Additional cardiovascular determinations such as blood flow can be performed in conjunction with the telemetric evaluations using percutaneous leads:

- Cardiac output
- Peripheral resistance
- Specific organ flow such as coronary flow

Anesthetized Cardiovascular Preparation
Acute anesthetized models are available for circumstances when ambulatory methods such as telemetry are not applicable. Parameters include:

- ECG
- Aortic pressure
- Left ventricular pressure
- Pulmonary artery pressure
- Pulmonary capillary wedge pressure
- Right atrial pressure
- Cardiac output
- Total peripheral resistance measurements

Looking for ways to condense study timelines? We can provide fully integrated cardiovascular, pulmonary and central nervous system (CNS) testing to streamline product registration and safety testing. Battelle delivers:

- GLP-compliant safety pharmacology studies in multiple species, including rodents, pigs/minipigs, canines and non-human primates
- State-of-the art implanted telemetry for highly accurate, automated monitoring and data collection
- In-house pathology and analytical and bioanalytical chemistry staff and laboratories for end-to-end service, including pharmacokinetics and pharmacodynamics studies
- Integrated CNS, cardiovascular and pulmonary testing and data collection to streamline your pre-clinical trial programs

A Comprehensive Suite of Cardiovascular and Pulmonary Services

Telemetry
Battelle leads the industry in simultaneous GLP cardiovascular/pulmonary safety pharmacology assessments. Implantable radiotelemetry allows for accurate measurements of many parameters in unrestrained, conscious test subjects:

- Blood pressure
- Heart rate
- ECGs (rhythm and morphology, arrhythmia analysis, and interval analysis including QT interval calculation)
- Body temperature
- Left ventricular pressure (contractility determinations)
- Pulmonary parameters: respiratory rate, tidal volume, resistance and compliance, and minute volume

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Isolated Heart Langendorff / Ex Vivo Assay
Get fast, accurate measurements of the direct effects of drugs or chemicals on the heart. We conduct high-throughput dose escalation studies using rodent models.

- All left ventricular parameters
- ECG (morphology, ECG intervals)
- Perfusion flow
Pulmonary

Pulmonary function determinations can be performed alone or in conjunction with cardiovascular evaluations in un-anesthetized large and small test systems. Assays include helmeted plethysmography or jacketed respiratory inductive plethysmography (RIP) bands.

- Minute volume
- Tidal volume
- Respiratory rate
- Resistance and compliance (intra-thoracic pressure)

Additional pulmonary function evaluations can be performed in anesthetized preparations.

- Resistance and compliance (dynamic)
- Diffusing capacity of carbon monoxide (DLCO)
- Bronchoalveolar lavage
- Blood gases
- Forced maneuvers (quasistatic volume/pressure curves and maximal flow/volume curves)

Screening Studies for an Orphan Drug

A small pharmaceutical company asked us to screen some of their early compounds using an isolated heart preparation. They had several candidate orphan drug compounds for a rare disease, and needed a fast, economical screening tool to separate the compounds that were worth further study. We conducted an ex vivo Langendorff study using a guinea pig model. One of their leading drug candidates demonstrated a dramatic and potentially dangerous effect on heart function in the study in dosages similar to those required for a therapeutic effect. While the drug was potentially promising, the study results showed that it was unlikely to meet the required margins of safety for FDA approval. Other candidates tested using the Langendorff study had no measurable impacts on heart function. As a result of the study, the company was able to refocus their development efforts on potentially safer alternatives.

Development of a Conscious Cyanide Exposure Model

A client needed a new conscious cyanide exposure model developed in order to test the efficacy of potential treatments. While anesthetized models existed, it was difficult to distinguish the cardiovascular and pulmonary effects of the anesthesia from the effects produced by cyanide exposure. The new model would need to accurately mimic both cardiovascular and pulmonary effects seen in cyanide exposure in humans in a conscious, un-anesthetized model in an exposure environment similar to real-world exposures. The new model was needed on a very tight budget and timeline. In order to streamline development as much as possible, Battelle researchers combined telemetry and pulmonary measurements to allow collection of as much data as possible in each trial. We conducted testing in three large animal models, one anesthetized and two conscious. The studies included a comprehensive set of cardiovascular and pulmonary measurements including ECG, blood pressure, left ventricular heart contractility responses, respiratory rate, tidal volume and minute volume. In addition, we monitored blood gases, lactate and methemoglobin. By combining multiple measurements into each trial, we were able to quickly identify the best animal model for the client's needs.

Increasing Accuracy for a GLP Study With Better Subject Handling

A pharmaceutical company needed cardiovascular and pulmonary data to complete an IND package for product approval. We developed a study protocol for a GLP-compliant safety pharmacology study to gather the required data. The study required IV dosing in conscious subjects using a non-human primate model. The client needed to be able to evaluate potentially subtle effects immediately after dosing. However, these effects are often masked by stress responses when the animal is initially dosed. To solve this problem, we created a protocol that would allow researchers to administer the dose remotely from a place where they could not be seen by the subjects. This prevented the rise in heart rate and other stress-related responses that typically occur when the subjects are exposed to humans. Subjects were implanted with vascular access ports and trained to sit comfortably for several hours in a quiet and calm environment. When they were able to do this consistently without showing a cardiovascular or pulmonary stress response, researchers could remotely administer the drug. This protocol allowed for measurement of subtle changes in cardiovascular and pulmonary function without masking effects caused by stress.

Ready to learn more?

Contact us today to talk to with a study design expert.

Every day, the people of Battelle apply science and technology to solving what matters most. At major technology centers and national laboratories around the world, Battelle conducts research and development, designs and manufactures products, and delivers critical services for government and commercial customers. Headquartered in Columbus, Ohio since its founding in 1929, Battelle serves the national security, health and life sciences, and energy and environmental industries. For more information, visit www.battelle.org.

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