Version 2.0

Abstract

Back to Hit List

Grant Number:	5K01HG000013-04
PI Name:	MELDRUM, DEIRDRE R.
PI Email:	gcsvcs@u.washington.edu
PI Title:	PROFESSOR
Project Title:	AUTOMATION OF STEPS IN LARGE SCALE DNA SEQUENCING

Abstract: The overall objective of this research career award is to develop new methods and tools for automated large-scale DNA sequencing. Initially, the specific aims of the award are to: Train extensively in the field of genomics via lab rotations, courses and seminars in the Department of Molecular Biotechnology. In the lab training the candidate will perform all steps of DNA sequencing via current methods. This experience combined with the candidate's electrical engineering background will be used to develop fast, efficient methods to automate certain steps in large-scale DNA sequencing procedures. Develop a prototype robot that will dispense sub-microliter to sub- nanoliter volumes of reagents for DNA sequencing reactions. A precise robotic positioning system will be designed and built to access individual wells on 384-well or 864-well microtiter plates and alternate denser formats. Investigate and develop a new, automated procedure for loading sequencing reactions onto gels from high density formats. Currently this step in large-scale DNA sequencing is performed manually but with higher density reactions this will be more problematic. Explore alternate electrophoretic formats that require no net migration. Signal processing and identification techniques will be employed to identify DNA molecules in free solution. While performing the steps of large-scale DNA sequencing in lab training during the first year of the five year SERCA program, bottlenecks in large-scale DNA sequencing procedures will be identified. The remainder of the award will be used to focus on solving these problems using new, automated techniques. Ultimately, these technological developments will increase the throughput in DNA sequencing and contribute to the sequencing of the Human Genome. Deirdre Meldrum, the candidate, received her Ph.D. in Electrical Engineering from Stanford University in 1992. At Stanford and the Jet Propulsion Laboratory, Deirdre worked extensively on robotic and controls for space structures, space robots, and computer disk drives. Her strong background in robotics, controls, dynamics, and electrical/mechanical design will be invaluable for fulfilling the goal of automating steps in large-scale DNA sequencing. Throughout the award period and beyond, Deirdre will train and work closely with the faculty in the Department of Molecular Biology while maintaining close ties with the Department of Electrical Engineering. Leroy Hood, the principle faculty advisor, is Professor and Chair of the Department of Molecular Biotechnology at the University of Washington.

Thesaurus Terms:
bioengineering /biomedical engineering, biomedical automation, method development, nucleic acid sequence
biomedical equipment development, biotechnology, nonclinical biomedical equipment, robotics

Institution:	UNIVERSITY OF WASHINGTON 3935 UNIVERSITY WAY NE SEATTLE, WA 98195
Fiscal Year:	1996
Department:	ELECTRICAL ENGINEERING
Project Start:	01-SEP-1993
Project End:	31-AUG-1998
ICD:	NATIONAL HUMAN GENOME RESEARCH INSTITUTE
IRG:	GRRC

Version 2.0

Abstract

Back to Hit List

Grant Number:	1R01HG001497-01
PI Name:	MELDRUM, DEIRDRE R.
PI Email:	gcsvcs@u.washington.edu
PI Title:	PROFESSOR
Project Title:	CAPILLARY AUTOMATED SUBMICROLITER SAMPLE PREPARATION

Abstract: The long term objective of this proposal is to automate and improve a key area and current bottleneck of genomic research: the automated handling of submicroliter fluid samples. Specifically, the research proposed in this application is the development of a novel, high-throughput, high-yield, fully automated system capable of performing restriction enzyme digests, PCPs, and sample preparation for DNA sequencing. The immediate goals of this system are to process 5,000 1 mu l samples per day, at a cost per finished sequence base pair of less than 20 cents. This will be accomplished through a 10 fold reduction in reagents and sample volumes, and a 10 fold increase in throughput derived from automation, parallelization, and integration of: (I) prior technology developed by the proposing team, and (2) new technology that will be developed during the course of this project. The system will interface in an automated fashion with microtiter plates, Eppendorf tubes, or capillaries at the front end, and with electrophoretic capillaries, electrophoretic gel loading combs, or microtiter plates at the back end. Other input/output media are also possible. The proposed system uses glass capillary tubes and several novel methods to reduce sample size, automate the handling of small fluid samples, reduce thermal cycling and incubation times, and minimize the amount of disposables used to perform DNA sequencing. All processing steps are performed within these capillaries. This use of capillaries also helps facilitate sample containment and minimize evaporation losses, which are particularly important for the high surface area to volume ratios of small samples. An important feature of the proposed system is that it is consistent with current methods of sample handling. Furthermore, it will reduce costs, increase yield, and increase throughput in deriving DNA sequence. The system described in this proposal will greatly aid the Human Genome Project in meeting its sequencing goals. It will also have a synergistic effect outside of the Human Genome Project, benefiting efforts in clinical testing, medical diagnostics, pharmaceutical development, environmental testing, DNA fingerprinting, and agricultural research.

Thesaurus Terms:
biomedical automation, capillary electrophoresis, method development, nucleic acid

sequence
DNA, genetic mapping, genome, polymerase chain reaction, restriction endonuclease

Institution:	UNIVERSITY OF WASHINGTON 3935 UNIVERSITY WAY NE SEATTLE, WA 98195
Fiscal Year:	1996
Department:	ELECTRICAL ENGINEERING
Project Start:	01-MAY-1996
Project End:	30-APR-2001
ICD:	NATIONAL HUMAN GENOME RESEARCH INSTITUTE
IRG:	SRC