**Equipment**

**General Instructions (remove these instructions and any material you do not need)**

When preparing a lis of equipment for your proposal, first look for requirements by the funding agency—what information do they want; what format they want; etc. Include that information in the funding agency’s requested format or using a specific form identified in the program announcement or instructions for proposal development. For example, this type of information may be needed in the *NSF Facilities, Equipment and Other Resources* document.

The following examples were provided by several UCCS faculty members and illustrate the difference between major and minor equipment.

**UCCS Research Equipment in the Osborne Center for Science and Engineering**

**PI Olesnicky Killian, University of Colorado at Colorado Springs, Department of Biology**

**Core and Minor Equipment:**

1. 4 stereomicroscopes, including a fluorescence stereoscope, with CO2 pads, for anesthetizing, dissecting and sorting *Drosophila.*
2. 4 incubators on 12-hour light/dark cycles for housing *Drosophila*, one of which houses *Drosophila* activity monitors.
3. -20**°**C freezer and a 4**°**C deli-style fridge with outlets for nutators and platform shakers.
4. Multiple heat blocks, water baths, vortexes, pipettemen, centrifuges, electrophoresis, immunoprecipitation and Western Blotting equipment as well as a Western Blotting Scanner.

**Dr. Jeremy M. Bono at University of Colorado at Colorado Springs, Department of Biology**

**Core and Minor Equipment:**

1. 2 thermocyclers, several centrifuges
2. Equipment for gel electrophoresis
3. -20°C freezer, 4**°**C refrigerator, and a fume hood.
4. Dissecting microscope equipped with imaging capabilities
5. Anesthesia station

**Dr. Meghan Lybecker at University of Colorado at Colorado Springs, Department of Biology Core and Minor Equipment:**

1. 4°C refrigerator, -20°C freezer
2. CO2 incubators, two heating and cooling incubators, multiple refrigerated centrifuges, dry cooling and heating blocks
3. Thermomixer
4. Agilent Bioanalyzer
5. Qubit flourometer
6. ABI thermocycler
7. Equipment required for vertical and horizontal gel electrophoresis, electroblotting, and dot-blotting.

**Dr. Andrew Subudhi at University of Colorado at Colorado Springs, Department of Biology Core and Minor Equipment:**

***Core Equipment*** includes:

1. Materials testing system for evaluating tensile strength of biological materials
2. AMTI force plates (2) embedded in the floor to evaluate ground reaction forces
3. MGC Diagnostics Ultima CPX metabolic measurement systems (x2)
4. Parvo Medics TrueMax metabolic measurement systems (x2)
5. 16 channel electromyography system for evaluating muscle function
6. Oxymon MkII near infrared spectrometer for tissue oxygenation measurements.
7. Oroboros O2K high resolution respirometers for analysis of mitochondrial function (x2)
8. Perimed Laser Doppler for measurement of skin blood flow.
9. Spencer ST3 transcranial Dopplers (4) for measurement of cerebral blood flow velocity.
10. DWL Transcranial Doppler for measurement of cerebral blood flow velocity.
11. GE Vivid e diagnostic ultrasound for monitoring vascular blood flow and cardiac output.
12. Nexfin HD finger plethysmographs (4) for beat-by-beat blood pressure and cardiac output measurements.
13. Colin 7000 tonometers (2) for beat-by-beat blood pressure monitoring (x2)
14. Oxigraf O2cap oxygen and carbon dioxide analyzers for metabolic measurements (x2).
15. Powerlab 16/30 data acquisition systems (x2).
16. Velotron Elite cycle ergometers for time trial exercise testing (x8).
17. Trackmaster treadmill with interfacing capabilities to both MGC and Parvo metabolic systems
18. Standard Industries force treadmill.
19. Altitude Control Technologies hypoxic gas generator.
20. Lower body negative pressure box for simulating cardiovascular strain.

***Minor equipment*** Nellcor N-200 (measures oxyhemoglobin saturation in the peripheral circulation (x2)), Masimo Rad 8 (measures oxyhemoglobin saturation in the peripheral circulation (x2)), Capnographs to monitor exhaled carbon dioxide (x2), Sable systems thermistors for monitoring skin temperature, CoreTemp HQ telemetry pills for monitoring core temperature, Powerlab 16/30 (both able to integrate up to 16 analog inputs into a single, time-aligned data file and allowing for real-time and offline manipulation of this data (x2)), Lactate Pro portable lactact analyzers (x2). SECA professional scale (weight measurement of research participants during study), as well as a Samaritan SED defibrillator pad (for basic life support). In addition, for basic blood chemistry preparation, the lab is equipped with a Jouan BR 3.11 Centrifuge (separates 5-50mL tubes), and the LW Scientific Microhematocrit Centrifuge (spins down twenty-four 75mL capillary tubes).

Dr. Subudhi also performs his research at the The Altitude Research Center (ARC), which is situated on the Anschutz Medical Campus (AMC) of the University of Colorado Denver (UCD), in Aurora, Colorado.

***Core Equipment*** includes:

1. Oxymon MkIII near infrared spectrometer for tissue oxygenation measurements.
2. Oxymon MkII near infrared spectrometer for tissue oxygenation measurements.
3. Spencer ST3 transcranial Doppler for measurement of cerebral blood flow velocity.
4. DWL Transcranial Doppler for measurement of cerebral blood flow velocity.
5. Sonosite Micromaxx diagnostic ultrasound for monitoring vascular blood flow and cardiac output.
6. Nexfin HD finger plethysmograph for beat-by-beat blood pressure and cardiac output measurements.
7. Colin 7000 tonometer for beat-by-beat blood pressure monitoring (x2)
8. Respiract respiratory gas mixer for controlling end-tidal concentrations of oxygen and carbon dioxide.
9. Ametek oxygen (S-3a/II) and carbon dioxide (CD-3A) analyzers for metabolic measurements (x2).
10. Oxigraf O2cap oxygen and carbon dioxide analyzers for metabolic measurements (x2).
11. Powerlab 16SP and 16/30 data acquisition systems.
12. Radiometer OSM-3 hemoximeter for hemoglobin and hematocrit measurements (x2).
13. Laboratory Instruments blood gas analyzer.
14. Velotron Elite cycle ergometer for time trial exercise testing.

***Minor equipment*** in the main ARC laboratory includes: Nellcor N-595 (measures oxyhemoglobin saturation in the peripheral circulation (2 each)), Criticare 503 (measures oxyhemoglobin saturation in the peripheral circulation (2 each)), Universal Ventilation Meter (measures ventilation via spirometry), O2Cap Oxygen Analyzer (measures oxygen and carbon dioxide concentrations (2 each)), Powerlab 16/30P and Power lab 16SP (both able to integrate up to 16 analog inputs into a single, time-aligned data file and allowing for real-time and offline manipulation of this data), Ametek O2 and CO2 analyzers (measures oxygen and carbon dioxide concentrations (2 each)), Vacuumed Metabolic Measurement System (measures ventilation, respiratory gases, and oxygen consumption (2 each)), SECA portable scale (weight measurement of research participants during study), as well as a Samaritan SED defibrillator pad (for basic life support). In addition we will set up a Sorvall RT 6000 Refrigerated Centrifuge (allows for the separation of 15-50 mL tubes at speeds of up to 6,000 revolutions per minute), the Jouan BR 3.11 Centrifuge (separates 5-50mL tubes), and the LW Scientific Microhematocrit Centrifuge (spins down twenty-four 75mL capillary tubes).

**Department of Biology Shared Equipment:**

Shared equipment located within the laboratory spaces includes -80**°**C freezers, autoclaves, multiple shaking incubators, environmental chambers, light/dark incubators, walk-in 4**°**C room for performing biochemical experiments, a Leica fluorescent compound microscope, Nikon fluorescent stereoscope, six stereoscopes, a dark room and dedicated space for radioisotope work, a scanner for Western blotting, UV gel imaging system, nanodrop and Qubit systems for measuring nucleic acid concentrations, multiple thermocyclers and 4**°**C centrifuges.

**Dr. Todd Bredbenner at University of Colorado at Colorado Springs, Biomechanics and Engineering Laboratory Core and Minor Equipment**

1. Bone storage, dissection, and specimen preparation bench.
2. Four -20 C freezers and a refrigerator are available for specimen storage
3. 3-axis CNC mill
4. Low speed diamond saw, and assorted hand tools are available for specimen preparation.
5. Three 5.5 kip (24.5 kN) servo-hydraulic testing systems available for structural testing of whole bones or bone-implant constructs or for specimen-level material property determination.
6. Four local workstations are available for image processing and compute jobs.
7. High performance computing resources are available through a renewable allocation from the National Science Foundation's Extreme Science and Engineering Discovery Environment (XSEDE) program. Remote and locally installed software includes Dragonfly, NESSUS Probabilistic Analysis Software, LS-DYNA, MPP/LS-DYNA, FEAP, FEBio, MATLAB, MathCad, Mathematica, Solidworks, LabView (test control and data acquisition), plus standard packages for word processing, graphics, data analysis, and statistics.
8. A machine shop is available within the Mechanical and Aerospace Engineering Department for fixture fabrication.

**Dr. Kathrin Spendier at University of Colorado at Colorado Springs, Biofrontiers Institute**

**Laboratory** **Core and Minor Equipment:**

The University’s Biofrontiers Institute is a shared facility located across the hall from the Biology laboratories that is well equipped with additional research equipment for quantitative RT-PCR, FACS sorting and cell culture. Additionally, Biofrontiers houses a number of microscopes available for our use for a subsidized facility user. Available microscopy equipment within BioFrontiers includes

1. Leica SP5 laser scanning confocal microscope,
2. WiTec alpha 300 spectral NSOM/AFM system,
3. A customized, single-molecule sensitive total internal reflection (TIRF) microscope (Leica, spectral applied research, described below),
4. A Tecsan scanning electron microscope.
5. An EL-Lab benchtop NMR spectrometer
6. Quantitative RT-PCR (Applied Biosystems)
7. a flow cytometer (Beckman cytomics FC500MPL)
8. an ultracentrifuge (Thermo Sorvall MX120+)
9. spectrophotometers (Beckman DU640 and Perkin-Elmer Lambda 1050)
10. spectrofluorometer (Horiba Jobin Yvon nanolog)
11. Thermo -80 deg. freezer)
12. Beckman HPLC
13. A differential scanning calorimeter, a microplate reader, Bio-Rad electrophoresis equipment, a cold room, a Beckman coulter counter, an autoclave, an ice machine, and several computers
14. A BSL-2 approved biosafety cabinet (NuAire).

The first super-resolution microscope setup is shared with the TIRF instrument listed above. The system consists of Leica DMI8 microscope equipped with 100X/1.47 NA TIRF objective, Andor Zyla sCMOS and photometrics EMCCD cameras, a filter wheel, and piezo-actuated Z stage. The structured illumination system consists of a LED light source, LCOS microdisplay for creating SIM patterns (type 3DM, Fourth Dimension Displays), and the associated lenses, filters, and polarizers. The system is controlled by Andor IQ software and electronics developed in the Hagen laboratory. The system also includes a TIRF illumination device and laser combiner with 405, 488, and 561 nm lasers (Spectral Applied Research). The laser TIRF laser system is also capable of single molecule localization microscopy (PALM/STORM, etc.)

The second super-resolution microscope setup includes an inverted, motorized, Olympus IX83 fluorescence microscope and Olympus plan-apochromatic silicone oil immersion objectives. Silicone oil immersion objectives offer several advantages when imaging live cells. The refractive index of the oil used by these objectives (1.404) more closely matches the refractive index of cellular contents compared to water. The microscope system includes a high sensitivity, high speed camera which is used for single molecule imaging. The microscope system also includes an incubation device, which is used for long term imaging of live cells

**Sports Medicine and Performance Laboratory Core and Minor Equipment**

The facilities will be equipped with state-of-the- art equipment for measuring physiological responses at rest and to various stressors, such as heat, humidity, altitude, exercise and lower body negative pressure. Specific equipment includes, but is not limited to, the following: mass spectrometer (1), blood gas analyzer (1), spectrophotometers (2), centrifuges (3), ultralow freezer (1), cardiovascular ultrasound (2), transcranial Doppler (5),laser Doppler (2), near infrared spectroscopy (4), coximeter (1), oximeters (6), respirometers (4), spirometers (6), fast-response gas analyzers (4), DEXA (1), Bod Pod (1), continuous blood pressure monitors (4), metabolic carts (6), and transcranial magnetic stimulator (1).

**Anschutz Medical Campus Equipment**

Drs. Artinger, Barlow, Appel and Macklin have fully equipped laboratory space with standard modern instrumentation for biochemical, cell, embryological and molecular work, including PCR machines, dissecting microscopes, compound microscopes, refrigerators and freezers (20°C and -80°C), hybridization ovens, incubators and shakers.

**Anschutz Medical Campus Core and Shared Equipment:**

1. Beckman ultracentrifuge
2. super-speed centrifuge
3. UV/visible spectrophotometers
4. scintillation counter
5. Sonicator
6. HPLC
7. Vibratome
8. Microtome
9. Real time-PCR machine
10. tissue culture hood
11. tissue culture incubator
12. liquid nitrogen storage tanks
13. hybridization ovens
14. documentation systems for UV
15. visible and chemiluminescent detection
16. speedvac
17. gel drier
18. table-top centrifuge
19. Leica M420 macroscope
20. access to Nikon TE200 inverted and E600 compound microscopes for visible, darkfield and fluorescence microscopy
21. Spot RT Digital cameras
22. an FPLC
23. BTX ECM2001 electroporation/electrofusion apparatus.
24. several confocal microscopes
25. spinning disk microscope
26. an electron microscope
27. TIRF microscope
28. 3D Storm Imager
29. phosphoimager

Additional core facilities at the Anschutz Medical Campus include

1. Mass Spectrometry Core
2. Biostatistics and Bioinformatics Shared Resource
3. Genomics and Microarray Core
4. Flow Cytometry Core
5. Transgenic and Gene Targeting Core
6. Behavior and Neurophysiology Core
7. Cytogenetics Core
8. Tissue Culture Core
9. Protein Chemistry Core Facility
10. Structural Biology Core Facility

Specific details regarding equipment of core facilities can be found at http://www.ucdenver.edu/academics/colleges/medicalschool/departments/medicine/Pages/CR-AMC-Research-Cores.aspx