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RESEARCH AREA

The focus of our research is to gain a deeper understanding of the electrical phenomena of the heart, including the cellular and organ-level electrophysiological studies of both healthy and abnormal hearts. We conduct a broad range of cardiac electrophysiology research. In our lab, we have the possibility to examine the electrophysiological characteristics of tissues and isolated cardiac cells derived from cardiac samples from both human and experimental animal models. These are our specific areas of study:

(1) Despite the widespread belief that the healthiest people in our society are elite athletes, there is strong evidence that long-term, high-intensity exercise can raise the risk of cardiac arrhythmias, such as atrial fibrillation, ventricular arrhythmias, and even sudden cardiac death. Using various *in vitro*, *ex vivo,* and *in vivo* techniques, we examine the factors that underpin training-induced cardiac remodelling and increased arrhythmia risk.

(2) A considerable percentage of adults suffer from high mortality heart failure. In our research, we employ cellular electrophysiological techniques to examine electrical dysfunctions of the human heart also caused by altered functions of myocardial transmembrane ion channels, including potassium channels.

(3) We map the electrophysiological differences at the cellular and organ level between various experimental animal models (mouse, rat, guinea pig, rabbit, and dog) and examine how different cardioactive agents affect repolarizing transmembrane ion currents (reserve).

One of our recent studies examines the electrophysiological characteristics of one of the most popular doping agent of our time, called testosterone with different measurement techniques in chronic and acute test settings.

TECHNIQUES AVAILABLE IN THE LAB

To learn basic *in vivo* cardiac electrophysiological methods, including multi-lead precordial ECG recordings in conscious animals. To examine atrial and ventricular arrhythmia susceptibility under different conditions, additionally, cardiac function is studied *ex vivo* in Langendorff perfused system in various animal models. To isolate myocardial cells from different species for cellular electrophysiological studies. To measure different transmembrane ionic currents and action potentials on isolated myocardial cells by patch clamp technique. Detailed analysis, presentation and interpretation of data.

SELECTED PUBLICATIONS

Mohammed, A. S. A., Mohácsi, G., Naveed, M., Prorok, J., Jost, N., Virág, L., Baczkó, I., **Topal, L.**, Varró, A. (2024). Cellular electrophysiological effects of the citrus flavonoid hesperetin in dog and rabbit cardiac ventricular preparations. **Sci Rep 14(1):** 7237.

Polyák, A.*, **Topal, L.***, Zombori-Tóth, N., Tóth, N., Prorok, J., Kohajda, Z., Déri, S., Demeter-Haludka,V., Hegyi, P., Venglovecz, V., Ágoston, G., Husti, Z., Gazdag, P., Szlovák, J., Árpádffy-Lovas, T., Naveed, M., Sarusi, A., Jost, N., Virág, L., Nagy, N., Baczkó, I., Farkas, A. S., Varró, A. (2023). Cardiac electrophysiological remodeling associated with enhanced arrhythmia susceptibility in a canine model of elite exercise. **Elife 12:** e80710.

Pintér, J. A., Polyák, A., Varró, A., Farkas, S. A., Baczkó, I., **Topal, L.** (2023) Fokozott aritmiaérzékenységgel társuló kamrai szívizom-remodelling vizsgálata sportszív nagyállatmodellben. **Cardiologia Hungarica 53(5):** 436-445.

Topal, L., Polyák, A., Tóth, N., Ágoston, G., Bencsik, P., Kohajda, Z., Prorok, J., Déri, S., Nagy, N., Jost, N., Virág, L., Farkas, A. S., Varró, A., Baczkó, I. (2022). Endurance training-induced cardiac remodeling in a guinea pig athlete's heart model. **Can J Physiol Pharmacol 100(10):** 993-1004.

Orvos, P., Pászti, B., **Topal, L.**, Gazdag, P., Prorok, J., Polyák, A., Kiss, T., Tóth-Molnár, E., Csupor-Löffler, B., Bajtel, Á., Varró, A., Hohmann, J., Virág, L., Csupor, D. (2020) The electrophysiological effect of cannabidiol on hERG current and in guinea-pig and rabbit cardiac preparations. **Sci Rep 10(1):** 16079.