

BIOGRAPHICAL SKETCH

NAME: ZURAWSKI, GERARD

POSITION TITLE: Director

EDUCATION/TRAINING

University of Sydney, Sydney, N.S.W.	BS	12/1972	Microbiology
University of Sydney, Sydney, N.S.W.	PHD	12/1976	Genetics
Stanford University, Stanford, California	Postdoctoral Fellow	12/1979	Charles Yanofsky Laboratory
Commonwealth Scientific and Industrial Research Organization, Canberra, A.C.T.	Fellow	12/1982	Division of Plant Industry

A. Personal Statement

I have been an Investigator at the Baylor Institute for Immunology Research (BIIR) since 2004 and am currently a BIIR Co-Director and Director for the BIIR Center for Biotechnology. I trained as a bacterial geneticist and received my Ph.D. from the Sydney University in Australia and trained in Molecular Biology at Stanford University, California and the C.S.I.R.O., Canberra. I am an expert in Molecular Biology and Protein Engineering, specializing in the immune system. Most particularly, in 21 years of work at the DNAX Research Institute, I identified and characterized cytokines and their receptor interactions, including IL-13, and IL-25. I directed the DNAX Genomics Division that was immensely successful in mining expressed sequence tag data for cytokine and cytokine receptor discovery and subsequent biological characterizations. At BIIR, I have led a vaccine-development program based on targeting antigens directly to human dendritic cells using antibody-antigen conjugates. Currently, with this platform technology our BIIR team and outside collaborators have successfully tested in human in vitro systems, as well as in mouse and monkey in vivo studies, novel vaccines against influenza, cancers, HIV, HCV, COVID-19 and HPV. Vaccines based on these studies are now in clinical development for HIV-1 therapeutic and prophylactic applications, COVID-19 and for treatment on HPV-based cancers of the mucosa.

B. Positions and Employment

1982 - 1986	Research Scientist, DNAX Research Institute, Palo Alto, CA
1987 - 1989	Senior Scientist, DNAX Research Institute, Palo Alto, CA
1990 - 1994	Associate Director, DNAX Research Institute, Palo Alto, CA
1995 - 2003	Senior Director, DNAX Research Institute, Palo Alto, CA
2004 -	Investigator, Baylor Institute for Immunology Research, Dallas, TX
2005 -	Adjunct Professor, Baylor University, Waco, TX
2012 -	Director Center for Biotechnology, Baylor Institute for Immunology Research, Dallas, TX
2014 -	Co-Director and currently Director, Baylor Institute for Immunology Research, Dallas, TX

Other Experience and Professional Memberships

C. Contribution to Science

1. Described mechanisms of translational control of bacterial operon transcription.

- a. Zurawski G, Brown K, Killingly D, Yanofsky C. Nucleotide sequence of the leader region of the phenylalanine operon of Escherichia coli. Proc Natl Acad Sci U S A. 1978 Sep;75(9):4271-5. PubMed PMID: 360214; PubMed Central PMCID: PMC336095.

- b. Stauffer GV, Zurawski G, Yanofsky C. Single base-pair alterations in the Escherichia coli trp operon leader region that relieve transcription termination at the trp attenuator. Proc Natl Acad Sci U S A. 1978 Oct;75(10):4833-7. PubMed PMID: 368800; PubMed Central PMCID: PMC336215.
 - c. Zurawski G, Elseviers D, Stauffer GV, Yanofsky C. Translational control of transcription termination at the attenuator of the Escherichia coli tryptophan operon. Proc Natl Acad Sci U S A. 1978 Dec;75(12):5988-92. PubMed PMID: 366606; PubMed Central PMCID: PMC393102.
 - d. Oxender DL, Zurawski G, Yanofsky C. Attenuation in the Escherichia coli tryptophan operon: role of RNA secondary structure involving the tryptophan codon region. Proc Natl Acad Sci U S A. 1979 Nov;76(11):5524-8. PubMed PMID: 118451; PubMed Central PMCID: PMC411681.
 2. **Studies the structure of chloroplast genes and exploited their sequence differences between species to establish a genomic basis for determining plant phylogeny.**
 - a. Zurawski G, Perrot B, Bottomley W, Whitfield PR. The structure of the gene for the large subunit of ribulose 1,5-bisphosphate carboxylase from spinach chloroplast DNA. Nucleic Acids Res. 1981 Jul 24;9(14):3251-70. PubMed PMID: 6269077; PubMed Central PMCID: PMC327350.
 - b. Zurawski G, Bottomley W, Whitfield PR. Structures of the genes for the beta and epsilon subunits of spinach chloroplast ATPase indicate a dicistronic mRNA and an overlapping translation stop/start signal. Proc Natl Acad Sci U S A. 1982 Oct;79(20):6260-4. PubMed PMID: 16593238; PubMed Central PMCID: PMC347100.
 - c. Zurawski G, Clegg MT, Brown AH. The Nature of Nucleotide Sequence Divergence between Barley and Maize Chloroplast DNA. Genetics. 1984 Apr;106(4):735-49. PubMed PMID: 17246206; PubMed Central PMCID: PMC1202303.
 - d. Golenberg EM, Giannasi DE, Clegg MT, Smiley CJ, Durbin M, Henderson D, Zurawski G. Chloroplast DNA sequence from a miocene Magnolia species. Nature. 1990 Apr 12;344(6267):656-8. PubMed PMID: 2325772.
 3. **Characterized fine details of IL-2 interaction with IL-2R.**
 - a. Zurawski SM, Imler JL, Zurawski G. Partial agonist/antagonist mouse interleukin-2 proteins indicate that a third component of the receptor complex functions in signal transduction. EMBO J. 1990 Dec;9(12):3899-905. PubMed PMID: 2249656; PubMed Central PMCID: PMC552160.
 - b. Imler JL, Zurawski G. Receptor binding and internalization of mouse interleukin-2 derivatives that are partial agonists. J Biol Chem. 1992 Jul 5;267(19):13185-90. PubMed PMID: 1618822.
 - c. Zurawski SM, Zurawski G. Receptor antagonist and selective agonist derivatives of mouse interleukin-2. EMBO J. 1992 Nov;11(11):3905-10. PubMed PMID: 1396584; PubMed Central PMCID: PMC556900.
 - d. Zurawski SM, Vega F Jr, Doyle EL, Huyghe B, Flaherty K, McKay DB, Zurawski G. Definition and spatial location of mouse interleukin-2 residues that interact with its heterotrimeric receptor. EMBO J. 1993 Dec 15;12(13):5113-9. PubMed PMID: 8262055; PubMed Central PMCID: PMC413773.
 4. **Discovered IL-13 and IL-13R composition and directed the DNAX Research Institute cytokine and cytokine discovery effort through genomic applications.**
 - a. McKenzie AN, Culpepper JA, de Waal Malefyt R, Brière F, Punnonen J, Aversa G, Sato A, Dang W, Cocks BG, Menon S. Interleukin 13, a T-cell-derived cytokine that regulates human monocyte and B-cell function. Proc Natl Acad Sci U S A. 1993 Apr 15;90(8):3735-9. PubMed PMID: 8097324; PubMed Central PMCID: PMC46376.
 - b. Zurawski SM, Chomarat P, Djossou O, Bidaud C, McKenzie AN, Miossec P, Banchereau J, Zurawski G. The primary binding subunit of the human interleukin-4 receptor is also a component of the interleukin-13 receptor. J Biol Chem. 1995 Jun 9;270(23):13869-78. PubMed PMID: 7775445.
 - c. Fort MM, Cheung J, Yen D, Li J, Zurawski SM, Lo S, Menon S, Clifford T, Hunte B, Lesley R, Muchamuel T, Hurst SD, Zurawski G, Leach MW, Gorman DM, Rennick DM. IL-25 induces IL-4, IL-5,

and IL-13 and Th2-associated pathologies in vivo. *Immunity*. 2001 Dec;15(6):985-95. PubMed PMID: 11754819.

- d. Schmitz J, Owyang A, Oldham E, Song Y, Murphy E, McClanahan TK, Zurawski G, Moshrefi M, Qin J, Li X, Gorman DM, Bazan JF, Kastelein RA. IL-33, an interleukin-1-like cytokine that signals via the IL-1 receptor-related protein ST2 and induces T helper type 2-associated cytokines. *Immunity*. 2005 Nov;23(5):479-90. PubMed PMID: 16286016.

5. Established the BIIR DC-targeting platform for novel vaccine applications.

- a. Li D, Romain G, Flamar AL, Duluc D, Dullaers M, Li XH, Zurawski S, Bosquet N, Palucka AK, Le Grand R, O'Garra A, Zurawski G, Banchereau J, Oh S. Targeting self- and foreign antigens to dendritic cells via DC-ASGPR generates IL-10-producing suppressive CD4⁺ T cells. *J Exp Med*. 2012 Jan 16;209(1):109-21. PubMed PMID: 22213806; PubMed Central PMCID: PMC3260876.
- b. Flamar AL, Xue Y, Zurawski SM, Montes M, King B, Sloan L, Oh S, Banchereau J, Levy Y, Zurawski G. Targeting concatenated HIV antigens to human CD40 expands a broad repertoire of multifunctional CD4⁺ and CD8⁺ T cells. *AIDS*. 2013 Aug 24;27(13):2041-51. PubMed PMID: 23615121; PubMed Central PMCID: PMC3859846.
- c. Joo H, Li D, Dullaers M, Kim TW, Duluc D, Upchurch K, Xue Y, Zurawski S, Le Grand R, Liu YJ, Kuroda M, Zurawski G, Oh S. C-type lectin-like receptor LOX-1 promotes dendritic cell-mediated class-switched B cell responses. *Immunity*. 2014 Oct 16;41(4):592-604. PubMed PMID: 25308333; PubMed Central PMCID: PMC4221489.
- d. Zurawski G, Shen X, Zurawski S, Tomaras GD, Montefiori DC, Roederer M, Ferrari G, Lacabartz C, Klucar P, Wang Z, Foulds KE, Kao SF, Yu X, Sato A, Yates NL, LaBranche C, Stanfield-Oakley S, Kibler K, Jacobs B, Salazar A, Self S, Fulp W, Gottardo R, Galmin L, Weiss D, Cristillo A, Pantaleo G, Levy Y. Superiority in Rhesus Macaques of Targeting HIV-1 Env gp140 to CD40 versus LOX-1 in Combination with Replication-Competent NYVAC-KC for Induction of Env-Specific Antibody and T Cell Responses. *J Virol*. 2017 Apr 13;91(9). pii: e01596-16. doi: 10.1128/JVI.01596-16. Print 2017 May 1. PubMed PMID: 28202751; PubMed Central PMCID: PMC5391468.

D. Full publication list

- 1) Alexandre, M, Marlin, Prague M, Coleon S, Kahlaoui N, Cardinaud S, Naninck T, Delache B, Surenaud M, Galhaut M, Dereuddre-Bosquet N, Cavarelli M, Maisonnasse P, Centlivre M, Lacabartz C, Wiedemann A, Zurawski S, Zurawski G, Schwartz O, Sanders RW, Le Grand R, Levy Y, Thiebaut R. Modelling the response to vaccine in non-human primates to define SARS-CoV-2 mechanistic correlates of protection. *eLife*, 2022, <https://doi.org/10.7554/eLife.75427>
- 2) Lin Y, Perovanovic J, Kong Y, Igyarto BZ, Zurawski S, Tantin D, Zurawski G, Bettini M, Bettin ML. Antibody-Mediated Targeting of a Hybrid-Insulin-Peptide Towards Neonatal Thymic Langerin⁺ Cells Enhances T Cell Central Tolerance and Delays Autoimmune Diabetes. *Diabetes*, 2022 doi: 10.2337/db21-1069.
- 3) Coléon S, Wiedemann A, Surénaud M, Lacabartz C, Hue S, Prague M, Cervantes-Gonzalez M, Wang Z, Ellis J, Sansoni A, Pierini C, Bardin Q, Fabregue M, Sharkaoui S, Hoest P, Léa Dupaty L, Picard F, El Hajj M, Centlivre M, Ghosn J, French COVID Cohort Study Group, Thiébaut R, Cardinaud S, Bernard Malissen B, Zurawski G, Zarubica A, Zurawski S M, Godot V, and Lévy Y. Design, immunogenicity, and efficacy of a pan-sarbecovirus dendritic-cell targeting vaccine. *eBioMed*. 2022, doi: 10.1016/j.ebiom.2022.104062.
- 4) Ceglia V, Zurawski S, Montes M, Kroll M, Bouteau A, Wang Z, Ellis J, Igyártó BZ, Lévy Y and Zurawski G. Anti-CD40 Antibody Fused to CD40 Ligand Is a Superagonist Platform for Adjuvant Intrinsic DC-Targeting Vaccines. *Frontiers in Immunol*. 2022 Jan 13;12:786144. doi: 10.3389/fimmu.2021.786144.

- 5) Ceglia V, Kelley EJ, Boyle AS, Zurawski S, Mead HL, Harms CE, Blanck J-P, Flamar A-L, Kirschman JH, Ogongo P, Ernst JD, Levy Y, Zurawski G and Altin JA. A framework to identify antigen-expanded T Cell Receptor (TCR) clusters within complex repertoires. *Frontiers in Immunol.* 2021, doi.org/10.3389/fimmu.2021.735584.
- 6) Ceglia V, Zurawski S, Montes M, Bouteau A, Wang Z, Ellis J, Igyártó BZ, Lévy Y and Zurawski G. Anti-CD40 antibodies fused to CD40 ligand have super agonist properties. *J. Immunol.* 2021, 207: 1 17.
- 7) Marlin R, Godot V, Cardinaud S, Galhaut M, Severin A, Zurawski S, Dereuddre-Bosquet N, Cavarelli M, Gallouët A-S, Prague M, Maisonnasse P, Dupaty L, Fenwick C, Naninck T, Lemaitre J, Gomez-Pacheco M, Kahlaoui N, Contreras V, Relouzat F, Ho R, Fang T, Wang Z, Ellis J, Chapon C, Centlivre M, Szurgot I, Liljeström P, van der Werf S, Pantaleo G, Thiébaud R, Zurawski G, Lévy Y, and Le Grand R. Targeting SARS-CoV-2 receptor-binding domain to cells expressing CD40 improves protection to infection in convalescent macaques. *Nature Communications*, 2021, 12, Article number: 5215.
- 8) Kervevan J, Zurawski S, Dieudonné L, Bonnet M, Lefebvre C, Hocini H, Surenaud M, Marlin R, Guguin A, Hersant B, Hermeziu O, Lacabaratz C, Lelievre J-D, Levy Y, Hammoudi A, Lonza J S, Godot V, Henri S, Menu E, Zurawski G, Igyarto B Z, Bouteau A, and Cardinaud S. Targeting human Langerin promotes HIV-1 specific humoral immune responses. *Plos Pathogens*, 2021, 17(7): e1009749.
- 9) Cheng L, Li G, Pellegrin C M, Yasui F, Li F, Zurawski S, Zurawski G, Levy Y, Ting J, Su L. TLR9-and CD40-targeting vaccination promotes human B cell maturation and IgG induction via pDC-dependent mechanisms in humanized mice. *Frontiers in Immunology*, 2021, 12:672143.
- 10) Bouteau A, Kervevan J, Su Q, Zurawski S, Contreras V, Dereuddre-Bosquet N, Le Grand R, Zurawski G, Cardinaud S, Levy Y, Igyártó BZ. DC subsets regulate humoral immune responses by supporting the differentiation of distinct Tfh cells. *Frontiers in Immunology*, 2019,10:1134
- 11) Fovet CM, Stimmer L, Contreras V, Horellou P, Hubert A, Seddiki N, Chapon C, Tricot S, Leroy C, Flament J, Massonneau J, Tchitchek N, 't Hart BA, Zurawski S, Klucar P, Hantraye P, Deiva K, Zurawski G, Oh S, Le Grand R, Serguera C. Intradermal vaccination prevents anti-MOG autoimmune encephalomyelitis in macaques. *EBioMedicine*, 2019 Sep;47:492-505.
- 12) Flamar A-L, Bonnabau H, Zurawski S, Lacabaratz C, Montes M, Richert L, Wiedemann A, Galmin L, Weiss D, Cristillo A, Hudacik L, Salazar A, Peltekian C, Thiebaut R, Zurawski G and Levy Y. Cellular immunity via HIV-1 epitopes targeted to Rhesus macaque CD40 and DCIR: a comparative safety and antigenicity study of prototype dendritic cell targeting therapeutic vaccine candidates. *Plos One*. 2018, Nov 30;13(11):e0207794. doi: 10.1371.
- 13) Cheng L, Wang Q, Li G, Banga R, Ma J, Yu H, Yasui F, Zhang Z, Pantaleo G, Perreau M, Zurawski S, Zurawski G, Levy Y, Su L. TLR3 agonist/CD40-targeting vaccination induces T cell response and reduces HIV-1 reservoirs. *J Clin Invest.* 2018, 128(10):4387-4396. doi: 10.1172/JCI99005.
- 14) Saunders KO, Verkoczy LK, Jiang C, Zhang J, Parks R, Chen H, Housman M, Bouton-Verville H, Shen X, Trama AM, Searce R, Sutherland L, Santra S, Newman A, Eaton A, Xu K, Georgiev IS, Joyce MG, Tomaras GD, Bonsignori M, Reed SG, Salazar A, Mascola JR, Moody MA, Cain DW, Centlivre M, Zurawski S, Zurawski G, Erickson HP, Kwong PD, Alam SM, Levy Y, Montefiori DC, Haynes BF. *Cell Rep.* 2017 Dec 26;21(13):3681-3690. doi: 10.1016/j.celrep.2017.12.028.
- 15) Cheng L, Zhang Z, Li G, Li F, Wang L, Zhang L, Zurawski SM, Zurawski G, Levy Y, Su L. Human innate responses and adjuvant activity of TLR ligands in vivo in mice reconstituted with a human immune system. *Vaccine.* 2017 Oct 27;35(45):6143-6153. doi: 10.1016
- 16) Graham JP, Authie P, Karolina Palucka A, Zurawski G. Targeting interferon-alpha to dendritic cells enhances a CD8+ T cell response to a human CD40-targeted cancer vaccine. *Vaccine.* 2017 Jul 22. pii: S0264-410X(17)30940-4. doi: 10.1016/j.vaccine.2017.07.032. [Epub ahead of print] PubMed PMID: 28743486.

- 17) Alaoui L, Palomino G, Zurawski S, Zurawski G, Coindre S, Dereuddre-Bosquet N, Lecuroux C, Goujard C, Vaslin B, Bourgeois C, Roques P, Le Grand R, Lambotte O, Favier B. Early SIV and HIV infection promotes the LILRB2/MHC-I inhibitory axis in cDCs. Cell Mol Life Sci. 2017 Nov 13. doi: 10.1007/s00018-017-2712-9.
- 18) Zurawski G, Shen X, Zurawski S, Tomaras GD, Montefiori DC, Roederer M, Ferrari G, Lacabartz C, Klucar P, Wang Z, Foulds KE, Kao SF, Yu X, Sato A, Yates NL, LaBranche C, Stanfield-Oakley S, Kibler K, Jacobs B, Salazar A, Self S, Fulp W, Gottardo R, Galmin L, Weiss D, Cristillo A, Pantaleo G, Levy Y. Superiority in Rhesus Macaques of Targeting HIV-1 Env gp140 to CD40 versus LOX-1 in Combination with Replication-Competent NYVAC-KC for Induction of Env-Specific Antibody and T Cell Responses. J Virol. 2017 Apr 13;91(9). pii: e01596-16. doi: 10.1128/JVI.01596-16. Print 2017 May 1. PubMed PMID: 28202751; PubMed Central PMCID: PMC5391468.
- 19) Salabert N, Todorova B, Martinon F, Boisgard R, Zurawski G, Zurawski S, Dereuddre-Bosquet N, Cosma A, Kortulewski T, Banchereau J, Levy Y, Le Grand R, Chapon C. Intradermal injection of an anti-Langerin-HIVGag fusion vaccine targets epidermal Langerhans cells in nonhuman primates and can be tracked in vivo. Eur J Immunol. 2016 Mar;46(3):689-700. doi: 10.1002/eji.201545465. Epub 2016 Jan 19. PubMed PMID: 26678013.
- 20) Yin W, Duluc D, Joo H, Xue Y, Gu C, Wang Z, Wang L, Ouedraogo R, Oxford L, Clark A, et al. Therapeutic HPV cancer vaccine targeted to CD40 elicits effective CD8+ T-cell immunity. Cancer Immunol Res. 2016 Aug 2. pii: canimm.0128.2016. [Epub ahead of print] PubMed PMID: 27485136.
- 21) Yin W, Gorvel L, Zurawski S, Li D, Ni L, Duluc D, Upchurch K, Kim J, Gu C, Ouedraogo R, et al. Functional Specialty of CD40 and Dendritic Cell Surface Lectins for Exogenous Antigen Presentation to CD8(+) and CD4(+) T Cells. EBioMedicine. 2016 Jan 28;5:46-58. doi: 10.1016/j.ebiom.2016.01.029. eCollection 2016 Mar. PubMed PMID: 27077111; PubMed Central PMCID: PMC4816850.
- 22) Zurawski G, Zurawski S, Flamar AL, Richert L, Wagner R, Tomaras GD, Montefiori DC, Roederer M, Ferrari G, Lacabartz C, et al. Targeting HIV-1 Env gp140 to LOX-1 Elicits Immune Responses in Rhesus Macaques. PLoS One. 2016 Apr 14;11(4):e0153484. doi: 10.1371/journal.pone.0153484.
- 23) Flamar AL, Contreras V, Zurawski S, Montes M, Dereuddre-Bosquet N, Martinon F, Banchereau J, Le Grand R, Zurawski G, Levy Y. Delivering HIV Gagp24 to DCIR Induces Strong Antibody Responses In Vivo. PLoS One. 2015 Sep 25;10(9):e0135513. doi: 10.1371/journal.pone.0135513. eCollection 2015. PubMed PMID: 26407317; PubMed Central PMCID: PMC4583231.
- 24) Joo H, Upchurch K, Zhang W, Ni L, Li D, Xue Y, Li XH, Hori T, Zurawski S, Liu YJ, Zurawski G, Oh S. Opposing Roles of Dectin-1 Expressed on Human Plasmacytoid Dendritic Cells and Myeloid Dendritic Cells in Th2 Polarization. J Immunol. 2015 Aug 15;195(4):1723-31. doi: 10.4049/jimmunol.1402276. Epub 2015 Jun 29. PubMed PMID: 26123355; PubMed Central PMCID: PMC4530104.
- 25) Akinbobuyi B, Byrd MR, Chang CA, Nguyen M, Seifert ZJ, Flamar AL, Zurawski G, Upchurch KC, Oh S, Dempsey SH, Enke TJ, Le J, Winstead HJ, Boquin JR, Kane RR. Facile syntheses of functionalized toll-like receptor 7 agonists. Tetrahedron Lett. 2015 Jan 8;56(2):458-460. PubMed PMID: 25601818; PubMed Central PMCID: PMC4296738.
- 26) Skinner JA, Zurawski SM, Sugimoto C, Vinet-Oliphant H, Vinod P, Xue Y, Russell-Lodrigue K, Albrecht RA, García-Sastre A, Salazar AM, Roy CJ, Kuroda MJ, Oh S, Zurawski G. Immunologic characterization of a rhesus macaque H1N1 challenge model for candidate influenza virus vaccine assessment. Clin Vaccine Immunol. 2014 Dec;21(12):1668-80. doi: 10.1128/CVI.00547-14. Epub 2014 Oct 8. PubMed PMID: 25298110; PubMed Central PMCID: PMC4248778.
- 27) Banchereau R, Baldwin N, Cepika AM, Athale S, Xue Y, Yu CI, Metang P, Cheruku A, Berthier I, Gayet I, Wang Y, Ohouo M, Snipes L, Xu H, Obermoser G, Blankenship D, Oh S, Ramilo O, Chaussabel D, Banchereau J, Palucka K, Pascual V. Transcriptional specialization of human dendritic cell subsets in

response to microbial vaccines. Nat Commun. 2014 Oct 22;5:5283. doi: 10.1038/ncomms6283.
PubMed PMID: 25335753; PubMed Central PMCID: PMC4206838.

- 28) Joo H, Li D, Dullaers M, Kim TW, Duluc D, Upchurch K, Xue Y, Zurawski S, Le Grand R, Liu YJ, Kuroda M, Zurawski G, Oh S. C-type lectin-like receptor LOX-1 promotes dendritic cell-mediated class-switched B cell responses. Immunity. 2014 Oct 16;41(4):592-604. doi: 10.1016/j.immuni.2014.09.009. Epub 2014 Oct 9. PubMed PMID: 25308333; PubMed Central PMCID: PMC4221489.
- 29) Epaulard O, Adam L, Poux C, Zurawski G, Salabert N, Rosenbaum P, Dereuddre-Bosquet N, Zurawski S, Flamar AL, Oh S, Romain G, Chapon C, Banchereau J, Lévy Y, Le Grand R, Martinon F. Macrophage- and neutrophil-derived TNF- α instructs skin langerhans cells to prime antiviral immune responses. J Immunol. 2014 Sep 1;193(5):2416-26. doi: 10.4049/jimmunol.1303339. Epub 2014 Jul 23. PubMed PMID: 25057007; PubMed Central PMCID: PMC4134993.
- 30) Flamar AL, Xue Y, Zurawski SM, Montes M, King B, Sloan L, Oh S, Banchereau J, Levy Y, Zurawski G. Targeting concatenated HIV antigens to human CD40 expands a broad repertoire of multifunctional CD4+ and CD8+ T cells. AIDS. 2013 Aug 24;27(13):2041-51. doi: 10.1097/QAD.0b013e3283624305. PubMed PMID: 23615121; PubMed Central PMCID: PMC3859846.
- 31) Duluc D, Gannevat J, Joo H, Ni L, Upchurch K, Boreham M, Carley M, Stecher J, Zurawski G, Oh S. Dendritic cells and vaccine design for sexually-transmitted diseases. Microb Pathog. 2013 May;58:35-44. doi: 10.1016/j.micpath.2012.11.010. Epub 2012 Nov 29. Review. PubMed PMID: 23201532; PubMed Central PMCID: PMC3596496.
- 32) Banchereau J, Zurawski S, Thompson-Snipes L, Blanck JP, Clayton S, Munk A, Cao Y, Wang Z, Khandelwal S, Hu J, McCoy WH 4th, Palucka KA, Reiter Y, Fremont DH, Zurawski G, Colonna M, Shaw AS, Klechevsky E. Immunoglobulin-like transcript receptors on human dermal CD14+ dendritic cells act as a CD8-antagonist to control cytotoxic T cell priming. Proc Natl Acad Sci U S A. 2012 Nov 13;109(46):18885-90. doi: 10.1073/pnas.1205785109. Epub 2012 Oct 29. PubMed PMID: 23112154; PubMed Central PMCID: PMC3503187.
- 33) Flamar AL, Zurawski S, Scholz F, Gayet I, Ni L, Li XH, Klechevsky E, Quinn J, Oh S, Kaplan DH, Banchereau J, Zurawski G. Noncovalent assembly of anti-dendritic cell antibodies and antigens for evoking immune responses in vitro and in vivo. J Immunol. 2012 Sep 1;189(5):2645-55. doi: 10.4049/jimmunol.1102390. Epub 2012 Aug 3. PubMed PMID: 22865916; PubMed Central PMCID: PMC3424314.
- 34) Romain G, van Gulck E, Epaulard O, Oh S, Li D, Zurawski G, Zurawski S, Cosma A, Adam L, Chapon C, Todorova B, Banchereau J, Dereuddre-Bosquet N, Vanham G, Le Grand R, Martinon F. CD34-derived dendritic cells transfected ex vivo with HIV-Gag mRNA induce polyfunctional T-cell responses in nonhuman primates. Eur J Immunol. 2012 Aug;42(8):2019-30. doi: 10.1002/eji.201242478. Epub 2012 Jul 4. PubMed PMID: 22585548; PubMed Central PMCID: PMC3649569.
- 35) Joo H, Coquery C, Xue Y, Gayet I, Dillon SR, Punaro M, Zurawski G, Banchereau J, Pascual V, Oh S. Serum from patients with SLE instructs monocytes to promote IgG and IgA plasmablast differentiation. J Exp Med. 2012 Jul 2;209(7):1335-48. doi: 10.1084/jem.20111644. Epub 2012 Jun 11. PubMed PMID: 22689824; PubMed Central PMCID: PMC3405503.
- 36) Banchereau J, Thompson-Snipes L, Zurawski S, Blanck JP, Cao Y, Clayton S, Gorvel JP, Zurawski G, Klechevsky E. The differential production of cytokines by human Langerhans cells and dermal CD14(+) DCs controls CTL priming. Blood. 2012 Jun 14;119(24):5742-9. doi: 10.1182/blood-2011-08-371245. Epub 2012 Apr 25. PubMed PMID: 22535664; PubMed Central PMCID: PMC3382933.
- 37) Li D, Romain G, Flamar AL, Duluc D, Dullaers M, Li XH, Zurawski S, Bosquet N, Palucka AK, Le Grand R, O'Garra A, Zurawski G, Banchereau J, Oh S. Targeting self- and foreign antigens to dendritic cells via DC-ASGPR generates IL-10-producing suppressive CD4+ T cells. J Exp Med. 2012 Jan

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E. Research Support

Ongoing Research Support

2011/08/01-2023/01/01

ANR-10-LABX-77, ANRS/Inserm/VR

Yves Levy (PI)

Developing Therapeutic and Preventive HIV Vaccines

The major goals of this project are to develop vaccines for therapeutic and prophylactic applications

Role: CPI

2014/04/01-2018/31/31

NIH NIAID, 5R01AI105066-04

SangKon Oh (PI)

DC-ASGPR as Novel Target for Controlling GVHD and Allograft Rejection

The goal is developing antibody therapeutics for GVHD and other autoimmune conditions

Role: CI

Completed Research Support

2011/12/01-2015/12/31

American Cancer Society Research Scholar, American Cancer Society

SangKon Oh (PI)

Antibody-based combination therapy against prostate cancer

Preclinical study for testing prostate cancer vaccines carried by anti-CD40 mAb in combination of anti-OX40L mAb to potentiate immunity against tumor.

Role: Co-Investigator

2012/09/01-2015/09/01

RepliVax Vaccine Platform, Gates Foundation

ZURAWSKI, GERARD (PI)

Pantaleo: RepliVax Vaccine Platform

1. To develop a RepliVax® based viral vector platform for delivering HIV antigens 2. To generate novel Env immunogens and delivery systems for Env proteins 3. Immunological characterization of the RepliVax® vectors and prime/boost immunization strategies

Role: Co-Investigator

2011/07/05-2015/06/30

U19 AI089987-02, National Institute of Allergy and Infectious Diseases (NIAID)

ZURAWSKI, GERARD (PI)

Protein Core

Role: PI

2003/09/30-2015/04/30

U19 AI057234-10, National Institute of Allergy and Infectious Diseases (NIAID)

ZURAWSKI, GERARD (PI)

Harnessing Human DC Subsets for Improved Muscosal Vaccines

Role: PI

2009/05/01-2014/04/30

U19 AI057234-06, National Institute of Allergy and Infectious Diseases (NIAID)

ZURAWSKI, GERARD (PI)

New DC-targeting Vaccine Constructs and Antibody Reagents

Role: PI

2009/09/30-2011/08/31

RC2 CA148460-01, National Cancer Institute (NCI)

ZURAWSKI, GERARD (PI)

Immunotherapeutic HPV cancer vaccines that target Langerhans cells

Role: PI

2009/09/30-2011/08/31

RC2 CA148460-02, National Cancer Institute (NCI)

ZURAWSKI, GERARD (PI)

Immunotherapeutic HPV cancer vaccines that target Langerhans cells

The major goals of this project are to develop safe & potent immunotherapeutic vaccines against HPV.

Role: PI

2010/07/12-2011/06/30

U19 AI089987-01, National Institute of Allergy and Infectious Diseases (NIAID)

ZURAWSKI, GERARD (PI)

Protein Core

The systems biology approaches will permit us to gain a comprehensive view of the immunobiology associated with a potent response to vaccination. This will lead to the identification of biomarker signatures indicative of the quality of vaccine-induced antibody responses. This, in turn, will facilitate the rational design and development of novel improved vaccines.

Role: PI

2009/07/14-2010/09/30

U19 AI057234-06S1, National Institute of Allergy and Infectious Diseases (NIAID)

ZURAWSKI, GERARD (PI)

New DC-targeting Vaccine Constructs and Antibody Reagents

Role: PI

2008/04/01-2009/03/31

U19 AI057234-05S1, National Institute of Allergy and Infectious Diseases (NIAID)

ZURAWSKI, GERARD (PI)

In vivo Targeting of Human Dendritic Cell Subsets

Role: PI

2010/02/01-2013/01/01

Towards an HCV Vaccine, INSERM

Yves Levy (PI)

Towards an HCV Vaccine

The major goals of this project are: (1): Genomic assessment of the immune system of HCV patients; (2): HCV-antigen-specific T cell repertoire of HCV patients; (3): Construction of HCV-protein-anti-DC receptor recombinant fusion proteins; and (4): Immunogenicity of HCV-protein-anti-DC recombinant fusion proteins
Role: CPI

2007/09/01-2011/08/01

Developing Therapeutic and Preventive HIV Vaccines, ANRS

Jacques Banchereau (PI)

Developing Therapeutic and Preventive HIV Vaccines

The major goals of this project are to develop HIV vaccines

Role: Co-Investigator

PATENTS AND PATENT APPLICATIONS (DNAX)

Truncated Human Interleukin-1alpha — Gerard Zurawski, Sandra M. Zurawski — US5017692A grant

Murine Interleukin-2 Muteins — Gerard Zurawski, Sandra M. Zurawski — EP0267795A2 grant

T-Cell Activation Markers — Keith D. Brown, Timothy R. Mosmann, Gerard Zurawski, Sandra M. Zurawski — WO1989007646A1

Muteins of Mammalian Cytokines — Sandra M. Zurawski, Gerard Zurawski — WO1996004306 A3 grant

Purified Mammalian FLT3 Ligands; Agonists; Antagonists — Charles H. Hannum, Frank D. Lee, Daniel Birnbaum, Oliver Rosnet, Sandra M. Zurawski, Gerard Zurawski — CA2163105A1 application

Antibodies that specifically bind DNAX leukocyte associated immunoglobulin-like receptor — Gosse Jan Adema, Linde Meyaard, Daniel M. Gorman, Terrill K. McClanahan, Sandra M. Zurawski, Gerard Zurawski, Lewis L. Lanier, Joseph H. Phillips, Jr. — US7999078B grant

Isolated Mammalian Monocyte Cell Genes; Related Reagents — Gosse J. Adema, Linde Meyaard, Daniel M. Gorman, Terrill K. McClanahan, Sandra M. Zurawski, Gerard Zurawski, Lewis L. Lanier, Joseph H. Phillips — EP20090178115

Antibodies that specifically bind DNAX leukocyte associated immunoglobulin-like receptor — Gosse Adema, Linde Meyaard, Daniel M. Gorman, Terrill K. McClanahan, Sandra M. Zurawski, Gerard Zurawski, Lewis L. Lanier, Joseph H. Phillips, Jr. — US7999078B2 grant

PATENTS AND PATENT APPLICATIONS (BSWRI)

1. **NT07-002/WO2008103953** ACTIVATION OF HUMAN ANTIGEN-PRESENTING CELLS THROUGH DENDRITIC CELL LECTIN-LIKE OXIDIZED LDL RECEPTOR-1 (LOX-1) Issued in AU, MX, NZ, TW, US, and ZA. Pending in HK, JP, EP and CA. US 8481314; US9339556

2. **NT07-005/WO2008097870** AGENTS THAT ENGAGE ANTIGEN - PRESENTING CELLS THROUGH DENDRITIC CELL ASIALOGLYCOPROTEIN RECEPTOR (DC- ASGPR) Issued in AU, CA, DE, FR, GB, IL, MX, NZ, US, and ZA. Pending in AU, US. US8236934; US8728481; US9453074
3. **NT07-060/ WO2008097817** MULTIVARIABLE ANTIGENS COMPLEXED WITH TARGETING HUMANIZED MONOCLONAL ANTIBODY Issued in AU, BE, CH, DE, DK, ES, FR, BG, IT, NL, SE, JP, MX, NZ, US, ZA. Pending in CA, HK, IL, US.
4. **NT07-076/ WO2008118587** THERAPEUTIC APPLICATIONS OF ACTIVATION OF HUMAN ANTIGEN-PRESENTING CELLS THROUGH DECTIN-1 Issued in AU, CN, DE, FR, GB, HK, MX, NZ, TW, and ZA. Pending in CA, JP and US.
5. **NT07-086/WO2008097866** VACCINES BASED ON TARGETING ANTIGEN TO DCIR EXPRESSED AN ANTIGEN-PRESENTING CELLS Issued in US, GB, FR, and DE. US8057798; US9102730; US8586052; US9234040
6. **NT08-043/US9109011** DENDRITIC CELL-SPECIFIC ANTIBODY CONJUGATE COMPRISING ANTI-CD40 MONOCLONAL ANTIBODIES CONJUGATED TO HIV-1 GAG/NEF Issued in AU, CA, CN, EP, JP, KR, MX, NZ, US, Pending in EP.
7. **NT09-008/ WO2010104761** ANTI-CD40 ANTIBODIES AND USES THEREOF Issued in AU, CN, AT, BE, CH, DE, DK, ES, FR, UK, IE, IT, NL, NO, PT, SE, JP, MX, and TW. Pending in CA, HK, US, IN and TW.
8. **NT09-010/ WO2010104748** ANTIGEN PRESENTING CELL TARGETED ANTI-VIRAL VACCINES Issued in AU, CH, DE, DK, ES, FR, GB, IE, IT, NL, SE, JP, MX, TW and US. Pending in CA, HK, CN and IN.
9. **NT09-012/ WO2010104747** ANTIGEN PRESENTING CELL TARGETED VACCINES Issued in AU, CH, DE, DK, ES, FR, GB, IE, IT, NL, IN, JP, MX, TW and US. Pending in AR, CA, HK, CN, IN and US.
10. **NT09-087/ US9315580** VACCINES DIRECTED TO LANGERHANS CELLS Issued in US.
11. **NT09-011/US9102734** FUSION PROTEINS COMPRISING ANTIBODY AND HPV E6 AND E7 ANTIGENS Issued in AU, AT, BE, CH, DE, DK, ES, FR, GB, IE, IT, NL, NO, JP, MX and TW. Pending in CA, CHK, CN, EP, JP and TW.
12. **NT11-100/ WO2012135132** COMPOSITION AND METHODS TO IMMUNIZE AGAINST HEPATITIS C VIRUS Pending in CA, EP and US.
13. **NT11-090/ WO2012061203** ENHANCEMENT OF PATHOGEN-SPECIFIC MEMORY TH17 CELL RESPONSES Pending in US.
14. **NT11-111/ WO2013033104** CONTROLLING ALLERGY AND ASTHMA BY ACTIVATING HUMAN DCs VIA DECTIN-1 OR TOLL-LIKE RECEPTOR 2 (TLR2) Issued in US.
15. **NT13-137/WO2014210540** DENDRITIC CELL ASGPR TARGETING IMMUNOTHERAPEUTICS FOR MULTIPLE SCLEROSIS Pending in CA, CN, HK, EP, IL, IN, JP and US

- 16. NT14-141/ WO2015106281** NOVEL VACCINES AGAINST HPV AND HPV-RELATED DISEASES
Pending in AU, CA, CHK, CN, EP, IL, IN, JP and US
- 17. NT14-143/ WO2016022468** ANTAGONISTIC ANTI-OX40L ANTIBODIES AND METHODS OF THEIR
USE Pending in AU, CA, CHK, CN, EP, IL, IN, JP and US
- 18. NT14-147/WO2015175957** METHODS AND COMPOSITIONS FOR TREATING AUTOIMMUNE AND
INFLAMMATORY CONDITIONS Pending in AU, CA, CHK, CN, EP, IL, IN, JP and US
- 19. NT14-148/ WO2015187637** METHODS AND COMPOSITIONS FOR TREATING ALLERGY AND
INFLAMMATORY DISEASES Pending in AU, CA, CHK, CN, EP, IL, IN, JP and US
- 20. NT18-001 METHODS AND COMPOSITIONS FOR TREATING AND PREVENTING HIV US**
Provisional pending.