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RESEARCH AREA

My laboratory focuses on the electrophysiological properties of electrically non-excitable cells. We mainly study the physiological and pathophysiological role of voltage-gated ion channels, with a special emphasis on K^+ channels. One of the main goals of my research is the study of the pharmacological, biophysical and cell biology of the ion channels of immune cells. Voltage-gated K^+ channels maintain a membrane potential in these cells that allows efficient Ca^{2+} -dependent signaling pathways for antigen recognition. Among the ion channels, the role of the Kv1.3 K^+ channel stands out, but in the last decade our knowledge about the role of other K^+, Ca^{2+}, Na^+, H^+ and other channels has also expanded significantly. Disruption of the physiological activity of Kv1.3 channels may diminish or completely abolish the response of T cells to the antigen, thus, achieving immunosuppression.

TECHNIQUES AVAILABLE IN THE LAB

- molecular biology
- ion channel biophysics
- ion channel molecular pharmacology
- patch-clamp technique
- Voltage-Clamp Fluorometry (VCF)
- Digital image microscopy (Ca^{2+}, pH and intracellular ion imaging)
- recombinant production of peptides
- biochemical purification of peptides
- in vitro production of T cell subpopulations
- complex separation of T cell subpopulations with magnetic beads
- T cell activation and proliferation assays based on flow cytometry
- ion channel biophysics, physiology and molecular pharmacology

SELECTED PUBLICATIONS

Naseem, M.U., Carcamo-Noriega, E., Beltran-Vidal, J., Borrego, J., Szanto,T.G., Zamudio, F.Z., Delgado-Prudencio, G., Possani, L.,D. **Panyi. G.** (2022) Cm28, a scorpion toxin having a unique primary structure, inhibits KV1.2 and KV1.3 with high affinity. **J Gen Physiol 154:** e202213146.

Csoti, A,. Del Carmen Najera Meza, R., Bogar, F., Tajti, G., Szanto, T.G., Varga, Z., Gurrola, G.B., Toth, G.K., Possani, L.D., **Panyi, G.** (2022) sVmKTx, a transcriptome analysis-based synthetic peptide analogue of Vm24, inhibits Kv1.3 channels of human T cells with improved selectivity. **Biochem pharmacol 199:** 115023.

Szanto, T.G,. Gaal, S., Karbat, I., Varga, Z., Reuveny, E., **Panyi, G.** (2021) Shaker-IR K+ channel gating in heavy water: Role of structural water molecules in inactivation. **J Gen Physiol 153:** e202012742.

Szanto, T.G., Zakany, F., Papp, F., Varga, Z., Deutsch, C.J., **Panyi, G.** (2020) The activation gate controls steady-state inactivation and recovery from inactivation in Shaker. **J Gen Physiol 152:** e20212591.

Meszaros, B., Papp, F., Mocsar, G., Kokai, E., Kovacs, K., Tajti, G., **Panyi, G.** (2020) The voltage-gated proton channel hHv1 is functionally expressed in human chorion-derived mesenchymal stem cells. **Sci Rep 10:** 7100.