



**Technology Transfer and Commercialization Office
NASA Johnson Space Center**

Bringing NASA Technology Down to Earth

JSC Health and Medicine Intellectual Property Catalog

preface



For more than five decades, NASA's Johnson Space Center (JSC) has led our nation and the world on a continuing adventure of human exploration, discovery, and achievement. The center plays a vital role in transcending the physical boundaries of our planet to further our knowledge and enhance our quality of life.

JSC proudly manages NASA's human spaceflight functions, including International Space Station. JSC is home to the NASA astronaut corps and is responsible for training space explorers from the United States and our space station partner nations. JSC also serves as NASA's lead center for life sciences research and applications. The Human Health and Performance (HH&P) Directorate is engaged in understanding the effects of the space frontier on the capabilities and limitations of humans living and working in that frontier.

Learn more about NASA JSC technologies by visiting Technology Transfer & Commercialization Office website at <http://technology.jsc.nasa.gov> and explore the research and development being done by our NASA scientists at the Human Health and Performance Directorate website, www.nasa.gov/centers/johnson/slsd/.

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introduction



NASA owns over 1,000 patents and patent applications that protect inventions in hundreds of subject matter categories. NASA makes these inventions available to industry and entrepreneurs through license agreements. The JSC patented and patent pending technologies included in this portfolio are all available for licensing. These technologies are the product of extensive research and development conducted in the five strategic areas of the Human Health and Performance Directorate.

Human Health and Performance Research & Development

Human Health and Countermeasures

Identifies the challenges that humans face in space and develops procedures, technologies, activities, and equipment to keep crewmembers safe in the space environment. These are also known as “countermeasures” since they counter the ill effects that the space environment has on the human body.

Behavioral Health and Performance

Assess the impact of space travel on human behavioral health and develop interventions and countermeasures to ensure optimal crew member health and performance.

Space Radiation

Study the impact of long-term exposure to space radiation and develop countermeasures that may help protect crewmembers from it, including the possibility of cancer, visual disorders, radiation sickness, damage to the central nervous system, and potential hereditary effects.

Space Human Factors and Habitability

Study and develop new equipment, procedures, and technologies to make the space environment more comfortable, livable, and more conducive to the crew being productive and effective. These technologies incorporate a Human Systems Integration approach, and include creating nutritious food and establishing exposure limits for environmental factors such as chemicals, bacteria, fungi, and lunar dust.

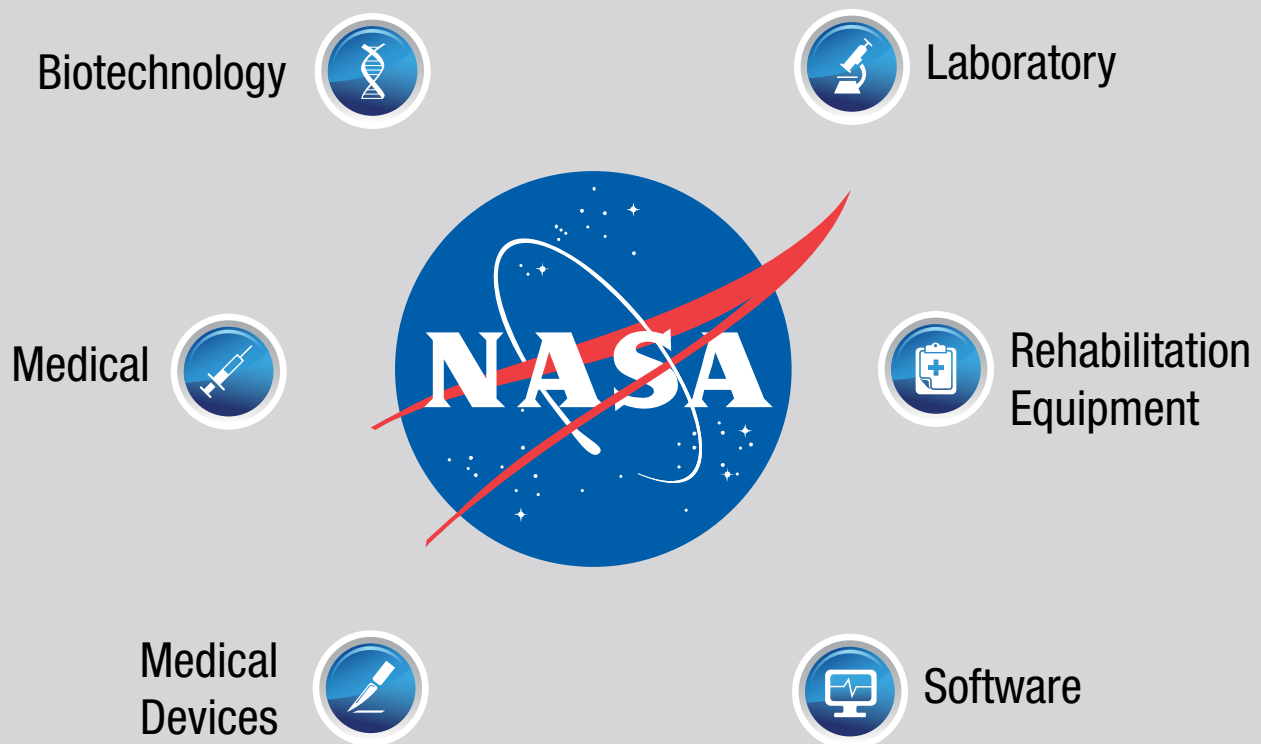
Exploration Medical Capability

The research conducted in the Exploration Medical Capability Element focuses on methods of monitoring and maintaining crewmember health by preventing health problems, learning to treat injuries, and minimizing illnesses that may occur in the course of a mission.



The technologies in this portfolio are divided into industries where their application would be most advantageous, by license availability, and by patented and patent pending. Many of the technologies were co-developed with universities and other institutions. These technologies are jointly owned and require coordination with the partnering institutions to obtain a license.

Please visit our Technology Transfer website at <http://technology.jsc.nasa.gov> to learn about the licensing process, download an application form, and learn about our success stories.





Biotechnology

Available for an Exclusive License

Micro-organ device

MSC-23988-1

Patent No. 8,343,740

A method for fabricating a micro-organ device (MOD) comprising of a microscale support having one or more microfluidic channels and one or more micro-chambers for housing a micro-organ and printing a micro-organ on the microscale support using a cell suspension in a syringe controlled by a computer-aided tissue engineering system, wherein the cell suspension comprises cells suspended in a solution containing a material that functions as a three-dimensional scaffold. The printing is performed with the computer-aided tissue engineering system according to a particular pattern. The MOD comprises of at least one micro-chamber each housing a micro-organ; and at least one microfluidic channel connected to the micro-chamber, wherein the micro-organ comprises cells arranged in a configuration that includes microscale spacing between portions of the cells to facilitate diffusion exchange between the cells and a medium supplied from the at least one microfluidic channel.

Available for a Partially-Exclusive License or Sub-license

Molecular specific antibodies against urokinase

MSC-21947-1

Patent No. 7,541,159

Antibodies have been developed against the different molecular forms of urokinase using synthetic peptides as immunogens. The peptides were synthesized specifically to represent those regions of the urokinase molecules which are exposed in the three-dimensional configuration of the molecule and are uniquely homologous to urokinase. Antibodies are directed against the lysine 158-isoleucine 159 peptide bond which is cleaved during activation from the single-chain (ScuPA) form to the bioactive double chain (54KDa and 33KDa) forms of urokinase and against the lysine 135 lysine 136 bond that is cleaved in the process of removing the alpha-chain from the 54KDa form to produce the 33KDa form of urokinase. These antibodies enable the direct measurement of the different molecular forms of urokinase from small samples of conditioned medium harvested from cell cultures.

Growth stimulation of biological cells & tissue by electromagnetic fields

MSC-22633-1, -2

Patent No. 6,485,963; 6,673,597

The present invention provides systems for growing two or three dimensional mammalian cells within a culture medium facilitated by an electromagnetic field, and preferably, a time varying electromagnetic field. The cells and culture medium are contained within a fixed or rotating culture vessel, and the electromagnetic field is emitted from at least one electrode. In one embodiment, the electrode is spaced from the vessel. The invention further provides methods to promote neural tissue regeneration by means of culturing the neural cells in the claimed system. In one embodiment, neuronal cells are grown within longitudinally extending tissue strands extending axially along and within electrodes comprising electrically conductive channels or guides through which a time varying electrical current is conducted, the conductive channels being positioned within a culture medium.

Production of functional proteins

MSC-22859-1, -2, -3, -5

Patent No. 6,730,498; 6,946,246; 7,198,947; 7,972,821

The present invention provides a method for production of functional proteins including hormones by renal cells in a three dimensional co-culture process responsive to shear stress using a rotating wall vessel. Natural mixture of renal cells expresses the enzyme 1- α -hydroxylase which can be used to generate the active form of vitamin D: 1, 25-diOH vitamin D3. The fibroblast cultures and co-culture of renal cortical cells express the gene for erythropoietin and secrete erythropoietin into the culture supernatant. Other shear stress response genes are also modulated by shear stress, such as toxin receptors megalin and cubulin (gp280). The technique can be used both to study previously known and to discover previously unknown responses of cells to shear stresses.



Medical

Available for a Partially-Exclusive License or Sub-license

Endothelium preserving microwave treatment for atherosclerosis

MSC-22724-1,-2,-3; MSC-23781-1

Patent No. 6,047,216; 6,226,553; 6,223,086; 7,410,485

The technology includes the method and device developed to treat atherosclerosis through the use of microwave energy. This involves propagating microwave energy into the arterial wall to produce a desired temperature profile therein at tissue depths sufficient for thermally necrosing connective tissue and softening fatty and waxy plaque while limiting heating of surrounding tissues including the endothelial layer and/or other healthy tissue, organs, and blood. A radically beveled waveguide antenna can be used to deliver microwave energy at various frequencies (25/30 GHz - 300 GHz). Because the atherosclerotic lesions are often asymmetrically disposed, directable or focused heating preserves healthy sectors of the artery and applies energy to the asymmetrically positioned lesion faster than a non-directed beam. A computer simulation predicts isothermic temperature profiles for the given conditions and may be used in selecting power, pulse duration, beam width, and frequency of operation to maximize energy deposition and control heat rise within the atherosclerotic lesion without harming healthy tissues or the sensitive endothelium cells.

Coronary artery disease diagnosis

MSC-23154-1-2; MSC-23449-1

Patent No. 7,113,820; 7,539,535; 7,386,340

Real time cardiac electrical data are received from a patient, manipulated to determine various useful aspects of the ECG signal, and displayed in real time in a useful form on a monitor. The monitor displays the high frequency data from the QRS complex in units of microvolts, juxtaposed with a display of conventional ECG data in units of millivolts or microvolts. The high frequency data are analyzed for their root mean square (RMS) voltage values and the discrete RMS values and related parameters are displayed in real time. The high frequency data from the QRS complex are analyzed with imbedded algorithms to determine the presence or absence of reduced amplitude zones, referred to herein as "RAZs". RAZs are displayed as "go, no-go" signals. The RMS and related values of the high frequency components are displayed as time varying signals, and the presence or absence of RAZs may be similarly displayed over time.



Medical Devices

Available for an Exclusive License

Microwave treatment system for prostate cancer and hyperplasia

MSC-23049-3,-4

Patent No. 6,592,579; 6,675,050

The microwave treatment system treats for benign prostatic hyperplasia (BPH). The technology includes a catheter with a small diameter disk loaded monopole antenna surrounded by fusion material having a high heat of fusion and a melting point at or near body temperature. Micro-waves from the antenna, heat prostatic tissue to promote necrosing of the prostatic tissue that relieves the pressure of the prostatic tissue against the urethra as the body reabsorbs the necrosed or dead tissue. The fusion material keeps the urethra cool, preventing damage to the urethra while the prostatic tissue is necrosed. A computer simulation is used to predict the resulting temperature profile produced in the prostatic tissue. Changing the various control features of the catheter and method of applying microwave energy, a temperature profile can be produced for each patient.

Determining postural stability using shoe insert pressure sensors*

MSC-24387-1

Patent No. 8,011,229

The invention is a software package for reading and analyzing pressure distributions from sensors mounted under a person's feet. Pressure data from sensors mounted in shoes or in a platform can be used to provide a description of postural stability (assessing competence to deficiency) and enables the determination of the person's present activity (running, walking, squatting, falling). The invention could be used, for instance, to help a physical therapist gauge the progress of a stroke patient as they relearn skills like standing, walking, and running. It could also be used to help train athletes, quantifying their daily behavior (time spent running, etc.) during training. It could be used to check how well an astronaut is adjusting to changes in gravitational field strength, in the context of earth re-entry following space travel, or a Moon or Mars mission.

* Jointly Owned Technology – licensing negotiations would be done with partnering university/institution.

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Collapsible, Light Portable Human Hyperbaric Chamber/Airlock System

MSC-23076-1

Patent No. 6,321,746

A toroidal inflatable skeleton provides initial structural support for the chamber, allowing the attendant and/or patient to enter the chamber. Oval hatches mate against bulkhead rings, and the hyperbaric chamber is pressurized. The hatches seal against an o-ring, and the internal pressure of the chamber provides the required pressure against the hatch to maintain an airtight seal. In the preferred embodiment, the hyperbaric chamber has an airlock to allow the attendant to enter and exit the patient chamber during treatment. Visual communication is provided through portholes in the patient and/or airlock chamber. Life monitoring and support systems are in communication with the interior of the hyperbaric chamber and/or airlock chamber through conduits and/or sealed feed-through connectors into the hyperbaric chamber.



Rehabilitation Equipment

Available for an Exclusive License

Advanced resistive exercise device (ARED)

MSC-23805-1

Patent No. 7,462,141

It is designed to enable the user to perform the three primary resistive exercises, for stimulating bone regeneration and exercising the major muscle groups. It also has the ability to perform 15 other exercises for secondary muscle groups. The major subsystems of the ARED are a pair of vacuum cylinders, a frame-and-platform assembly, an arm base assembly, a wishbone arm/lift bar, a cable-and-pulley mechanism, and a flywheel mechanism.



Laboratory Devices

Available for a Partially-Exclusive License or Sub-license

Preservation of liquid biological samples

MSC-22616-2-3

Patent No. 6,133,036; 6,716,392

This technology is a method for adding a patented preservative to a commercial off-the-shelf collection kit. This proprietary process coats the interior of the storage vile with the patented preservative chemical cocktail. For example, this additive in conjunction with centrifuging, allows saliva samples to be stored at room temperature for up to six months. The preservative technology can be used with different biological liquid samples and in different clinical applications that require long-term storage of biological samples at ambient temperatures.

Patent Pending

Available for a Partially-Exclusive License or Sub-license



High-density spot seeding (HDSS)

Patent Application No. 12/880602

MSC-24314-1

Filing Date: 9/13/2010



This technology is simple, reproducible, and cost effective method to create 2D and 3D tissue models by high-density spot seeding (HDSS) of cells. Tissue models created by these methods include but are not limited to skeletal muscle, cardiac muscle, nerve, and bone. This method enables generation of highly-aligned, linear contracting tissue without the use of laborious grids or expensive serum additives to induce cellular differentiation.



Re-growing cartilage cells by noninvasive method Electromagnetic time variance magnetic fields (TVMF)

Patent Application No. 12/899815

MSC-24541-1

Filing Date: 10/7/2010



The technology stimulates the regrowth of cartilage cells by the non-invasive method of electromagnetic time variance magnetic fields (TVMF) at predetermined frequencies. The device can be wrapped around the joints on a patient where infected cartilage is located. Molecular and marker data have shown this innovation to work with the method described in the patent application. This is a non-invasive technology that regenerates the patient's own tissue, allowing for possibly no significant side-effects or foreign matter reactivity.



Self-enclosed and pipette free DNA/RNA isolation device

Patent Application No. 13/461,487

MSC-24811-1; MSC-24813-1

Filing Date: 5/01/2012



The technology is a self-enclosed kit for isolating DNA, RNA, proteins, and/or cells without the use of pipettes or centrifuge. This compact, self-contained fluidic system equipped with functionalized membranes, micropumps, and reagents permits the extension of laboratory isolation protocols to many applications. The system employs the proven polymerase chain reaction method. A book-sized (10in. X 10in. X 2in.) prototype isolation kit has been constructed and has successfully validated the technical approach.



Hydrostatic hyperbaric chamber

Patent Application No. 13/774,835

MSC-25313-1

Filing Date: 2/22/13

This technology differs from standard hyperbaric chambers in that the majority of its volume is filled with substantially non-compressible liquid in a lower portion of the chamber which is pressurized by oxygen being supplied in the portion of the chamber containing the patients head. This greatly reduces the amount of oxygen required to sustain a hyperbaric atmosphere, thereby making the system more safe and economical to operate. The patient is able to breathe oxygenated gas that has been hyperbarically introduced to the top portion of the chamber.



Systems and methods for RFID enabled information collections

MSC-24919-1, MSC-25590-1, MSC-25604-1, MSC-25605-1

Patent Application No. 13/790,591; 13/790,927; 13/791,584, 13/790,721

Filing Date: 3/8/13; 7/13/12; 3/8/13; 3/8/2012

This group of technologies addresses methods of monitoring product inventory and tracking via RFID when the items is too small to tag e.g., bulk grain foods, liquids, pills, etc. The innovation can also serve as a level indicator or a number of other sensor types such as a distributed pressure sensor. This technology has improved dispenser with 1.25 cm and 2.5 mm resolution, RFID enabled reel dispenser, point-of-purchase display, gravity-assisted incline dispenser, and methods for warehouse/retail site-wide rapid inventory.

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Digital to analog transformations and reconstructions of multichannel electrocardiograms

MSC-25265-1

Patent Application No. 13/851,778

Filing Date: 3/27/13



This technology has hardware and software for digital to analog conversion and reconstruction of multichannel electrocardiograms. One of the possible methods covered under the patent includes receiving digital information representative of a plurality of independent signals, producing a plurality of analog outputs from said digital information wherein a first analog output is designated as a common reference, and imposing a predetermined voltage on a second analog output with respect to said common reference, which provides for a substantial recreation of the original independent signals. The apparatus comprises a processor operable for receiving digital information representative of independent lead signals from a first ECG machine and digital to analog circuitry for substantially reproducing the original lead signals for analysis on a second ECG machine for convenient and efficient second opinions of cardiac data. A prototype exists and has been used for a study where reconstructed versus original files were tested.



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