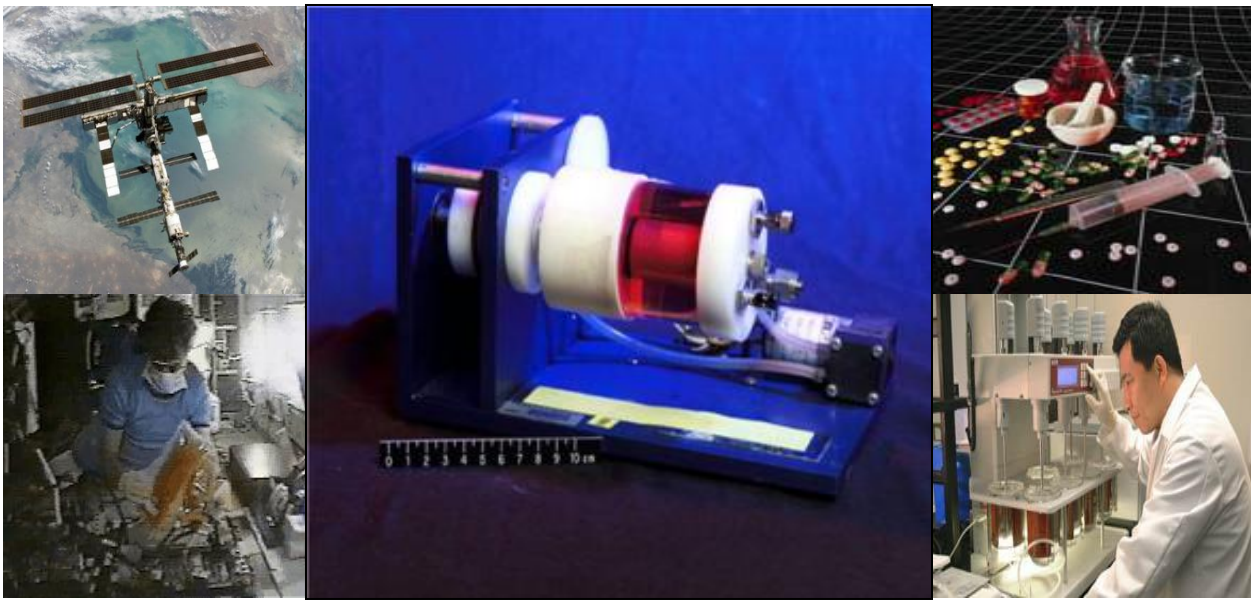
National Aeronautics and Space Administration

technology opportunity

New High-Yield Method for Producing Functional Proteins



Innovators at NASA Johnson Space Center have invented a method that produces three-dimensional, natively glycosylated proteins in a rotating bioreactor by using mammalian cells instead of recombinant RNA/DNA cells. Erythropoietin, interferon, granulocyte stimulating factor and vitamin-D3 are some of the natural proteins produced by this method. These substances are commonly used to treat cancer, diabetes and hepatitis. This new production method produces a higher molecular unit per volume than existing methods and reduces the manufacturing steps in the current production process because the use of bacteria is no longer needed to produce the proteins

Highlights

Benefits

- **End Product:** Natural, 3-D, functional proteins and biomolecules
- **Scientific Advancement**: Compatible with human or animal physiology by eliminating bacterial toxicity

Strengths

- **Manufacturing Process:** Reduces production space by using bioreactors
- **Production:** Time is reduced because fewer steps are required in the process to produce proteins
- **New Research and Development:** New method can be used to produce new protein types as well as newer biomolecule strains

Applications

- Bioengineering
- Biochemical
- Laboratory
- Medical
- Pharmaceuticals

Technology Status

☐ Patent Pending

X U.S. Patent(s)

☐ Copyrighted

X Available for License

☐ Available for No-Cost Transfer

X Seeking Industry Partner for Co-Development

Technology Details

Why this was developed

Scientists at NASA Johnson Space Center, looking for ways to simulate the microgravity environment here on Earth discovered the bioreactor. The bioreactor was used as an experiment on the Space Shuttle and International Space Station many times. NASA scientists also discovered uses for the bioreactor on Earth and used it to develop new methods for growing three dimensional cell cultures in simulated microgravity.

How this works

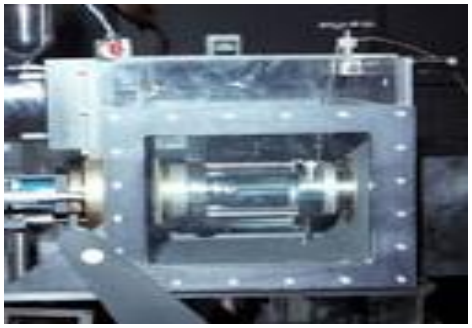
This innovation uses mammalian cells in a cell-culture vessel with a cylindrical outer wall that rotates slowly about a horizontal axis (bioreactor) as small shear stresses are applied to the cells. These stresses are small enough to prevent damaging cells and allows tissue–like assemblies to form on an orderly basis. Combining the effects of gravitation and rotational techniques creates an environment which in many ways mimics the human and animal physiology thereby allowing the production of three dimensional functional proteins.

Findings

Applying this novel technique resulted in the following discoveries:

1. Human and rodent kidney cells were grown and maintained receptors for two types of common toxins: nephrotoxic amino glycoside antibiotics and myeloma light chains.

2. Human kidneys expressed the enzyme 1-ahydroxylase, which can be used to generate an active form of vitamin D, known as 1-25-dihidroxy D3.



Testing apparatus for the production of proteins

3. A mixture of mammalian kidney cells enriched in renal fibroblasts secretes erythropoietin (EPO), which is the hormone that regulates the production of red blood cells.

Patent (s)

NASA has patented this technology under U.S. Patents 6,730,498, 6,946,246, 7,198,947 and 7,972,821 “Production of Functional Proteins: Balance of Shear Stress and Gravity” and are jointly owned with Tulane University.

Licensing and Partnering Opportunities

This technology is part of NASA’s Innovative Partnerships Program (IPP), which seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry.

NASA invites companies to consider licensing this technology (MSC-22859) for commercial applications.

For More Information

If you would like more information or want to pursue transfer of this technology please contact us at:

NASA Johnson Space Center
Technology Transfer and Commercialization Office
Phone: 281-483-3809
Email: jsc-techtran@mail.nasa.gov