



**F**or nearly 20 years, Prof. Lehmann and the team of scientists working with him have been focused on establishing the scientific foundations of ELISPOT assays and to test the utility of the technology in various fields of T cell diagnostics. CTL's peer-reviewed publications are listed here by theme with the hopes of providing a useful reference for your research.

### Single-cell Resolution and Frequency

Hanson J, Sundararaman S, Caspell R, Karacsony E, Karulin AY, and Lehmann PV. ELISPOT assays in 384-well format: Up to 30 data points with one million cells. *Cells*. 2015; 4(1):71-83.

Karulin AY, Caspell R, Dittrich M, and Lehmann PV. Normal distribution of CD8+ T cell-derived ELISPOT counts within replicates justifies the reliance on parametric statistics for identifying positive responses. *Cells*. 2015; 4:96-111.

Wunsch M, Zhang W, Hanson J, Caspell R, Karulin AY, Recks MS, Kuerten S, Sundararaman S, and Lehmann PV. Characterization of the HCMV-specific CD4 T cell responses that are associated with protective immunity. *Cells*. 2015; 7:4414-4437.

Zhang W, Moldovan I, Targoni OS, Subbramanian RA, Lehmann PV. How much of Virus-Specific CD8 T Cell Reactivity is Detected with a Peptide Pool when Compared to Individual Peptides? *Viruses*. 2012. 4:2636-2649.

Kuerten S, Batoulis H, Recks MS, Karacsony E, Zhang W, Subbramanian R, Lehmann, PV. Resting of Cryopreserved PBMC Does Not in General Benefit the Performance of Antigen-specific T Cell ELISPOT Assays. *Cells*. 2012. 1:313-324.

Zhang W, Caspell R, Karulin AY, Ahmad M, Haicheur N, Abdelsalam A, Johannesen K, Vignard V, Dudzik P, Georgakopoulou K, Mihaylova A, Silina K, Aptsiauri N, Adams V, Lehmann PV, McArdle S. ELISPOT assays provide reproducible results among different laboratories for T-cell immune monitoring – even in hands of ELISPOT-inexperienced investigators. *Journal of Immunotoxicology*. 2009. 6:227-34.

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Hofstetter HH, Targoni OS, Karulin AY, Forsthuber TG, Tary-Lehmann M, Lehmann PV. Does the frequency and avidity spectrum of the neuroantigen-specific T cells in the blood mirror the autoimmune process in the central nervous system of mice undergoing experimental allergic encephalomyelitis? *Journal of Immunology*. 2005. 174:4598.

Hesse MD, Karulin AY, Boehm BO, Lehmann PV, Tary-Lehmann M. A T cell clone's avidity is a function of its activation state. *Journal of Immunology*. 2001. 167:1353.

Targoni OS, Baus J, Hofstetter HH, Hesse MD, Karulin AY, Boehm BO, Forsthuber TG, Lehmann PV. Frequencies of neuroantigen-specific T cells in the central nervous system versus the immune periphery during the course of experimental allergic encephalomyelitis. *Journal of Immunology*. 2001. 166:4757.

Helms T, Boehm BO, Asaad RJ, Trezza RP, Lehmann PV, Tary-Lehmann M. Direct visualization of cytokine-producing recall antigen-specific CD4 memory T cells in healthy individuals and HIV patients. *Journal of Immunology*. 2000. 164:3723.

### Measuring Th1, Th2, Th17 and Other Effector Lineages

Wunsch M, Zhang W, Hanson J, Caspell R, Karulin AY, Recks MS, Kuerten S, Sundararaman S, and Lehmann PV. Characterization of the HCMV-specific CD4 T cell responses that are associated with protective immunity. *Cells*. 2015; 7:4414-4437.

Lehmann PV, Sundararaman S. When results of T cell immune monitoring match or do not match clinical outcomes of tumor vaccine trials — what more could and should we measure? *In The Tumor ImmunoEnvironment*, ed. M. Shurin, Victor Umansky & A.M. Malyguine, Springer 2013.

Karulin AY, Quast S, Hesse M, Lehmann PV. Neuroantigen-specific CD4 Cells Expressing IFN- $\gamma$ , IL-2, and IL-3 in a Mutually Exclusive Manner Preval in EAE, Representing Independent Th1 Sublineages. *Cells*. 2012. 1:576-596.

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- Ott PA, Herzog BA, Quast S, Hofstetter HH, Boehm BO, Tary-Lehmann M, Durinovic-Bello I, Berner BR, Lehmann PV. Islet-cell antigen-reactive T cells show different expansion rates and Th1/Th2 differentiation in type 1 diabetic patients and healthy controls. *Clinical Immunology*. 2005. 115:102.
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### Cognate Cytokine Production by T Cells versus Bystander Cytokine Production

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### Measurements of Functional T Cell Avidity

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### Cytokine Coexpression/Two-color ELISPOT Assays

Wunsch M, Zhang W, Hanson J, Caspell R, Karulin AY, Recks MS, Kuerten S, Sundararaman S, and Lehmann PV. Characterization of the HCMV-specific CD4 T cell responses that are associated with protective immunity. *Cells*. 2015; 7:4414-4437.

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Quast S, Zhang W, Shive C, Kovalovski D, Ott PA, Herzog BA, Boehm BO, Tary-Lehmann M, Karulin AY, Lehmann PV. IL-2 absorption affects IFN- $\gamma$  and IL-5, but not IL-4 producing memory T cells in double color cytokine ELISPOT assays. *Cell Immunology*. 2005. 237:28.

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Karulin AY, Hesse MD, Tary-Lehmann M, Lehmann PV. Single-cytokine-producing CD4 memory cells predominate in type 1 and type 2 immunity. *Journal of Immunology*. 2000. 164:1862.

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Sundararaman S, Karulin AY, Ansari T, BenHamouda N, Gottwein J, Laxmanan S, Levine SM, Loffredo JT, McArdle S, Neudoerfl C, Roen D, Silina K, Welch M, and Lehmann PV. High reproducibility of ELISPOT counts from nine different laboratories. *Cells*. 2015; 4(1):21-39.

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Targoni OS, Lehmann PV. Endogenous myelin basic protein inactivates the high avidity T cell repertoire. *Journal of Experimental Medicine*. 1998. 187:2055.

### Working with Peptides and Peptide Pools

Zhang W, Moldovan I, Targoni OS, Subbramanian RA, Lehmann PV. How much of Virus-Specific CD8 T Cell Reactivity is Detected with a Peptide Pool when Compared to Individual Peptides? *Viruses*. 2012. 4:2636-2649.

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### Assay to Assay Reproducibility of Ex Vivo Measurements on PBMC

Sundararaman S, Karulin AY, Ansari T, BenHamouda N, Gottwein J, Laxmanan S, Levine SM, Loffredo JT, McArdle S, Neudoerfl C, Roen D, Silina K, Welch M, and Lehmann PV. High reproducibility of ELISPOT counts from nine different laboratories. *Cells*. 2015; 4(1):21-39.

Kuerten S, Batoulis H, Recks MS, Karacsony E, Zhang W, Subbramanian R, Lehmann, PV. Resting of Cryopreserved PBMC Does Not in General Benefit the Performance of Antigen-specific T Cell ELISPOT Assays. *Cells*. 2012. 1:313-324.

Zhang W, Caspell R, Karulin AY, Ahmad M, Haicheur N, Abdelsalam A, Johannesen K, Vignard V, Dudzik P, Georgakopoulou K, Mihaylova A, Silina K, Aptsiauri N, Adams V, Lehmann PV, McArdle S. ELISPOT assays provide reproducible results among different laboratories for T-cell immune monitoring – even in hands of ELISPOT-inexperienced investigators. *Journal of Immunotoxicology*. 2009. 6:227-34.

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Gebauer BS, Hricik DE, Atallah A, Bryan K, Riley J, Tary-Lehmann M, Greenspan NS, Dejele C, Boehm BO, Hering BJ, Heeger PS. Evolution of the enzyme-linked immunosorbent spot assay for post-transplant alloreactivity as a potentially useful immune monitoring tool. *American Journal of Transplantation*. 2002. 2:857.

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### Fresh versus Cryopreserved PBMC

Wunsch M, Caspell R, Kuerten S, Lehmann PV, and Sundararaman S. Serial measurements of apoptotic cell numbers provide better acceptance criterion for PBMC quality than a single measurement prior to the T cell assay. *Cells*. 2015; 4:40-55.

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### Cytotoxicity, Granzyme B, and Perforin ELISPOT

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### ELISPOT for Cells Other than Human PBMC or Murine Lymph Node/Spleen Cells

Kuerten S, Rottlaender A, Rodi M, Velasco VB Jr, Schroeter M, Kaiser C, Addicks K, Tary-Lehmann M, Lehmann PV. The clinical course of EAE is reflected by the dynamics of the neuroantigen-specific T cell compartment in the blood. *Clinical Immunology*. 2010. 137(3):422-32.

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