



Purifying Nucleic Acids From Samples of Extremely Low Biomass

NASA's Jet Propulsion Laboratory, Pasadena, California

A new method is able to circumvent the bias to which one commercial DNA extraction method falls prey with regard to the lysing of certain types of microbial cells, resulting in a truncated spectrum of microbial diversity. By prefacing the protocol with glass-bead-beating agitation (mechanically lysing a much more encompassing array of cell types and spores), the resulting microbial diversity detection is greatly enhanced.

In preliminary studies, a commercially available automated DNA extraction method is effective at delivering total DNA yield, but only the non-hardy members of the bacterial bisque were

represented in clone libraries, suggesting that this method was ineffective at lysing the harder cell types. To circumvent such a bias in cells, yet another extraction method was devised. In this technique, samples are first subjected to a stringent bead-beating step, and then are processed via standard protocols. Prior to being loaded into extraction vials, samples are placed in microcentrifuge bead tubes containing 50 μ L of commercially produced lysis solution. After inverting several times, tubes are agitated at maximum speed for two minutes. Following agitation, tubes are centrifuged at 10,000 \times g for one minute. At this time, the aqueous

volumes are removed from the bead tubes and are loaded into extraction vials to be further processed via extraction regime.

The new method couples two independent methodologies in such a way as to yield the highest concentration of PCR-amplifiable DNA with consistent and reproducible results and with the most accurate and encompassing report of species richness.

This work was done by Myron La Duc, Shariff Osman, and Kasthuri Venkateswaran of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov. NPO-45740

Adjustable-Viewing-Angle Endoscopic Tool for Skull Base and Brain Surgery

Surgeons could operate more precisely.

NASA's Jet Propulsion Laboratory, Pasadena, California

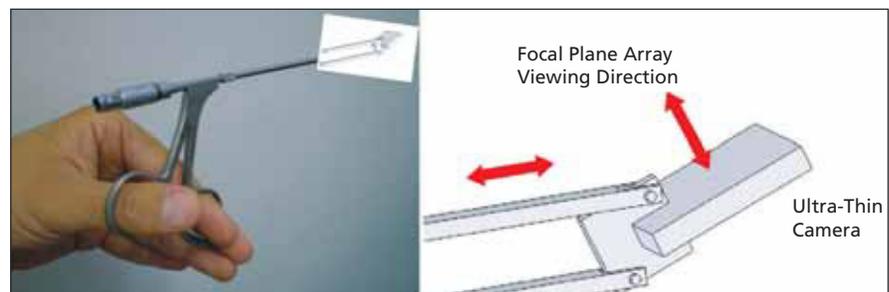
The term "Multi-Angle and Rear Viewing Endoscopic tool" (MARVEL) denotes an auxiliary endoscope, now undergoing development, that a surgeon would use in conjunction with a conventional endoscope to obtain additional perspective. The role of the MARVEL in endoscopic brain surgery would be similar to the role of a mouth mirror in dentistry. Such a tool is potentially useful for *in-situ* planetary geology applications for the close-up imaging of unexposed rock surfaces in cracks or those not in the direct line of sight.

A conventional endoscope provides mostly a frontal view — that is, a view along its longitudinal axis and, hence, along a straight line extending from an opening through which it is inserted. The MARVEL could be inserted through the same opening as that of the conventional endoscope, but could be adjusted to provide a view from almost any desired angle. The MARVEL cam-

era image would be displayed, on the same monitor as that of the conventional endoscopic image, as an inset within the conventional endoscopic image. For example, while viewing a tumor from the front in the conventional endoscopic image, the surgeon could simultaneously view the tumor from the side or the rear in the MARVEL image, and could thereby gain additional visual cues that would aid in

precise three-dimensional positioning of surgical tools to excise the tumor. Indeed, a side or rear view through the MARVEL could be essential in a case in which the object of surgical interest was not visible from the front.

The conceptual design of the MARVEL exploits the surgeon's familiarity with endoscopic surgical tools. The MARVEL would include a miniature electronic camera and miniature radio



The MARVEL would include part of the mechanism of an endo-scissor. The scissor linkage would be modified for use in adjusting the camera angle instead of actuating a scissor blade.

transmitter mounted on the tip of a surgical tool derived from an endo-scissor (see figure). The inclusion of the radio transmitter would eliminate the need for wires, which could interfere with manipulation of this and other surgical tools. The handgrip of the tool would be connected to a linkage similar to that of an endo-scissor, but the linkage would be configured to enable adjustment of the camera angle instead of actuation of a scissor blade.

It is envisioned that thicknesses of the tool shaft and the camera would be less than 4 mm, so that the camera-tipped tool could be swiftly inserted and with-

drawn through a dime-size opening. Electronic cameras having dimensions of the order of millimeters are already commercially available, but their designs are not optimized for use in endoscopic brain surgery. The variety of potential endoscopic, thoracoscopic, and laparoscopic applications can be expected to increase as further development of electronic cameras yields further miniaturization and improvements in imaging performance.

This work was done by Youngsam Bae, Anna Liao, and Harish Manohara of Caltech and Hrayr Shahinian from Skull Base Institute for NASA's Jet Propulsion Labora-

tory. Further information is contained in a TSP (see page 1).

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

*Innovative Technology Assets Management
JPL*

Mail Stop 202-233

4800 Oak Grove Drive

Pasadena, CA 91109-8099

E-mail: iaoffice@jpl.nasa.gov

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UV-Resistant Non-Spore-Forming Bacteria From Spacecraft-Assembly Facilities

NASA's Jet Propulsion Laboratory, Pasadena, California

Four species of non-spore-forming bacteria collected from clean-room surfaces in spacecraft-assembly facilities could survive doses of ultraviolet (UV) radiation that would suffice to kill most known cultivable bacterial species. In a previous study, high UV resistance was found in spores of the SAFR-032 strain of *Bacillus pumilus*, as reported in "Ultraviolet-Resistant Bacterial Spores," *NASA Tech Briefs*, Vol. 31, No. 9 (September 2007), page 94. These studies are parts of a continuing effort to understand the

survival of hardy species of bacteria under harsh conditions, and develop means of sterilizing spacecraft to prevent biocontamination of Mars that could in turn interfere with future life detection missions.

The four species investigated were *Arthrobacter* sp. KSC_Ak2i, *Microbacterium schleiferi* LMA_AkK1, *Brevundimonas diminuta* KSC_Ak3a, and *Sphingomonas trueperi* JSC_Ak7-3. In the study, cells of these species were mixed into Atacama Desert soil (to elucidate the shadowing

effect of soil particles) and the resulting mixtures were tested both in solution and in a desiccated state under simulated Martian atmospheric and UV conditions. The UV-survival indices of *Arthrobacter* sp. and *Microbacterium schleiferi* were found to be comparable to those of *Bacillus pumilus* spores.

This work was done by Kasthuri Venkateswaran and Shariff Osman of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov. NPO-45739