

BUSINESS PLAN

**Institute for Integrative Genome Biology
University of California, Riverside**

2007-2009

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I. Historical Background

The Institute for Integrative Genome Biology (IIGB), formerly named the Genomics Institute, was established in 2000 to pioneer solutions for hunger, disease and environmental sustainability. It pursues these aims by embracing advances in genomics technologies and the current trend for increasingly multidisciplinary and multidimensional research. Natasha Raikhel assumed leadership of the Institute in October 2006, and immediately sought to strengthen interdisciplinary research and training efforts among physical and life scientists, engineers, biologists, computer scientists, and statisticians on campus and throughout the broader scientific community by investing existing resources in IIGB's future. With approximately \$1 million in carry forward funds as of June 30, 2006, Dr. Raikhel established an internal review mechanism for dispersing IIGB resources and proceeded to invest in state-of-the-art scientific instrumentation, the recruitment of excellent faculty and support staff, opportunities for collaborative work through pilot projects and travel awards, seminar and symposium support, and the development of a comprehensive marketing plan. Currently the Institute embodies the varied research efforts of over 100 participating faculty from approximately 20 academic departments, applying an interdisciplinary, systems-based approach and state-of-the-art technology towards addressing today's significant biological questions. Given the development of centers such as the Center for Disease Vector Research, planned areas of focus such as Biological Sciences and Biotechnology, Agricultural Genomics, and Mammalian Genomics, the anticipated completion of the new Genomics Building in February 2009, and recent infrastructure enhancements, the foundation has been solidly established for making the Institute a world-class operation.

II. Leadership and Management Structure

Commitment is necessary in order to achieve any worthwhile endeavor. One of the first steps initiated by Director Raikhel in a memo dated 10/23/06 was to confirm current membership among faculty previously affiliated with the Institute, with the clear understanding that membership implied involvement. The next step was to stimulate and maintain interest in the Institute by regularly providing a format for the collective exchange of ideas and concerns, and by involving members in activities integral to IIGB's mission.

It was determined by faculty at the first IIGB Forum held on January 25, 2007 that meetings for all IIGB members would be scheduled twice a year. The first forum was widely attended by IIGB members and the format was informal to welcome and encourage discussion. The next meeting has been scheduled for Thursday, June 14, 2007 and invitations have been extended to key lab personnel who will either accompany faculty or represent those unable to attend.

Recruitment for an Academic Administrator to provide managerial oversight of the instrumentation core facilities at Keen Hall and investigate interdisciplinary research and training opportunities was approved December 2006, and the position filled effective May 1, 2007. This position will work with the three Ph.D.-level Academic Coordinators in the visual microscopy, bioinformatics, and proteomics cores, the technical staff in the genomics core, and the IIGB Director in developing strategies to:

- increase usage of Keen Hall services
- maintain and introduce new high-end technologies, and
- better serve the needs of campus researchers.

As stipulated in the Memorandum of Understanding Concerning the Institute of Integrative Genome Biology (IIGB) and the Center for Plant Cell Biology (CEPCEB) signed on August 17, 2006 by IIGB Director Natasha Raikhel and former CNAS Dean Steve Angle, the Dean's Office will provide permanent 19900 funding (with funding released due to the elimination of the Genomics Core Academic Coordinator position), for 0.90 FTE (90% of salary and benefits) for the first year, 0.80 FTE (80% of salary and benefits) for the second year, 0.70 FTE (70% of salary and benefits) for the third year, and 0.60 FTE

thereafter. The remainder of the Academic Administrator's salary and benefits will be funded on the Genomics Core Instrumentation Facility sales and service activity and/or extramural/grant funds.

To successfully implement a vision, enlist active participation, and make sound decisions representing the wide-ranging research interests within the Institute, the following committees were established by Director Raikhel with clearly defined roles.

A. IIGB Advisory Committee (established 11/8/2006)

Members:

Peter Atkinson - Center for Disease Vector Research, Dept. of Entomology
 Richard Sutch - Biotechnology Impacts Center, Dept. of Economics
 Sarjeet Gill - Dept. of Cell Biology and Neurosciences
 Jerome Schultz - Dept. of Bioengineering
 Katherine Borkovich - CEPCEB, GGB Graduate Program, Dept. of Plant Pathology
 Monica Carlson - UCR/UCLA Biomedical Sciences
 Cheryl Y. Hayashi - Dept. of Biology

Role:

The IIGB Advisory Committee is comprised of faculty representing each of the major research areas within the institute (vector biology, mammalian biology, plant biology, biology, bioengineering, social consciousness). The IIGB Advisory Committee serves as the primary consultative body for the director and provides input regarding daily operational issues, expenditures exceeding \$60k and the short- and long-term goals of the Institute. Committee members are approached on a regular basis by the director and have agreed to respond to all general and pressing issues within 12 hours via email whenever possible. The committee also meets on an as-needed basis, as determined by the director or advisory committee members.

B. IIGB Equipment Committee (established 11/8/2006)

Members:

Mike Adams (Dept. of Cell Biology and Neurosciences)
 David Carter (Academic Coordinator, Microscopy)

Role:

The two-member Equipment Committee is responsible for making recommendations to the Director and Advisory Committee on IIGB equipment/instrumentation needs based on current and projected user interest. Both members were appointed to this committee based on their expertise and experience with state-of-the-art genomics technology. They function on an as-needed basis, soliciting feedback when requested or at their own initiation.

C. Seminar Committees (established 11/8/2006)

The Institute allocates \$8k/yr to each of the Centers for seminar-related expenses. In order to attract the best attendance, secure optimal venues, and promote maximal educational/research benefits, it was determined to schedule IIGB, CEPCEB and IGERT seminars on a rotating basis on Fridays. In this manner, the chances of inundating campus researchers and students with several seminars throughout a given week are minimized. The following faculty members were appointed to coordinate seminar activities within the Institute:

IIGB Seminar Committee:

Members:

Frances Sladek - (Chair) Dept. of Cell Biology and Neuroscience
Larry Li - Dept. of Botany and Plant Sciences
Jiayu Liao - Dept. of Bioengineering

Role:

IIGB seminars are devoted to systems biology and high-throughput genomics across all organisms. This seminar series features prominent speakers in the field and is often announced as an IIGB Distinguished Lecture as appropriate.

CEPCEB Seminar Committee:

Members:

Xuemei Chen (Chair) - Dept. of Botany and Plant Sciences
Venu Reddy - Dept. of Botany and Plant Sciences
Tao Jiang - Computer Science and Engineering Dept.

Role:

Established in 2002, the CEPCEB seminar series (BPSC252: Special Topics in Botany) allows prominent speakers as well as internal faculty and postdocs the opportunity to present and discuss noteworthy research discoveries in the fields of plant cell and molecular biology and genomics.

CEPCEB Noel T. Keen Lecture and Award Committee:

Award Committee Members:

Harley Smith (Award Committee Chair) – Dept. of Botany and Plant Sciences
Xinping Cui – Dept. of Statistics
Yinsheng Wang – Chemistry Dept.
David Carter – CEPCEB Microscopy Core
Marc Surpin – Botany & Plant Sciences (Assoc. Research Plant Cell Biologist)
James Kim – Cell, Molecular and Developmental Biology Graduate Student/IGERT Student

Role:

Established In 2002, the Center for Plant Cell Biology (CEPCEB) scholarship award fund sponsors an annual Special Lecture and Awards Ceremony where an invited leading scientist presents his or her work and where postdocs, graduate students and undergraduate students receive public recognition of their accomplishments. The Noel T. Keen Lecture has become a top-notch lecture series. Previous lecturers have included: Fred Ausubel (Harvard), Jeffrey Dangl (University of North Carolina at Chapel Hill), Chris Somerville (Stanford), Joanne Chory (Salk Institute) and Bernhard Palsson (University of California, San Diego).

CDVR Seminar Committee:

Members:

Peter Atkinson - (Chair) Dept of Entomology
Karine Le Roch – Dept. of Cell Biology and Neuroscience
Shou-wei Ding – Dept. of Plant Pathology

Role:

Started in 2005, CDVR continues to bring leading as well as young researchers together to discuss seminal discoveries related to molecular biology and the genomics of disease vectors.

D. IIGB Website Committee (established March 22, 2007)

Members:

Peter Atkinson – Dept of Entomology
 Julia Bailey-Serres – Dept of Botany & Plant Sciences
 Katherine Borkovich – Dept of Plant Pathology
 Norman Ellstrand – Dept of Plant Pathology
 Timothy Close – Dept of Botany & Plant Sciences
 Frances Sladek – Dept of Cell Biology & Neuroscience
 Thomas Girke – Dept of Botany & Plant Sciences
 Morris Maduro – Dept of Biology
 David Lo – Dept of Biomedical Sciences
 Sean Cutler – Dept of Botany & Plant Sciences
 Venugopala Reddy – Dept of Botany & Plant Sciences
 Jocelyn Brimo – Dept of Botany & Plant Sciences

Role:

The importance of advertising Institute activities, accomplishments and services through a user-friendly website was identified among IIGB faculty as a priority at the IIGB Forum in January. Members were appointed to the IIGB Website Committee based on their significant roles in existing or proposed IIGB centers and graduate programs or their expertise in certain areas of research and technology. The responsibility of this committee is to ensure that all interests and needs for faculty, students, and other users are represented in IIGB-related websites. For the renovated website(s) to remain current and relevant, a content management system (CMS) is being explored, allowing faculty and other key personnel a mechanism for editing/uploading site contents. To foster interdisciplinary activity, search mechanisms will be built into website functionality allowing for the quick identification of faculty specializing in focused research areas. Services and rates of all instrumentation relevant to research interests within the Institute will also be clearly accessible to increase usage of core facilities and expertise. Information needed for proposal submissions (facilities description, forms, etc.) will also be available for quick reference. IIGB is consulting the Office of Strategic Communications and Computing and Communications regarding mandated templates and available technology and is targeting project completion by Fall of 2007.

E. External Scientific Advisory Board (under development)

Members (6): to be invited

Role:

Once a year, IIGB's Scientific Advisory Board (SAB) will meet to provide advice and scientific expertise to the IIGB Director. The SAB will be informed of the progress of IIGB's research and pilot projects and be asked to provide feedback and ideas intended to critically and constructively evaluate and accelerate achievements as they relate to IIGB objectives.

III. Mission

A revised and focused mission statement was proposed by the IIGB Director to clarify IIGB's short- and long-term goals. The revised mission statement is as follows:

Revised Mission Statement:

1. Foster and support interdisciplinary collaborations among researchers on campus and in the scientific community utilizing a systems-based approach to science
2. Develop novel approaches and technologies to solve complex biological problems
3. Train students and postdocs in interdisciplinary research
4. Explore the translational development of potentially commercial technologies and projects

IV. Current Investments

Reducing the Institute's large July 2006 carry forward in 19900 funds was a topic at the IIGB Forum in January 2007 and discussed among IIGB Advisory Committee and Equipment Committee members. The list below summarizes major 2006-07 financial commitments made in support of IIGB's revised mission in the areas of instrumentation enhancements and maintenance, additional hires, interdisciplinary training and research award opportunities, and symposium/seminar support.

A. Equipment/Maintenance

To facilitate research efforts on campus and attract top-notch faculty, IIGB endeavors to provide world-class instrumentation capabilities, either housed in Keen Hall or elsewhere on campus. In keeping with this goal, a few central instruments have been purchased for the microscopy and imaging core facility at Keen Hall to maintain a comprehensive suite of high performance imaging capabilities, along with a small range of supporting non-image based equipment. Recent acquisitions to upgrade the suite include:

- a laser capture micro-dissection system [J, Table A]
- a macro luminescence system, and
- the recently acquired tabletop scanning electron microscope (SEM) [B, Table A]

IIGB faculty members were initially surveyed regarding their interest and Advisory and Equipment Committee members were consulted prior to purchases.

Once available, users from all departments will have access to five different types of confocal microscopes to cover all requirements for speed, sensitivity, versatility, resolution and automation. They will be able to transform cells with a gene gun, verify results on two fluorescence stereo microscopes, and study surface details of live material on the SEM. The laser capture system was ordered to integrate more tightly with each of the core disciplines, enabling separation of different cell types from mixed tissues for more precise genomic and proteomic analysis. Supporting this instrument are a complete set of tissue sectioning instruments; a microtome, an ultramicrotome, an oscillating tissue slicer, and a cryostat. There are three robotic systems supporting IIGB's chemical genomics initiative and the largest of them is being modified to handle the tedious work of seed placement.

The circular dichroism instrument [F, Table A] is a key piece of instrumentation for scientists interested in biochemical/biophysical measurements of proteins and nucleic acids, and a key attraction for new hires working in Bio-organic, Biochemistry and Biophysical areas of research. It will be housed in the ACIF Optical Spectroscopy Lab in Chemistry to replace an older version, recently rendered inoperable. In the same manner, the GenePix 4000 Scanner [E, Table A] was purchased to replace the current scanner in the Genomics Core of Keen Hall that caused image distortion, making alignment with commercial array templates (for post-hybridization analysis) impossible. The GenePix 4000 scanner was selected for its large variety of scanning applications, including spotted arrays, Combimatrix arrays, Agilent arrays, and the fluorescent scanning of microscopy slides. Several smaller items have been purchased for the Genomics Core, as indicated in Table A.

In accordance with campus policies, the Sales and Service Activities of IIGB/CEPCEB Core instrumentation facilities (Funds 66019, 66036, 66220 and 66221) will be managed as break-even operations. All rate structures within the IIGB and CEPCEB will be reviewed by the Director and Academic Administrator on an annual basis to ensure that the lowest possible rates are offered to researchers both internally and externally. Hands-on workshops of Keen Hall instrumentation will continue to be offered on a regular basis, free of charge, to all campus researchers in a continuing effort to increase usage of core technology and expertise. Services and rates of all instrumentation relevant to research interests within the Institute will be prominently advertised on the renovated website.

Table A. 2006-07 Equipment/Maintenance:

Equipment	Initial Request	Consideration/ Review	Amount	IIGB Contribution	Purchase Date	PO #
A. Eppendorf Mastercycler Thermal Cycler (control panel incl.) (PCR)	Yoongi Choi	N. Raikhel	\$7,283.90	\$7,283.90	09/14/2006	NG10047449
B. Marine Reef International Hitachi Tabletop Microscope	David Carter	IIGB Faculty, N. Raikhel	\$64569.19	\$64569.19	10/27/06	OA10055131
C. Hoshizaki Ice Machine (replacing old and broken machine)	Yoongi Choi	N. Raikhel	\$3,225.26	\$3,225.26	10/27/2006	NG10055986
D. Eppendorf Mastercycler Gradient Cycler (PCR)	Yoongi Choi	N. Raikhel	\$5,536.89	\$5,536.89	11/07/2006	NG10057264
E. GenePix 4000 Scanner	Xuemei Chen/ Katherine Borkovich	IIGB Faculty	\$47,749.94	\$47,749.94	12/19/2006	NG10065745
F. Circular Dichroism Instrument	Cynthia Larive	N. Raikhel	\$80,000	\$10,775.00	2/7/2007	FC10075636
G. Affymetrix Malaria Mosquito Micro Array Machine	Peter Atkinson	IIGB Advisory Committee	\$240,000	\$20,000.00	3/15/2007	ITF
H. Refrigerator/Freezer; Fisher Isotemp Flammable-Materials storage	Yoongi Choi	N. Raikhel	\$1,849.70	\$1,849.70	03/21/2007	NG10082228
I. Labconco Purifier Horizontal Clean Bench; w/ Vibration Table	Yoongi Choi	N. Raikhel	\$6,004.76	\$6,004.76	03/21/07	NG10082228
J. Arcturus XP System: Laser Capture Microdissection Microscope	David Carter	IIGB Faculty	\$133,365.69	\$83,365.69	4/19/2007	NG10089409
Equipment Service Contracts/Repair:						
Steris Corporation Service Agreement-Autoclave (1yr)	Yoongi Choi	N. Raikhel	\$9,532.92	\$1,211.86	11/06/06	NG10057769
Service Agreement-Typhoon Microarray (1 yr)	Yoongi Choi	N. Raikhel	\$10,107.00	\$10,107.00	01/17/07	NG10069549
Service Agreement – GeneChip Scanner (3 yr)	Yoongi Choi	N. Raikhel	\$29,565.00	\$29,565.00	01/30/2007	NG10069614
Perkin Elmer Life & Analytical Sciences Multiprobe II Robot Service Contract (1 yr)	Yoongi Choi	N. Raikhel	\$9,564.00	\$9,564.00	2/16/2007	OA10076280
Multiprobe II Instrument Repair/Upgrade	Yoongi Choi	N. Raikhel	\$15,982.53	\$15,982.53	04/16/2007	NG10084495
Beckman Coulter Biomek Liquid Robot Service Contract: (1 yr)	David Carter	N. Raikhel	13,413.00	\$13,413.00	4/1720/07	NG10088821
TOTALS			\$688,216.86	\$328,991.86		

B. Positions

Recruitment for three faculty members specializing in Bioinformatics and Computational Biology was approved September 2006, and second interviews are currently underway. These new hires will be housed in the recently vacated office and laboratory space on the second floor of Keen Hall. An offer was extended and accepted by an Academic Administrator candidate who started May 1, 2007. In consultation with the Advisory Committee, a web programmer was hired on a limited six-month appointment with IIGB 19900 funds to assist in renovating the Institute and related center websites. A part-time Administrative Assistant III has also been hired on IIGB funds to assist with the numerous recruitments, seminars and other administrative tasks necessary to operate a fast-growing institute. A lab assistant is currently being recruited in the Genomics Core to provide research support in the areas of genomics and gene expression by assisting in plasmid prep and DNA sequencing projects. This position will be supported by sales and service income, which has been averaging an annual budget of approximately \$500,000.

The Cluster of three positions specializing in epigenetics and chromatin remodeling areas in non-plant organisms was submitted to Interim Dean Cooksey as an urgent request in April 2007 by the IIGB Director. It was determined by the IIGB Advisory Committee that having a researchers in these areas would complement IIGB's current expertise in plants and facilitate efforts to obtain training grants or center grants from NIH. *S. pombe*, *C. elegans*, *Drosophila*, *Neurospora*, mouse, and human would be considered as model organisms of study, and broad target areas related to epigenetics and chromatin remodeling, such as nuclear organization (nuclear bodies, chromatin dynamics, ribonucleocomplexes), histone modifications, role of RNA in chromatin remodeling and genome stability (both long and short RNAs), the interactions between the nuclear pore apparatus and gene transcription and mechanistic studies on RNAi and microRNAs would be advertised. It is hoped that technology such as X-ray crystallography, Cryo-EM, and single molecule analysis as well as the conventional biochemical and molecular genetic approaches will be brought to the campus. A request for a cluster of Systems Biology positions was submitted to the Dean's Office in November 2006 in response to the Planning and Budget Call for FY 2007-08.

The Center for Plant Cell Biology has also committed \$20k in 2007-08 in support of a project investigating small RNA biogenesis and function. Small RNAs have emerged as sequence-specific regulators of gene expression in eukaryotes in recent years, and obtaining a mechanistic understanding of small RNA pathways can potentially provide vast opportunities for the manipulation of biological systems to improve agriculture and human health. The funds will be used in partial support of a postdoc under the direction of Xuemei Chen whose project involves subcellular localization of small RNA-mediated processes in Arabidopsis.

Table B. Hired and Requested Positions:

Position	Rank	Review	Submitted	Status
IIGB Academic Administrator Position	Academic Administrator	Approved	N/A	Recruitment complete. Hired eff. 5/1/07; 10% first year S&S
Information Technology: Web/Database Developer Position	Programmer Analyst II	IIGB Advisory Committee	11/14/06 to CNAS Dean's office	Hired on IIGB 19900 funds for limited 6-mo. Appt (end date: 8/31/07)
Administrative Assistant (50%)	Admin Asst III	N. Raikhel		Hired on IIGB 19900 funds for limited 6-mo. Appt (end date: 8/31/07)
Bioinformatics and Computational Biology (3 positions)	Asst, Assoc or Full Professor	Approved	N/A	Recruitment underway; second interviews in process
\$20k towards Project under the direction of Xuemei Chen (Bin Yu) for FY07-08	PGR I	N. Raikhel		Funding to start 7/1/07 from CEPCEB 19900 funds

Molecular Cell Biology	Asst or Assoc Professor	IIGB Advisory Committee	11/14/06 to CNAS Dean's office	Pending Approval
IIGB Lab Asst III (Genomics Core)	Laboratory Asst III	N. Raikhel	Posted: 4/4/07	Recruitment Underway; supported by S&S
Cluster of 4 Recruitments in Systems Biology				
Systems Biology 1: Mathematical Biology	Asst, Assoc, or Full Professor	IIGB Advisory Committee	11/14/06 to CNAS Dean's office	Pending Approval
Systems Biology 2: Genomics/Proteomics/Metabolomics	Asst/Assoc Professor of Regulatory Biology	IIGB Advisory Committee	11/14/06 to CNAS Dean's office	Pending Approval
Systems Biology 3: Computational Biology/Modeling of Complex Systems	Asst, Assoc, or Full Professor	IIGB Advisory Committee	11/14/06 to CNAS Dean's office	Pending Approval
Cluster of 3 Positions in Epigenetics and Chromatin Remodeling Areas in Non-plant Organisms		IIGB Advisory Committee	11/14/06 to CNAS Dean's office	Pending Approval

C. IIGB Research and Training Awards

In an effort to foster interdisciplinary collaborations within the Institute and develop promising technologies that could subsequently enable private sector development by licensing or the establishment of start-up companies, the Institute will be offering limited project support to 2-3 projects at \$50,000 each to groups of at least two IIGB members. An odd-numbered review committee will be appointed by the IIGB Director and proposals evaluated on the basis of:

- the quality of science,
- the multi- and inter-disciplinary nature of the proposed work,
- the combination of basic and translational science,
- the possibility of translating the innovation to an application within a reasonable timeframe,

The Request for Proposals was emailed March 21, 2007 to all IIGB investigators with a due date of July 2, 2007. The Institute plans to fund projects as early as October 2007. The Institute also committed \$3,000 in travel award support to students in the Genetics, Genomics and Bioinformatics graduate program.

To ensure cross-disciplinary student training, the Center for Plant Cell Biology has agreed to provide a stipend of \$30k/yr for two international students for two years (total of \$120k) to participate in the pioneering ChemGen IGERT Program. The goal of this innovative training program is to provide students with a team-based research environment that intercalates engineers, chemists and bio-informaticians into research teams with cell biologists. Students in this program have two major professors from two disciplines and attend lab meetings from both research groups. Since NSF funding is only available to domestic applicants, CEPCEB is contributing additional resources to allow international students the opportunity to become adept practitioners in the new field of chemical genomics. The first international student has been selected and funding will start Summer 2007.

Table C. Research and Training Awards

Type	Amount	Target	Review	Relevant Dates
Travel Awards	\$3,000/yr	Genetics, Genomics and Bioinformatics Graduate Students	N. Raikhel	Transferred March 2007 to GGB Graduate Program
CEPCEB Stipends for International IGERT Graduate Students	\$60,000/yr for two years	International ChemGen IGERT Graduate Students	N. Raikhel	Start Date: Summer 2007
Pilot Interdisciplinary Research Projects	\$150,000 (three awards at \$50k ea)	IIGB Faculty	IIGB Advisory Committee	Request for Proposals: 3/21/07; Proposals Due: July 2, 2007

D. Seminar/Symposium Support

The following support was offered to IIGB-related symposiums/seminars in 06-07 to promote learning, interaction, collaboration, and resource sharing among researchers in the various fields.

Table D. Seminar/Symposium Support

Type	Amount	Target	Review	Relevant Dates
24 th Symposium in Plant Biology: "Gene Silencing: The Biology of Small RNAs and the Epigenome"	\$5,151.37	IIGB Faculty, Postdocs and Graduate Students	N. Raikhel	Jan. 18-20, 2007
CDVR/Mir Mulla symposium	\$4,000	Campus and External researchers	N. Raikhel	May 29-31, 2007
CEPCEB Seminar: BPSC 252 - Special Topics in Botany	\$15,000*	CEPCEB Faculty, Postdocs and Students	N. Raikhel	Fridays at Noon
CDVR Seminars	\$8,000	CDVR Faculty, Postdocs and Students	N. Raikhel	Tuesdays at Noon
IIGB Distinguished Lecture	\$8,000	IIGB Faculty, Postdocs and Students	N. Raikhel	Fridays at Noon
*exception, normally \$8k				

V. Future Investments and Directions

In the past few years UCR has witnessed unprecedented development. By hiring several new faculty, UCR has created the necessary momentum in one of the hottest areas of science: the junction between experimental biology and informatics. The Institute has created a state-of-the-art infrastructure that has enabled scientists in biology, chemistry, computational science, and engineering to come together in exciting cutting-edge research, and is continuously enhancing its services and instrumentation to reflect the latest trends in research with a vision for the future. As befits UCR, with its strong emphasis on plant and agricultural sciences, the Institute centered its new activity on plant cell biology and the biology of insects and disease vectors and is considering possible Centers for Agricultural Genomics and Stem Cell Research. The Institute hopes to secure more NSF IGERT and REU grants to provide additional interdisciplinary training opportunities to a new generation of scientists who are interested in these new initiatives. Funds for the NSF Research Experience for Undergraduates (REU) program were first awarded to CEPCEB researchers in 2002 for a period of three years, and renewed in 2005 for five years. As an NSF REU Site, CEPCEB brings research experiences to students of two- and four-year colleges who have limited opportunity to learn about the excitement and career options that research in plant cell biology offers. In 2005, CEPCEB researchers were also awarded 2.9 million in funding for the first Integrative Graduate Education and Research Trainee (IGERT) program at UC Riverside. The five-year interdisciplinary program will ultimately train 23 Ph.D. students versed in cell biology, chemistry, computational sciences and engineering, in advanced chemical genomics. As other Centers within the Institute develop and grow, additional student training opportunities will be sought to continue this trend. If funded, the positions identified in the 07-08 budget call will complement existing strengths within the Institute and augment pioneering research in such areas as RNA Interference and vector-pathogen systems. Hopefully, this will ultimately lead to a deeper understanding into the complexity of living organisms.

In compliance with the aforementioned MOU and as reflected in this document, the Institute has made great strides to substantially reduce carry-forward funds over the last year to within allowable limits stipulated (\$250k for IIGB and \$30K for CEPCEB; \$20k for Microscopy and \$10k for Proteomics). Deducting firm commitments for 2007-08, the Institute's carry forward for the 2006-07 fiscal year is estimated at \$156,438, and CEPCEB's at \$49,082. However, it is clear that to meet the objectives of IIGB's mission and gain recognition as a world-class Institute, it is necessary to continue accumulating carry forwards in the Equipment Replacement Fund as in previous years. CEPCEB lacks an operating budget, and the Institute's annual allocation of \$25,290/year barely covers support of Center-related

seminars, not to mention service contracts, repairs and upgrades on Keen Hall instrumentation as indicated in Table A. For example, the lack of a service contract on the Atto Automated Microscope has recently resulted in more than one month's down time for repairs. The Proteomics Core does not currently support service contracts, which could potentially lead to costly repairs.

The Core Instrumentation Facility serves as the nerve center of IIGB and is essential to the research and teaching activities in genomics, including the recruitment of top-notch faculty and graduate students. This facility provides the technical foundation for investments in life and agricultural sciences and the emerging area of health sciences-related research. Sizeable increases in contract and grant activity rely on an infrastructure that boasts modern equipment, trained personnel and the ability to adapt to changing trends in genomics research. It is vital that carry forwards be available to update equipment for new services and research objectives, and as leverage for matching funds on external grants.

Although future commitments are detailed in Appendix A, below is a summary of needs not already mentioned in this document:

A. 2007-08 Projected Needs:

1. Equipment:

a. Biacore X100: \$40k IIGB Contribution (total cost: \$143,725)

In response to faculty requests and upon consultation with the Advisory Committee, IIGB plans to contribute to the purchase of a new Surface Plasmon Resonance instrument, the Biacore X100, to be housed within the IIGB. The Biacore relies on real-time detection of protein interactions on a sensor chip, allowing sensitive measurements of protein and small molecule binding kinetics without the need for chemical conjugation of probes that might interfere with the function of the proteins being studied. In contrast to other more common instruments for measurements of molecule interactions that only measure equilibrium binding affinity, the Biacore is also able to measure distinct on- and off-rate kinetics, which provides much more detailed information on the interactions between molecules.

Several of the faculty within the IIGB already have experience using the Surface Plasmon Resonance method to study molecule interactions. An older, manual Biacore instrument on campus has been used for some of these studies, but the sensitivity of this instrument is low, and it also requires manual operation of sample and buffer changes, which can take several hours per experiment. The new instrument is not only more sensitive, it is automated, allowing for more complex experiments to be performed in each run. The acquisition of this new updated instrument will enable both IIGB faculty and other university researchers to study a much greater variety of important biological mechanisms. Housing the new instrument in the IIGB core will enable access for a greater number of faculty, and also make it possible to provide outreach and training for new investigators seeking to benefit from the capabilities of the instrument.

B. Upgrade to QSTAR MS: est. \$50k

IIGB will upgrade the exciting QSTAR Mass Spectrometer (proteomics core) so that it can be used for LC-MS/MS experiments. These upgrades will require an HPLC, a new ionization source and software for processing the large datasets generated by LC-MS/MS experiments. The biological motivation for this upgrade stems from two main areas of interest: chemical genomics and metabolomics. Many labs have identified and are characterizing the effects of new biologically active small molecules and LC-MS/MS is currently the most sensitive method for unambiguously identify small molecules and their metabolites in biological specimens. When characterizing the effects of a molecule in new tissues or organisms, it is critical to know if the molecule is accumulating and is stable in these tissues. Without this

data, interpretation of results is severely limited; LC-MS can be used to address this issue. Additionally, LC-MS/MS is invaluable for identifying the small-molecule metabolites and for characterizing the detoxification processes that often limit bioactivity of compounds that emerge from small molecule screens.

Another area of interest to many labs is the use metabolites as markers of biological processes (metabolomics). LC-MS/MS is the technical foundation of metabolomics. The software package that will be added onto the QSTAR is designed for metabolite identification and biomarker discovery and thus is critical to the applications of the LC-MS in both chemical genomic and metabolomic applications.

- C. Office Equipment: est. \$8,500
Computer and office equipment upgrades are anticipated for IIGB and CEPCEB support staff to ensure the Institute's standards for productivity are met.

2. *Marketing Plan: est. \$10k*

A comprehensive marketing plan is being developed to include the renovation of websites and the development of brochures, folders, information sheets, postcards, posters, etc. Recognizing that online and printed marketing material can favorably impact faculty, student and staff recruitments, collaborative research efforts, and subsequent funding opportunities, the Institute is committed to providing adequate funds for a comprehensive and quality campaign. General themes, styles and artwork will be incorporated into all marketing products.

3. *Keen Hall Security System: est. \$20k*

Unlike most campus buildings, the value of instrumentation/equipment in Noel Keen Hall is estimated into the millions and one large scale theft could incapacitate operations. It has thus far been difficult to encourage use of facility services without compromising building security. The facility's services are often in demand after regular work hours. Currently, keys to Keen Hall are issued to lab personnel on campus who are in need of after-hour services, and codes/passwords are authorized by the UC Police Department when anticipated hours overlap activation of the building's automatic alarm (between 2-6am). While keys are authorized by Academic Coordinators and restricted to rooms corresponding to specific services, there is no effective system in place for recovering keys upon misplacement or employee termination. The UC Police Department has commented on the building's breaches in security created by access from Batchelor Hall Rm 2158 and the loading dock. UCPD has also made several complaints regarding the frequency with which officers have been dispatched to Noel Keen Hall in response to false alarms caused by human error. In FY05-06, there were 30 human false alarms caused by code or password failures, at a charge to the Institute of \$26.75 each. This charge can only be recharged to a lab if the person triggering the false alarm stays in the building during UCPD's response. The Institute has been asked by UCPD to reevaluate the current alarm system for breaches in security and to minimize the time spent by officers responding to false alarms.

A proposal has been drafted in consultation with the UC Lock Shop and Police Department for two systems: a Hirsch door access entry system with card activated locks and a GE Storesafe digital recorder with 10 Sony camera surveillance systems. These systems will provide the appropriate balance of security, accessibility and coverage, enabling access to be controlled and a means of tracking when security has been breached.

4. *External Scientific Advisory Board: est. \$12k*

Travel and related meeting costs have been committed annually for meetings of the external Scientific Advisory Board members.

B. Two-year Vision:

The following are anticipated directions for each of the Keen Instrumentation Cores over the next two years:

1. *Bioinformatics Core:*

The bioinformatics facility will add various new online data analysis services and databases to its existing infrastructure. This will include new open-source web services for comparative genomics, drug discovery, data mining and network analysis. The facility's over-utilized Linux cluster will need to be upgraded from 64 CPUs to a 256-CPU supercomputer with 512 GB of total memory to meet needs in the fast growing bioinformatics and drug-informatics areas at UCR. This upgrade is currently estimated at \$300k. Various new bioinformatics workshops and online manuals will be provided in the areas of data mining, machine learning, systems biology, and drug informatics.

2. *Microscopy/Imaging Core:*

Future plans for the Microscopy suite include acquisition of time resolved fluorescence capability, which is useful for studying a wide range of interactions at the molecular level. Also, addition of a multipurpose macro imaging system for combined fluorescence, luminescence and x-ray morphology will be useful for the growing biomedical contingent on campus, a need which will be partially addressed by the ordered luminescence-only system which is still being prototyped.

3. *Proteomics Core:*

The nano-LC/MS/MS will remain the key technical platform in proteomics for the next few years and future improvements to the Proteomic Core's technology and service will center on this approach. The current system is able to handle samples containing hundreds of proteins, which is still limited compared to the total number of cellular proteins of either plants or human. The system's capability will need to be upgraded to handle thousands of proteins in a single study in order to meet the challenges in large-scale proteomics projects. A key issue here is the separation of analytes, including proteins and peptides. For the next two years, methods of multi-dimension separation will need to be introduced to the existing system. This will include three components: a 2D-LC system for protein separation (estimated ~\$200k), technical development and/or modifications to employ the MudPIT method, and the application of ion-mobility MS to further enhance ion separation capability. Additional services will include multi-dimension protein separation at around \$800 per unit, and the MudPIT at around \$1000 per unit. These improvements will be required to significantly enhance the Core's capability and keep UCR at the forefront of proteomics research.

It is also anticipated that a bioinformatics person capable of analyzing the large volume of data will be needed in the proteomics core over the next two years.

4. *Genomics Core:*

Two new services will be added to each of the Genomics Core suites (gene expression, genomics) over the next two years. Custom microarrays will be added as an additional service to the gene expression suite, to include labeling, hybridization, scanning and data analysis. This service will require the purchase of a hybridization and fluidic station, currently estimated at \$65k. In the genomics suite, plasmid prep (tube submission), plasmid prep plus DNA sequencing for individual samples (tube submission), and PCR clean-up plus sequencing services will be offered. These services do not require the purchase of additional equipment but rely instead on existing instruments and expertise. Upon the recommendation of the Advisory Committee, 2-3 sequencing and Typhoon imaging workstations will also be added to the Genomics core for campus users in space recently vacated.