Infectious Disease**. 2021 May 14;ciab437. PMC8241438

160. Grifoni, A., Sidney, J., Vita, R., Crotty, S., Weiskopf, D., and Sette, A. SARS-CoV-2 human T cell epitopes: adaptive immune response against COVID-19. **Cell Host & Microbe**. 2021 Jul 14;29(7):1076-1092. PMC8139264

161. Sahoo, D., Katkar, G.D., Khandelwal, S., Behroozikhah, M., Claire, A., Castillo, V., Tindle, C., Fuller, M., Taheri, S., Rogers, T.F., Beutler, N., Ramirez, S.I., Rawlings, S.A., Pretorius, V., Smith, D.M., Burton, D.R., Crotty Alexander, L.E., Duran, J, Crotty, S., Dan, J.M., Das, S., and Ghosh, P. AI-guided discovery of the invariant host response to viral pandemics. **EBioMedicine. The Lancet.** 2021 June 11;68:103390. PMC8193764

162. Tarke, A., Sidney, J., Methot, N., Ye, E.D., Zhang, Y., Dan, J.M., Goodwin, B., Rubiro, P., Sutherland, A., Wang, E., Frazier, A., Ramirez, S.I., Rawlings, S.A., Smith, D.M. da Silva Antunes, R., Peters, B., Scheuermann, R.H., Weiskopf, D., Crotty, S., Grifoni, A., and Sette, A. Impact of SARS-CoV-2 variants on the total CD4+ and CD8+ T cell reactivity in infected or vaccinated individuals. **Cell Reports Medicine**. 2021 Jul 20;2(7):100355. PMC8249675

163. Masso-Silva JA, Moshensky A, Shin J, Olay J, Nilaad S, Advani I, Bojanowski CM, Crotty S, Li WT, Ongkeko WM, Singla S, Alexander LEC. Chronic E-Cigarette Aerosol Inhalation Alters the Immune State of the Lungs and Increases ACE2 Expression, Raising Concern for Altered Response and Susceptibility to SARS-CoV-2. **Front Physiol.** 2021 May 31;12:649604. PMC8194307

164. 1. Milner JJ, Toma C, Quon S, Omilusik K, Scharping NE, Dey A, Reina-Campos M, Nguyen H, Getzler AJ, Diao H, Yu B, Delpoux A, Yoshida TM, Li D, Qi J, Vincek A, Hedrick SM, Egawa T, Zhou M-M, Crotty S, Ozato K, Pipkin ME, Goldrath AW. Bromodomain protein BRD4 directs and sustains CD8 T cell differentiation during infection. **J Exp Med.** 2021;218(8):e20202512. PMC8160575

165. Antibody responses induced by SHIV infection are more focused than those induced by soluble native HIV-1 envelope trimers in non-human primates. **PLOS Pathogens**. In press.

166. Lee, J.H., Toy, L., Kos, J.T., Safonova, Y., Schief, W.R., Havenar-Daughton, C., Watson, and Crotty, S*. Vaccine genetics of IGHV1 VRC01-class broadly neutralizing antibody precursor naive human B cells. **NPJ Vaccines**. Accepted for publication.

167. Antanasijevic, A., Sewall, L., Cottrell, C., Carnathan, D., Jimenez, L., Ngo, J., Silverman, J., Groschel, B., Georgeson, E., Bhiman, J., Bastidas, R., LaBranche, C., Allen, J., Copps, J., Perrett, H., Rantalainen, K., Cannac, F., Yang, Y., Torrents de la Peña, A., Froes Rocha, R., Berndsen, Z., Baker, D., King, N., Sanders, R., Moore, J., Crotty, S., Crispin, M., Montefiori, D., Burton, D., Schief, W., Do Silvestri, G., and Ward, A.. Polyclonal antibody responses to HIV Env immunogens resolved using cryoEM. **Nature Communication**s. Accepted for publication.

168. Mateus J, Dan JM, Zhang Z, Moderbacher CR, Lammers M, Goodwin B, Sette A*, Crotty S*, Weiskopf D*. Low dose mRNA-1273 COVID-19 vaccine generates durable T cell memory and antibodies enhanced by pre-existing crossreactive T cell memory. **Science**. 2021;2021.06.30.21259787. Accepted for publication.

Peer reviewed papers published, accepted, or pending acceptance, through July 12, 2021:

75 corresponding author papers, 13 first author papers. 166 total peer reviewed papers.
h-index = 80. 57 of which are 1st author or corresponding author.
Citations (Google Scholar) > 30,000

i10 index = 155
Weighted RCR (NIH iCite) = **1,086**
Mean RCR = 6.9

COMMENTARIES, BOOK CHAPTERS, EDITORIAL CONTRIBUTIONS, and OTHER PUBLICATIONS

Shane Crotty. "Biotechnology Industry." ***The Oxford Companion to United States History***. Ed. Paul S. Boyer. Oxford University Press. 2001 p.76-77.

Shane Crotty and Raul Andino. "Virus-based vectors for gene expression in mammalian cells: Poliovirus" ***Gene Transfer and Expression in Mammalian Cells***. Ed. S.C. Makrides. 2003 p.169-187.

Shane Crotty and Rafi Ahmed. "Immunological Memory" ***Topley and Wilson's Microbiology and Microbial Infections***. 10th Edition. Immunology Volume. 2005 Eds. Stefan Kaufmann and Michael Steward.

Stephen P. Schoenberger and Shane Crotty "Immunological Memory" In ***Fundamental Immunology***. 2008 Ed. William E. Paul. 6th Edition. Chapter 28. p. 862-897

Susan Kaech, Shane Crotty, and Stephen P. Schoenberger. "Immunological Memory" ***Fundamental Immunology***. Ed. William E. Paul. 7th Edition.

Alessandro Sette and Shane Crotty. "Neutralizing Concerns about vaccines." [Commentary]. ***San Diego Union-Tribune***. Jan 24, 2013.

Youn Soo Choi and Shane Crotty. "Retroviral vector expression in TCR transgenic $CD4^+$ T cells" In **T follicular helper cells--Methods and Protocols**. 2015. Eds. Marion Espeli and Michelle Linterman.

Simon Belanger, Shane Crotty*. "Dances with cytokines, featuring T_{FH} cells, IL-21, IL-4 and B cells." 2016. **Nature Immunology**. 2016 Sep 20;17(10):1135-6. *Corresponding author.

Shane Crotty. 'The new NIH 'Rule of 21' Threatens to Give Up on American Preeminence in Biomedical Research Based on a Flawed Concept and Flawed Analysis' [Internet]. Medium.com. 2017 [cited 2017 Jun 23]. Available from: https://medium.com/@shane_52681/the-new-nih-rule-of-21-threatens-to-give-up-on-american-preeminence-in-biomedical-research-based-c40060bd3022

Shane Crotty. 'Considering assessments of scientific productivity and 'ghost authors" [Internet]. Medium.com. 2017 [cited 2017 Jun 23]. Available from: https://medium.com/@shane_52681/considering-assessments-of-scientific-productivity-and-ghost-authors-57e13c40e448

Patricia D'Souza M, Allen MA, Baumblatt JAG, Boggiano C, Crotty S, Grady C, Havenar-Daughton C, Heit A, Hu DJ, Kunwar N, McElrath MJ, Lymph Node Webinar Contributors. Innovative approaches to track lymph node germinal center responses to evaluate development of broadly neutralizing antibodies in human HIV vaccine trials. **Vaccine**. 2018 Sep 11;36(38):5671–7.

Shane Crotty. "Raging evolution of a B cell response to a viral infection". **Nature Reviews Immunology.** 2018 Feb;18(2):79. [Invited Article]

Editor, **Immune Memory and Vaccines: Great Debates**. Co-editor with Rafi Ahmed. Cold Spring Harbor Laboratories Press. 2017.

Editor, **Current Opinion in Immunology**, Vaccines issue 2019
Shane Crotty. "Editorial Overview: Vaccine immunology: what is seen and not seen"

Shane Crotty*, Blish C, Cadwell K, Chi H, Goldrath A, Green D, Kaech SM, Krummel M, Pepper M, Rothlin CV, Wherry EJ, and Once-a-Year Pledge Supporters. "Reinvigorating NIH Grant Peer Review." **Immunity**. 2020 Jan 14;52(1):1–3. *Corresponding author.

- www.lji.org/peerpledge
- Altmetric: 108

Alex Sette*, Shane Crotty*. Pre-existing immunity to SARS-CoV-2: the knowns and unknowns. **Nature Reviews Immunology**. 2020 Aug;20(8):457-458. PMCID: PMC7339790 https://dx.doi.org/10.1038/s41577-020-0389-z

- Altmetric: 3,888
- Highest ever Altmetric for Nature Reviews Immunology
- > 200,000 downloads by Nov 2020
- New York Times, September 2, 2020. "A New Coronavirus Adviser Roils the White House With Unorthodox Ideas". https://www.nytimes.com/2020/09/02/us/politics/trump-scott-atlas-coronavirus.html

Crotty, S. Hybrid immunity. COVID-19 vaccine responses provide insights into how the immune system perceives threats. **Science**. 2021 June 25;6549:1392-1393.

- Altmetric: 1,500

MEDIA OUTREACH

2020 Media Outreach: Over 400 TV, radio, newspaper, and internet interviews and quotes, between Crotty and Sette.

Full Crotty list available as a separate file.
Partial list: https://annacrotty2.medium.com/shanes-covid-19-media-bd82389b5a65

Selected examples:

TV = Bloomberg News. CNN International. EW Scripps nationwide. Local San Diego news.
Radio = LA talk radio KNX, multiple appearances
Newspaper = New York Times, multiple articles. WSJ, LA Times.
Internet = Business Insider. COVID video: > 210,000 views. MedCram. COVID vaccine and immune memory video: > 750,000 views. MedCram COVID vaccine deep dive video 1,800,000 views.

Twitter: > 32,000 followers.
Multiple tweets with > 1 million views.
Top viewed tweet thread ~ 3 million views. "Are RNA vaccines safe?"
Top retweeted tweet > 5,000 re-tweets. "Are RNA vaccines safe?"
Top likes > 11,000 likes. Tony Fauci paper photo
Immune memory to SARS-CoV-2 tweet threads: ~2 million views, and engaged people ranging from Nate Silver to Senator Rand Paul.
Youtube: Business Insider. COVID video (> 210,000 views). MedCram COVID vaccine deep dive video 1,800,000 views. MedCram. COVID vaccine and immune memory video: > 750,000 views.

2021 Outreach:

Selected media examples:

New York Times, Scientific American, Wall St. Journal, Bloomberg, Washington Post, Nature, Science
BBC Radio, LA News radio
TV = Japanese network. Local San Diego News

VEBA California Schools COVID-19 vaccine outreach seminar (3x). 150,000 educators organization. $1,500 donations to LJI for the service.

SCIENTIFIC SEMINARS

2022 Octoberfest Conference.
2022 Nobel Symposium in Medicine.
2022 Icahn School of Medicine at Mount Sinai.
2022 Vanderbilt University. Invited Speaker.
2022 Palm Springs Symposium on HIV/AIDS. Invited Speaker.
2022 University of Washington, Immunology Seminar Series.
2022 Penn CFAR Seminar.
2022 Microbiology and Immunology at Stanford University School of Medicine Virtual Seminar. "Adaptive immunity and immune memory to SARS-CoV-2 and COVID-19"
2022 University of Texas. MD Anderson Cancer Center.
2022 Keystone Symposia on HIV Vaccines and Therapies. Invited Speaker.
2022 60th Midwinter Conference, Asilomar. Invited Speaker.

2021 Antibody Engineering & Therapeutics Conference (AE).
2021 AIRR-C Seminar.
2021 CCHI Steering Committee Annual Investigator Meeting.
2021 Australian and New Zealand Society of Immunology Annual Meeting. "Adaptive immunity and immune memory to SARS-CoV-2 and COVID-19"
2021 9th Annual Meeting of the International Cytokine & Interferon Society (ICIS).
2021 Drexel University College of Medicine. Immune Modulation and Engineering Collaborative Virtual Seminar Series.
2021 MIT COVID Seminar. "Adaptive immunity and immune memory to SARS-CoV-2 and COVID-19"
2021 West Virginia University School of Medicine. Graduate Students Invited Seminar Speaker.
2021 DAIDS Workshop on Lesson from COVID Vaccines - HIV Vaccines. Leveraging the COVID Vaccine Experience to Accelerate a Safe and Efficacious HIV Vaccine.
2021 Cytokines 2021 Hybrid Meeting. Symposium 16: Determinants of cell fate. "Adaptive immunity and immune memory to SARS-CoV-2 and COVID-19"
2021 GSK's Immunology Network Summit "Immunology of Vaccines". Invited Speaker. "Understanding the immunology of germinal centers and Tfh cells for vaccines and COVID"
2021 CIAR Presentation.
2021 Yale University. Immunobiology Seminar Series. "Adaptive immunity and immune memory to SARS-CoV-2 and COVID-19"
2021 CIML Center for Immunology of Marseille-Luminy. Invited Speaker. "Assessing the engines of affinity maturation: germinal centers and T follicular helper (T_{FH}) CD4 T cells"
2021 LJIC COVID-19 Summit.
2021 Nomura Singapore Limited, MacroBrew Session
2021 Janssen R&D 2021 Global Scientific Symposium. "Adaptive immunity and immune memory to SARS-CoV2 and COVID-19"
2021 ECTRIMS Symposium.
2021 Scripps Seminar Series. "Adaptive immunity and immune memory to SARS-CoV-2 and COVID-19"
2021 TWiV, Columbia University.
2021 WHO R&D Blueprint Consultation.
2021 University of San Francisco Medical Grand Rounds.
2021 CIVICs Annual Meeting.
2021 ImmunoSkamania Conference. "Scientist's Social Media Starter Kit"
2021 NIH NIAMS Intramural Research Program Annual Scientific Retreat. Invited Keynote speaker. "Adaptive immunity and immune memory to SARS-CoV2 and COVID-19"
2021 World Health Organization. COVID-19 vaccines - WHO meeting on correlates of protection. Invited speaker. "Understanding T cell immunity to COVID-19 and relationships to vaccine correlates and mechanisms of protection"
2021 Osaka University IFReC ImmunoSeminar. "Adaptive immunity and immune memory to SARS-CoV-2 and COVID-19"
2021 Hoffmann-La Roche. TriMS Conference.
2021 VEBA Seminar.
2021 AAI Annual Meeting. NIAID Symposium. "Immune memory to SARS CoV-2 and COVID-19"
2021 Food and Drug Administration. Office of Biotechnology Product Immunogenicity Working Group. "Adaptive immunity and immune memory to SARS-CoV-2"
2021 CHAVD Scientific Advisory Board Meeting. "T cell responses to SARS-CoV-2"
2021 IUIS and EFIS Webinar. "Adaptive immunity and immune memory to SARS-CoV-2"
2021 VEBA, Southern California Teachers. "COVID vaccines"
2021 Australian National University. John Curtin School of Medical Research. "Adaptive immunity and immune memory to SARS-CoV-2"
2021 U.S. Department of Health and Human Services. "Adaptive immunity and immune memory to SARS-CoV-2 and COVID-19"
2021 American Thoracic Society International Conference. "Immune memory to SARS-CoV-2 as a determinant of protection against reinfection, disease risk, and vaccine efficacy"
2021 HVTN AIDS Clinical Lab Group. "Adaptive immunity and immune memory to SARS-CoV-2 and COVID-19"
2021 Montefiore Medical Center, Albert Einstein College of Medicine. "Adaptive immunity and memory SARS-CoV-2 and COVID-19"
2021 Clinical Immunology Society (CIS). "Adaptive immunity and immune memory to SARS-CoV-2 and COVID-19"
2021 Pfizer. Vaccine Research and Development. "Adaptive immunity and immune memory to SARS-CoV2 and COVID-19"

2021 University of Wisconsin-Madison, Cellular and Molecular Pathology. Student Choice Seminar. "Adaptive immunity and immune memory to SARS-CoV-2 and COVID-19"
2021 Emory Infectious Disease Across Scales Seminar Series. "Adaptive immunity and immune memory to SARS-CoV-2 and COVID-19"
2021 University of Massachusetts Medical School. "Adaptive immunity and immune memory to SARS-CoV-2 and COVID-19"
2021 National Jewish Health Grand Rounds. "Adaptive immunity and memory to COVID-19"
2021 CHAVD/VRC COVID Conference. "Adaptive immunity to SARS-CoV-2"
2021 Arizona State University. "Adaptive immunity and immune memory to SARS-CoV-2 and COVID-19"
2021 US Representative Scott Peters Town Hall. "COVID-19 vaccines"
2021 NIH. National Cancer Institute (NCI). Understanding Cell-mediated Immunity to SARS-CoV-2: Challenges and Opportunities.
2021 AAAAI Annual Meeting. Immune Profiling of COVID-19 Patients. "Adaptive immune responses to SARS-CoV-2"
2021 American Chemical Society. "COVID vaccines"
2021 Oxford University. MRC Weatherall Institute of Molecular Medicine. "Immunological memory to SARS-CoV-2 after COVID-19"
2021 Gates Foundation COVID Vaccine Meeting. Variants and T cells Workshop.
2021 Baylor College of Medicine. "Adaptive immunity an immune memory to SARS-CoV-2 and COVID-19"
2021 Howard Hughes Medical Institute. "Adaptive Immunity and Immune Memory to SARS-CoV-2 after COVID-19"
2021 University of California San Francisco. Ground Rounds. "The immunology of SARS-CoV-2 variants"
2021 HIV Research for Prevention Conference (HIVR4P). "Adaptive immunity an immune memory to SARS-CoV-2 and COVID-19"
2021 New York Academy of Sciences: "The Quest for a COVID-19 Vaccine" Conference
2021 Queen Mary University of London. William Harvey Research Institute, School of Medicine & Dentistry. "Adaptive immunity and immune memory to COVID-19"
2021 Kiowa Kirin National meeting. "COVID-19 virus, immunology, vaccine development and novel (e.g. mRNA) technologies"
2021 Wake Forest University Seminar. "Adaptive immunity and memory to COVID-19"
2021 German Cancer Research Center Seminar. "Adaptive immunity to COVID-19"
2021 University of Toronto, Charles Gould Easton Seminar, "Adaptive immunity and immune memory to SARS-CoV-2 and COVID-19"
2021 World Health Organization (WHO). "Adaptive immunity an immune memory to SARS-CoV-2 and COVID-19"
2021 San Diego Rotary. "Understanding COVID-19 immunology"
2021 Keystone Symposia on Next Generation HIV Vaccines & Therapies. Invited Speaker. Meeting Cancelled.
2021 Google COVID-19 Sunday Sync. "Immune responses to COVID-19 and variants: Natural infection and vaccines"
2021 University of Utah, "Adaptive immunity an immune memory to SARS-CoV-2 and COVID-19"
2021 The Scientist. COVID-19 Webinar research series. "Adaptive immunity an immune memory to SARS-CoV-2 and COVID-19"
2021 25Madison. "Understanding COVID-19"
2021 The Scripps Research Institute. DiscoBio Retreat. "Adaptive immunity and immune memory to COVID-19"
2021 Cal State University system CSUPERB Symposium. Keynote speaker. "COVID-19 vaccines and immunological memory to SARS-CoV-2"

2020 World Vaccine & Immunotherapy Congress. "Understanding adaptive immunity to COVID-19"
2020 GSK Vaccines R&D Community Seminar. "Multifaceted effects of antigen valency on B cell response composition and differentiation in vivo"
2020 Emory University Department of Microbiology and Immunology Seminar Series. "Understanding adaptive immune responses to COVID-19"
2020 NIH CCHI Annual Meeting. "Adaptive immunity to COVID-19"
2020 MD VIP. "Adaptive immunity to COVID-19: Big questions for protective immunity and disease severity"
2020 SEM CIVIC. "Adaptive immunity and immune memory to SARS-CoV-2 in humans: CD4 T cells, CD8 T cells, memory B cells, and antibodies up to 8 months after COVID-19"
2020 NIH/NIAID Workshop on Post Acute Sequelae of COVID-19. Invited speaker. "The potential roles of T cells in long COVID / PASC"
2020 Harvard Medical School. CVVR Seminar Series. "Adaptive immune responses to COVID-19"
2020 Princeton University. Systems Microbiology and Immunology. "Adaptive immunity to COVID-19"
2020 Cell Press. International Symposium. COVID-19: Understand, Manage, Control. Invited speaker. "Understanding adaptive immunity to COVID-19"

2020 Mayo Clinic Infection and Immunity Symposium. "Understanding adaptive immunity to COVID-19"
2020 Rutgers New Jersey Medical School, Pandemic Diseases Seminar. "Understanding adaptive immunity to COVID-19"
2020 UCSD CFAR. "Multifaceted effects of antigen valency on B cell response composition and differentiation in vivo"
2020 CEPI WHO COVID-19 Seminar series. "Adaptive immune responses to COVID-19: the importance of T cells, and associations with disease severity and age"
2020 Pfizer. "Adaptive Immunity to COVID-19"
2020 Duke CHAVD Annual meeting. "The impacts of vaccine delivery kinetics and antigen valency on adaptive immune responses"
2020 Sanofi North American Medical Team. Seminar. "Antigen-Specific Adaptive Immunity to SARS-CoV-2"
2020 University of California San Francisco (UCSF) Immunology Seminar. "Understanding adaptive immunity to COVID-19"
2020 Society for Immunotherapy of Cancer (SITC) COVID-19/Cancer. "Adaptive immune responses to COVID-19"
2020 British Society for Immunology, Translational Immunology Conference. "Understanding immunity to COVID-19: Antigen-specific adaptive immune responses to SARS-CoV-2 in COVID-19 cases, and healthy controls"
2020 NIH, Next Generation of Assays, Tools, Technology to Evaluate Immune Responses to Vaccines for Infectious Diseases. "Tools for understanding Tfh cell help for germinal centers and affinity matured antibody responses'
2020 National Autonomous University of Mexico, Open Box Science Symposium. "Bcl-6 is the nexus transcription factor of T follicular helper cells via repressor-of-repressor circuits"
2020 Garvan Institute of Medical Research, Sydney, Australia. "Understanding immunity to COVID-19: Antigen-specific adaptive immune responses to SARS-CoV-2 in COVID-19 cases, and healthy controls"
2020 Bernstein Group. "Immune responses to COVID-19: big questions for disease severity, and for COVID-19 vaccines"
2020 UCSD ID/GPH Grand Rounds and Case Conference. "Understanding immunity to COVID-19: Antigen-specific adaptive immune responses to SARS-CoV-2 in acute COVID-19 cases"
2020 KPBS Producers Club. "Vaccines and COVID-19"
2020 Bridging Innovation and Translation in T Cell Immunotherapy. Invited speaker. (postpones to 2022)
2020 Parker Institute COVID group. "Antigen-specific adaptive immunity to SARS-CoV-2 in acute COVID-19 and associations with disease severity"
2020 Human Vaccines Project, Global Lab Meeting. "T Cell Responses to SARS-CoV-2"
2020 AAI Introductory Course. 'B Cell Activation and Humoral Immunity'
2020 NIH NIAID Workshop on Multisystem Inflammatory Syndrome in Children , MIS-C. "Major knowledge gaps in understanding COVID-19 immunity"
2020 Immunochemistry and Immunobiology GRC. "Engineering vaccine immunity: Understanding the immunology of helper T cells, germinal centers, and the human naive B cell repertoire to enable better vaccine design" Postponed
2020 Columbia University, COVID19 Symposium Series. "Targets of T cell responses to SARS-CoV-2 coronavirus in humans with COVID-19 disease and unexposed individuals"
2020 CEPI. "Targets of T cell responses to SARS-CoV-2 coronavirus in humans with COVID-19 disease and unexposed individuals"
2020 Bill & Melinda Gates Foundation. Summer Seminar series. "Understanding immunity to COVID-19"
2020 LJI Coronavirus Updates. Live from the Laboratory. "Vaccines and Pandemics"
2020 CHAVD Scientific Advisory Board Meeting. "Immunization strategies"
2020 American Thoracic Society Seminar, COVID-19 Critical Care Training Forum. "T Cell Responses to SARS-CoV-2"
2020 Keystone Symposia, Transforming Vaccinology. "T follicular helper (T_{FH}) CD4 T cells, germinal center B cells, immunodominance, and antibody responses in the context of challenging vaccine targets". Cancelled
2020 Conference on Retroviruses and Opportunistic Infections (CROI). Plenary Speaker. "Engineering vaccine immunity: Understanding the immunology of helper T cells, germinal centers, and the human naive B cell repertoire to enable better vaccine design"
2020 Keystone Symposia, Antibodies as Drugs: From B Cell Biology to New Treatments. Plenary Speaker. "T follicular helper (T_{FH}) CD4 T cells, germinal center B cells, and antibody responses in the context of challenging vaccine targets"
2020 LJI Lunch-and-Learn.
2020 Gossamer Bio. "T follicular helper (T_{FH}) CD4 T cells and germinal center B cell response in the context of vaccines and infections"

2019 CCHI National Kick-off Meeting, NIAID, NIH, DHHS, 'Mechanisms of differential responses to whole cell and acellular pertussis vaccination'
2019 CAVD Session, 'Slow delivery immunization modulates germinal center immunodominance'
2019 UCLA School of Medicine. Clinical and Translational Science Institute (CTSI) I3T Seminar Series. 'T follicular helper (T_{FH}) CD4 T cells and germinal center B cell response in the context of vaccines and infections'

2019 Samsung Global Research Symposium (Samsung GRS) on T Cell Biology. 'T follicular helper (T_{FH}) CD4 T cells and germinal center B cell response in the context of vaccines and infections'
2019 University of Montreal. CHUM Research Center. 'T follicular helper (T_{FH}) CD4 T cells and germinal center B cell responses in the context of vaccines and infections'
2019 School of Medicine at Mount Sinai, 'T follicular helper (Tfh) CD4 T cells and germinal center B cell response in the context of vaccines and infections'
2019 CHAVD Kick-off meeting. 'When designing vaccines, consider the starting material: the human B cell repertoire'
2019 Vaccine Research Center, NIAID, NIH Seminar. 'Enhancing HIV neutralizing antibody and germinal center responses via modulation of immunodominance.'
2019 Scripps Immunology. Departmental Retreat. Invited speaker, Keynote presentation. 'T_{FH} cells and B cells and immunodominance'
2019 Follicular Helper T cells: 10 years and beyond. International symposium. Keynote lecturer. 'Bcl6 is the nexus transcription factor of T_{FH} differentiation'
2019 AAI Introductory Course in Immunology. 'B Cell Activation and Humoral Immunity'
2019 Ragon Institute of MGH, MIT and Harvard, and Harvard University Center for AIDS Research. "T follicular helper (Tfh) CD4 T cells and germinal center B cell response in the context of vaccines and infections"
2019 Immuno-Summit Skamania Conference: Charting a Course. 'The future of NIH funding'
2019 Human Vaccines Project and Michelson Medical Research Foundation Symposium at UCLA. 'Gently opening the black box of human germinal centers: Lymph node FNA of vaccines'
2019 Human Vaccines Project Scientific Advisory Board Meeting. "Lymph node FNAs for human vaccine studies"
2019 Duke Immunology Seminar. Invited speaker. 'T follicular helper (T_{FH}) CD4 T cells, germinal centers, immunodominance, and vaccines'
2019 Tri-Institutional Immunology Seminar Series. Memorial Sloan Kettering Cancer Center – Cornell Med – Rockefeller Univ. 'T follicular helper (T_{FH}) CD4 T cells and germinal center B cell response in the context of vaccines and infections'
2019 Cutting Edge in Organ Transplantation Conference, Sensitization in Transplantation. 'How T cells control antibody responses: T follicular helper (T_{FH}) CD4 T cells and germinal center B cell responses to vaccines'
2019 Keystone Symposia on B Cell-T Cell Interactions, joint with Molecular Approaches to Vaccines. Invited plenary speaker. 'T_{FH} and germinal center B cell responses in the context of vaccines'
2019 UT Health San Antonio. Long School of Medicine. Department of Microbiology & Immunology. Invited speaker. 'How T cells control antibody responses: T follicular helper (T_{FH}) CD4 T cells and germinal center B cell responses to vaccines'
2019 Miami Winter Symposium – Evolving Concepts in HIV and Emerging Viral Disease. Plenary speaker. 'Assessing the engines of affinity maturation: germinal centers and T follicular helper (T_{FH}) CD4 T cells'

2018 World Vaccine and Immunotherapy Congress, 'How T cells control antibody responses: T follicular helper (T_{FH}) CD4 T cells and germinal center B cell responses to vaccines'
2018 Gates Foundation 13th Annual CAVD Meeting. Co-chair. 'Lymph node immunology in vaccine research and cure research'. Topics of Interest session.
2018 Gates Foundation 13th Annual CAVD Meeting. Invited speaker. 'Probing the human naive B cell repertoire'
2018 Gates Foundation 13th Annual CAVD Meeting. Presenter. 'Adjuvants and antigen delivery systems'. Adjuvants Topics Of Interest session.
2018 University of Chicago Seminar Series 2018-2019, 'T follicular helper (T_{FH}) CD4 T cells and germinal center B cell response in the context of vaccines and infections'
2018 KAI International Meeting from Korean Association of Immunologists, Seoul, Korea. 'How T cells control antibody responses: T follicular helper (T_{FH}) CD4 T cells and germinal center B cell responses in the context of vaccines and infections'
2018 Seminar at Seoul National University College of Medicine. 'Assessing the engines of affinity maturation: germinal centers and T follicular helper (T_{FH}) CD4 T cells'
2018 IDWeek, IDSA. Invited speaker. 'How T cells control antibody responses: T follicular helper (T_{FH}) CD4 T cells and germinal center B cell responses in the context of vaccines and infections'
2018 Merck Palo Alto (DNAX). Invited speaker. 'Assessing the engines of affinity maturation: germinal centers and T follicular helper (T_{FH}) CD4 T cells'
2018 Mayo Clinic. Grand Rounds. Departments of Medicine & Immunology at the Mayo Clinic, Immunology Seminar Series. 'T follicular helper (T_{FH}) CD4 T cells and germinal center B cell responses in the context of vaccines and infections'
2018 American Society of Hematology. Meeting on Lymphoma Biology. Invited Speaker. 'Assessing the engines of affinity maturation: germinal centers and T follicular helper (Tfh) CD4 T cells'
2018 Scripps Clinic, Carmel Valley. Allergy Grand Rounds. 'Assessing the engines of affinity maturation: germinal centers and T follicular helper (T_{FH}) CD4 T cells'
2018 Human Vaccines Project – Scientific Leadership Meeting

2018 Immunochemistry & Immunobiology Gordon Research Conference. Invited speaker. 'T follicular helper (T_{FH}) CD4 T cells, germinal centers, immunodominance, and the generation of memory to vaccines'
2018 AAI Introductory Course in Immunology. 'B Cell Activation and Humoral Immunity'
2018 American Society for Microbiology (ASM) Microbe 2018. Invited Speaker. 'T follicular helper (T_{FH}) CD4 T cells and germinal center B cell responses in the context of vaccines and infections'
2018 Emory University Vaccine Center. Invited Speaker. 'T follicular helper (T_{FH}) CD4 T cells and germinal center B cell responses in the context of vaccines and infections'
2018 Garvan Institute of Medical Research, Sydney, Australia. 'T follicular helper (T_{FH}) CD4 T cells and germinal center B cell responses in the context of vaccines and infections'
2018 Singapore Immunology Network (SIgN), A*STAR. Immunology Seminar Series. Inaugural graduate student invited speaker. 'T follicular helper (T_{FH}) CD4 T cells and germinal center B cell responses in the context of vaccines and infections'
2018 Compugen. 'Assessing the engines of antibody affinity maturation: germinal centers and T_{FH} CD4 T cells in the context of vaccines and infections"
2018 Stanford University School of Medicine. Immunology Seminar Series, Invited Speaker. 'T follicular helper (T_{FH}) CD4 T cells, germinal center B cells, and the generation of memory to vaccines'
2018. David Baltimore's 80th Birthday Celebration Symposium. Caltech. Session chairperson
2018 LJI Life Without Disease. Lecture series. "A Battle for the Ages"
2018 Palm Springs Symposium on HIV/AIDS. HIV Disease: New Insights into Pathogenesis, Prevention and Therapy. 'T follicular helper (T_{FH}) CD4 T cells, germinal centers, immunodominance, and the generation of memory to vaccines'
2018 Genentech Immunology Lecture Series. 'T follicular helper (T_{FH}) CD4 T cells, germinal centers, immunodominance, and the generation of memory to vaccines'
2018 UCSF Immunology. Postdoctoral Fellow Invited Lecturer. 'T follicular helper (T_{FH}) CD4 T cells, germinal centers, immunodominance, and the generation of memory to vaccines'
2018 Keystone Symposia on Immunological Memory: Innate, Adaptive, and Beyond/Aging, Inflammation and Immunity. Invited Plenary speaker. 'T follicular helper (T_{FH}) CD4 T cells, germinal centers, and the generation of memory'
2018 Keystone Symposia on Progress and Pathways Toward an Effective HIV Vaccine. Joint Symposium with Emerging Technologies in Vaccine Discovery and Development. Invited Plenary speaker. 'Wrangling the complex cellular dynamics involved in successful germinal center CD4 T and B cell responses for generating neutralizing Abs to HIV and other difficult targets'
2018 Scripps CHAVI-ID Annual Meeting. Session Chair. Antibody Repertoire Studies
2018 Scripps CHAVI-ID Annual Meeting. "Distinct subclasses of VRC01-class naive B cell precursors represent advantageous eOD-GT8 beachheads for eliciting HIV vaccine bnAb lineages"

2017 Gates Foundation CAVD Meeting. "Immunodominance and other challenges face by germinal center responses for eliciting neutralizing antibodies to Env, or for affinity maturation to germline-targeted immunogens"
2017 Gates Foundation CAVD Meeting. Topics of Interest Session. "Why aren't animal models humans?"
2017 Gates Foundation CAVD Meeting. Topics of Interest Session. "Non-cytokine assays for antigen-specific CD4 T cells: What do AIM assays measure?"
2017 Australasian Society for Immunology Annual Meeting. International Invited speaker. 'T follicular helper cells (Tfh) and GC B cell responses in the context of vaccines and infections'
2017 KAI International Meeting 2017. Sejong University Convention Center, Seoul, Korea. International Invited speaker. Cancelled.
2017 AABB. T Follicular Helper Cell (TFH) Control of Antibody Production Session. 'T follicular helper cells (Tfh) and GC B cell responses in the context of vaccines and infections'
2017 Dept. of Chemistry and Biochemistry at Brigham Young U (BYU). Invited Speaker. 'T follicular helper (Tfh) CD4 T cells and germinal center B cell responses in the context of vaccines and infections'
2017 Immune Tolerance Network. Steering Committee. 'Application of lymph node FNAs to immunology research'.
2017 Program in Immunology (UC San Diego-La Jolla Institute) Kick Off Symposium. 'Wrangling the complex cellular dynamics involved in successful B:T collaboration for neutralizing Ab responses to HIV and other difficult targets'
2017 50th Anniversary Germinal Center Conference. The 19th International Conference on Lymphatic Tissues and Germinal Centres in Immune Reactions (GCC). Invited Speaker. 'T follicular helper cells (Tfh) and GC B cell responses in the context of vaccines and infections'
2017 Curie Institute, Paris. Invited Speaker. 'Assessing the engines of antibody affinity maturation to vaccines: germinal centers and Tfh cells'
2017 NIAID Webinar. LN Sampling: Fine needle aspirates vs. intact lymph node biopsies. Speaker. Chairperson.
2017 17th Annual Meeting of the Federation of Clinical Immunology Societies (FOCIS 2017). Manipulating T Follicular Helper Cells and the Germinal Center. 'Assessing the engines of affinity maturation to vaccines: germinal centers and Tfh cells'
2017 AAI Introductory Course in Immunology. 'B Cell Activation and Humoral Immunity.'

2017 University of Pittsburgh Department of Immunology, invited speaker. 'T follicular helper cells (Tfh) and B cell responses in the context of vaccines and infections'
2017 National Institutes of Health (NIH) Immunology Interest Group (IIG). Invited speaker. 'T follicular helper cells (Tfh) and B cell responses in the context of vaccines and infections'
2017 Scripps CHAVI-ID SAB
2017 Keystone Symposium on B Cells and T Follicular Helper Cells – Controlling Long-Lived Immunity. Invited speaker. ' Tfh differentiation and B cell responses in the context of vaccines and infections'
2017 University of Arizona, Microbiology and Immunology Department, invited speaker. 'Tfh differentiation and B cell responses in the context of vaccines and infections'
2017 IAVI Neutralizing Antibody Consortium. Invited participant.
2017 Inaugural Chiba University-UCSD Symposium on Mucosal Immunology, Allergy and Vaccines: Impact on Mucosal Diseases and Global Health. 'Vaccine immune response evaluation. Assessing the engines of affinity maturation: germinal centers and Tfh cells'
2017 University of Colorado, Denver. School of Medicine. Invited speaker. 'Vaccine immune response evaluation. Assessing the engines of affinity maturation: germinal centers and Tfh cells'
2017 University of California, San Diego. School of Medicine. Division of Infectious Diseases. Invited speaker. 'Vaccine immune response evaluation. Assessing the engines of affinity maturation: germinal centers and Tfh cells'

2016 University of Minnesota, Microbiology and Immunology (MICaB) Program. Graduate students annual invited speaker. 'Vaccine immune response evaluation. Assessing the engines of affinity maturation: germinal centers and Tfh cells'
2016 HIV Vaccines Trials Network (HVTN) Annual Meeting. Invited Speaker. 'Immunogen immune response evaluation in NHPs and humans. Measuring the engines of affinity maturation: germinal centers and Tfh cells'
2016 LJI Inhouse Seminar Series. 'Why is it so hard to make an HIV vaccine? Immunological pitfalls to HIV neutralizing antibody responses and how Tfh cells can help'
2016 The Scripps Research Institute, Florida. Immunity and Microbial Sciences Department. Invited Speaker. 'T follicular helper cells (Tfh) and B cell responses in the context of vaccines and infections'
2016 University of Miami Miller School of Medicine, Center for AIDS Research. 'T follicular helper cells (Tfh) and B cell responses in the context of vaccines and infections'
2016 Frontiers of Retrovirology 2016. "HIV evasion of neutralizing antibodies: challenges for B cells and Tfh cells"
2016 University of Basel. Distinguished Visiting Immunologist. 'T follicular helper cells (Tfh) and B cell responses in the context of vaccines and infections'
2016 Scripps Hospital. Sylvia Bodamer Allergy and Immunology Conference.
2016 AAI Introductory Course in Immunology. 'B Cell Activation and Humoral Immunity.'
2016 ImmunologyLA 2016. Keynote speaker. 'T follicular helper cells (Tfh) and B cell responses in the context of vaccines and infections'
2016 American Association of Immunologists (AAI) Annual Meeting. Seattle. Major Symposium, Invited speaker. "Follicular helper T cells in infections and antiviral vaccines"
2016 New York University School of Medicine, Immunology Club, Invited Speaker. 'T follicular helper cells (Tfh) and B cell responses in the context of vaccines and infections'
2016 Pfizer Vaccines. Invited speaker. 'Follicular helper T cells (Tfh) and Germinal Centers in infections and antiviral vaccines'
2016 Columbia University, Institution for Cancer Genetics. 'T follicular helper cells (Tfh) and B cell responses in the context of vaccines and infections'
2016 IAVI/NIAID/BMGF Clinical Assays for Germline Targeting and Trimer Immunogens.
2016 Bill and Melinda Gates Foundation (BMGF). Conference: Path Toward Understanding Germinal Center B and T cell Dynamics to Maximize Vaccine Efficacy and Durability. "Tfh cells, germinal centers, and HIV neutralizing antibodies: Vaccine lessons from NHPs and Tfh cellular biology"
2016 Stanford Immunology Seminar Series. "Cellular and molecular biology of T follicular helper (Tfh) CD4 T cells"
2016 Scripps Research Institute (TSRI). Department of Immunology and Microbial Science. Invited speaker. "Regulation of Tfh differentiation and B cell responses in the context of vaccines and infections"
2016 Inaugural Keystone Conference on "T Follicular Helper Cells (Tfh) and Germinal Centers." **Conference Co-Organizer**, with Carola Vinuesa. Presentation: "Regulation of Tfh differentiation and B cell responses in the context of vaccines and infections"
2016 16th International Conference on Lymphocyte Activation and Immune Regulation. Theme: Application of Big Data to Human Immune Response. Invited speaker. "Deciphering the transcription factor network determining Tfh differentiation"
2016 Asilomar 55th Midwinter Immunology Conference. **Conference Co-Organizer**, with Shannon Turley. Presentation: "Regulation of human Tfh cells in the context of vaccines"

2016 UCSD Institute of Engineering in Medicine. Vaccine Engineering Center Symposium. "Regulation of T follicular helper (Tfh) CD4 T cells and B cells in the context of vaccines and infections"
2016 Scripps CHAVI-ID Investigators Retreat.

2015 UCSD Pathology Research Lecture Series (PRLS). "Regulation of T follicular helper (Tfh) CD4 T cells in the context of human vaccines and infections"
2015 Tsinghua University, Beijing. "Regulation of T follicular helper (Tfh) CD4 T cells and B cells in the context of vaccines and infections"
2015 Sixth Xiamen Winter Symposium. Invited Speaker. "Regulation of T follicular helper (Tfh) CD4 T cells in the context of vaccines and infections"
2015 American Association of Blood Banks (AABB) Annual Meeting. Invited plenary speaker. Session: Recent Advances in Mechanisms Involved in B- Cell/Antibody Regulation. "T Follicular helper (Tfh) CD4 T cells and their roles in health and disease"
2015 Massachusetts General Hospital. Immunology Seminar Series. "Molecular Regulation of Tfh Differentiation"
2015 Harvard Medical School Immunology program. Invited speaker. "Molecular Regulation of Tfh Differentiation"
2015 Ragon Institute. Seminar Speaker. "T follicular helper (Tfh) CD4 T cells and B cells in the context of HIV vaccines and infections"
2015 La Jolla Immunology Conference. Invited Speaker. "LEF-1 and TCF-1 orchestrate T follicular helper cell (Tfh) differentiation by regulating signaling circuits upstream of Bcl6"
2015 Global HIV Vaccine Enterprise. Enterprises eAccess Meeting. Webinar. Germinal Center Dynamics. "Germinal center dynamics and Ab affinity maturation for protective immunity"
2015 University of Oklahoma Health Sciences Center. The UOHSC graduate student nominated Annual Distinguished Speaker. "Regulation of T follicular helper (Tfh) CD4 T cells in the context of vaccines and infections"
2015 NIH Germinal Center Dynamics and Antibody Affinity Maturation for Protective Immunity. Closed NIH consultation workshop. Session 2 Co-Chair. Session 2 speaker. Session 3 speaker.
2015 St. Jude's Childrens Hospital. Immunology Seminar Series. Invited speaker. "T Follicular helper cells (Tfh) and antibody responses in health and disease"
2015 AAI Introductory Course in Immunology. "B Cell Activation and Humoral Immunity."
2015 University of Utah. Microbiology and Immunology Invited Speaker. "How does Bcl6 control Tfh biology?"
2015 AAI Annual Meeting. Workshop speaker, and Session Chair. "BCL6 orchestrates Tfh cell differentiation via multiple distinct mechanisms"
2015 joint Keystone Symposia on HIV Vaccines/The Golden Anniversary of B Cells**.** Invited Joint session speaker. "B/T Cell Interactions" Session Chair. "T Cell Help to B Cells: Follicular Helper CD4 T Cell (Tfh) Biology"
2015 Novel Immunotherapeutics Summit. Joint 3 conference Plenary speaker. "Follicular helper T cells (Tfh) and antibody responses in health and disease"
2015 Asilomar Midwinter Immunology Conference. Invited speaker. "How does Bcl6 control Tfh biology?"

2014 Babraham Institute, Cambridge. Immunology Seminar series invited speaker. "Designing vaccines: Genetics of T follicular helper cells (Tfh)"
2014 Cancer UK, London Research Unit. Invited Speaker. "Genetics of Tfh Differentiation"
2014 Royal Society Discussion Meeting. *Biological challenges to effective vaccines in the developing world.* Invited international lecturer. "Designing vaccines: The importance of Tfh cells, and how to find them"
2014 UC Berkeley. Molecular and Cell Biology Department. Invited Speaker. "Designing vaccines: Differentiation and regulation of follicular helper CD4 T cells"
2014 UCSF Immunology Program. Invited Speaker. "Genetics of Tfh Differentiation"
2014 UCSD, Department of Medicine. Pulmonary & Critical Care. Grands Rounds. "Tfh cells: The source of T cell help to B cells. Critical players in protective immunity, and autoimmunity"
2014 Seattle Biomedical Research Institute. "Designing vaccines: Differentiation and regulation of follicular helper CD4 T cells"
2014 International Immunological Memory and Vaccine Forum (IIMVF). "Genetics of Tfh cells"
2014 Scripps Hospital. Sylvia Bodamer Allergy and Immunology Conference. "Tfh cells: The source of T cell help to B cells. Critical players in protective immunity, and probably in allergies"
2014 AAI Introductory Course in Immunology. "B Cell Activation and Humoral Immunity."
2014 FASEB Biology of the Immune System. Session Chair.
2014 FOCIS. Invited Speaker. Germinal centers and autoimmunity. "Differentiation and function of follicular helper T cells (Tfh)"
2014 NIH Glycoimmunology Workshop. Session Chair.
2014 Stanford Medical School. "Differentiation and function of follicular helper T cells"

2014 U. Pittsburgh, Immunology Department and Richard King Mellon Foundation Institute. 2014 Pittsburgh Immunology Symposium. "Genetics of Tfh differentiation"
2014 NIH DAIDS "B Cell Help in HIV Vaccine Strategies Think Tank". Session Chair and speaker.
2014 Cincinnati Children's Hospital Research Foundation. Invited Lecture. "Designing vaccines: Differentiation and regulation of follicular helper CD4 T cells"
2014 UAB Medical School. Inaugural John Volanakis Immunology Lecturer, Graduate Student invited lecturer. "Genetics of Tfh differentiation"
2014 Keystone Symposium. HIV Vaccines: Adaptive Immunity and Beyond. Invited speaker. "Human follicular helper CD4 T cells and Tfh memory"
2014 Keystone Symposium. Biology of B cell responses. Invited Speaker. "Genetics of Tfh Differentiation"
2014 NIH NIAID DAIDS Tfh Working Group Webinar
2014 AAAAI, invited speaker. "Differentiation of follicular helper CD4 T cells"
2014 USC Medical School. Invited speaker. "Designing vaccines: Differentiation and regulation of follicular helper CD4 T cells"

2013 UCSD CFAR Immunology. ""Follicular helper CD4 T cells (Tfh) in vaccines and HIV infections"
2013 La Jolla Immunology Conference. Invited speaker. "Designing vaccines: Differentiation and regulation of follicular helper CD4 T cells"
2013 International Cytokine Society Annual Conference. Invited Speaker. "Designing vaccines: Differentiation and regulation of follicular helper CD4 T cells"
2013 University of Pennsylvania, Immunology program. Invited speaker. "Designing vaccines: Differentiation and regulation of follicular helper CD4 T cells"
2013 Memorial Sloan-Kettering and Cornell Medical College, Immunology and Microbial Pathogenesis Program Research Seminar Series, Invited speaker. "Designing vaccines: Differentiation and regulation of follicular helper CD4 T cells"
2013 Gordon Conference on T Follicular Helper Cells (Tfh), Hong Kong. Invited Speaker. "Designing vaccines: Differentiation and regulation of follicular helper CD4 T cells"
2013 FASEB Molecular Mechanisms of Immune Cell Differentiation and Function. Invited Speaker. "Regulating the T follicular helper fate decision"
2013 AAI Annual Conference. "Human circulating memory Tfh cells correlate with the capacity to make a broadly neutralizing HIV antibody response"
2013 Cold Spring Harbor Symposium. Immunity and Tolerance. Invited Speaker. "Designing vaccines: Differentiation and regulation of follicular helper CD4 T cells"
2013 U. Washington. Immunology Seminar series. "Differentiation and function of follicular helper CD4 T cells (Tfh)"
2013 Keystone Symposium. HIV Vaccines. Invited speaker. Plenary session. "Human blood Tfh cells"
2013 KHK, Tokyo. "Follicular helper CD4 T cells (Tfh): A new type of CD4 T cell critical for antibody responses both for good vaccines and bad autoimmune diseases"
2013 Tokyo University. Tokyo Immunology Club for Young Dermatologists. "Follicular helper CD4 T cells (Tfh): A new type of CD4 T cell critical for antibody responses both for good vaccines and bad autoimmune diseases"
2013 UCSD Cellular and Molecular Medicine Seminar Series. Invited speaker. "Designing vaccines: Differentiation and regulation of follicular helper CD4 T cells"
2013 Keystone Symposium. Type 2 Immunity. Invited plenary speaker. "The Relationship between Th2 and Tfh Cells: Defining Characteristics of Tfh Cell Differentiation and Function"

2012 Immunological Mechanisms of Vaccination. Keystone Symposium. Invited plenary speaker. "Tfh Cells: Providing T Cell Help for B Cell Responses"
2012 M.D. Anderson. Invited speaker. "Designing vaccines: Follicular helper CD4 T cells (Tfh cells) and SAP"
2012 Washington University. Invited speaker. "Designing vaccines: Follicular helper CD4 T cells (Tfh cells) and SAP"
2012 Emory Vaccine Center. "Differentiation and function of follicular helper CD4 T cells (Tfh)"
2012 Vaccine and Gene Therapy Institute (VGTI). "Designing vaccines: Follicular helper CD4 T cells and SAP"
2012 U. Michigan Immunology program. Invited speaker. "Differentiation and function of follicular helper CD4 T cells (Tfh)"
2012 NIH Immunobiology Seminar Series. Invited speaker. "Designing vaccines: Follicular helper CD4 T cells and SAP"
2012 *Harnessing CD4 T cell responses in HIV Vaccine Development* . Conference Organizer. Session chair. Speaker.
2012 AAI Annual Conference. Award lecture. American Association of Immunologists BD Biosciences Investigator Award. For outstanding, early-career research contributions to the field of Immunology. "Designing vaccines: Follicular helper CD4 T cells and SAP"
2012 Yale Immunobiology invited speaker. "Designing vaccines: Follicular helper CD4 T cells and SAP"
2012 John Hopkins University, Immunology program. Graduate Student Invited speaker. "Designing vaccines: Differentiation and function of follicular helper CD4 T cells"
2012 San Diego Microbiology Forum. "Designing vaccines: Differentiation and function of follicular helper CD4 T cells"

2012 Keystone Viral Immunity / HIV Vaccines Conferences. Joint Plenary speaker. "Designing vaccines: Differentiation and function of follicular helper CD4 T cells"
2012 U. Chicago. Graduate Student Annual Invited speaker. "Differentiation and function of follicular helper (Tfh) CD4 T cells"
2012 RIKEN Center for Allergy and Immunology (RCAI) – LIAI joint conference. "SAP and follicular helper CD4 T cells."
2012 14th International Conference on Lymphocyte Activation and Immune Regulation. Invited speaker. "Differentiation and function of follicular helper (Tfh) CD4 T cells"

2011 40th Japanese Society of Immunologists (JSI) Annual Conference. International Invited speaker. "Differentiation and function of follicular helper CD4 T cells"
2011 Scripps Research Institute. Immunology and Microbial Science Affinity Group, Invited speaker. "Designing vaccines: Differentiation and function of follicular helper CD4 T cells"
2011 Genomics Novartis Foundation Institute. "Designing vaccines: Differentiation and function of follicular helper CD4 T cells"
2011 NIH Division of AIDS Research. "Designing vaccines: Differentiation and function of follicular helper CD4 T cells"
2011 MedImmune, Maryland campus. Invited speaker. "Designing vaccines: Differentiation and function of follicular helper CD4 T cells"
2011 Garvan Institute of Medical Research. Sydney, Australia. Australian Society of Immunology visiting speaker. "Differentiation and function of follicular helper CD4 T cells"
2011 Australian National University. Australian Society of Immunology visiting speaker. "Differentiation and function of follicular helper CD4 T cells"
2011 University of Melbourne. Australian Society of Immunology visiting speaker. ""Differentiation and function of follicular helper CD4 T cells"
2011 Annual Meeting of the Immunology Group of Victoria, Australia. Keynote speaker. "Designing vaccines: Differentiation and function of follicular helper CD4 T cells"
2011 International DNA Vaccines Conference. Invited speaker. "Designing vaccines: Differentiation and function of follicular helper CD4 T cells"
2011 OSA Molecular Biology Seminar
2011 U. Iowa. Immunology Graduate Program. Graduate student Invited Speaker. "Follicular helper CD4 T cell differentiation and the development of protective antibody responses"
2011 UT Southwestern. Invited speaker. "Follicular helper CD4 T cell differentiation and the development of protective antibody responses"
2011 Wake Forest University Center for Bioethics, Health and Society. ""The David Baltimore Affair: Lessons on Scientific Conduct"
2011 Wake Forest University School of Medicine. Immunology Graduate Program. Graduate student Invited Speaker. "Follicular helper CD4 T cell differentiation and the development of protective antibody responses"
2011 MedImmune. Palo Alto campus. Invited speaker. "Designing vaccines: Differentiation and function of follicular helper CD4 T cells"
2011 Genentech. Invited speaker. "Follicular helper CD4 T cell differentiation and the development of protective antibody responses"
2011 UCSF Immunology. Invited speaker. "Follicular helper CD4 T cell differentiation and the development of protective antibody responses"
2011 Univ. of Toronto, Dept of Immunology. Invited speaker. "Designing vaccines: Differentiation and function of follicular helper CD4 T cells"
2011 Massachusetts General Hospital. Invited speaker. "Follicular helper CD4 T cell differentiation and the development of protective antibody responses"
2011 Harvard Medical School. Invited speaker. "Follicular helper CD4 T cell differentiation and the development of protective antibody responses"
2011 Univ. of Rochester, Dept. of Microbiology and Immunology. Invited Speaker. "Follicular helper CD4 T cell differentiation and function"

2010 Univ. of Massachusetts Medical School. Invited speaker. "Follicular helper CD4 T cell differentiation and the development of protective antibody responses"
2010 National Institutes of Health (NIH) T3 Symposium on T Cell Differentiation: Stability and Plasticity. Invited Speaker. "Follicular Helper CD4 T cell (Tfh) differentiation and function"
2010 Keystone Gates Vaccine Conference. Invited Speaker. "Follicular helper CD4 T cell differentiation and the development of protective antibody responses"
2010 Keystone Gates Vaccine Conference. Pre-meeting workshop Invited Speaker. "Human B cell responses"

2010 UC San Diego School of Medicine. Invited Speaker. "Understanding follicular helper CD4 T cells and antibody responses: From mice to tonsils to vaccines"
2010 Cancer Research Institute (CRI) Annual Symposium. Invited Speaker. "Follicular Helper CD4 T cell (Tfh) differentiation and function"
2010 U. Penn Medical School. Invited speaker. "Follicular helper CD4 T cell differentiation and the development of protective antibody responses"
2010 Chiba University, Japan. Invited speaker. "Follicular helper CD4 T cell differentiation and the development of protective antibody responses"
2010 FASEB "Biology of the Immune System". Invited speaker. "Follicular Helper CD4 T cell (Tfh) differentiation and function"
2010. MASIR, European Immunology conference. Invited speaker. "Follicular Helper CD4 T cell (Tfh) differentiation"
2010 UCLA David Geffen School of Medicine. Invited speaker. "Follicular Helper CD4 T cell (Tfh) differentiation and function"
2010 American Association of Immunologists (AAI). Invited speaker, Major Symposium. "Follicular Helper CD4 T cell (Tfh) differentiation and function"
2010 NIH Vaccine Research Institute (VRC). invited speaker. "Follicular Helper CD4 T cell (Tfh) differentiation and function"
2010 U. Vermont Medical School. Invited speaker. "Follicular Helper CD4 T cell (Tfh) differentiation and function"
2010 Keystone Symposium. Viral Immunology. Invited Speaker. "What have we learned from the smallpox vaccine?"
2010 French American Biotechnology Symposium. Vaccines session chairman.
2010 Clinical Vaccinology Course. National Foundation for Infectious Diseases (NFID). "How Vaccines Work"
2010 IAVI HIV Neutralizing Antibody Consortium (NAC) Brainstorming conference.
2010 Keystone Symposium. Lymphocyte Activation. Poster: "SLAM and SAP are required for IL-4 production by germinal center CD4 T cells."
2010 Asilomar Midwinter Immunology Conference. Invited Speaker. "Understanding T cell help to B cells in the context of vaccines"

2009 UC Riverside. "The famous Baltimore Affair. Lessons on Scientific Conduct."
2009 La Jolla Immunology Conference "Follicular helper CD4 T cell differentiation and function."
2009 Cold Spring Harbor Symposium on Harnessing Immunity. Invited Speaker. "Understanding the immunobiology of the smallpox vaccine"
2009 American Society for Virology, Invited Speaker. "State-of-the-Art" lecture. "Understanding the immunobiology of the smallpox vaccine"
2009 Clinical Vaccinology Course. National Foundation for Infectious Diseases. "Vaccine Immunology"
2009 Pew Scholars Annual Meeting. "Understanding the immunobiology of the smallpox vaccine"
2009 University of Pittsburgh, "Understanding the immunobiology of the smallpox vaccine."
2009 Keystone Symposium. B cell. in Context. "Understanding the immunobiology of the smallpox vaccine"
2009 UC Davis. "Understanding the immunobiology of the smallpox vaccine"

2008 Scripps Research Institute. "Understanding the immunobiology of the smallpox vaccine"
2008 Indiana University. "Immunity induced by vaccinia: Understanding how vaccines work"
2008 IAVI. "Immunity induced by vaccinia: Understanding how vaccines work"
2008 American Society for Virology (ASV) Annual Meeting. "Immunity induced by vaccinia: Understanding how vaccines work"
2008 International Poxvirus Mtg, Germany. "Immunity induced by vaccinia: Understanding how vaccines work"
2008 Keystone Symposium. Viral Immunology. "Immunity induced by vaccinia: Understanding how vaccines work"

2007 19th Antibody Engineering Conference. "Long term antibody responses to Vaccines and Viral Infections"
2007 Simon Frasier University. Dept. of Molecular Biology. "Understanding long-term B cell memory and antibody responses to smallpox"
2007 American Society for Virology (ASV) Annual Meeting. "Deterministic linkage between CD4 T cell and antibody specificities to a large viral pathogen"
2007 AAI Annual Meeting (session Chair). "Deterministic linkage between CD4 T cell and antibody specificities to a large viral pathogen"
2007 Loma Linda University Medical Center. "Understanding long-term B cell memory and antibody responses to infectious diseases"
2007 UC Irvine Center for Immunology. "Understanding long-term B cell memory and antibody responses to infectious diseases"
2007 Keystone Symposium. Immunological Memory. "Deterministic linkage between CD4 T cell and antibody specificities to a large viral pathogen"

2006 University of Washington, Seattle. Dept. of Immunology. "Understanding long-term B cell memory and antibody responses to infectious diseases"
2006 FASEB Lymphocytes and Antibodies. "Understanding long-term B cell memory and antibody responses to infectious diseases"
2006 Keystone Symposium. AIDS Vaccines. Plenary Session speaker. "Understanding long-term B cell memory and antibody responses to infectious diseases"
2006 Pew Scholars Meeting. "Understanding long-term B cell memory and antibody responses to infectious diseases"
2006 Keystone Symposium. Lymphocyte Activation. "SAP regulation of follicular helper CD4 T cell development is independent of SLAM and Fyn kinase"
2006 Keystone Symposium. Host Resistance. "SAP deficiency triggers CD8-mediated immunopathology and hypogammaglobulinemia in a non-herpes virus chronic infection"

2005 NIH Twinbrook. "Understanding long-term B cell memory and antibody responses to infectious diseases"
2005 Karolinska Institute Nobel Forum. "Maintenance of long-term immunity in man"
2005 La Jolla Immunology Conference. "SAP regulation of follicular helper CD4 T cell development is independent of SLAM and Fyn kinase"
2005 UCSD Rheumatic Disease Center. "Understanding long-term B cell memory and antibody responses to infectious diseases"
2005 American Society for Virology (ASV) Annual Meeting. "SAP deficiency leads to an inability to control a chronic viral infection"
2005 From Innate Immunity to Vaccines Conference. "Understanding long term humoral immune responses to infectious diseases in humans"
2005 University of California, Irvine. Center for Virus Research Seminar. "Understanding long term humoral immune responses to infectious diseases"
2005 Vical. "Long term B cell memory in humans after smallpox vaccination"
2005 Keystone Symposium. B Cell Function. "Long term B cell memory in humans after smallpox vaccination"
2005 RIKEN Institute for Allergy and Immunology, Yokohama, Japan. "Understanding long term humoral immune responses to infectious diseases"

2004 La Jolla Immunology Conference. "The role of SAP in the generation of long term humoral immunity"
2004 The Scripps Research Institute. Immunology Seminar Series. "Long term humoral immunity to infectious diseases"
2004 American Society for Microbiology, Biodefense Research Meeting. "Long term B cell memory in humans after smallpox vaccination"
2004 Keystone Symposium. Bioterrorism and Emerging Infectious Diseases. "Long term B cell memory in humans after smallpox vaccination"

2003 CDC. "Quantifying anthrax-specific memory B cells elicited by vaccination."
2003 Yale University School of Medicine. Molecular Virology and Immunology Seminar. "Antiviral humoral immunity"
2003 Washington University School of Medicine. Division of Infectious Diseases Seminar. "Long term humoral immunity to infectious disease: from SAP to smallpox."
2003 Yale University School of Medicine. Immunobiology Seminar. "Long term humoral immunity to infectious disease."
2003 Rockefeller University. "Long term humoral immunity to infectious disease."
2003 Johns Hopkins University School of Medicine. Institute for Cell Engineering Seminar. "Long term humoral immunity to infectious disease."
2003 Harvard Medical School. Department of Microbiology Special Seminar. "Long term humoral immunity to infectious disease."
2003 Keystone Symposium. B cells and antibodies. "SAP is required to generate long-term humoral immunity"
2003 La Jolla Institute of Allergy and Immunology. "Long term humoral immunity to infectious disease."

SERVICE AND TEACHING

SERVICE

2004-2007	LIAI Annual Report faculty liaison
2005-2010	LIAI Institutional Review Board (IRB) Vice Chair.
2007	NIH NIAID Special Emphasis Panel Study Section
2008	NIH NIAID IHD Immunity and Host Defense Study Section, ad hoc reviewer

2008 NIH NIAID Special Emphasis Panel Study Section
2008 NIH NIAID IHD Immunity and Host Defense Study Section, ad hoc reviewer
2009 NIH NIAID IHD Immunity and Host Defense Study Section, ad hoc reviewer
2009 NIH NIAID IHD Immunity and Host Defense Study Section, ad hoc reviewer
2012-2015 AAI Program Committee
2013 AAI 100th Anniversary Annual Meeting, Block Symposium chair
2010-2014 NIH NIAID IHD Immunity and Host Defense Study Section. Standing Member
2014 American Association of Immunology (AAI) Introductory Course. Lecturer.
2015 American Association of Immunology (AAI) Introductory Course. Lecturer.
2015 American Association of Blood Banks (AABB) Annual Meeting, Educational Lecture.
2015-2016 LJI Senior faculty recruitment committee
2016 Asilomar Midwinter Immunology Conference. Conference Co-Organizer, with Shannon Turley.
2016 Inaugural Keystone Conference on T Follicular Helper Cells (Tfh) and Germinal Centers. Co-Organizer.
2016 American Association of Immunology (AAI) Introductory Course. Lecturer.
2016 NIH NIAID IMVC Opportunity Fund Review Panel
2017 UCSD BMS PhD Program Interview Day
2017 American Association of Immunology (AAI) Introductory Course. Lecturer.
2017 NIH NIAID ZRG1 IMM Study Section
2017-2018 LJI Faculty Search Committee
2018 External tenure review committee member, Harvard University.
2018 UCSD BMS PhD Program Interview Day
2018 NIH NIAID ZRG Special Emphasis Panel, Study Section reviewer
2018 External PhD thesis examiner. 'Lara' Omolara Olujimi Baiyegunhi, Doctor of Philosophy in Immunology. Nelson R Mandela School of Medicine University, KwaZulu-Natal.
2018 External evaluator for tenure review, University of Pennsylvania School of Medicine.
2018 External evaluator for tenure review, University of Michigan School of Medicine.
2018 Gates Foundation / Page Foundation, vaccine research grant reviewer.
2017-present Human Vaccines Project Leadership Group
2018-2019 Michelson Prize Selection Committee
2019 NIH Director's New Innovator Award (DP2) , Distinguished Editor/Reviewer Study Section Panel
2019 UCSD BMS PhD Program Interview Day 1
2019 UCSD BMS PhD Program Interview Day 2
2019 Keystone Symposia meeting on B Cell-T Cell Interactions. Meet the Scientist mentorship Workshop
2019 LJI Grant mentorship panel. Shresta
2019 LJI Grant mentorship panel. Herra.
2019 External Evaluator for tenure review, NIH NIAID
2019 LJI Faculty search committee on autoimmunity and inflammation
2019 NIH NIAID DAIDS AIDS Vaccine Research Section (AVRS) Advisory Committee (September)
2019- Dr. Isabel Newton, Assistant Professor, VA. Mentor.
2020 External Evaluator for faculty tenure review, U Penn
2020 External Evaluator for faculty promotion review, a top research institution
2020 NIH NIAID Immunity and Host Defense Study Section, ad hoc reviewer
2021- T32 Advisory board, CHARM UCSD.

2003-present LIAI/LJI Public Relations faculty liaison
2006-present LIAI/LJI Normal Human Blood Donor Program (NBDP) founder and faculty liaison
2009-present IEDB Advisory council
2011-present UCSD Moores Cancer Center. Member
2017-present UCSD/LJI Asthma Center. Scientific Advisory Council
2020-present The American Association of Immunologists Nominating Committee

TEACHING

1994	MIT Biology. Developer. The MIT Biology Hypertextbook (www.mit.edu:8001/afs/athena/course/other/esgbio/www/7001main.html)
1998	UCSF School of Medicine, teaching assistant. "Molecular Biology"
2007	Houten Thesis Committee, Simon Fraser University
2009	UCSD ICD 140 Lecture
2010	UCSD BMS Minor prop committee
2010	UCSD BMS Minor prop committee
2010	UCSD Immunology course (BICD 140)
2010	UMass Medical School Thesis Defense. External Reviewer. Mina Seedhom, Welsh Lab
2006-2011	PhD Thesis Advisor. Robert Johnston, graduate student, UCSD BMS program
2010-2011	UCSD Biology, Immunology faculty search committee
2010-2012	PhD Thesis Advisor. Tania Escobar. UCSD BMS program
2008-2012	Thesis Committee. Laura Ruff. UCSD BMS program
2009-2012	Thesis Committee. Amanda Herman. UCSD BMS program
2009-2012	Thesis Committee. Amanda Herman. UCSD BMS program
2011	UCSD BMS Minor Prop Committee
2011	UCSD Advanced Animal Virology Course (BGGN226)
2008-2012	Thesis Committee. Cliff Yang. UCSD Biology program
2010-2012	Thesis Committee. Timothy O'Sullivan. UCSD BMS Program
2008-2012	Thesis Committee. Adam Best. UCSD BMS program
2010-	Thesis Committee. Gavin Lewis. UCSD BMS program
2012-2017	Thesis Committee. Laura Shaw. UCSD BMS Program
2010-2013	Thesis Committee. Tamara Bhandari. UCSD BMS program
2012	UCSD Advanced Animal Virology Course (BGGN226)
2012	UCSD Immunology course (BICD 140)
2012	UCSD Graduate BIO200 course. Microbes Module.
2013	UCSD Immunology course (BICD 140)
2013	UCSD Advanced Animal Virology Course (BGGN226)
2013	External Thesis Reviewer, PhD Thesis Defense, Scripps Research Institute, Joe Jardine
2013	UCSD Graduate BIO200 course. Microbes Module.
2014	AAI Introductory Course in Immunology
2014	UCSD Advanced Animal Virology Course (BGGN226)
2014	UCSD Graduate BIOM 200 course. Microbial Threats and Immune Defenses Module.
2015	UCSD Advanced Animal Virology Course (BGGN226)
2015	UCSD Immunology course (BICD 140)
2015	MD/PhD UCSD Rotation Student. Bethany Fixsen
2015	UCSD Graduate BIOM 200 course. Microbial Threats and Immune Defenses Module.
2015	UCSD BMS Rotation Student. Jacob Wozniak
2016	UCSD Immunology course (BICD 140)
2016	UCSD Advanced Animal Virology Course (BGGN226)
2016	Carmel Valley Middle School. 7th grade science. "The Immune System and Vaccines"
2016	UCSD Graduate BIOM 200 course. Immune Defenses Module.
2016	AAI Introductory Course in Immunology
2016	UCSD Immunology Course (BICD 140)
2017	Immunology Graduate course (BGGN225)
2017	2017 AAI Introductory Course in Immunology
2017	UCSD BMS Rotation student. Aaron Oom
2017	UCSD BMS Minor Prop Committee. Aaron Oom
2018	Pfizer Immunology Course
2018	Immunology Graduate course (BGGN225)
2018	2018 AAI Introductory Course in Immunology
2017-	UCSD PhD Thesis Committee. Aaron Oom
2018	UCSD BMS Rotation student. Ivy Phung

2019 Immunology Graduate course (BGGN225)
2019 External Thesis Reviewer, PhD Thesis Defense, Scripps Research Institute, Bartosz Nogal
2019- UCSD BMS PhD Thesis student. Ivy Phung
2019 UCSD BMS Rotation student. Sonya Haupt
2020 UCSD BGGN225 Graduate Immunology
2020- UCSD BMS PhD Thesis student. Sonya Haupt
2016- Biomedical Sciences Graduate Program, Immunology Track Chair, LJI
2021 UCSD BDDN225 Graduate Immunology
2021 AAI Introductory Course in Immunology
2021 UCSD BMS Rotation student. Hannah Pettit
2021 UCSD BMS PhD Program Interview day
2021 UCSD Biology Rotation student. Brian Stack
2022 UCSD Medical School Intefectious Diseases Core Lecture. "B Cell Memory to Infectious Diseases".

PEER REVIEW

2012-2014, Associate Editor, Journal of Immunology
2014-2016, Associate Editor, Journal of Immunology

Ad Hoc Reviewer

Nature, Science, Cell, New England Journal of Medicine, Nature Medicine, Immunity, Nature Immunology, Science Translational Medicine, Science Immunology, Cell Reports, Journal of Experimental Medicine (JEM), Nature Communications, Journal of Clinical Investigation (JCI), Proceedings of the National Academy of Sciences (PNAS), The Lancet, Journal of Immunology, Journal of Virology, Nature Reviews Immunology, Vaccine, eLife, European J. Immunology, and others

PROFESSIONAL SOCIETY MEMBERSHIPS

American Association of Immunologists (Full member 2004-now)
American Society for Virology (Full member 2005-)
American Society for Microbiology (2002-now)
American Association for the Advancement of Science (AAAS) (1996-now)

TRAINEES NOW IN ACADEMIA

1. Prof. Mohammed Rafii-El-Idrissi Benhnia, PhD. Professor, Dept of Medical Biochemistry and Immunology. School of Medicine, University of Seville
2. Laurel Monticelli, PhD. Instructor, Columbia University
3. Prof. Youn Soo Choi, PhD. Associate Professor, Seoul National University, School of Medicine
4. Prof. Michela Locci, PhD. Assistant Professor, University of Pennsylvania, Medical School. Department of Microbiology and Immunology.
5. Prof. Jennifer Dan, MD/PhD. Assistant Professor, UCSD School of Medicine.
6. Robert Abbott, PhD. NIH K99/R00 recipient
7. Prof. Jinyong Choi, PhD. Assistant Professor, The Catholic University of Korea, College of Medicine, Department of Microbiology
8. Prof. Robert Abbott, PhD. Assistant Professor, University of Texas, Medical Branch (UTMB) Galveston.

COMMITMENT TO DIVERSITY

The Crotty lab is committed to a diverse and equitable work environment. An academic lab is a training and educational environment, as well as a workplace. The Crotty lab puts a high priority on diverse recruitment. A high proportion of all Crotty lab postdoctoral fellows and graduate students over time have been female, and great time and effort is spent on career development for each lab member. Underrepresented minorities have been key members of the Crotty lab. Our high impact 2019 *Cell* paper "Slow Delivery Immunization Enhances HIV Neutralizing Antibody and Germinal Center Responses via Modulation of Immunodominance" was led by an underrepresented minority postdoctoral fellow, and the lab currently has multiple underrepresented minority lab members. Dr. Sydney Ramirez, MD/PhD, is another lab URM trainee who has been exceptionally successful. She is co-1st author on our

high impact COVID-19 2021 *Science* paper "Immunological memory to SARS-CoV-2 assessed for up to eight months after infection", which was covered by the New York Times and other major media outlets. Dr. Ramirez has also co-authored other COVID-19 immunology papers in *Cell* and *Science* in the past year, and has recently been awarded a prestigious Giannini Fellowship.

We have had female scientists from Africa visit our lab for training on two separate occasions, to learn T and B cell techniques. URM Crotty lab technicians have received extensive training and mentoring during their time in the lab and have gone on to excellent jobs in pharma or to a top business school MBA program. The central scientific goal of the lab is to improve vaccine development worldwide, because vaccines have the incredible ability to help out communities that are most in need. The Crotty lab was founded to work on vaccines because of their enormous importance to health worldwide. Our priorities fully align with the longstanding Gates Foundation mantra "All lives have equal value," which leads to an obvious prioritization of vaccine development as one of the most impactful scientific research endeavors for health equity worldwide.