

Charles R. Drew University of Medicine and Science

Capability Statement (Rev. 11/1/16)

Charles R. Drew University (CDU) is a private, non-profit, non-sectarian, minority-serving medical and health sciences institution located in the Watts-Willowbrook section of south Los Angeles. CDU is the only designated minority-serving health-sciences university in a county with a population of more than 10 million residents, 70 percent of whom are from minority communities. The University earned designation as a minority-serving institution by the U.S. Office for Civil Rights, and is recognized by the Department of Education under Title III, Part B as a Historically Black Graduate Institution. CDU is also a charter member of the Hispanic-Serving Health Professions Schools, a national not-for profit organization dedicated to improving the health of Hispanic people through research initiatives, training opportunities, and academic development. The University serves as the only academic health sciences and medical research center for the local service area's 1.5 million residents-- the largest underserved urban area in the United States.

CDU's mission is to cultivate diverse health professional leaders who are dedicated to social justice and health equity for underserved populations through outstanding education, research, clinical service, and community engagement. At its creation, CDU was conceived as a postgraduate medical school and later a medical education partnership program with UCLA was established—an arrangement that remains today in addition to multiple programs in the College of Medicine, College of Science and Health and Mervyn M. Dymally School of Nursing.

Our research enterprise has emerged as a leading player in the national effort to eliminate health disparities, specifically through the following areas and resources:

- Cancer Research
- Vivarium
- Cardiometabolic Research
- HIV/AIDS Research
- Translational Science Research
- Biomedical Informatics
- Division of Community Engagement
- Clinical and Translational Research Center (CTRC)

By promoting strategies that create synergy in research teams and between investigators and the community, CDU aims to create novel best practice solutions to transform the health of underserved communities that can be used as innovative models throughout the nation and the world. CDU's specific research areas and resources are elaborated below.

Cancer Research

In 2002, the Department of Internal Medicine established a formal Division of Cancer Research and Training under the leadership of Dr. Jaydutt Vadgama. In 2003, Drs. Judith Gasson (UCLA - Jonsson Comprehensive Cancer Center, JCCC) and Jaydutt Vadgama (CDU) secured a collaborative U56 planning grant from the NCI for planning a series of collaborative programs in cancer research and treatment. The center is designed to include an administrative, research, planning and evaluation, and developmental core, all of which encompass programs that focus on the biology, etiology, prevention, detection, diagnosis and/or treatment of human malignancies, including breast cancer. UCLA established investigators mentor

or co-investigate with promising CDU breast cancer researchers, as well as share UCLA-JCCC and CDU resources to create a breast cancer research program within a freestanding CDU cancer center with a focus on minority and underserved populations. Since then, CDU and UCLA have collaborated on several projects, which have secured more than \$20 million in grants from federal institutions.

The Center to Eliminate Cancer Health Disparities was established through the Division of Cancer Research and Training in 2009, through a grant from the National Institute of Health. Numerous research projects are currently being conducted by the Center's faculty and staff, including basic laboratory research, community outreach and engagement and clinical trials activities.

Vivarium

All animal-related research activities take place in the CDU Vivarium. This recently renovated facility incorporates a 10,600 sq. ft. area dedicated to animal care and use, including administrative offices, animal holding facilities, operating theaters, cage washing facilities, equipment storage, freight receiving quarters, and locker/shower rooms. A large animal kennel of approximately 2,900 sq. ft. is located on the roof of the same building.

The American Association for Accreditation of Laboratory Animal Care (AAALAC) has approved this facility for operation and the Vivarium is in compliance with the Public Health Service Policy on Humane Care and Use of Laboratory Animals, Office of Protection from Research Risk (OPRR), and Welfare Assurance. There are laboratories located in the Vivarium for small and large animals, as well as for animal physiology research.

CDU received funding (G12-RR03026-15) to create a state-of art transgenic-phenotyping mouse facility that will focus on metabolic diseases and will compliment the clinical research activities. The following equipment has been added: 9500 Basil (Steris) cage and rack washer, 59030 Waste management system, Super Mouse Micro-Isolator Tm, Plantar Analgesia Meter (Harvard Apparatus cat # 72-3937) and a Stay Clean TM workbench with digital display.

Cardiometabolic Research

Cardiometabolic Research at CDU is led by Dr. Theodore Friedman, Professor of Medicine, Chairman of the Department of Internal Medicine and Chief of the Division of Endocrinology, Molecular Medicine, and Metabolism. The goal of cardiometabolic research at CDU is to foster collaborative solutions for improving minority health and reducing ethnic and geographic disparities in cardiovascular and related diseases. The cluster aims to accelerate research advances by employing innovative, multi-disciplinary and inter-institutional team-science approaches aimed at improving minority health and reducing ethnic and geographic disparities in the incidence and outcomes of cardiometabolic diseases. Our faculty are most noted for their commitment and contributions to the improvements of diabetes in clinical practices. They devote their time in educating, improving, and empowering the lives of diabetic patients in areas such as South Los Angeles.

HIV/AIDS

Community research, community-inspired research and community-partnered research are the defining features of the HIV/AIDS center at CDU.

CDU CARES PROGRAMS

CDU CARES, a center for clinical, educational and research excellence in HIV/AIDS is based at CDU. Its mission is to eliminate disparities in care for ethnic minorities living with or affected by HIV/AIDS. Supported by a 3-year grant from the California University-wide AIDS Research Program, the center builds academic-community partnerships to provide HIV treatment and research in Los Angeles County.

Clinical – CDU provides comprehensive health services to nearly 1,500 people living with HIV/AIDS of who 65% are African American, 25% Latin American and 10 % Caucasian, Asian/Pacific Islander, or Native American; 35% are women.

- Medical – The OASIS Clinic and Early Intervention Program were formed in 1985 and 1990 respectively, and currently has 1100 clients enrolled.
- SPECTRUM Mental Health – Established in 1994 as a mental health demonstration project, it currently provides psychiatric assessments, individual, family and group counseling to 250 people each year.
- SPECTRUM Case Management – This program provides assistance to obtain benefits, shelter, food, clothing, linkages to medical care and substance abuse counseling for 180 people each year.
- SPECTRUM Treatment Education – This program assists 250 individuals living in Los Angeles to adhere to antiretroviral medical regimes while preparing and educating them on HIV/AIDS, advocating for them and teaching them to advocate for themselves.
- Mobile HIV Testing Units - Travel throughout South Central Los Angeles and other parts of the county providing free HIV antibody screening to at-risk populations. These units screen approximately 5000 individuals per year. The rates of positive tests obtained from the two vans are amongst the highest reported for HIV test sites in Los Angeles County.

OASIS Clinic Resources

- The OASIS (Outpatient Alternative Service Intervention System) Clinics for HIV at newly titled MLK Comprehensive Health Center started in 1984 by Dr. Wilbert Jordan. Currently, the OASIS staff includes a full and part-time pharmacist, a nurse practitioner and a part-time registered nurse who are assisted by a licensed vocational nurse and two medical assistants, and a licensed social worker. The OASIS provider team now cares for more than 1,000 people living with HIV, with a client base of 65% African American and 30% Latino.
- OASIS' confidential services can be grouped under three types: Testing, Early Intervention and Outpatient Treatment. These include confidential HIV testing with counseling, physical examinations, and medical treatment as well as individual psychosocial counseling or psychotherapy referrals. All services are offered in both English and Spanish regardless of the client's ability to pay, age, race, sexual orientation, race, religion, national origin or physical impairment, and clients are matched with staff of the same race or ethnic background whenever possible. Both Early Intervention and Outpatient Programs are available to those with confirmed HIV/AIDS and require enrollment.

Translational Science Research

CDU has several grants that support biomedical improvements through translational research. Two programs are highlighted below which are:

- Accelerating eXcellence In translational Science (AXIS)**
- Clinical and Translational Science Institute (CTSI)**

AXIS

AXIS (**Accelerating eXcellence In translational Science**) is the catalyst to implement the CDU research strategic plan. It is the integrated home for clinical and translational research. AXIS houses experienced and dedicated leadership as well as a myriad of clinical and translational, community, training, and technology resources. AXIS also provides excellent research consultation services.

As its cornerstone, AXIS builds multidisciplinary and interdisciplinary collaborations between CDU investigators and community partners. Our team science activities are supported by eleven core functions at CDU: Biomedical Informatics; Community Engagement; Clinical and Translational Research Center; Research Design and Biostatistics; Evaluation; Innovations and Partnerships; Pilot Program; Regulatory; Research Education and Training; and 2 Technology Core Laboratories. The overall purpose of AXIS is to better position CDU for conducting clinical and translational research, especially research that is focused on health disparities. The goals are to:

Goal 1: Transform the CDU research enterprise from traditional basic and clinical research domains into a highly integrated clinical and translational research environment by reorganizing research administration, centralizing and enhancing physical and intellectual resources, and promoting participation in the RCMI Translational Research Network (RTRN) and Clinical and Translational Science Institutes (CTSI).

Goal 2: Develop a unique model for community, multidisciplinary, and multi-institutional partnerships that ensures that clinical and translational research yields high-quality, cost-effective health outcomes.

Goal 3: Implement innovative translational research training and career development activities at CDU and in partnership with RTRN that recognize that the interdependence of basic science, clinical discovery, and patient-oriented research will accelerate improved patient outcomes.

Clinical and Translational Science Institute (CTSI)

The Clinical and Translational Science Institute is composed of four partnered institutions located in the Los Angeles County:

- University of California, Los Angeles (UCLA)
- Cedars-Sinai Medical Center (CEDARS-SINAI)
- Charles R. Drew University of Medicine and Science (CDU)
- Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center (LA BIOMED)

As a partner of the UCLA-CTSI consortium, CDU has been able to leverage resources to engage in a multitude of activities with other CTSI partners. As a member of this consortium, CDU Investigators are eligible for various funding mechanisms under the CTSI. Its mission is to bring UCLA innovations to bear on the greatest health needs of Los Angeles and the nation. UCLA CTSI is organized into nine program areas that support a wide range of research. CTSI investigators tackle the most pressing challenges in addiction, cancer, disease prevention, heart disease, HIV, mental health, patient safety, stroke, and women's health. UCLA CTSI supports this work by providing seed grants, training, and access to specialized expertise or resources in the form of statisticians, computer databases, clinical tests, gene sequencers and other sophisticated, high-tech equipment, and study volunteers. To achieve its mission, UCLA CTSI has formed collaborations with community organizations, health clinics and schools. These research partnerships ensure that its discoveries are relevant to the health needs of Los Angeles.

UCLA CTSI is one of 60 such institutes to receive a Clinical and Translational Science Award (CTSA) from the National Center for Advancing Translational Sciences, part of the National Institutes of Health (NIH). The NIH created the CTSA's to enhance the translation of basic research into drugs, medical devices, tools and interventions that improve health.

Biomedical Informatics

The Center for Bioinformatics is under the leadership of Dr. Omolola Ogunyemi and Dr. Robert Jenders. This core facility is one of the many infrastructure cores established by the RCMI program to assist investigators at CDU, and provides support in informatics applications in the areas of image transmission and display, video teleconferencing, and multimedia databases between participating institutions, using a high-speed network infrastructure at CDU, and paved the way for joining "Internet 2". Information technology (IT) infrastructure is also useful acquiring, indexing, archiving, and extracting content (e.g., data mining) from large volumes of data.

RCMI BRC/CRC Systems

RCMI BRC and CRC off campus research facilities are connected to the main campus and our Internet2 connection via a 100Mb/s Free Space Optic transceiver, with a backup 1.5Mb/s T1 connection. RCMI/CRC activities are supported by 2 application servers and 1 file server. The application Server is a Gateway 975 Pentium 2.8Ghz Xeon processor, 2 Gb RAM, 1 Terabyte of disk storage. The file server is an HP Proliant ML 530 Pentium 3 Mhz Xeon Processor, 3.5 Gb RAM, RAID 5 configured, 500 Gb of disk storage with 18Gb mirrored for boot partition. All the servers are Win 2003 with Service Pack 1 installed. The research labs, RCMI administration office and Epistat unit use Dell Dimension Pentium Xeon-based workstations. The servers are backed up by an LTL 3 tape library which has 800 Gb capacity dual density tape drives (3) and total up to 2.5 terabytes storage space, and tapes backed up offsite. CRC utilizes a mixture of Macintosh computers and PC clones.

Division of Community Engagement

The mission of the Division of Community Engagement is to improve the quality of health and eliminate health disparities among underserved communities (locally, nationally, and internationally) from a community-focused approach. This community-focused approach will entail actively engaging multiple stakeholders and representing the community's diversity to guide the development of mutually respectful community-academia partnerships that produce community-informed and relevant research.

Objectives:

1. Improve the translation of advancing technology into “real world” setting by a commitment to the community-participatory partnership paradigm.
2. Establish a representative network of collaborative partnerships with community based organizations and community serving agencies locally, nationally, and internationally.
3. Expand the academic capacity by developing a cadre of faculty researchers with expertise in community-participatory partnership research.
4. Establish an academic appointment process for Community Faculty.
5. Create a Community Engagement Speakers Bureau, which will highlight expertise of Community Faculty members, as well as increase the capacity of CDU faculty in community-participatory research strategies.

CDU/UCLA Project Export Center

The CDU/UCLA Export Center builds upon a long tradition of collaboration between CDU and UCLA, and includes close involvement with the minority communities, substantial success in training minority investigators in disparities research, and a distinguished record of scholarship in the area of disparities.

The Center emphasizes diabetes mellitus and mental health and illness in Latinos and African Americans. The center is organized into seven cores: (1) an Administrative, Planning and Evaluation Core, which directs the Center, selects Center participants, supervises evaluation of all Center activities, selects pilot projects, coordinates relationships to the External Advisory Board and Community Advisory Board and manages reports; (2) a Training and Mentorship Core, which recruits and mentors minority junior investigators in the areas of disparities and minority health, providing them with individualized curricula, career guidance and supervision; (3) a Community Outreach/Information Dissemination Core, which disseminates culturally-sensitive health information to low-income Latinos and African Americans and evidence-based health care information to their providers, partner with communities to engage community members in research, and provides mentorship to junior faculty in community-based research activities; (4) a Research Core that translates an intervention of proved efficacy for lowering the incidence of diabetes mellitus through weight loss into a form that will be acceptable to and useful in low-income minority populations (initially Latinos); (5 and 6) two Shared Resources Cores, that will bring state-of-the-art instruments, study designs and analytical methods to the research activities of Center investigators; and (7) a Pilot Projects Core that funds pilot projects in the area of disparities for Center Investigators, giving highest priority to the substantial number of promising junior investigators in the Center and its sponsoring institutions. The Center has established milestones for evaluation to assure that the Center's resources are optimally applied to addressing the major problems facing the nation in the area of disparities in health and health care.

CTRC (Clinical Translational Research Center)

The CDU-CTRC is located in 5,000 square foot outpatient and administrative unit with seven exam/treatment rooms, a processing laboratory and a dedicated consultation space for study participant interviews. We provide cardiovascular and metabolic assessment resources, a site dedicated pharmacist, negotiated lab fees for assays, and participant transportation. Our site also offers Wi-Fi and a conference room capable of state of the art collaborative meetings for community partners and collaborators. In addition to our CTRC unit, the CDU offers additional conference room spaces and houses both Morphometry and Core Laboratories.

Our CTRC clinical staff is knowledgeable and skilled in protocol implementation, data collection, phlebotomy, IV insertions, pharmacokinetic studies, administration of investigational drugs, multiple sample collection, Oral Glucose Tolerance Tests, glucose clamp studies, EKGs, and assisting

investigators with minor bedside procedures. Pharmacy services include procurement, disposal, packaging, randomization and dispensing. Currently CTRC services seven actively recruiting studies in the areas of HIV/AIDS, Cancer, Social/ Behavioral and Cardio-metabolic Research.

Appendix A

Laboratory and Equipment:

General Laboratory Facilities

The CDU research facilities are designed for multi-disciplinary and interdepartmental use. Fourteen laboratories designed for bench research are located in the Augustus Hawkins building. These labs occupy a total of 30,000 sq. ft and were developed with a 3.5 million-dollar grant from the State of California. They are located on the third floor of the Hawkins building, which is located next to the main hospital (accessed by an internal connecting bridge). Over 4,000 sq. ft. of space have been dedicated to outpatient clinical research activity. This space is located in a separate ward one floor below the basic science research areas, and represents an expansion from the initial 900 sq. ft. of space previously available. The university has built an adjacent 8,000 square feet, state-of-the-art facility to house its growing body composition and exercise physiology laboratories and related programmatic activities.

RCMI DNA and Tissue Storage Repository Core

This facility provides support for all types of molecular biology projects. This core has both expertise and state-of-the-art equipment to assist trainees with molecular biology studies. This core is composed of two modules:

1. The DNA Analysis Laboratory Module is a state of the art laboratory for the analysis of DNA using:
 - High –throughput PCR-based STS screening and genotyping
 - Detection of mutations in known genes by SSCP and BESS
 - DNA sequencing of PCR fragments to characterize mutations
 - Fluorescent In Situ Hybridization (FISH) chromosome mapping to detect chromosomal abnormalities

2. The Gene Expression Analysis Laboratory Module supports analysis of mRNA and protein tissues and will perform the following types of assays:
 - RT-PCR and northern blot analysis for the quantitation of mRNA
 - Differential display PCR
 - In situ hybridization
 - cDNA hybridization of gene microarrays for gene expression profiling
 - Sequencing analysis
 - Western blot analysis for the quantitation of specific proteins
 - Immunohistochemistry

3. Equipment for this core includes:
 - Fluor-S Imager/PC 100-240V
 - iCycler Thermal Cycler
 - iCycler iQ Optical Module, Demo
 - iCycler iQ Accessories
 - iCycler iQ Filtersetrox/Texasred
 - 377 ABI Prims Sequencer/96 Well Upgrade

- HM 505EVPCryostat w/Vacutone Auto approach and freeze plate
- RM2125 Rotary Microtome w/no retraction
- TP1020 Tissue Processor w/Fume control system
- Leica EG1140C Embedding Colling Plate
- Leica “ H Heated Embedding Module
- Fluorescent Microscope
- High Resolution Parafoalizing
- Robocycler 96 Gradient Temperature Cycles
- Robocycler 96 Hot Top Assembly
- 377 ABI Prism Sequencer/96 Well Upgrade w/Power Macintosh Monitor
- DNA Sequencing Racks and Plates
- Misc equip Algra 6R, Rfrg Bench Centrifuge
- Spectrafuge 120V Strip
- Digital Image Capture Analysis System
- CO₂ Incubator Isotemp
- Locator 6 PLS w/Leve Mnt 120v

Molecular Biology Equipment: several electrophoretic apparatuses, Hoeffer Western Blot transfer apparatus, electrofocusing equipment, pulse-field gel electrophoresis equipment, temperature regulated circular water baths, vacuum oven, speed-vac, gel dryers, photographic equipment for autoradiography, and manifolds for dot blot hybridization. A video-densitometer and luminometer are available as common use equipment. DNA sequencing equipment, and five Perkin Elmer DNA thermocyclers for polymerase chain reaction, and real-time PCR machine for quantitative measurement of mRNA concentrations are available.

Counting Equipment: an autogamma counter, small hand held (non-automated) gamma counter for iodination screening, and a Delphia multichannel 500 tube programmable automatic gamma counter with an attached PC and Multi-Calc software for data analysis. In addition, CDU has Beckman automatic beta counters, and an LKB Wallac 1230 arcus fluorometer.

Centrifuges available for common use: three low speed refrigerated centrifuges, high speed Sorvall refrigerated centrifuges, and Beckman preparative ultracentrifuges, and desktop non-refrigerated centrifuges that are used for both tissue culture cell separation and other preparatory steps.

Tissue Culture Equipment: two laminar flow hoods, 3 CO₂ humidified atmosphere incubators, an autoclave, an inverted photomicroscope with light, dark field and phase contrast capabilities, a liquid nitrogen cell bank and microfuges for cell separation.

Automatic Radioimmunoassay Equipment: automatic pipetting stations, each capable of pipetting 400 assay tubes per hour, an LKB 1296 plate-washer, and several desktop automated and semi-automated pipettors.

Gas-Liquid Chromatography/Mass Spectrometer: A Hewlett-Packard, Model 5985B gas-liquid chromatography/mass spectrometer (GC/MS) is available. The Equipment is at GCRC stable Isotope Core Laboratory at Harbor-UCLA, in Torrance.

Other Equipment: pH meters, osmometers, spectrophotometers and balances both top loading as well as analytical and electrobalances. There are also three Dubinoff metabolic shaker water baths, and a Coulter counter. CDU has an HPLC System with three pumps and a flow through UV detector.

Equipment for Immunohistochemical Staining and Histomorphometry: A state-of-the-art Immunohistochemical Staining and Histomorphometry Laboratory was recently established in the Molecular Medicine Core Lab of the RCMI Biomedical Research Program. This lab has microtomes, automated platforms for histochemical staining, microscopes, and image analysis hardware and software. Confocal microscope is also available through a collaborative arrangement with Dr. Swerdloff's laboratory at Harbor/UCLA.

The Hormone Assay Laboratory

The Hormone Assay Core Laboratory has had considerable success in refining existing assays to meet specific needs of investigators, and in developing new assays. For instance, the Hormone Assay Core laboratory validated highly sensitive assays for the measurement of very low total and free testosterone levels in women. Similarly, in collaboration with Dr. Gonzalez-Cadavid, the Hormone Assay Core lab generated antibodies and developed a radioimmunoassay for the measurement of serum myostatin levels. Below is a list of hormone assays that are currently available to the CDU investigators:

Serum LH: A 2-site directed fluoroimmunoassay (FIA).

Serum FSH: A 2-site directed fluoroimmunoassay (FIA).

Testosterone: The assay for testosterone uses an iodinated tracer and extraction of serum samples using anhexane: ethyl acetate (2:3) mixture, prior to immunoassay. The laboratory has published the development of a highly sensitive testosterone assay that has been optimized for the measurement of low testosterone levels in women.

Free Testosterone: Free testosterone levels are measured by a direct equilibrium dialysis procedure. The laboratory has published the development and validation of the sensitive assay for the measurement of low free testosterone levels in women, and the generation of normative data in menstruating women.¹

Dihydrotestosterone: Serum samples are extracted and chromatographed through a Celite column. DHT concentrations are measured in the eluate from the Celite fractions by RIA.

Sex-Hormone Binding Globulin (SHBG): Serum SHBG binding capacity is measured by using tracer amounts of [3H-DHT] and serial dilutions of DHT standards.

Insulin: Insulin assay uses a standard from Wellcome equated to 1st IRP GG/304, antiporcine antibody from ICN and porcine insulin from Lilly for iodination.

C-Peptide: C-Peptide assay uses antisera, standards and iodination material supplied through the Eli Lilly Company and an ethanol separation technique. Androstenedione, DHEA, Estrone, estradiol, myostatin, inflammatory markers, C-reactive protein and IL-6.

Additional Biomedical Equipment: Flow Cytometer – BD FACSAria Cell Sorter/Flow Cytometer System: The BD FACSAria cell sorter is an easy-to-use benchtop system that delivers high-speed sorting and multicolor analysis. It incorporates a fixed-alignment cuvette flow cell. This new flow cell provides superior fluorescence sensitivity, while the fixed optical system offers freedom from instrument maintenance and alignment. This cell sorter benefits from several new technologies that were brought together, including cuvette-based cell sorting to free the operator from tedious instrument optimization, self-contained fluidics to remove the special and often costly facility requirements of traditional high-speed flow cytometers, and advanced digital electronics to improve multicolor analysis and sorting and to offer sample acquisition rates of up to 70,000 events per second. The new design eliminates costly facility

requirements, removes the need for daily instrument optimization, increases operator productivity, and reduces the learning curve for instrument operation.

Palm Microbeam Laser Capture: The Palm Microbeam Laser Capture system is a state-of-the-art tool that allows individual cells and tissue regions in microscopic specimens to be captured, positioned, and microsurgically processed with absolute precision and, unlike other systems, without the risk of contamination. The lasers used are interfaced into a research microscope and focused through objectives with high numerical aperture to a minimum possible spot size. The effective laser energy is concentrated on this minute focal spot only and most biological objects are transparent for the applied laser wavelengths. It is therefore possible to work inside a living cell without disturbing its viability. The laser is low energy and allows for cell survival after capture, and thus cell culture.

Leica DM4000B Microscope: This instrument was designed to view and analyze microscopic images, convert them into digital images, and perform quantitation using morphometric analysis. The microscope can be used for brightfield, phase contrast, interference contrast, darkfield and polarization applications. Leica Digital Microscope can also detect fluorescence by fitting a turret with up to five filter cubes. The microscope also has Leica DFC480 digital camera for color pictures of fluorescence specimens. The instrument also has capacity for attachment to cameras with live image or real time video with exposure times of a few microseconds to several minutes.

Kodak Image Station 2000 Multi-Modal Imager: This equipment provides high performance *in vitro* molecular imaging on one system, which allows a researcher to capture images from a wide range of samples. It also features cooled CCD camera technology and selectable multi wavelength illumination to deliver high signal and low background quantitative imaging for a broad range of labels and sample formats. It enables documentation and quantitation of DNA and RNA agarose gels, western blots and protein gels. It also can be used for direct chemiluminescent and fluorescent analyses of cultured cells. We also are requesting the RAD PADD accessory for radioisotope imaging. This allows rapid quantitation of radioisotopes permitting analysis of pulse-chase gels, northern blots, and other gels containing radioactivity.

Real-Time PCR: The ABI PRISM 7500 Sequence Detection System is a complete, Real-Time PCR system that detects and quantitates nucleic acid expression. In Real-Time PCR, cycle-by-cycle detection of accumulated PCR product is possible. Real-Time PCR can be used similarly to regular PCR to amplify DNA; however, it is advantageous in that it is quantitative. Quantitation can be achieved using the SYBR green dye or using a labeled internal probe. The current available model for Real-Time PCR from ABI is the 7500. A newer model will be available shortly and is advertised as higher quality, although no specifications have been released. At the time of funding, we may opt to purchase the 7300 model if the price is comparable.

This state-of-the-art instrument provides more precise determinations and all kinds of temperature regulated kinetic determinations, particularly measurements on very small samples (5 μ l). This is critical for looking at material isolated by Laser Capture and RNA amplification, thus demonstrating the inter-connection between the different proposed equipment.

DU 800 Spectrophotometer: The DU 800 HP spectrophotometer is a PC controlled system intended for use in quantitative and qualitative analysis in biological and industrial procedures that require spectrophotometric measurements in the UV and visible region of the electromagnetic spectrum. The DU 800 Spectrophotometer operates in the wavelength range of 190 to 1100nm and has a bandwidth of $< + 1.8$ nm. The focused micro-beam design provides a wide linear range and other specific benefits for small volumes and precious samples. This instrument is crucial for quantitating DNA, RNA and protein.