



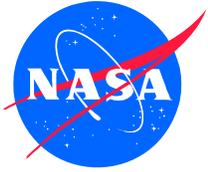
CELL SCIENCE RESEARCH

Biotechnology Specimen Temperature Controller

General Overview Summary

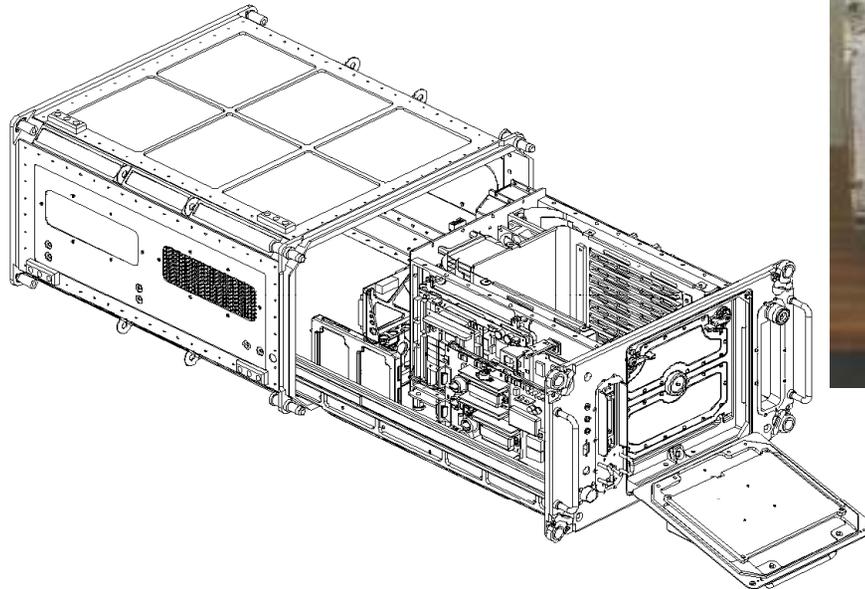
NASA-owned Hardware

**Developed, Integrated and Operated
by Wyle Integrated Science & Engineering**



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Biotechnology Specimen Temperature Controller



- Isothermal incubator that houses 32 stationary bioreactors: maintains cell cultures at a specified temperature in a controlled atmosphere
- Supports 3D tissue culture microanatomy, genomic, and proteomic experiments
- Allows for on-orbit initiation of experiments
- Minimal down mass and volume: could be brought home on other than the Shuttle
- Supported cellular biotechnology investigations on two Shuttle missions and ISS Increments 3, 4, & 5
- Hardware currently resides on ISS; will need to be recertified



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Biotechnology Specimen Temperature Controller

STS-86 / MIR 6

- * Rat Renal Tubular cells, T. Hammond, M.D.B.S., Tulane University Medical Center
- PC-12 - Neuroendocrine, P. I. Lelkes, Ph.D., University of Wisconsin Medical School
- * HL-60 cells, N. R. Pellis, NASA, JSC

STS-90

- * Human Renal Tubular cells, T. Hammond M.D.B.S., Tulane University Medical Center
- * HL-60 cells, N. R. Pellis, NASA, JSC

ISS experiment durations were ~ 2 weeks

Increment 3

- * MIP-101 - Colon Carcinoma, J. M. Jessup, M.D., University of Pittsburgh Medical School
- * PC-12 - Pheochromocytoma, P. I. Lelkes, Ph.D., Drexel University
- * LN-1 – Ovarian Tumor, J. L. Becker, Ph.D., University of South Florida
- * HRCE – Human Renal Cortical Epithelial cell, T. Hammond M.D.B.S., Tulane University Medical Center

Increment 4

- * EMS-3 – Murine Rauscher Erythroleukemia, A. J. Sytkowski, M.D., Ph.D., Harvard Medical School
- * HRCE – Human Renal Cortical Epithelial cell, T. Hammond M.D.B.S., Tulane University Medical Center
- * HLT – Human Lymphoid Tissue, J. Zimmerberg, National Institutes of Health

Increment 5

- * Human Liver Cells, Albert Li, Ph.D., StelSys LLC, Baltimore, MD

16 June 2009



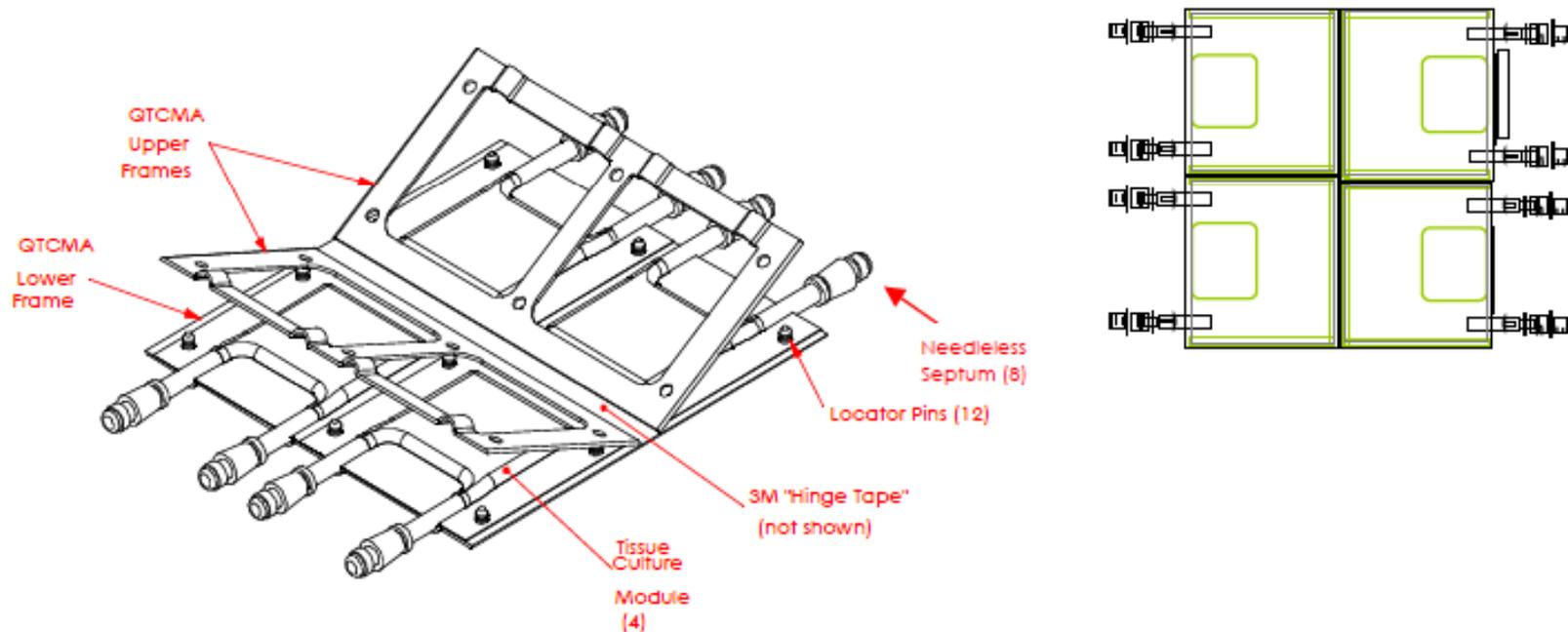
Scott Parazynski, MD



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Tissue Culture Modules in Quad Tissue Culture Module Assembly



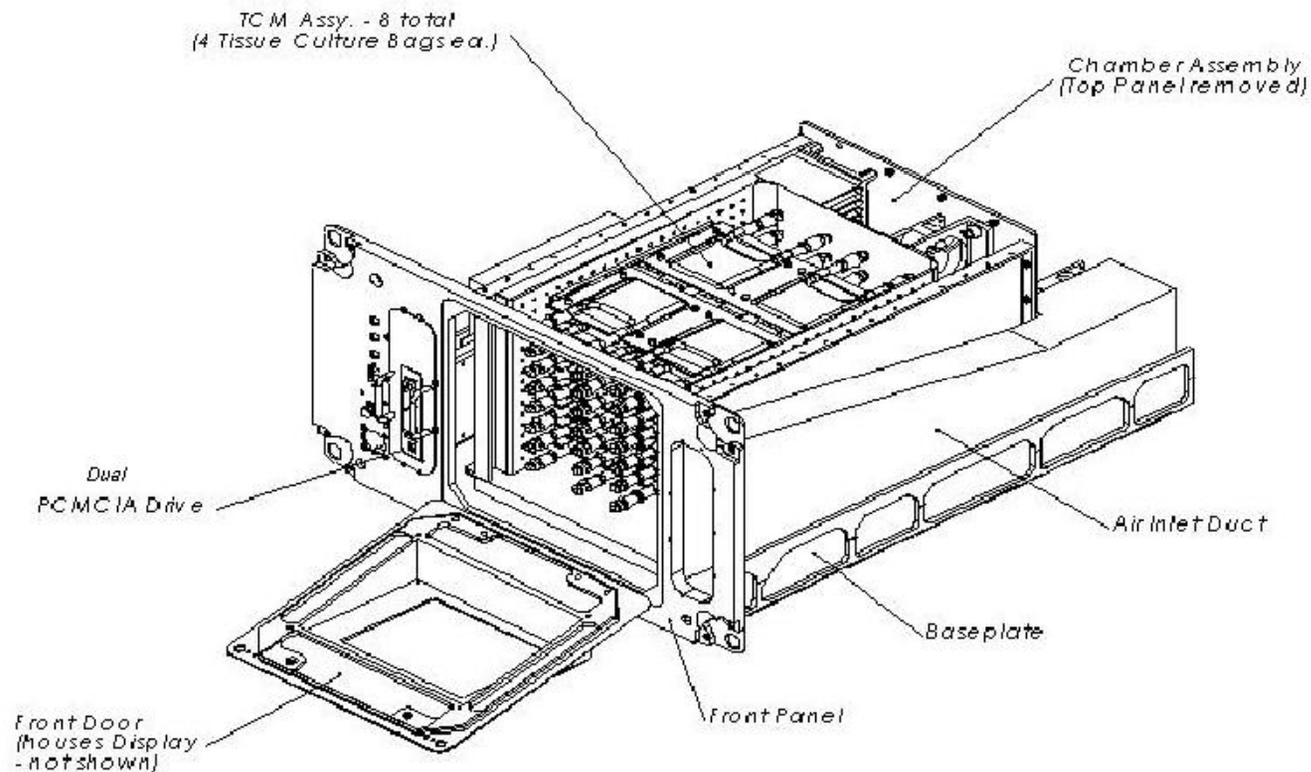
- The Tissue Culture Modules are stationary bioreactors that are held in Quad Tissue Culture Module Assemblies.
- The Assemblies allow for multiple / replicate experiments to be performed simultaneously, with a capacity of 32 Tissue Culture Modules at a time.

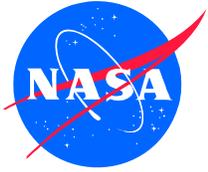


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Biotechnology Specimen Temperature Controller With 8 Quad Tissue Culture Module Assemblies

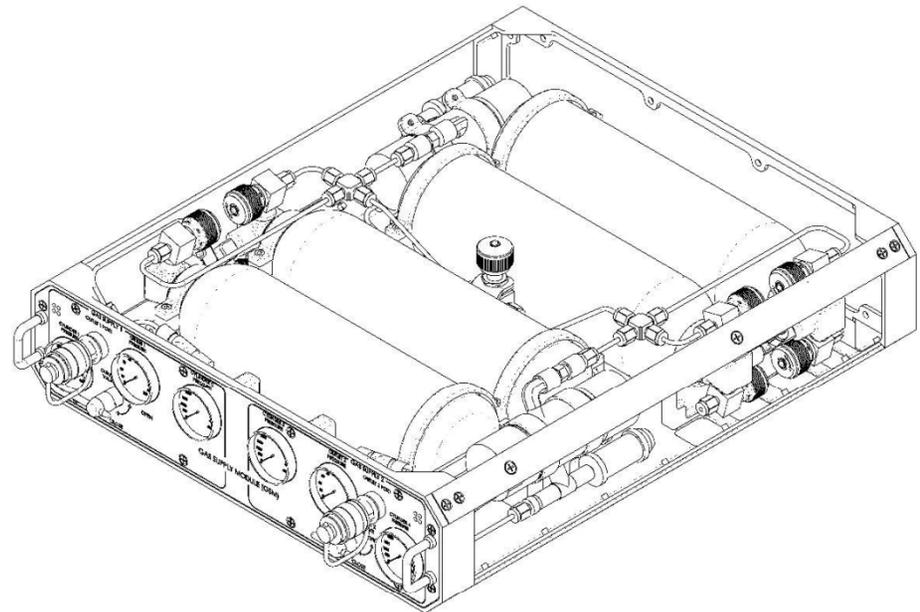




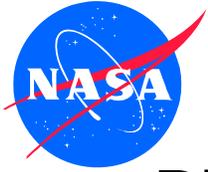
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Gas Supply Module



- The Gas Supply Module is a passive, support payload that supplies CO₂ enriched air to the Biotechnology Specimen Temperature Controller.
- It contains two independent supply lines for multi-experiment support.



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Biotechnology Specimen Temperature Controller

Biotechnology Cell Science Stowage

- Ambient supplies provides all necessary equipment to perform experiments
- PCBA: pH, Glucose, O₂, CO₂, others



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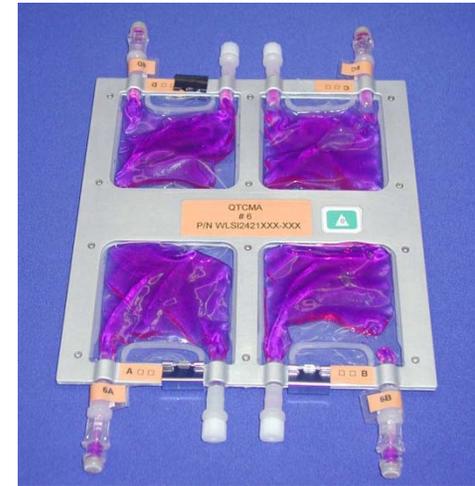
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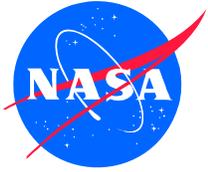
Biotechnology Specimen Temperature Controller

Suite of hardware completes
your science needs on ISS



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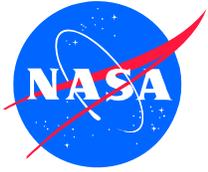
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Backup

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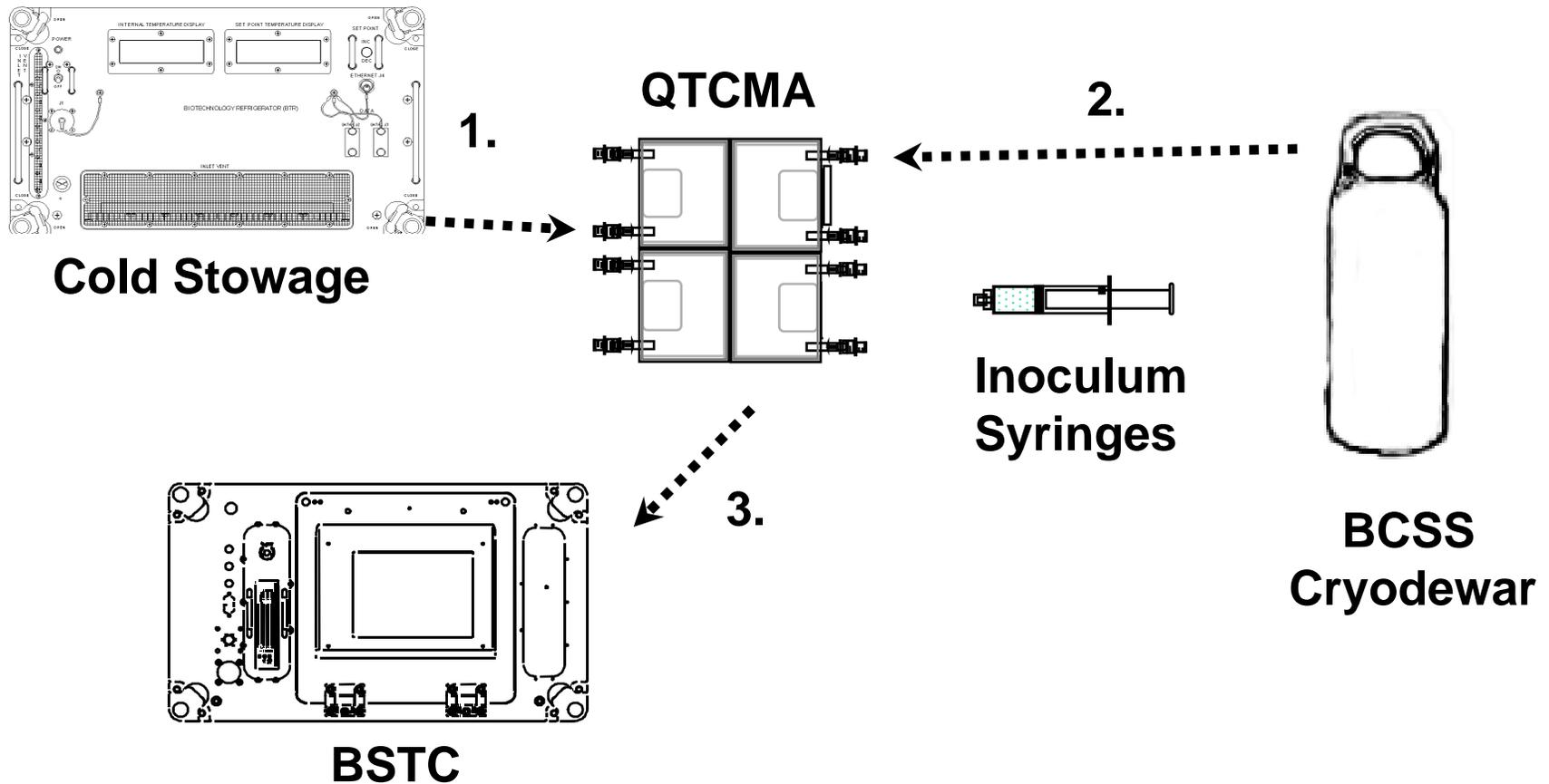


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Biotechnology Specimen Temperature Controller

Example Operations Diagram

Experiment Initiation



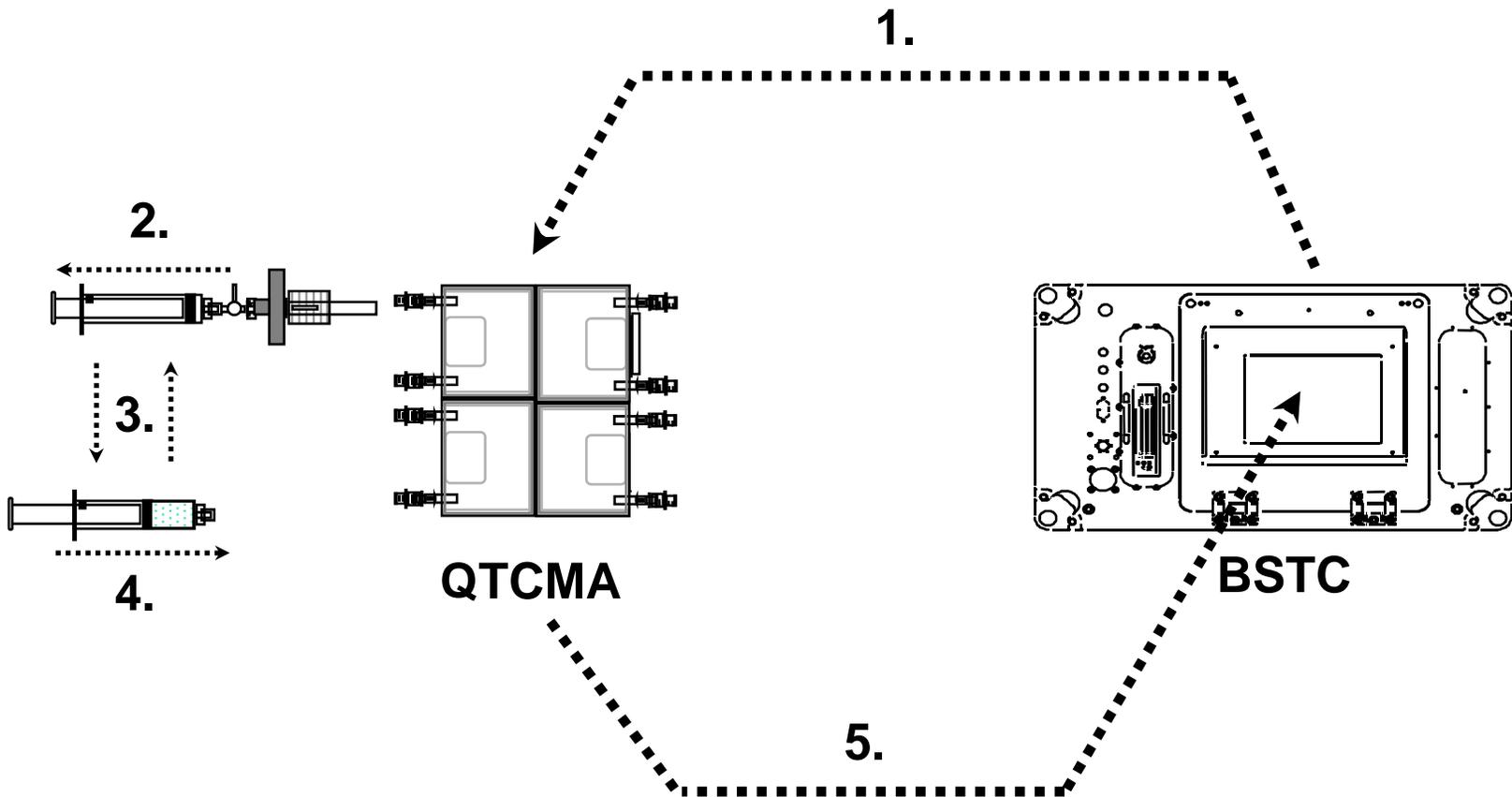


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Example Operations Diagram

Media Exchange



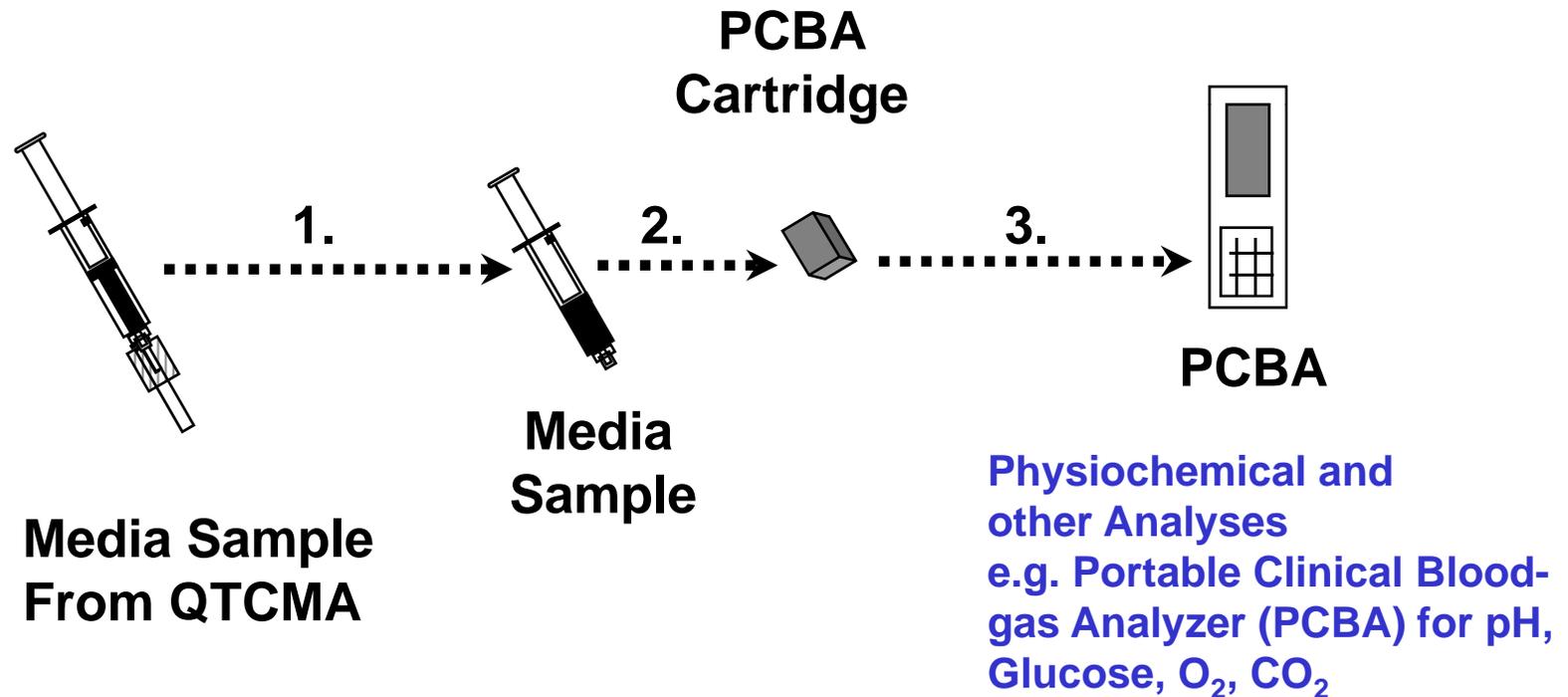


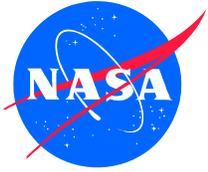
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Biotechnology Specimen Temperature Controller

Example Operations Diagram

Media Analysis



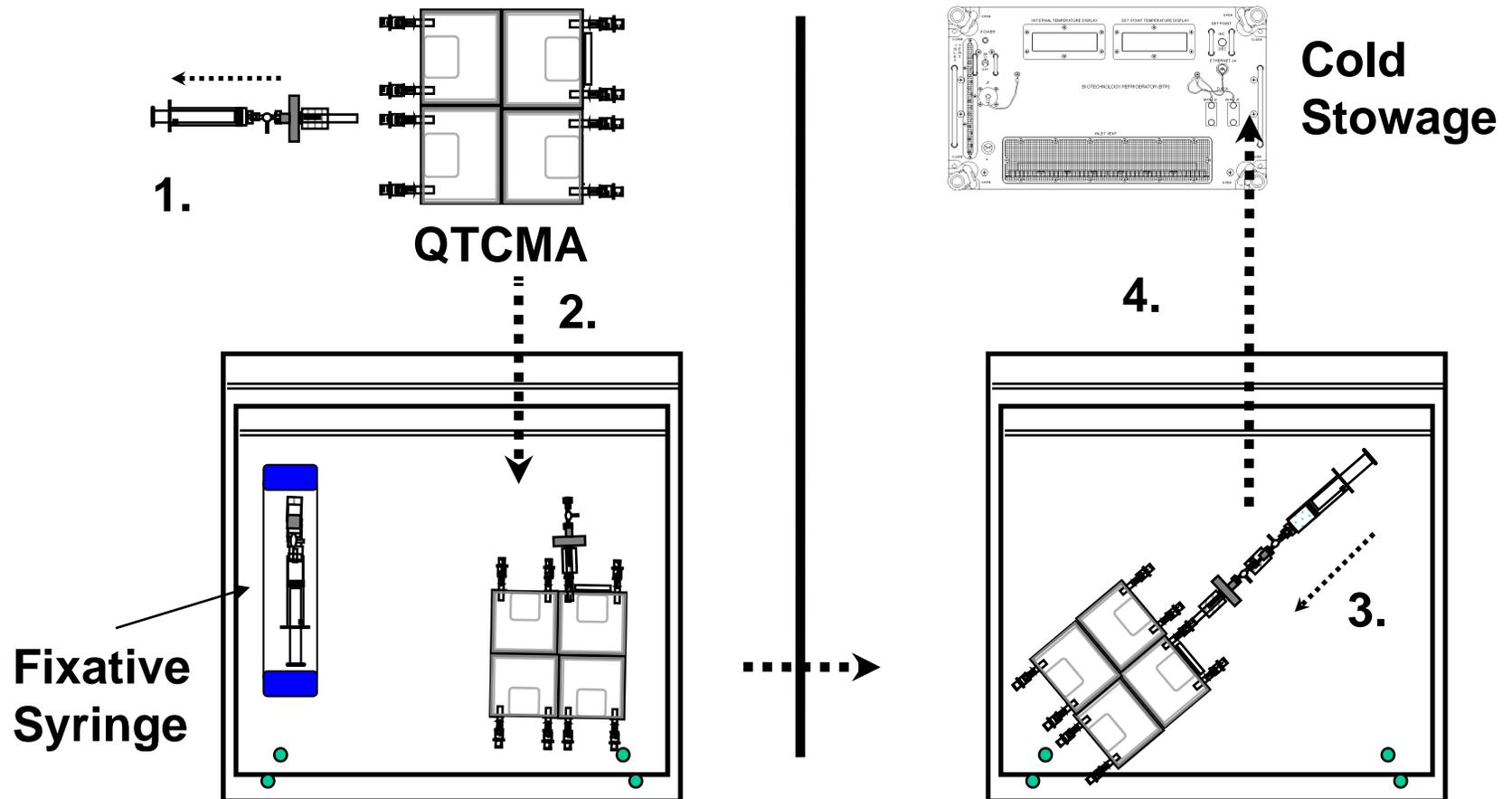


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Example Operations Diagram

Culture Preservation



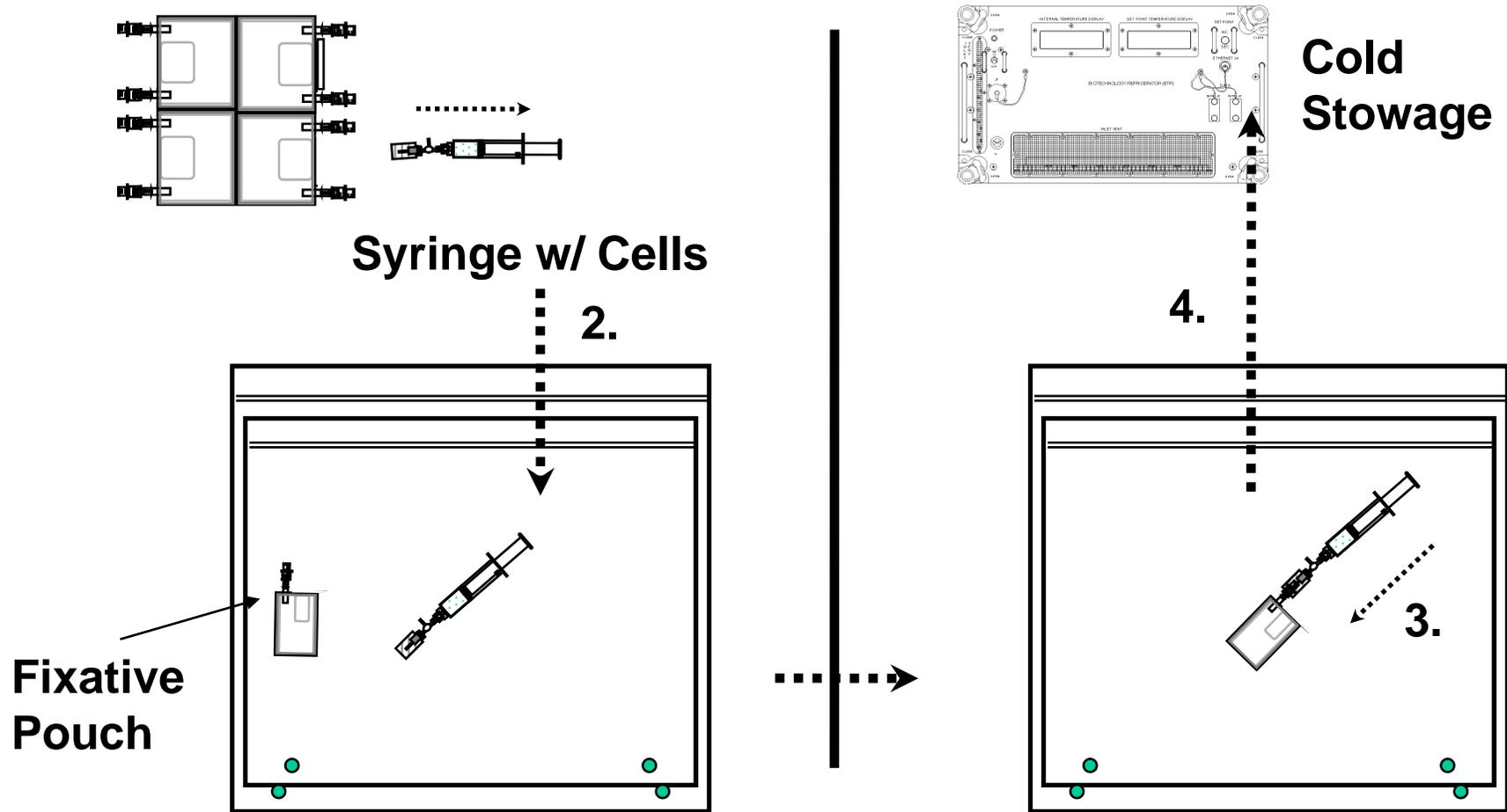


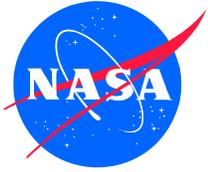
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Example Operations Diagram

Alternative Culture Preservation (for EM)





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Ancillary Equipment on ISS: Cold stowage, centrifuge, microscopes, glovebox and other support equipment/supplies

Minus Eighty Laboratory Freezer for ISS



Microgravity Sciences Glovebox



Human Research Facility 2 (HRF-2) Refrigerated Centrifuge



Saibo Experiment Rack (Saibo) that includes a Clean Bench glovebox with microscope