



DESIGN. INTEGRITY. RELIABILITY.

## Smart undershirt

Teresa Woodger

### Telemetry

In recent reviews, cardiovascular-related toxicities have ranked amongst the two top causes of drug withdrawals from either the USA or worldwide markets<sup>1</sup>. This high incidence indicates that cardiac assessment, through telemetry studies, needs to be done earlier in the development of a drug. Good practices in behavioral management promote ambulatory models and minimally invasive procedures, which lead to the development of the jacketed telemetry systems. In fact, the members of the Safety Pharmacology Society, in their 2010 survey, have published scientific viewpoints on best practices, which include the “optimization of electrocardiographic recordings in non-rodent toxicology studies through the use of new technologies, such as jacketed telemetry”<sup>2</sup>. In addition, the ICH S7A guidance document on Safety Pharmacology studies also states that “information from toxicology studies adequately designed and conducted to address safety pharmacology endpoints may reduce or eliminate the need for separate safety pharmacology studies”<sup>1</sup>. Jacketed telemetry models enable that type of refined research and now, Lomir Biomedical has pushed the refinement even further by integrating innovative textile technology into their equipment.

### Innovation

In current jacketed telemetry models, we use a 3 layer system: electrodes are held in place by an undershirt over which a jacket that contains the telemetry equipment is placed (Figs. 1 and 2). In studies conducted in 2009 and 2013: *Assessment of two external telemetry systems (PhysioJacket™ and JET™) in beagle dogs with telemetry implants*<sup>3</sup> and *Detection of QTc interval prolongation using jacket telemetry in concious non-human primates: comparison with implanted telemetry*<sup>4</sup>, it was established that this method offers a sensitivity of detection in ECG and HR changes that is comparable to implanted telemetry in dogs and non-human. Although, in those studies, they identified movement artifact as a limitation of external telemetry in comparison with implanted telemetry. This artifact is in great part due to skin electrode migration or dry out and their placement variation between measurements. One way of reducing that movement, would be to reduce the amount of layers of equipment on the animal.

Using recent advances in textile innovation, Lomir has integrated the electrodes to their undershirt. This new smart undershirt can detect heart rate and ECG on live, ambulatory animals. By going from a 3 layer system to a much simpler 2 layer system we improve:

- Repeatability
- Comfort for the animals
- Simplicity of use for the technicians



FIGURE 1 | Example telemetry EMKA jacket

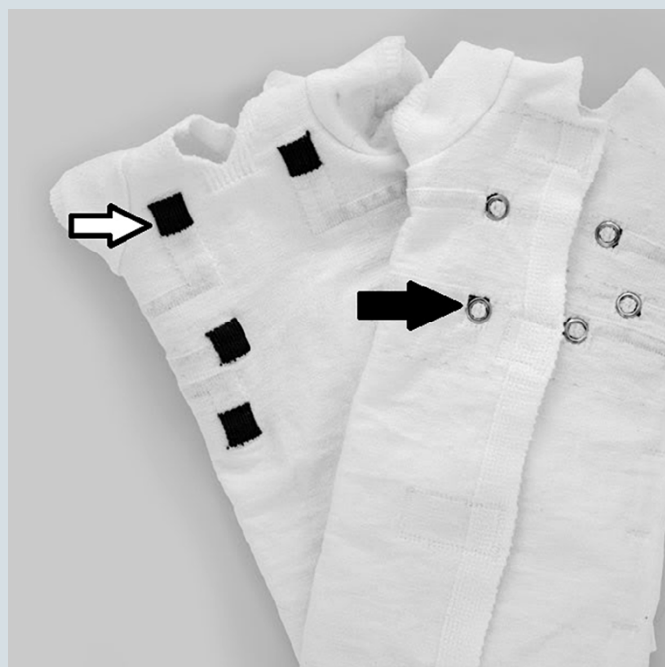
### Smart wearables

Smart wearables are already being used for various applications in human medicine and fitness. At Lomir, we seized the opportunity to incorporate this recent technology to our range of products. We



FIGURE 2 | Example undershirt

Lomir Biomedical Inc. Correspondence should be addressed to TW (Teresa@lomir.com).



**FIGURE 3** | Example smart undershirt

beneficiated from the help of a nonprofit organization that developed this technology for human usage. The transfer to animals in a research context presented certain challenges. With our combined expertise, we were able to create a product that fits the animals, research and handlers' needs. So far, the development of the project has been made by testing the equipment on non-human primates, but it is expected that it will transfer well to other species.

#### How it works

Technically speaking, the undershirt is made of COOLMAX®, which is a polyester and lycra fiber with nanotubes for moisture management and avoiding body temperature changes. The electrodes are made of a silver textile and are connected in the back to snaps that are compatible with EMKA and DSI telemetry systems.

The overall product is light, breathable and supple, insuring the animal's comfort (Fig. 3). The animals will still need to be shaved where the electrodes are placed. We have made the electrodes big enough to adapt to individual physical variations and the stretch material ensures a good fit, reducing movement artifact. The jacket containing the telemetry equipment can then be added and connected to the undershirt. While being comfortable, the smart undershirt is still robust enough to be used for many hours in a row and be reused after standard washing procedures. As with any other clothing equipment, it is primal that animals get acclimatized to the undershirt prior to the start of the study. Good science, increased animal welfare and reduced labor costs might generate new applications for this telemetry model.

#### Company profile

Lomir is a Canadian designer and manufacturer of high quality, innovative, and durable equipment for international life science or biomedical research facilities. Products include infusion systems, protective jackets, restrainers, handling equipment, environmental enrichment and custom products for use in laboratory animals. Lomir products are designed with the well-being and comfort of the subject in mind and success is founded on respect for integrity and commitment to customer satisfaction.

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