Abstract
Nonhuman primates (NHPs) are a social species and benefit from group housing. Positive social interactions can lead to lower stress which is important for animal welfare, but also for reducing potential confounding effects in a toxicology study, especially for sensitive cardiovascular endpoints. The European Council requires that NHPs be housed with one or more cohabitants, while US policy strongly recommends doing so. While social housing is highly desirable for enhancing animal welfare, it can introduce challenges to the collection of high quality cardiovascular data via jacketed telemetry with blood pressure (JET-BP). A comparison of two Covance sites was undertaken to evaluate the consistency of JET-BP assessments in ETS 123 compliant pens across sites. At both Covance-Madison and Münster, etilefrine was administered to NHPs at 0, 1, or 10 mg/kg on 3 occasions to 12 animals (4/group) and cardiovascular changes assessed using JET-BP technology. Systolic blood pressure was slightly increased at 1 mg/kg (10 mmHg; Münster) and markedly increased at 10 mg/kg (≥25 mmHg; Madison and Münster). In addition to comparable levels when assessed by JET-BP at Covance-Madison or Covance-Münster, Sotalol was found to increase systolic blood pressure when assessed by JET-BP at Covance-Madison or Covance-Münster.

Cardiovascular Data Consistency Across Two Covance Sites

Etilefrine
- Etilinefrine given on three occasions at 1 and 10 mg/kg (data not shown at 1 mg/kg) significantly increased systolic pressure (Figure 1A) and pulse pressure (Figure 1B), to comparable levels when assessed by JET-BP at Covance-Madison or Covance-Münster.

Sotalol
- Sotalol given at 30 mg/kg significantly increased QT interval (Figure 1C) and decreased heart rate (Figure 1D) to comparable levels when assessed by JET-BP at Covance-Madison or Covance-Münster.

Conclusions
- JET-BP measurements from NHPs at two Covance sites (Madison and Münster) were comparable.
- Good longevity (through 6 months) of the BP device was demonstrated at Covance-Madison.
- Animals in pen housing (group-housed) had slightly lower heart rate and mean pressure compared with individually housed animals.
- Regulatory agencies already require or recommend social housing of NHPs to enhance animal welfare. However, social housing with JET-BP adds challenges that should be considered during study design to ensure desired study endpoints and program milestones are appropriately met.

Methods
- Cynomolgus monkeys (NHPs) were implanted with a blood pressure transmitter at two Covance locations (Madison, WI and Münster, Germany) and were housed in European guideline (ETS123) compliant pens. NHPs were given etilefrine (non-specific adrenergic agonist) at 1 and 10 mg/kg, and sotalol (non-selective β-blocker and hERG channel blocker) at 30 mg/kg by oral gavage.
- JET-BP collections were performed on days of dosing for at least 90 minutes prior to dosing and continuously for at least 20 hours postdose.
- Data collected were used to determine PR, QRS, QT and rate-corrected QT (QTc); systolic, diastolic and mean arterial pressures; heart rate; and arterial pulse pressure. Data were summarized as one-hour (light phase) or two-hour (dark phase) averages.

Conventional Gold Standard for Consistency of Cardiovascular Data Across Sites

Longevity of BP Device
- Reliable signals from all implants were detected through 9 weeks after the first animal lost BP signal.
- The majority of animals (94%) maintained consistent signals for 6 months. After 6 months, devices began to fail with greater frequency, possibly due to battery failure.

Nonhuman Primates at 0, 1, or 10 mg/kg on 3 occasions to 12 animals (4/group) and cardiovascular changes assessed using JET-BP technology. Systolic blood pressure was slightly increased at 1 mg/kg (10 mmHg; Münster) and markedly increased at 10 mg/kg (≥25 mmHg; Madison and Münster). In addition to comparable levels when assessed by JET-BP at Covance-Madison or Covance-Münster, Sotalol was found to increase systolic blood pressure when assessed by JET-BP at Covance-Madison or Covance-Münster.