Application for Consent to Conduct Marine Scientific Research in Areas Under National Jurisdiction of

United Kingdom
(name of coastal state)

Date: January 29, 2009

1. General Information

1.1 Cruise name and/or #:	R/V Sorcerer II 09 North Atlantic/European Expedition

1.2 Sponsoring institution:	J. Craig Venter Institute
Name:	Dr. J. Craig Venter
Address:	9704 Medical Center Drive Rockville, MD 20850
Name of Director:	Dr. J. Craig Venter

1.3 Scientist in charge of the project (include CV and passport photo): Appendix I	
Name:	Dr. J. Craig Venter
Address:	9704 Medical Center Drive Rockville, MD 20850
Telephone:	301-795-7000
Fax:	858-200-1879
Email:	jcventer@jcvi.org

1.4 Scientist(s) from coastal state involved in the planning of the project:	
Name(s):	Name(s) of collaborator(s) Dr. Ian Joint
Address:	Plymouth Marine Laboratory Prospect Place The Hoe Plymouth PL1 3DH United Kingdom Email: irj@pml.ac.uk Tel: +44 (0) 1752 633100 Fax: +44 (0) 1752 633 101

1.5 Submitting officer:	
Name and address:	Sarah Dyste Coordinator, Global Ocean Sampling 10355 Science Center Drive San Diego, CA 92121
Nationality:	U.S.A.
Telephone:	858-200-1868
Fax:	858-200-1879
Email:	sdyste@jcvi.org

2. Description of Project (Attach additional pages as necessary)

2.1 Nature and objectives of the project:

Research need:

ENVIRONMENTAL GENOME SHOTGUN SEQUENCING OF MICROBIAL POPULATIONS IN THE WORLD'S OCEANS

Overview:

The J. Craig Venter Institute, a U.S. based, not-for-profit, basic science research institute is sampling ocean water throughout the globe to better understand microbial biodiversity; to discover new genes of ecological importance; and to establish a freely shared, global environmental genomics database that can be used and added to by scientists around the world.

The Venter Institute recently completed a global voyage of discovery to study marine microbial biodiversity. Many of the sampling locations on the global circumnavigation were in the open ocean, far from population centers. The European seas have been influenced by substantial human activity for centuries. The Venter Institute proposes a two-year sampling expedition (2009-2010) that would include transects in the Baltic, North, Mediterranean, Adriatic, Aegean, and Black Seas. A sampling expedition traversing the North Atlantic and the major water bodies of Europe would both significantly increase scientific understanding of how ocean ecosystems function and greatly expand the known universe of genes and proteins.

Microorganisms are responsible for most of the chemical transformations that occur within the major biogeochemical cycles vital to life on earth. However, microorganisms are the least well understood groups of species on the planet, especially within the oceans. One fundamental question in microbial ecology is simply, how many "species" exist? Bacteria lack morphologically distinct characteristics that allow species to be differentiated visually, and the vast majority (> 90%) cannot be grown in the laboratory. Most recent estimates of diversity have relied on analysis of a single conserved gene (16S rRNA)—an enormous advance over previous methods, but one that still has significant limitations. 16S rRNA sampling techniques may hint at the extent of diversity, but they tell us nothing about the role that each species plays in the environment. For this, we must delve deeper, and examine the full gene complement of the community using a shotgun sequencing approach. Not only do we want to know what species are present, but what potential roles they play and functions they provide within the complex marine ecosystem. One can think not only of a community of microorganisms, but the community of those organisms' genes that enable them, for example, to capture energy from the sun, remove carbon dioxide from the air, use organic carbon from other organisms, and cycle nitrogen through the ecosystem in its several forms. Such information is vital, for example, for understanding how carbon is cycled between the atmosphere and the ocean, a key question for understanding climate change. In addition to microorganisms' effect on the carbon cycle, many microorganisms affect other geochemical cycles of importance.

In 2003, we initiated a research expedition circumnavigating the globe, called the Sorcerer II Global Expedition. We sampled approximately every 200 miles as we transited the globe, with additional sampling programs designed for coastal areas based on differences in marine nutrient regimes, human impact, concurrent studies, and/or uniqueness of habitat (Rusch et al. *PLoS* 2007).

Our program has the following goals:

- Inventory the vast legion of unseen microorganisms and their gene complement that live in our oceans
- Better understand overall species diversity
- Discover and characterize new bacterial and viral species
- Evaluate the ecological roles that dominant (but generally unculturable) microbes play in the ecosystem
- Establish a freely shared, global environmental genomics database that can be used by scientists around the world

Sampling within the waters of United Kingdom:

As we transit our vessel from the United States to Baltic Sea, we will pass through Exclusive Economic Zone (EEZ) and territorial waters of the United Kingdom. We are now seeking to supplement our research as we transit from the United Kingdom to the Baltic Sea. We request permission to collect six (6) standard oceanographic water samples in the Atlantic Ocean and English Channel. These samples will substantially add to the understanding of species biodiversity and ecosystem functioning in the English Channel.

The global sampling expedition will create great benefit to the public and scientific communities in United Kingdom and throughout the world by publishing basic scientific data on marine microbial biodiversity and associated genetic diversity. The Venter Institute will not pursue intellectual property rights to any of the genomic data. The costs associated with this leg of the Global Ocean Sampling Sorcerer II Expedition are being funded by the San Diego Foundation and other funders.

We will provide United Kingdom with a full report of our research activities and results, including a list of microbial species found in the samples taken from United Kingdom. We would also be happy to discuss opportunities for future collaborations for research and training.

2.2 Relevant previous or future research cruises:

We circumnavigated the globe between 2003 and 2006 (www.sorcerer2expedition.org), sampling in 14 countries (Figure 1).

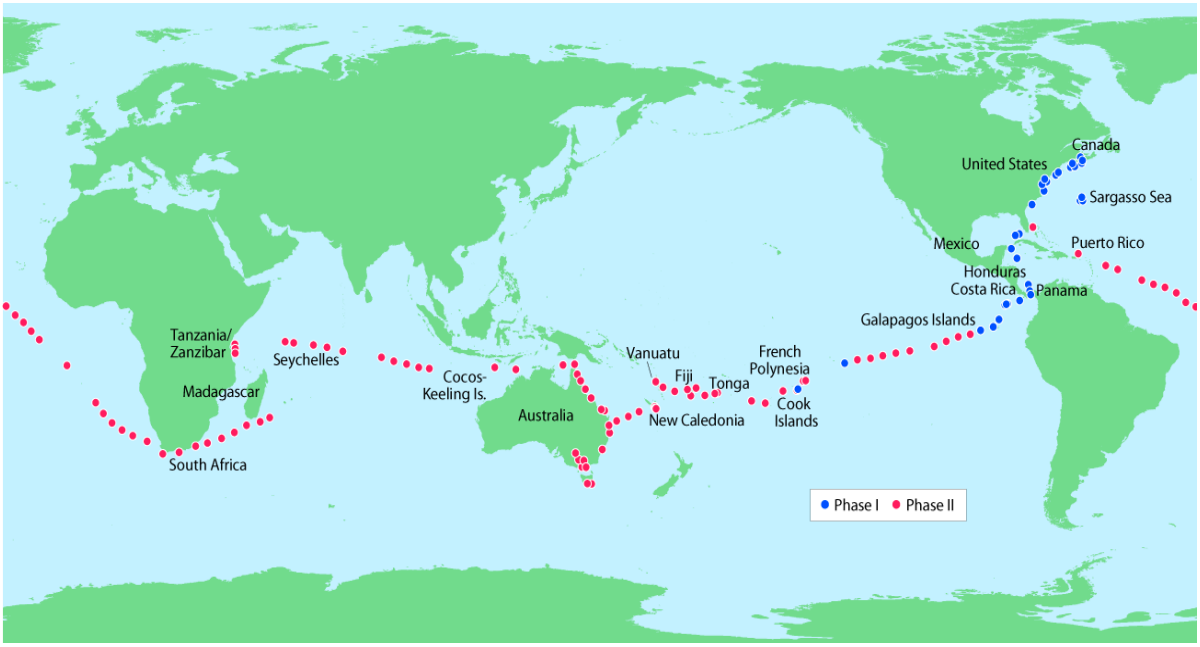


Fig. 1: Sorcerer II 2003 to 2006 Global Expedition route.

Sorcerer II Expedition 2007 began from Virginia heading through the Chesapeake Bay and then south along the East Coast of the United States. After a transit through the Panama Canal, the vessel headed north through Central America and on to Mexico. The Expedition continued into the Sea of Cortez and then up the West Coast of the United States to Alaskan waters, then returned to San Diego. (Figure 2)

Fig. 2: Sorcerer II 2007 Expedition route.

The majority of the 2009 to 2010 Sorcerer II Expedition will be devoted to sampling within the Baltic, North, Mediterranean, Adriatic, Aegean, and Black Seas (Figure 3).

Fig 3: Sorcerer II 2009 to 2010 proposed European expedition route.

2.3 Previously published research data relating to the project:

Shaw, A. K., Halpern, A. L., Beeson, K., Tran, B., Venter, J. C., Martiny, J. B. It's all relative: ranking the diversity of aquatic bacterial communities. *Environ Microbiol.* 2008 Sep 10.

Yooseph, S., Li, W., Sutton, G. Gene identification and protein classification in microbial metagenomic sequence data via incremental clustering. *BMC Bioinformatics.* 2008 Apr 10; 9(1): 182.

Williamson, S. J., Rusch, D. B., Yooseph, S., Halpern, A. L., Heidelberg, K. B., Glass, J. I., Andrews-Pfannkoch, C., Fadrosh, D., Miller, C. S., Sutton, G., Frazier, M., Venter, J. C. The Sorcerer II Global Ocean Sampling Expedition: Metagenomic Characterization of Viruses within Aquatic Microbial Samples. *PLoS ONE.* 2008 Jan 23; 3(1): e1456.

Sharon, I., Tzahor, S., Williamson, S., Shmoish, M., Man-Aharonovich, D., Rusch, D. B., Yooseph, S., Zeidner, G., Golden, S. S., Mackey, S. R., Adir, N., Weingart, U., Horn, D., Venter, J. C., Mandel-Gutfreund, Y., Beja, O. Viral photosynthetic reaction center genes and transcripts in the marine environment. *Isme* J. 2007 Oct 01; 1(6): 492-501.

Yutin, N., Suzuki, M. T., Teeling, H., Weber, M., Venter, J. C., Rusch, D. B., Beja, O. Assessing diversity and biogeography of aerobic anoxygenic phototrophic bacteria in surface waters of the Atlantic and Pacific Oceans using the Global Ocean Sampling expedition metagenomes. *Environ Microbiol.* 2007 Jun 01; 9(6): 1464-75.

Douglas, B.R., Halpern, A.L., Heidelberg, K.B., Sutton, G., Williamson, S., Yooseph, S., Wu, D., Eisen, J.A., Hoffman, J.M., Howard, C.H., Foote, C., Dill, B.A., Remington, K., Beeson, K., Tran, B., Smith, H., Baden-Tillson, H., Stewart, C., Thorpe, J., Freemen, J., Andrews-Pfannkoch, C., Venter, J.E., Li, K., Kravitz, S., Heidelberg, J.F., Utterback, T., Rogers, Y., Zhang, S., Bafna, V., Falcon, L.I., Souza, V., Bonilla, G., Eguiarte, L.E., Karl, D.M., Nealson, K., Sathyendranath, S., Platt, T., Bermingham, E., Gallardo, V., Tamayo, G., Ferrari, M.R., Friedman, R., Strausberg, R.L., Frazier, M., and Venter, J.C. The Sorcerer II Global Ocean Sampling Expedition: The Northwest Atlantic through the Eastern Tropical Pacific. *PLoS Biology*. March 2007; 5(3): 0398-0431.

Yooseph, S., Sutton, G., Rusch, D.B., Halpern, A.L., Williamson, S.J., Remington, K., Eisen, J.A., Heidelberg, K.B., Manning, G., Li, W., Jaroszewski, L., Cieplak, P., Miller, C.S., Li H., Mashiyama, S.T., Joachimiak, M.P., van Belle, C., Chandonia, J., Soergel, D.A., Zhai, Y., Natarajan, K., Lee, S., Raphael, B.J., Bafna, V., Friedman, R., Brenner, S.E., Godzik, A., Eisenberg, D., Dixon, J.E., Taylor, S.S., Strausberg, R.L., Frazier, M., and Venter, J.C. Expanding the Universe of Protein Families. *PLoS Biology.* March 2007; 5(3): 0432-0466.

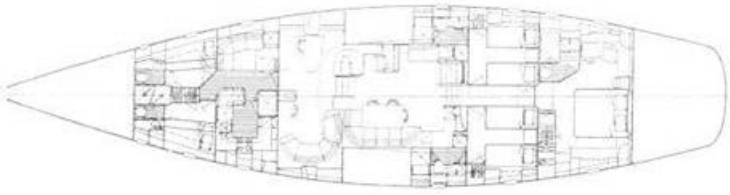
Kannan, N., Taylor, S. S., Zhai, Y., Venter, J. C., Manning, G. Structural and functional diversity of the microbial kinome. *PLoS Biology.* March 2007; 5(3): e17.

Venter, JC, Remington, K, Heidelberg, JF, Halpern, AL, Rusch, D, Eisen, JA, Wu, D, Paulsen, I, Nelson, KE, Nelson, W, Fouts, DE, Levy, S, Knap, AH, Lomas, M W, Nealson, K, White, O, Peterson, J, Hoffman, J, Parsons, R, Baden-Tillson, H, Pfannkoch, C, Rogers, YH, Smith, HO. 2004. Environmental genome shotgun sequencing of the Sargasso Sea. *Science.* 304 (5667): 66-74.

3. Methods and Means to be Used

3.1 Particulars of vessel:	
Name:	Sorcerer II (class: YAT)
Nationality (Flag state):	U.S.A. (Rhode Island)
Owner:	LLC-Sorcerer II 38 Bellevue Avenue, Unit H, Newport, RI 02840
Operator:	The J. Craig Venter Institute
Overall length (meters):	29 m (Beam 7.01m)
Maximum draught (meters):	3.6 m
Displacement/Gross tonnage:	81 tons displacement
Propulsion:	Sail and Aux 300hp
Cruising & Maximum speed:	10 Knots
Novarania dinghy	HIN : XDC304AGF596; Length: 4.27 m
Call sign:	WDB 5354 (located starboard and port sides)
Method and capability of communication	X Band Furono Radar, 3 cm 9410 MHz

(including emergency frequencies):	Furono Depth Sounder/Sonar 50 and 200 KHz KVH Fleet Satcom: 1626.5-1660.5 MHz (phone number 011-870-763-733315#) Thrane 3026L Mini-C Satcom : 1626.5-1660.5 MHz (phone number 011-871-631-967310#) ICOM 710 SSB Marine radio 1.8-27.5 MHz VHF marine radios 156-157.5 MHz
Name of master:	Charles Howard (chashoward@yahoo.com) 9704 Medical Center Dr. Rockville MD 20872; 240-328-3825
Number of crew:	5
Number of scientists on board:	2



3.2 Aircraft or other craft to be used in the project: No

3.3 Particulars of methods and scientific instruments

At each site, a CTD device will be deployed to determine temperature, salinity, dissolved oxygen, chlorophyll a fluorescence, pH, and turbidity over the upper 100m of the site. A 400 L non-intrusive water sample will be collected from the depths of interest using a pneumatic diaphragm water pump and tygon tubing. Discrete subsamples will be collected for the measurement of dissolved nitrate, ammonia, urea, phosphate, and silicate. Several small volumes that will be used for microscopic examination of the microbial community will be fixed and stored frozen. Another 1L subsample will be passed through a glass fiber filter, which will be used to determine particulate carbon and nitrogen concentrations. The majority of the 400L water sample and the associated microbes will be size-fractionated by serial filtration through 20 µm nytex, 3, 0.8, and 0.1 µm membrane filters, and finally a 50 kilo Dalton cut-off tangential flow filter. The filters, with the captured organisms, will be placed in a -20 ^{o}C freezer on the research vessel until transport back to the laboratory in the United States. On return to the lab, the filter will be subjected to enzymatic lysis to collect the DNA and RNA. The DNA will be randomly sheared and cloned into plasmid vectors for sequencing using previously developed methods. RNA will be converted to cDNA via reverse transcriptase prior to cloning and sequencing.

Types of samples and data	*Methods to be used*	*Instruments to be used*
Non-invasive water samples -nutrients -particulate carbon and nitrogen -DNA and RNA	12V pump with tygon tubing Vacuum filtration	Pump with tubing Vacuum pump and filter funnels
Conductivity, Temperature, chlorophyll a fluorescence, dissolved O_2 and pH	Standard oceanographic equipment	CTD package lowered from the boat. Data collected on a computer.
Other equipment on boat Research sample freezers, compound microscope, computers, satellite radio and broadband link, camera equipment (detailed list provided on request).		

3.4 Indicate whether harmful substances will be used: No

3.5 Indicate whether drilling will be carried out: No

3.6 Indicate whether explosives will be used: No

4. Installations and Equipment

Details of installations and equipment (dates of laying, servicing, recovery; exact locations and depth):
All equipment will be hand deployed and remain with/attached to the vessel. No equipment will be installed.

5. Geographical Areas

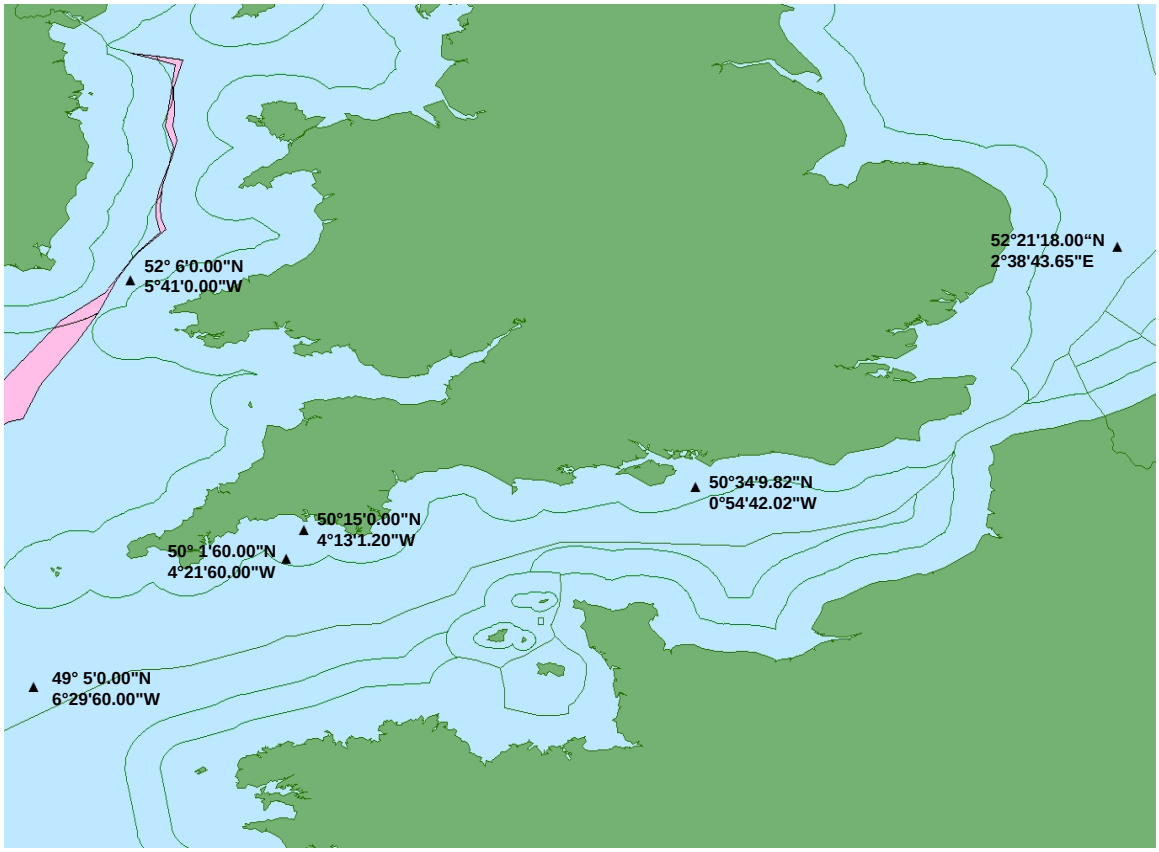
5.1 Indicate geographical areas in which the project is to be conducted (with reference in latitude and longitude):

We propose to filter six (6) 400-Liter non-invasive oceanic water samples in the Exclusive Economic Zone and territorial waters of United Kingdom with the following Latitude/Longitude coordinates:

Sample Number	Location (Lat/Long)
1	49° 5.00' N, 6° 30' W
2	50° 1'60.00"N, 4°21'60.00"W
3	50°15'0.00"N, 4°13'1.20"W
4	50°34'9.82"N, 0°54'42.02"W
5	52°21'18.00"N, 2°38'43.65"E
6	52° 6'0.00"N, 5°41'0.00"W

Our research interest spans the entire microbial community smaller than 20 microns, which includes viruses, bacteria, and picoeukaryotes. Phytoplankton blooms, including cyanobacteria, are extremely variable and their location cannot be predicted months in advance. Thus, we would also like to request additional sampling based on real-time satellite images provided by Ian Joint of the Plymouth Marine Laboratory. We are requesting the flexibility to sample at locations where the satellite images indicate cyanobacteria blooms are present when our vessel is within the waters of the United Kingdom. We will, of course report the locations of sampling shortly thereafter, or if you prefer, convey the coordinates as the real-time satellite images and data are provided to us. We understand that this flexibility does not follow the usual procedure, but believe that this will significantly benefit the science.

5.2 Attach chart(s) at an appropriate scale (1 page, high-resolution) showing the geographical areas of the intended work and, as far as practicable, the positions of intended stations, the tracks of survey lines, and the locations of installations and equipment.



6. Dates

6.1 Expected dates of first entry into and final departure from the research area of the research vessel:
We will enter the Exclusive Economic Zone (EEZ) waters of United Kingdom in the Atlantic Ocean around May 10, 2009 (or later in May 2009). Planned departure from waters of United Kingdom is by May 31, 2009. Please note that exact dates may vary since we are a sailing research vessel and thus our schedule is weather dependent. We will re-enter the Exclusive Economic Zone (EEZ) waters of United Kingdom in the English Channel around August 28, 2009 (or later in September 2009). Planned departure from waters of United Kingdom is by September 21, 2009. Please note that exact dates may vary since we are a sailing research vessel and thus our schedule is weather dependent. If requested, we can provide a progress report and a more detailed schedule for the vessel as the cruise passes through the waters of individual coast states in transit to United Kingdom.

6.2 Indicated if multiple entry is expected:
Yes

7. Port Calls

7.1 Dates and names of intended ports of call:
May 10 to May 20, 2009 - Plymouth May 15 to May 25, 2009 - Southampton At this time, we cannot easily specify dates for all ports of call. However, we will convey this information as soon as it is finalized.

7.2 Any special logistical requirements at ports of call:
None

7.3 Name/Address/Telephone of shipping agent (if available):
None

8. Participation:

8.1 Extent to which coastal state will be enabled to participate or to be represented in the research project:
We are collaborating with Ian Joint of Plymouth Marine Laboratory during our transit through the United Kingdom. Transportation, birth on our vessel, and board will be made available for this person if requested. Our group will not require any additional laboratory facilities or equipment. We hope that this visit will further develop the collaborative research between our institution and scientists in the United Kingdom.

8.2 Proposed dates and ports for embarkation/disembarkation:
Plans for in-country scientists to birth and board on our vessel have not been made at this time. We can provide a progress report and a more detailed schedule for the vessel as the cruise passes through the waters of individual coast states in transit to the United Kingdom.

9. Access to data, samples and research results

9.1 Expected dates of submission to coastal state of preliminary reports, which should include the expected dates of submission of the final results:
No more than 30 days from the end date of the cruise.

9.2 Proposed means for access by coastal state to data and samples:
The data collected in United Kingdom will become part of a global environmental genomics database accessible by scientists worldwide. All data collected within the jurisdictional waters of United Kingdom will be identified as such. This collection will allow study of the complex interplay between groups of microorganisms that affect the environmental processes of regional and global importance. Data will be made available from the National Center for Biotechnology Information (NCBI) website (GenBank) operated by U.S. National Institutes of Health. Data will also be available from the Community Cyberinfrastructure for Advanced Marine Microbial Ecology Research and Analysis (CAMERA) database, operated by the University of California, San Diego.

9.3 Proposed means to provide coastal state with assessment of data, samples and research results or provide assistance in their assessment or interpretation:
Our scientific and educational team will work with regional scientists to understand and utilize the resulting data set. We are working in collaboration with Dr. Ian Joint, Plymouth Marine Laboratory, who will be able to utilize the obtained data for ongoing or future studies in the region.

9.4 Proposed means of making results internationally available:
We will publish the results of our research conducted on this voyage in a prestigious scientific journal. Our group has a strong history of publications of research results. Additionally, our genomic data will be posted on an internationally available website for free access by all scientists as described in section 9.2.

Appendix 1: Cruise Participants and Curriculum Vitae of Lead Scientist

Investigation Participants (7 members)

Dr. J. Craig Venter (Lead Scientist)
John Craig Venter
Date of birth: 14 October 1946
United States of America, Passport No. 077501289, Issued 14 February 2005, Expires 13 February 2015

Charles Howard (Captain/Engineer)
Date of birth: 5 May 1957
United States of America, Passport No. 102764861, Issued 8 July 2008, Expires 7 July 2018

Sarah Dyste (Logistics Coordinator/Stewardess)
Date of birth: 1 December 1966
United States of America, Passport No. 219709525, Issued 15 December 2006, Expires 14 December 2016

Karen McNish (Cook)
Date of birth: 26 July 1958
United States of America, Passport No. 710178246, Issued 21 January 2003, Expires 20 January 2013

Jeremiah Niles (Deckhand)
Date of birth: 8 June 1983
United States of America, Passport No. 078023481, Issued 25 January 2006, Expires 24 January 2016

* Two more people to be determined

* There will be official notification to the Government of the United Kingdom of changes prior to entering.

CURRICULUM VITAE

J. Craig Venter, Ph.D.

J. Craig Venter Institute
9704 Medical Center Dr.
Rockville, MD 20850
Phone: (240) 268-2750
Fax: (240) 268-4007

Born:	October 14, 1946 - Salt Lake City, Utah
Citizenship:	United States

MILITARY SERVICE

1965 - 1968	U. S. Navy Medical Corps (Danang, Vietnam 1967-1968)

EDUCATION

1975	Ph.D., Physiology and Pharmacology, University of California, San Diego - San Diego, California, Thesis Advisor: Professor Nathan O. Kaplan
1972	B.A., Biology, with Honors, University of California, San Diego - San Diego, California

BIOGRAPHY

J. Craig Venter, Ph.D., is regarded as one of leading scientists of the 21st century for his numerous invaluable contributions to genomic research. He is Founder and Chairman of the J. Craig Venter Institute, a not-for-profit, research and support organization dedicated to human, microbial, plant and environmental genomic research, the exploration of social and ethical issues in genomics, and to seeking alternative energy solutions through genomics. The J. Craig Venter Institute has two divisions, The Institute for Genomic Research (TIGR), founded by Dr. Venter in 1992; and The Center for the Advancement of Genomics (TCAG). He is also founder and CEO of Synthetic Genomics Inc., a privately held company dedicated to synthetic genomic advances.

Dr. Venter began his formal education after a tour of duty as a Navy Corpsman in Vietnam from 1967 to 1968. After earning both a Bachelor's degree in Biochemistry and a Ph.D. in Physiology and Pharmacology from the University of California at San Diego, he was appointed professor at the State University of New York at Buffalo and the Roswell Park Cancer Institute. In 1984, he moved to the National Institutes of Health campus where developed Expressed Sequence Tags or ESTs, a revolutionary new strategy for rapid gene discovery. In 1995 at TIGR, he and his team decoded the genome of the first free-living organism, the bacterium *Haemophilus influenzae*, using his new whole genome shotgun technique. TIGR has sequenced more than 50 genomes to date using Dr. Venter's techniques.

In 1998, Dr. Venter founded Celera Genomics to sequence the human genome using new tools and techniques he and his team developed for this work. The successful completion of this research culminated with the February 2001 publication of the human genome in the journal, *Science*. He and his team at Celera also sequenced the fruit fly, mouse and rat genomes. Dr. Venter and his team at the Venter Institute continue to blaze new trails in genomics research and have recently published important papers covering areas in environmental genomics, synthetic genomics and the sequencing of other mammalian and microbial genomes.

Dr. Venter, one of the most frequently cited scientist, is the author of more than 200 research articles. He is also the recipient of numerous honorary degrees, public honors, and scientific awards. These include: the 2001 Paul Ehrlich and Ludwig Darmstaedter Prize, and the 2002

Gairdner Foundation International Award. Dr. Venter is a member of numerous prestigious scientific organizations including the National Academy of Sciences, the American Academy of Arts and Sciences, and the American Society for Microbiology.

POSITIONS AND AFFILIATIONS

2005 - Present	Founder and CEO, Synthetic Genomics, Inc. - Rockville, Maryland
2004 - Present	Founder, Chairman & President, J. Craig Venter Institute - Rockville, Maryland
2002 -2006	Founder and President, J. Craig Venter Science Foundation - Rockville, Maryland
1992 - 2007	Founder and Chairman of the Board, The Institute for Genomic Research - Rockville, Maryland
2002 - 2004	Founder and President, The Center for the Advancement of Genomics - Rockville, Maryland
2002 - 2004	Founder and President, Institute for Biological Energy Alternatives - Rockville, Maryland
1998 - 2002	Founder, President and Chief Scientific Officer, Celera Genomics – Rockville, Maryland
1992 - 1998	President, The Institute for Genomic Research - Rockville, Maryland
1991 - 1992	Chief, Receptor Biochemistry and Molecular Biology Section, Office of the Director, NINDS, NIH - Bethesda, Maryland
1988 - 1992	Director, NINDS DNA facility, NIH - Bethesda, Maryland
1990 - 1991	Chief, Laboratory of Molecular and Cellular Neurobiology, NINDS, NIH - Bethesda, Maryland
1987 - 1991	Chief, Receptor Biochemistry and Molecular Biology Section and Co-Director, Laboratory of Molecular and Cellular Neurobiology, NINDS, National Institutes of Health - Bethesda, Maryland
1984 - 1987	Chief, Section of Receptor Biochemistry, LNP, NINCDS, National Institutes of Health - Bethesda, Maryland
1984 - 1985	Research Professor of Biochemistry, State University of New York at Buffalo (Roswell Park Division) - Buffalo, New York
1983 - 1989	Adjunct Professor of Biochemical Pharmacology, State University of New York at Buffalo - Buffalo, New York

POSITIONS AND AFFILIATIONS CONT'D

1982 - 1985	Associate Chief Cancer Research Scientist (Professor), Dept. of Molecular Immunology, Roswell Park Cancer Institute - Buffalo, New York
1982 - 1982	Associate Professor of Biochemistry, State University of New York at Buffalo - Buffalo, New York
1979 - 1982	Chairman, Interdisciplinary Graduate Group in Biomembranes - Buffalo, New York
1976 - 1981	Assistant Professor of Pharmacology and Therapeutics, SUNY at Buffalo, Schools of Medicine and Dentistry - Buffalo, New York