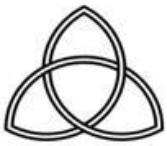


UCSF Research Resource Program

5-YEAR STRATEGIC ROADMAP REPORT

April, 2015

Strategic Roadmap for Shared Scientific Research Facilities ("Cores")

Strategic Roadmap for Shared Scientific Research Facilities ("Cores")

CONTENTS

APPENDICES

Attached: Situation Targeted Proposal to EVCP- Core Strategic Roadmap

Section I: CONTEXT

To support the vision of becoming the world's preeminent health sciences innovator, a key strategy identified in the 2007 UCSF Strategic plan was to provide Campus Core Research Facilities which offer the advanced, innovative instrumentation and/or specialized services needed by a broad segment of the research community. Given the diversity in organizational structures that has emerged for providing these critical services, the more inclusive term of "Shared Scientific Research Facilities" has been adopted in this document. The University has made great progress toward implementing the proposed strategy with the establishment of the UCSF Research Resource Program (RRP) in 2010.

In 2011, the University updated the Strategic Plan to identify five major goals to serve as a roadmap through 2015. Two of these goals have a major emphasis on using innovative science and technology and are particularly relevant to the RRP. Strategic Plan Goal #2 is to improve health worldwide through innovative science by identifying necessary investments in infrastructure to support research (reference strategic plan: http://www.ucsf.edu/about/ucsfs-2014-2015-plan). Strategic Goal #4 is to be the workplace of choice for diverse top talent by identifying investments to enhance development opportunities for faculty and staff and which create an environment in which faculty and staff can thrive.

In support of these goals and to advance the mission of the RRP, Executive Vice Chancellor & Provost Jeff Bluestone has requested the creation of a five-year strategic roadmap for Shared Scientific Research Facilities (SSRFs). The specific objectives for this strategic roadmap are to:

- Develop a comprehensive view of the SSRF strategic priorities across all areas including basic, translational and clinical research, education and business management needs;
- Identify areas of impact and benefit to the UCSF enterprise and the interdependence across all initiatives; and
- Assist leadership in identifying the funding sources to fulfill investment requirements and priorities.

Section II: APPROACH

A Steering Committee that comprised a cross-section of research faculty and core directors was formed to provide leadership for this initiative. One of the key objectives was to gather input from the research community through an Open Proposal Survey to which all members of the UCSF research community could submit ideas to improve research support. The survey was open from November 2013 through March 2014. During this time individuals could: 1) Submit ideas online using the RRP Feedback Forum; 2) Browse other ideas proposed, offer comments and "like" ideas; and 3) Subscribe to email updates to view new proposals and comments. A total of 77 suggestions were submitted for review. 83 individuals provided 150 comments on the suggestions. (A list of the ideas submitted through the Open Proposal process is included in Appendix A). The complete list of initiatives were reviewed and categorized as either *tactical* or *strategic.* Proposals that were identified as *tactical* in nature were considered in discussions at individual committee meetings and their content was integrated into the overall vision as part of the recommendations below. Proposals that were identified as being *strategic* in nature were stratified into the following six groups, which formed the basis for more in-depth analysis and investigation:

1. Biobanking
2. Bio/Drug Development

3. Core Support
4. Data
5. Imaging
6. Mass Spectrometry

Subcommittees were formed according to these categories to facilitate the review of the submitted ideas and identify additional initiatives. Members of the subcommittees included members of the RRP Roadmap Steering Committee and other subject matter experts. A list of the members of the Roadmap Steering Committee and each Subcommittee is provided in Appendix B and C.

To explore synergies with other campus strategic plans under development, the Steering Committee also met with representatives from the Institute for Computational Health Sciences and the Clinical Research Infrastructure Committee.

Section III: TYPES OF SHARED SCIENTIFIC RESEARCH FACILITIES

Shared research facilities are varied in structure and mission. Those with a 3-fold mission of Service, Training and R&D, and which serve the entire UCSF research community broadly, are considered official UCSF Shared Scientific Research Facilities (SSRFs) and are preferentially the focus of this roadmap. A more detailed definition of SSRFs is provided in the Appendix. SSRFs provide access to cutting-edge technologies and expertise in use of research tools. Professionals provide high quality scientific, technical, and educational services and also manage the business functions of these complex operations. Therefore, this strategic planning project focuses not only on gaps in the services and technologies available to the community, but on supporting the needs of existing facilities in improving their infrastructure and operational efficiency. (See appendix D for a detailed definition)

Section IV: VISION AND THEMES

The vision for scientific research support is to *provide expertise and advanced, innovative, and cost-effective instrumentation and the specialized services needed by a broad segment of the research community*. Nine key recommendations emerged as areas for investment to facilitate improvement in the delivery of support to the UCSF research community. In addition to these recommended areas of investment the Roadmap Steering Committee also strongly recommends establishing a *SSRF Advisory Committee* to oversee the implementation of the Roadmap and to make recommendations concerning proposals for enhancing existing SSRFs and implementing new SSRFs. There is no current mechanism for users to submit ideas about how to improve services in existing SSRFs or to provide new capabilities that would benefit their research. Creating a committee to receive and evaluate proposals in a consistent manner will help department chairs and other members of campus leadership to prioritize expenditures in a manner that is most effective. This Committee could also serve as a liaison to the campus space committee (see recommendation #8) and other campus groups that are focused on research support.

1. ***Provide Funds for Investment in Emerging Technologies and State of the Art Equipment.***
   Developing new facilities or obtaining new instrumentation for existing facilities requires a substantial investment in time and cost that often becomes a roadblock in making state-of-the-art capabilities available to the campus community. Deciding between competing proposals requires not only consideration of the scientific rationale for acquiring new capabilities but a clear understanding of requirements to support staff salaries, operational costs and service contracts.

Providing expertise from the RRP to assist in financial planning (see #7a), acquiring, installing and making proper use of new technologies is critical for ensuring that funds made available for supporting these investments will be used in a cost effective and timely manner.

a. Continue investment in the Enabling Technologies Funding Program that brings to campus promising, yet not widely available, technologies to help UCSF researchers make major advances in discovery or translational research. Examples of new facilities that were proposed as part of this process and that would be considered for support are as follows:
    - UCSF Bioinformatics Core Facility
    - Recombinant Antibody / Antibiome Center
    - Tethering Core: The Center for Site-Directed Fragment Discovery
    - Single Cell Analysis Core
    - Lipid MS Core
    - Microscopy Image Analysis Core

b. Establish a New Technology Support Program that provides a mechanism for SSRFs that acquire new technologies (whether through central or department campus funds, shared instrumentation grants, or long term demonstration/loaner instruments) to apply for salaries to support the staff effort needed for a limited time period to roll out cutting edge capabilities until a self-sustaining user base can be developed. The ability to demonstrate this type of campus support is often critical in applying for shared instrument grants. In the case of demo/loaner instruments, there could be a minimum timeline of 6 months to a year that the demo agreement has to be in place, but SSRFs should be able to apply for support for new demo instruments also.

c. Provide resources to support an SSRF Training Support Program that allows facility staff to spend time and use resources for training researchers in how to best utilize both existing and new cutting edge instrumentation.

2. ***Develop expertise and support for management and analysis of big data.***
The resources for working with large datasets are inadequate to support the growing needs of the research community. This includes clinical data, mass spectrometry, imaging, flow cytometry and sequencing data. There are requirements at all levels, including personnel (PI's with experience working with big data, programmers and biostatisticians), novel software tools and new hardware capabilities. While it is clear that many different types of solutions are possible, it is recommended that SSRFs should use common, centralized resources for managing and analyzing big data whenever possible.

a. In conjunction with the Institute for Computational Health Sciences (ICHS), the RRP should work to identify areas where further investment in recruitment and resources would help to make tools to work with big data widely available to the research community at UCSF

b. Many of the shared scientific research facilities have instrumentation that produces large, complex datasets. Rather than developing isolated solutions that do not scale well as technology evolves, it is recommended that these facilities are provided with improved connectivity and access to resources that provide cost effective data storage

and post-processing capabilities in order that their users can receive and interpret their data in a time efficient manner

3. ***Centralize and standardize biospecimen banking across campus.***
There has been an explosion in biomedical advances over the last several decades, and UCSF has been a leader in the field. Recent advances in technology have increased methods for studies of human specimens, and UCSF must continue to invest in biospecimen collection and specimen management research to remain at the forefront. Although UCSF has many well-characterized patient groups, several large biobanks, and multiple small biobanks, it is lacking a coordinated approach to biobanking. Small faculty groups, often with inadequate support to maximize their potential, have established almost all current biobanks. As such, there are no uniform standards or best practices, and no uniform quality control or security measures. A central biobanking facility can address many of these issues, and will build on the efforts that have been initiated by individual investigators. Recommendations to improve biobanking at UCSF include:

    a. Create a centralized office of biospecimen banking to lead the coordination and standardization of campus biobanking efforts.

    b. Expand freezer space (start with approximately 20 freezers).

    c. Develop a campus-wide informatics infrastructure for biobanking.

    d. Implement uniform standards, procedures, and security for all aspects of biobanking.

4. ***Provide career development support for core research management and staff.***
Director, managers and support staff for SSRFs occupy a specialized niche at UCSF but do not have clearly defined career paths and access to training opportunities necessary for advancing their technical or management skills. This leads to difficulties in recruiting and retaining staff with the appropriate skills, which can limit operational efficiency and of results in lack of continuity in technical support. It is critical for SSRF staff to have a recognized career path at UCSF and to be encouraged to obtain training that expands their knowledge and abilities.

    a. Establishing a formal career path for Directors and Managers of SSRFs that includes consistent job designations and recognizes that their expertise is essential for the success of UCSF as a premier research institution.

    b. Develop a formal training program that includes cross-training opportunities for members of the staff in multiple different facilities. This will allow them to improve their knowledge of different technologies and gain a wider skill set, which will make career opportunities at UCSF more attractive.

5. ***Acknowledge and provide support for SSRF activities that are not supported through recharge.***
SSRF staff members who provide expertise in areas that are not funded through recharge or grants should be eligible for salary support. These activities are integral to the continuation of productive and useful SSRFs and include: 1) Assisting investigators with writing grants; 2) Providing expertise in response to inquires from the general community (consultation); 3) Teaching; and 4) Mentoring junior investigators, postdocs and clinical fellows and graduate students. Having these efforts

unfunded can place enormous strain on the financial health of the SSRF. Those with a proven record of providing these services should be eligible to receive salary support for such activities.

6. ***Support the development of current and new researchers.***
SSRFs are critical for providing faculty with services that they need to complete their research and obtain ongoing funding. One of the tensions between being able to attract new users and maintaining financial viability is the difficulty in obtaining resources to support the acquisition of pilot data. Programs that encourage the use of SSRFs and make it possible for a larger group of users to try out their capabilities are essential.

    a. Create a bridge funding mechanism based upon a voucher system to provide junior and new faculty with access to SSRFs while they are also trying to obtain external funding. While successful, the Core Exploratory award (CEA) program was only funded for a short period of time and was only available for use of new SSRFs or for new users of SSRFs. Permanent funding should be made available for a larger, modified program that will serve a broader segment of the community.

    b. Expand the pilot grant programs that are provided by the Research Allocation Program (RAP) to include support for labs that do not currently have sufficient funding to access SSRFs. The objective would be to generate data to support future grant applications and to encourage increased usage of existing facilities.

    c. Support hands-on-training and mentoring for postdoctoral fellows, students and faculty in the early stages of their career. For example, K awardees who are interested in utilizing specific technologies could work within the SSRF to perform their experiments and analysis under the direction of SSRF staff with mentoring from the director.

7. ***Improve the financial management processes for SSRFs.***
Models for management of SSRFs and delivery of services are not standardized across different units. Most are housed within departments or ORUs and therefore rely on local staff for financial management and for support in developing and maintaining business plans. The methodology and expertise available for determining whether a recharge methodology or other mechanism for sharing expenses should be considered varies widely among units. Many SSRFs do not have sufficient expertise in these areas and plans that are developed do not adequately cover the costs incurred. Having a central body that can provide such assistance and making the process more efficient are critical in moving forward.

    a. A campus resource team should be established in the RRP, which has experience in the recharge process and the management of technology-focused centers.

    b. The procedures defined to approve recharge proposals do not currently provide adequate support for SSRFs. It can take from six months to one year to review and approve new proposals. This delays the roll out of new services, makes it difficult to recover the costs of instrumentation, and to manage services.

8. **Consolidate space within and between shared scientific research facilities, where appropriate.**
The issue of SSRFs was brought up as part of recent discussions in the campus space committee but there were with no clear conclusions as to how they fit into future space plans. Given the increased

emphasis on consolidation and efficiency, it is critical to address the issue of ensuring the availability of adequate, quality and sustainable space for SSRFs. Two actions seem appropriate to ensure that space for SSRFs remains a priority and that they can operate efficiently.

a. A sub-group of the space committee should be charged to work with members of the SSRFs or a representative from the RRP should be added to the space committee in order to make appropriate recommendations.

a. Several SSRFs have instruments in different rooms, as equipment has been acquired and placed wherever space was available as opposed to being planned prospectively. Consolidating instruments within contiguous space would result in improved efficiency. Having multiple facilities share common space can also work well by allowing intellectual exchanges between staff and users. An example is the Nikon Imaging Center and Center for Advanced Technology, which have long shared a single room at Mission Bay.

9. ***Promote the availability of all Shared Scientific Research Facilities (SSRFs) and their training programs.***

From the comments and suggestions made to the RRP survey it became clear that some faculty and research staff are unaware of existing SSRFs. To increase the awareness of what shared scientific research facilities and services are available to all facets of the research community, it is necessary to invest resources in improved communication and marketing tools.

a. A single, user friendly and searchable portal should be created that is well-advertised and readily accessible to basic, translational and clinical scientists. The current central website (cores.ucsf.edu) provided a good start in collecting information about what is available but is not widely used and requires ongoing updates.

b. The central website should include not only information about the research services offered but also details about specific training and education opportunities. While these training opportunities are offered by a number of facilities, they are not widely or consistently advertised, yet they provide critical resources for educating young scientists in state-of-the-art technologies.

APPENDICES

A. Submissions submitted through the Open Proposal Process (*active links to the suggestion on the Open Proposal website*)

Author	Original Category (used with stakeholders when discussing the project)	Suggestion Title	Revised Name	Strategic or Tactical	Type (MB's first pass at categorization)	Original Category (used with stakeholders when discussing the project)	Number of Comments	Likes
Urmimala Sarkar	Computation, Strategic/refer to ICHS	"Big Data" computational resources	Computational Analysis Support of Big Data	Strategic/refer to ICHS	New Core/Expertise	Computation	1	15
Gaurav Chopra	Computation, Strategic/refer to ICHS	Systems modeling and analysis core	-	Strategic/refer to ICHS	New Core/Expertise	Computation	1	2
Sunita Ho	Computation, Strategic/refer to ICHS	Image Processing Center	-	Strategic/refer to ICHS	New Core/Expertise	Computation	0	0
Sophie Dumont	Computing/Refer to ICHS	Computing Infrastructure		Strategic/refer to ICHS	Computing/Refer to ICHS	0		
Elizabeth Sinclair	Education & Training	Core Access for Junior Investigators	Provide funding support for junior investigators to access Cores	Strategic	CEA program	Education & Training	1	11
Aditi Bhargava	Education & Training	Better funding support for basic science faculty for use of core	Funding Support for Junior faculty to access cores	Strategic	CEA program	Education & Training	1	0
Jane Gordon	Education & Training	Centralized users education core	Unify Training courses provided by all Cores	Strategic	Education & Training	Education & Training	2	1
William Seaman	Education & Training	Training and assistance in analysis for all cores	Technology & Analysis Training	Strategic	Education & Training	Education & Training	1	4
Ernesto Diaz Flores	Education & Training, Tactical/ Available refer to HR or Library	Adobe Training and Microsoft Office Training	Productivity Software Training	Tactical/ Available refer to HR or Library	Education & Training	Education & Training	1	3
Ariana Jostad-Las...	Education & Training, Tactical/refer to SOM	Expand qualitative research training	Training on how to perform qualitative research	Tactical/refer to SOM	Education & Training	Education & Training	0	1
Khalida Sabeur	Expert Personnel Support	Training and Development	Training & Development	Strategic	Expert Personnel Support	Expert Personnel Support	1	4

		Program	Program for Core Staff					
Steven Hall	Expert Personnel Support	Career Track for Core Facility Directors/Managers	Career Track for Core Staff	Strategic	Expert Personnel Support	Expert Personnel Support	5	13
Joseph Mccune	Expert Personnel Support	Shoring the cores	Professional development of staff in Cores	Strategic	Expert Personnel Support	Expert Personnel Support	0	3
Elizabeth Sinclair	Expert Personnel Support	Expert Personnel Supplements to Technology Grants	Funding to support required training of Core Staff in new technologies	Strategic	Salary Suport	Expert Personnel Support	0	9
Elizabeth Sinclair	Expert Personnel Support	Funding Core Expertise	Support to Provide Core Advisory Services	Strategic	Salary Support	Expert Personnel Support	5	17
Joseph Mccune	Expert Personnel Support	Sandler-Moore Mass Spectrometry Facility	Expanded Mass Spectometry Core	Strategic	Technology	Expert Personnel Support	6	12
Anna Bakardjiev	Expert Personnel Support	Sandler-Moore Mass Spectrometry Facility	Expanded Mass Spectometry Core	Strategic	Technology	Expert Personnel Support	0	0
Chong Park	Space	Designated space for Core facilities	Designated Core Space at each Location	Strategic	Space	Space	8	16
Dennis Nielson	Space	Rent-A-Clinical Research Space	-	Strategic/Refer to CRIAC	Space	Space	1	1
Naoko Morinushi	Tactical/Refer to ?	need more plug at cole hall	Expanded power in Cole hall	Tactical/Refer to ?	Space	Space	0	0
Hubert Stoppler	Support Tools	Development of an UCSF wide freezer surveillance system/network	Implement common freezer surveillance system across all Cores	Strategic	Tools	Support Tools	1	2
Kirsten Copren	Support Tools	Effective & Affordable University Courier Services for Samples	-	Strategic	Tools	Support Tools	0	1
Sasha Cuttler	Support Tools	Nursing research at San Francisco General Hospital	Nursing Research Advisory Service at SFGH	Strategic	New Core/Expertise	Support Tools	1	4

Eric Chow	Support Tools	Continue Funding Shared Equipment Grants	Fund Shared Equipment Grants	Strategic	Funding Support	Support Tools	1	5
Dominic Montagu	Support Tools, Tactical/Already in place	Institutional DropBox Access	Institutional Drop Box	Tactical/Already in place	Tools	Support Tools	2	3
Edward Murphy	Support Tools, Tactical/EDW Underway	Additional Support and Enhancement of the CTSI Integrated Data Repository (IDR)	Enhancement of IDR	Tactical/EDW Underway	Tools	Support Tools	0	2
Monica Mclemore	Support Tools, Tactical/Refer to CTSI	Biostatistical package and support at SFGH library	Biostats Software	Tactical/Refer to CTSI	Tools	Support Tools	3	4
Andrew Phelps	Tactical/Refer to CTSI	Free Statistical Support for UCSF Faculty Research Projects	Statistical Support	Tactical/Refer to CTSI	Expertise/Funding Support to access	Support Tools	9	27
Paula Johnson	Support Tools, Tactical/refer to RDO	improved grant writing support	Hybrid training course for grant writing	tactical/refer to RDO	Expertise	Support Tools	0	0
Khalida Sabeur	Technology	A centralized system for specimen banking	Implement a Unified Biobanking System across UCSF	Strategic	New Core	Technology	3	3
Yvonne De Souza	Technology	Biobanking at UCSF	Implement a Unified Biobanking System across UCSF	Strategic	New Core/Expertise	Technology	0	0
William Seaman	Technology	Single cell sequencing	Single Cell Sequencing Technology	Strategic	Equipment	Technology	4	7
Orion Weiner	Technology	Increased support for Nikon Imaging Center	Advance Light Microscopy	Strategic	Equipment	Technology	4	10
Zachary Knight	Equipment	Fluorescence slide scanning	Automated Slide Scanning Fluorescence Microscopes	Strategic	Equipment	Equipment	1	1
Alexandra Nelson	Equipment	Augment High Throughput Imaging in Core	Slide Scanner for Fluorescence Microscopy	Strategic	Equipment	Equipment	1	2

Diane Nathaniel	Equipment	Suggestion -- slide scanner	Slide Scanner for Fluorescence Microscopy	Strategic	Equipment	Equipment	0	0
Al Burlingame	Equipment	Maintain State of the Art Mass Spectrometers		Strategic	Equipment	Equipment		
Binh Diep	Equipment	IVIS SpectrumCT		Strategic	Equipment	Equipment		
Stefan Habelitz	Equipment	Scanning Electron Microscope		Strategic	New Core	Equipment	0	0
Jason Cyster	New Core	Lipid Mass Spectrometry	Lipid Mass Spectrometry Equipment & Support	Strategic	New Core/Expertise	New Core	2	4
Loren Frank	New Core	Electronics technology core	Electronics Construction & Testing Core	Strategic	New Core	New Core	7	11
Kurt Thorn	New Core	Image Analysis Core	Image Analysis Support Core	Strategic	New Core	New Core	5	13
Philip Nova	New Core	Conceptual Editing Core	Core Advisory Service: Conceptual Editing	Strategic	New Core	New Core	0	1
William Hyun	New Core	New Mass Cytometry Core Resources	Provide a Mass Cytometry Core	Strategic	New Core	New Core	9	10
Lewis Lanier	New Core	Gnotobiotic Mouse Core Facility	Provide a Gnotobiotic Mouse Core	Strategic	New Core	New Core	1	2
Diane Barber	New Core	Protein biochemistry core at Parnassus campus		Strategic	New Core	Technology	4	10
Dean Schillinger	New Core	Health Communications Research Center	Clinical and Public Health Core - population sciences?	Strategic	New Core	Technology	0	0
Sharmila Majumdar	New Core	INTEGRATED BIOMEDICAL IMAGING CORE	Unify pre-clinical and human imaging research Core	Strategic?	New Core	New Core	6	2
Paul Simpson	New Core, Strategic/Refer to CFAR	Drug Development Core	Drug Development Core	Strategic/Refer to CFAR	New Core	Technology	1	0
Rebecca Elmes	New Core	Core authority	Hiring Authority within Cores	Tactical	Policy	New Core	3	1

Shuvo Roy	New Core	Biomedical Device Prototyping Resources (Collaboratory)		Strategic	5	New Core	8	5
Stuart Gansky	New Core	Informatics & Analytics		Strategic	0	New Core	0	0
Sophie Dumont	New Core	genome engineering core		Strategic	0	New Core	0	0
Sophie Dumont	New Core	Imaging Facility at Parnassus		Strategic	0	New Core	0	0
Sunita Ho	New Core?	A Center for Microscopy, Tomography, and Correlative Imaging		Strategic	0	New Core?	0	0
Stuart Gansky	New Core?	Health Policy and Health Economics		Strategic	0	New Core?	0	0
Arnold Kriegstein	Core/ES Cell Targeting Core at MIssion bay is currently providing custom TALEN service!	Gene editing core		Strategic	Core/ES Cell Targeting Core at MIssion bay is currently providing custom TALEN service!	1		
Sophie Dumont	Tactical - but important	Centralized Website		Tactical		0		
Stuart Gansky	Tactical - but necessary	Core Inventory and Needs Assessment		Tactical		0		
Marsilius Mues	Tactical	Unblock blocked time slots in the MyCores scheduler	Modication to MyCores Scheduler	Tactical	Process		2	6
Matthew Krummel	Tactical	Implement a 'Notify Next User' and 'Standby' Mode in MyCores	Modification to MyCores	Tactical	Process		1	11
Frederick Schaufele	Tactical	Central Coordination	Standard Procurement Process/Guidelines for all Cores	Tactical	Process/Central Coordination		0	4
Rebecca Elmes	Tactical	Easy Access for External Users	Provide Core Service to External Entities	Tactical	Process/Policy?		3	5
Philip Darney	Tactical/Refer to biobanking	accessing support	Increased communications	Tactical	communications		0	0

Steven Miller	Tactical/Refer to CTSI and others	Universal patient consent for research	Universal Consent Form	Tactical/Refer to biobanking	Policy		6	16
Owen Wolkowitz	Tactical/Refer to CTSI and others	suggestions for campus-wide research productivity	Multiple - need to elaborate	Tactical/Refer to CTSI and others	Multiple		1	2
Bill Taeusch	Tactical/Refer to ITS	information sharing	Coordination of Research Information	Tactical/Refer to CTSI and others	Process		0	3
Daniel Ciccarone	Tactical/Refer to RRP	Improve Web videoconferencing	Web Conferencing	Tactical/Refer to ITS	Infrastructure		2	12
Elizabeth Sinclair	Tactical/Refer to RRP	Central Organization with Distributed Service Locations for Specimen Processing and Flow Cytometry Cores	Unified Services and Processes for Specimen Processing and Flow Cytometry Core	Tactical/Refer to RRP	Central Coordination		2	7
Kurt Thorn	Tactical/Refer to schools	Campus-wide mechanism for determining need for new technologies	Assess campus demand of proposed ideas	Tactical/Refer to RRP	Central Coordination		1	7
Yongqiang Wang	Tactical/refer to SOM	A new category of a small funding temporarily named as "Sparkling Fire"	Establish small start up funds	Tactical/Refer to schools	general research support		0	4
David Schneider	Tactical/refer to SOM	Primary Care Clinical Research Support	Support for Family Medicine Research	Tactical/refer to SOM	Salary Support		0	2
Jeremy Reiter	Tactical	Good descriptions of existing cores			3		2	3

B. Members of the Steering Committee

Brad Aouizerat - Professor, Department of Physiological Nursing
Chip Chambers – Professor, Department of Medicine; Director, Clinical Research Services, CTSI; Chief, Division of Infectious Diseases, SFGH
Jane Czech – Director of Administration, Department of Neurology
Tejal Desai – Professor and Chair, Department of Bioengineering
Susan Fisher – Professor, Department of ObGyn, Reproductive Services
John Gross – Associate Professor, Department of Pharmaceutical Chemistry
Carl Grunfeld – Professor, Department of Medicine
Roland Henry – Professor, Department of Neurology
Nevan Krogan – Professor, Department of Cellular Molecular Pharmacology
Jackie Maher – Professor, Department of Medicine
Geoff Manley – Professor, Department of Neurological Surgery
Sri Nagarajan – Professor, Department of Radiology
Bob Nussbaum – Professor, Department of Medicine
Adam Olshen – Professor, Department of Epidemiology and Biostatistics
Jason Rock – Assistant Professor, Department of Anatomy
Andrej Sali – Professor, Department of Bioengineering
Bill Seaman – Professor, Department of Medicine; Associate Chair of Medicine for Research
Kurt Thorn – Associate Professor, Department of Biochemistry and Biophysics; Director, Nikon Imaging Center
Jim Wells – Professor and Chair, Department of Pharmaceutical Chemistry
Torsten Wittman – Associate Professor, Department of Cell and Tissue Biology

C. Members of the Subcommittees

* Indicates chair of subcommittee

Biobanking
Bradley Aouizerat – Department of Physiological Nursing
Esteban Burchard – Department of Bioengineering
Yvonne De Souza – AIDS Specimen Bank
John V Fahy – Department of Medicine
Debra Garcia – AIDS and Cancer Specimen Resource, SFGH
John Greenspan – Department of Orofacial Sciences
Adriane Joo – Department of Orofacial Sciences
Richard Jordan – Department of Orofacial Sciences
John P Kane – Department of Medicine
Anna Karydas – Department of Neurology
Pui-Yan Kwok – Cardiovascular Research Institute
Britt-Marie Ljung – Department of Pathology
Tippi MacKenzie – Department of Surgery
Greg Macway - Procurement
Jackie Maher – Department of Medicine
Geoff Manley – Department of Neurological Surgery
Mike McGrath – Department of Laboratory Medicine
Patti Mitchell – Capital Programs
Bill Seaman* - Department of Medicine
Joseph Shieh – Department of Pediatrics
Jeff Simko – Department of Pathology
Paul Volberding – Department of Medicine

Bio/Drug Development
Adam Abate – Department of Bioengineering
Bruce Conklin – Department of Medicine
William DeGrado – Department of Pharmaceutical Chemistry
Joe Derisi – Department of Biochemistry and Biophysics
Jason Gestwicki – Institute for Neurogenerative Diseases
Arnold Kriegstein - Department of Neurology
Wendell Lim – Department of Cellular Molecular Pharmacology
Jonathan Weissman - Department of Cellular Molecular Pharmacology
Jim Wells* - Department of Pharmaceutical Chemistry

Core Support
Aditi Bhargava – Department of Surgery
Chip Chambers – Department of Medicine
Eric Chow – Department of Biochemistry and Biophysics
Kirsten Copren – HDF Comprehensive Cancer Center
Jane Czech – Department of Neurology
Sarah Elmes – HDF Comprehensive Cancer Center
John Gross – Department of Pharmaceutical Chemistry
Mike McCune – Department of Medicine
Dennis Nielson – Department of Pediatrics
Chong Park – ES Cell Targeting Core
Elizabeth Sinclair – Department of Medicine
Kurt Thorn* - Department of Biochemistry and Biophysics

Data
Carl Grunfeld* - Department of Medicine
Nevan Krogan - Department of Cellular Molecular Pharmacology
Monica McLemore – Family Health Care Nursing
Adam Olshen - Department of Epidemiology and Biostatistics
Andrew Phelps – Department of Radiology
Andrej Sali - Department of Bioengineering
Michael Schembri – Department of ObGyn, Reproductive Services
Erik Verschueren - Department of Cellular Molecular Pharmacology

Imaging
Larry Ackerman – Department of Anatomy
Conrad Alano – Department of Neurology
Wenhan Chang – Department of Medicine
Stefan Habelitz – Department of Preventive and Restorative Dental Sciences
Roland Henry - Department of Neurology
Zachary Knight – Department of Physiology
Sarah Knox – Department of Cell and Tissue Biology
Matthew Krummel – Department of Pathology
Srikantan Nagarajan – Department of Radiology
Jeremy Reiter – Department of Biochemistry and Biophysics
Jason Rock – Department of Anatomy
Fred Schaufele - Department of ObGyn, Reproductive Services
Kurt Thorn* - Department of Biochemistry and Biophysics, Nikon Imaging Center
Mark Von Zastrow – Department of Psychiatry
Orion Weiner – Cardiovascular Research Institute
Torsten Wittmann - Department of Cell and Tissue Biology

Mass Spec
Jason Cyster – Department of Microbiology and Immunology
Robert Farese – Department of Medicine
Michael Fischbach – Department of Bioengineering
Susan Fisher* - Department of ObGyn, Reproductive Services
Brad Gibson – Department of Pharmaceutical Chemistry
Steven Hall - Department of ObGyn, Reproductive Services
Jeffrey Johnson - Department of Cellular Molecular Pharmacology
Nevan Krogan* - Department of Cellular Molecular Pharmacology
Lewis Lanier – Department of Microbiology and Immunology
Eric Verdin – Department of Medicine

D. Detailed Recommendations by Subcommittee

I. Biobanking
II. Bio/Drug Development
III. Core Support
IV. Data
V. Imaging
VI. Mass Spectrometry

I. Biobanking Recommendations

a. Statement of Opportunity/Need

There has been an explosion in biomedical advances over the last several decades, and UCSF has been a leader in the field. Recent advances in technology have increased methods for studies of human specimens from, but UCSF has not been at the cutting edge of human basic science. We should be. We have exceptional faculty in both basic and clinical sciences, which provides the essential ingredient for success. We also have many well-characterized patient groups as well as several large biobanks, and multiple small biobanks. We lack a coordinated approach to biobanking. Small faculty groups, often with inadequate support to maximize their potential, have put almost all current biobanks together. There are no uniform standards or best practices and no uniform quality control or security measures. A central biobanking facility can address many of these issues, building on the efforts that have been initiated by individual investigators.

UCSF has funds to begin a centralized biobanking initiative, and support can be sought from the CTSI, Departments and ORUs, and from individual investigators, but these sources will not suffice for sustaining and expanding the biobanking program, and that is the focus of this proposal. The subcommittee was aided in this proposal by the 2011 "Report of the UCSF Campus Task Force on Biospecimen Banking," which was thorough in its examination but has not yet received funding. The RRP Biobanking Subcommittee recommends the following priorities, with the understanding that the initiatives could be developed in overlapping sequence:

1. Create a centralized *Office of Biospecimen Banking* to coordinate and standardize campus efforts in biobanking and to assist investigators.
2. Expand freezer space (~20 freezers to start).

3. Develop a campus-wide informatics infrastructure for biobanking.
4. Over time, provide centralized biobanking at all steps, freeing investigators from this effort and assuring uniform standards, procedures, and security.

b. *Benefits:*

There is currently great opportunity for human biomedical research, and UCSF is well positioned to advance medical science by pursuing this. Advances in research often arise at the interface between disciplines, and biobanks make possible interactions between clinical and basic scientists that will advance human research. At a practical level, such interactions will also attract funding from the NIH and from private philanthropies. Such research requires well-characterized patients and well-characterized biological specimens that are available at reasonable cost.

c. Challenges:

Biobanking is complex and expensive. It requires uniform standards and quality control, beginning with characterization of patients, recording of patient information in an accessible manner that does not violate privacy, clear patient consent (even for unanticipated science), and specimen collection, processing, transportation, storage, and recovery. Uniform quality control is required at each step, including periodic sampling and curating of stored specimens. Expenses are large. They can be reduced by economies of scale, efficient business plans, and periodic purging of specimens, but even with these in place, subsidy of biobanking will be necessary, because granting agencies do not provide sufficient resources to pay the costs of a biobanking enterprise.

d. Scope of the project:

The Biobanking Program will both collect and process specimens, including evaluation of specimen quantity and quality, preparation of specimens for storage as frozen and/or fixed specimens, and preparation and staining of tissue sections as needed. The program will also provide education to investigators regarding biobanking. At the onset, the program will focus primarily on specimens from investigator-acquired clinical cohorts. As biobanking becomes an intrinsic part of clinical operations, we expect that clinical materials will be collected routinely at surgeries, and blood samples will be obtained on broader groups of patients. The project will assure the security and privacy of specimens and of all clinical information. It will routinely assess samples for successful storage, and it will oversee periodic purging of banks to sustain the most relevant specimens at minimum cost. The program will also support patient coordinators/data collectors, to assure that clinical data are linked to specimens. What patient data are collected and the thoroughness of collection will be of importance to the operation, and will be monitored, but for studies of patient cohorts the decisions about this information will lie with the investigator.

e. Size of the project:

It is intended that the biobank will serve all investigators who have a legitimate need. At present, many of the individual biobanks may wish to function independently of the central biobank. There is no intent to mandate that all biobanks join the central biobank, and the parsing of services to biobanks who do not join, remains to be determined. Despite these and other uncertainties, it is reasonable to estimate ~40,000 specimens/year within 5 years, based on current figures from the AIDS specimen bank, and including an expansion into surgical specimens.

f. Location:

The central office of the program will be at Parnassus. Satellite offices may be subsequently be developed at the SFGH and/or the VA. The facility at Parnassus will include storage for recent

specimens and for specimens that may be part of active utilization. Otherwise, most storage will initially be at Oyster Point. Consideration will be given in the future to utilizing commercial services for storage because of the breadth of services offered and economies of scale.

g. Estimated time for implementation:

UCSF is already in the planning process for biobanking and has funds to begin support for a centralized program office, so this could be initiated in the coming year. There is an acute need for storage space and support for this could also be initiated in the coming year. It will take longer for the centralized program office to develop an informatics infrastructure, and to offer centralized biospecimens collection and storage, but the need is present now and this could begin as early as the second year.

h. Funding:

The request is that start-up costs be born by the University. While the CTSI has a longstanding interest in the support of biobanking, the funds available from CTSI are unknown at this point. After the startup, investigators should share in the cost of biobanking, in part to reward economical use of the facility. The extent of cost sharing is at this point uncertain. It is likely that current grant support will not cover more than half of the cost of biobanking. Because a major reason for biobanking is the development of a resource for use by future investigators, it is justifiable that the costs not be born solely by current investigators. In line with this, there should a charge to future investigators who use the core, likely with subsidies for development and feasibility studies and/or work by junior investigators.

i. *Estimated Cost of Implementation (capital expense) and Ongoing Maintenance (operating cost)* – See next two pages.

	IMPLEMENTATION COSTS (including first year of operation)			
I.	FTE (including fringe benefits)			
	Program manager	$ 200,000		
	Programmer	125,000		
	Technicians and informatics personnel (2)	250,000		
	Patient coordinator and data collector	150,000		
	Subtotal		$ 725,000	
II.	Equipment/Hardware			
	Mechanical freezers (5 @ $12K)	$ 60,000		
	Liquid nitrogen storage units	30,000		
	Biological safety cabinets (2, installed)	30,000		
	Crysostat	50,000		
	Centrifuges (1 floor and 2 Eppendorf)	20,000		
	Inverted microscope and lenses	30,000		
	Tissue processor	60,000		
	Tissue embedding station	25,000		
	Microtome	30,000		
	H&E autostainer	40,000		
	minus 20 deg freezer, 4 deg refrigerator	10,000		
	Small laboratory equipment	20,000		
	Coulter counter	35,000		
	Ice maker	3,000		
	Robotic core sampler	200,000		
	Subtotal		$ 405,000	
III.	Software		$ 40,000	
IV.	Consulting		$ -	
V.	Other:			
	Equipment maintenance	$ 30,000		
	Liquid nitrogren (low initial cost, will rise)	5,000		
	Storage monitoring systems	10,000		
	Reagents and media	20,000		
	Daily items (gowns, gloves, pipette tips,	30,000		
	shipping supplies, office supplies, etc)			
	Renovations	1,000,000		
	Subtotal		$1,095,000	
	Grand Total for implentation + first year			$ 2,265,000

	MAINTENANCE COSTS			
I.	FTE (including fringe benefits)			
	Program manager	$ 200,000		
	Pathologist (25%) for histological reviews	125,000		
	specimen imaging and analysis			
	QI manager for all specimens	175,000		
	Programmer	125,000		
	Technicians and informatics personnel (2)	250,000		
	Patient coordinators and data collectors (2)	300,000		
	Subtotal		$1,175,000	
II.	Equipment/Hardware			
	Additional mechanical freezers (3/yr @$12K)	$ 36,000		
	Additional liquid nitrogen storage units	10,000		
	Data storage	20,000		
	Subtotal		$ 66,000	
III	Software		$ 20,000	
IV.	Consulting		$ -	
V.	Other			
	Equipment maintenance	$ 35,000		
	Liquid nitrogren (low initial cost, will rise)	5,000		
	Storage monitoring systems	3,000		
	Reagents and media	20,000		
	Daily items (gowns, gloves, pipette tips,	30,000		
	shipping supplies, office supplies, etc)			
	Outside storage charges*	60,000		
	Subtotal		$ 153,000	
	Grand total for maintenance costs			$ 2,808,000
	There is an immediate need for freezers, but in the long run it is likely to prove cost			
	effective to pay for outside storage, including monitoring and distribution.			
	The cost is ~$12,000/freezer/year. We have begun with 5 freezers.			

II. Bio/Drug Development Recommendations

1. Create a UCSF Bioinformatics Core Facility.

a. Statement of Opportunity/Need

This core is intended to assist UCSF investigators in studies using the large biologic datasets, including but not limited to single-cell RNA and DNA sequencing of cell populations, multiparameter single-cell analysis of expressed proteins by time-of-flight mass spectroscopy (CyTOF®), targeted resequencing, and other complex biological systems.

Recent advances in biotechnology allow the examination of cellular DNA, RNA, proteins, and protein activity at the single cell level at a cost that makes these tools accessible to both bench researchers and clinical researchers. These advances have already expanded our understanding of the complexity of cell biology in ways that have important implications for virtually all fields of human biology and disease. A major barrier to the use of these methods, however, is the need for expertise in using these tools to examine large datasets, including not only the mathematical methods for computation but also steps such as barcoding that may advance the experimental design and interpretation. This core would address these needs.

b. Benefits

It is hard to overstate the potential benefits of the ability to conduct studies at the single-cell level. Such studies are already in use in other institutions not only for basic biological research but also for clinical analysis of malignancies and of immune response, as examples. The benefit of a Bioinformatics Core is that it will make these tools broadly accessible and will assure their proper use.

c. Challenges

The primary barriers to the use these advances are the availability of expertise and the need for efficiencies of scale. Also, although the cost of the experiments makes them within reach, they are still expensive and some subsidy for their use will advance science broadly at UCSF.

d. Estimated Time for implementation

UCSF is already planning core facilities in relevant areas. The time required to establish a Bioinformatics Core is limited only by funding, finding the right people, and space. With funding, these should not take more than 2-3 months.

e. Estimated cost of implementation and of maintenance.

Implementation Costs (including first year of operation)

I.	FTE (year one, including fringe).		
	Analyst/bioinformatician/statistician		$ 150,000
	Web programmer (full time only 1st year)	100,000	
II.	Equipment/Hardware		
	Computers		20,000
	Data Storage		20,000
	IT support (first year)		4,000
III.	Software (we will rely on open-source software		0
IV.	Consulting		0
V.	Other		

Renovations, wiring	30,000
TOTAL implantation/First Year Costs	$ 324,000

Maintenance Costs

I. FTE (offset by fees).	
Analyst/bioinformatician/statistician	$ 75,000
Web programmer (part-time)	25,000
II. Equipment/Hardware	
Computers (annualized replacement)	5,000
Data Storage	30,000
III. Software	0
IV. Consulting	0
V. Other	
IT support	3,000
Miscellaneous	7,000
TOTAL yearly maintenance costs	$ 145,000

f. Other Comments/Notes

The proposed core would leverage experience from the laboratories of David Erle and Charlie Kim in the production of automated analysis pipelines to establish automated workflows and a user-friendly web interface for parameter selection. Users will still be responsible for interpreting their own data and running any required specialized analyses, but the goal is to cover the vast majority of UCSF investigator needs through automated analysis with assistance from the Analyst.

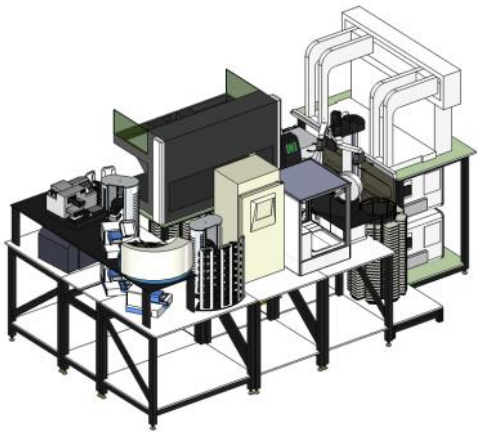
The hardware required for such analysis is distinct from existing publicly available hardware, in that it is "high resource". This refers to the need for large number of computational SSRFs on a single machine, as well as large amounts of memory required for storage of large datasets (e.g., the human genome and its annotations).

2. UCSF Recombinant Antibody /Antibiome Center

a. Statement of Opportunity/Need

Virtually all antibodies available to the community are polyclonal or animal derived monoclonals that are not renewable, of unknown composition, and (often) poor quality. Renewable antibodies are cloned, sequenced and expressible antibody genes and they represent the future for biological and biomedical research and therapeutics. Two years ago Jim Wells (Pharm Chem) along with investigators at University of Chicago (Tony Kossiakoff) and University of Toronto (Dev Sidhu) received a U54 grant to establish robotic platforms to generate renewable antibodies to human transcription factors (TFs). This lead to a tri-institutional cooperative research agreement that established the Recombinant Antibody Network (RAN), devoted to industrializing renewable antibodies to the proteome. The U54 was supplemented at UCSF with an S10 grant of $600K to build the robot, plus restoring moth-balled equipment from Liz Blackburn's effort on large scale sequencing of human telomeres.

Briefly, the RAN takes advantage of recent advances in phage antibody engineering to rapidly identify Fabs and single-chain antibodies (average Kd~10 nM) against complex antigens. The RAN has collectively generated nearly 2000 antibodies to over 250 TFs using phage display methods pioneered by this group. The next major focus is the extracellular space: antibodies to all membrane and secreted proteins. In a follow up grant specifically centered at UCSF, Charly Craik, Jim Wells, Jim Marks have received a favorable score (15) on an NIH P41 Center Grant to further develop an antibody resource at UCSF for set signaling proteins and membrane proteins. This method has proven to be particularly useful in developing antibody reagents that bind to conformationally active targets, post-translational modifications, soluble and membrane proteins. In turn, these renewable antibodies can be used as probes or diagnostics to better understand and treat human disease. Institutional support for the Antibiome Center at UCSF would accelerate its implementation and expand the scope of capabilities available to UCSF investigators across many disciplines.



b. Benefits/Impact on the UCSF

Antibodies remain the most appealing and rapidly expanding scaffolds for modern therapeutics and diagnostics. Access to a unique, renewable and rapid source of new antibodies would have a major impact on many research programs across UCSF.

c. Challenges (e.g., Key people, process or policy changes)

The key people and expertise for the core are largely in-place, including the Antibiome Center team (Mike Hornsby, Tet Matsuguchi, Brian Lee and Karolina Wypsniak) that is managed by Jim Wells. Core technologies and applications at UCSF are developed in the Wells, Marks, and Craik labs. There are numerous UCSF collaborators who have had antibodies made or in the process including: Jeff Bluestone, Robert Fletterick, Nevan Krogan, Michelle Arkin, and Robert Stroud and numerous others who have expressed strong interests including Bill DeGrado, Shaun Coughlin, Kathy Giacomini and many more. There are numerous collaborations on the outside too including Chris Garcia and Brian

Kobilka at Stanford, as well as Wade Harper, Jinying Yuan and Steve Elledge at Harvard. These have only been set up by word-of mouth, not by a systematic web presence. The major hurdle for the Antibiome Center is to staff the core and provide sufficient equipment to ramp-up screening operations.

d. Estimated Time for Implementation

The Antibiome Center is operational but the funding for the U54 grant will run out early next year. We are waiting to for initiation of the p41 grant. However, the p41 will only fund those projects specified and is inadequate for supporting the current Antibiome Center. Additional funding is currently being sought through other means including industrial collaborations. However, these will not support all the projects requested from UCSF investigators nor those on the outside, which are increasing in scope and number.

e. Estimated Cost of Implementation and Maintenance

a. Implementation Costs. The estimated costs for generating antibodies is currently about $1000/Fab. This is about 10-fold below the current costs for generating monoclonal antibodies. With time it is expected these costs to decrease even further especially as the scale increases. A recharge system is being put in place to recoup some of these costs but likely will discourage broader use without some institutional support. In addition to the fixed costs for generating antibodies with the current system the center will need to create new antibody libraries (which will run out this year) as well as maintain and upgrade equipment as needed to further improve efficiency.
b. Maintenance Costs. The current maintenance contract for the Antibody robot (the Antibot) is about $150K per year.

2. *Other Comments/Notes: The Antibiome Center requests $200K to fund the generation of* new antibody libraries ($50K), cover debt we expect this year due to the expiration of the U54 for maintenance contract, and supplement recharge to reduce the burden on UCSF investigators requesting antibodies.

3. UCSF Tethering Core: The Center for Site-Directed Fragment Discovery

a. Statement of Opportunity/Need

Many emerging drug targets are non-canonical – including protein-protein interactions (PPIs), allosterically regulated enzymes, and orphan receptors. Methods for finding drug-like molecules to probe the biology of these targets remain limited. "Tethering" is a powerful, emerging technology for finding compounds that modulate protein function. In most applications, a single cysteine is introduced at the putative interaction surface and a library of thiol-reactive drug fragments (<300 Da) is screened (typically by mass spectrometry) to identify those with favorable interactions. The fragments are then elaborated to generate drug-like molecules or cell-based probes (Figure 1). Tethering was introduced to UCSF by Jim Wells and Michelle Arkin, who helped develop the technology at Sunesis Pharmaceuticals. Adam Renslo's lab has built a unique 2000-member library for Tethering screening. UCSF is the only university that practices the methodology, and more than a dozen collaborators have already worked with these labs to develop chemical probes. Tethering is a highly sought-after resource at UCSF, but infrastructure support is needed to meet the demands for UCSF collaborators and to extract the maximum value from the technology.

To meet the needs of the UCSF community, the team has proposed to develop a Center for Site-directed Fragment Discovery (CSFD) that would add world-class capabilities in Tethering technologies. The CSFD will be integrated with other centers for enabling technologies including the Small Molecule Discovery Center (SMDC), the Recombinant Antibody Network, and the independent labs of Dr. Wells, Dr. Arkin, and Dr. Renslo. This integration ensures that equipment and knowledge will be shared, making the centers highly efficient and effective. For example, the SMDC staff developed a method to batch process mass spectrometry data, store results in the SMDC's database, and visualize Tethering screenings through the SMDC's web-based interface called HiTS.

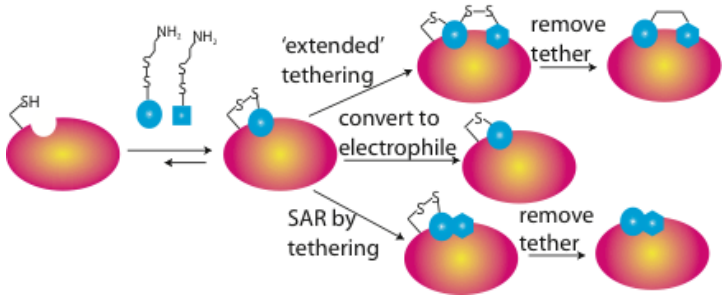


Figure 1. Tethering technology for site-directed ligand discovery.

Towards the goals of bringing Tethering to UCSF, the PIs have used traditional academic resources (*i.e.* grants and start-up funds) to develop Tethering libraries and a screening workflow. Key limitations to the current approach include a) limited equipment for primary screening, b) few resources for new library/technology development, and c) limited chemistry support for post-screening optimization. The CSFD is actively seeking federal funds to overcome thee limitations.

b. Benefits/Impact on the UCSF

UCSF is regarded as the premier institution for tethering-based drug discovery. As an example, Shokat, Wells and colleagues recently published the tethering-based discovery of a new allosteric site on kRAS (Nature, 2013), opening the door to new therapeutics. With additional funding, the CSFD would maintain this competitive advantage, while pushing forward the technology for local users. As federal funding agencies continue to emphasize translational research, universities with established drug discovery capability (especially in cutting edge methodologies) will continue to

have an advantage. Further, the CSFD would advance the capabilities of the SMDC, a highly successful screening and research "collaboratory" in SOP.

c. Challenges (e.g., Key people, process or policy changes)

The key people and expertise for the core, including Jim Wells, Michelle Arkin and Adam Renslo, are largely in-place. The major hurdle is to staff the core and provide sufficient equipment to ramp-up screening operations. Here, we propose to support two chemists who will focus on optimizing Tethered compounds. This capability is critically needed to extract the high potential impact of Tethering screens.

d. Estimated Time for Implementation

Tethering experiments are currently run as collaborations with postdocs and students from the Wells, Arkin, and Renslo laboratories. Professionalization into the CSFD core will be an ongoing process of seeking/implementing infrastructure improvements. Currently, the PIs have submitted the first step of an NIH P41 Center Grant and have applied for an NIH S10 instrument grant. Each improvement will have immediate value to current and planned collaborations, and evidence of cost sharing will further increase the attractiveness to funding agencies.

e. Estimated Cost of Implementation and Maintenance

- Implementation Costs. Here, we recommend $200,000/year to support two chemistry staff scientists to address the critical bottleneck in Tethering at UCSF.

- Maintenance Costs. In total, the CSFD will cost ~$500K/year in equipment and personnel infrastructure. These costs will be borne by a combination of grants, recharges, and industry collaborations. UCSF support of chemistry would be game-changing for the Center.

f. Other Comments/Notes

Profs. Jim Wells, Michelle Arkin and Adam Renslo have submitted an NIH Center Grant pre-proposal on this topic and will be submitting a Center Grant proposal in January 2015 if invited. They have also submitted an S10 grant for a mass spectrometer. On related applications, reviewers have noted the lack of financial institutional support for personnel and/or instrument maintenance as an important weakness. Institutional support for this core would be perceived as a major plus with the NIH.

4. <u>UCSF Single Cell Sequencing Core</u> (Single Cell Biology Center (SCBC))

a. *Statement of Opportunity/Need*
Fluidigm has developed state-of-the art technology for single-cell transcriptomics and has recently acquired DVS, the developer of the CyTOF Mass Cytometer, a powerful tool for the detection of protein expression. These technologies allow multiplexed detection of gene or protein expression from single cells and are uncovering a new level of biological heterogeneity in apparently homogenous cell populations. The equipment and expertise for this type of analysis is already present, or in the process of being purchased, at UCSF – and we now have the opportunity to bring state-of-the-art equipment together into a centralized facility that will allow access to the whole UCSF community and reduce costs to individual investigators. Furthermore, Fluidigm has expressed a strong interest in providing expertise, training and other support.

b. *Benefits/Impact on UCSF –*
The Single Cell Biology Center would have very broad applications in research across the UCSF campus, as it allows the dissection of individual cell responses in a sample. Examples of uses are in tumor analysis for diversity, assessment of the diversity of an inflammatory response, exploration of the range of an immune response, studies of development, and many more.

c. Challenges (e.g., Key people, process or policy changes)

- **Space** Dedicated space is required to centralize all the necessary instrumentation, to streamline workflow and facilitate instrument management
- **Informatics capability.** Substantial computing ability is required to make use of the power of single cell analysis. The quantity of data generated from CyTOF and Biomark is an order of magnitude greater than many investigators are equipped to deal with. Current users of these technologies collaborate with informatics experts to process and interpret data. This proposal will greatly benefit from the creation of the proposed **informatics core** that can support experimental design and interpretation of large datasets and thus remove a major barrier to adoption of this technology.

d. *Estimated Time for Implementation. The CyTOF has been ordered and available space is currently* being evaluated. Once renovations are complete it will take approximately 1 year to fully implement the core, though the CyTOF should be running and available within 2 months of delivery.

e. *Estimated Cost of Implementation and Maintenance*

<u>Implementation Costs</u>

- **FTE $162,325 (1.4 FTE)**
  - Faculty Director 0.2FTE ($27,800 plus benefits $11,954) Oversee establishment of center, work with Fluidgim to build CyTOF, C1 and Biomark user base; assist investigators with grant writing and budgets for CyTOF/ C1/ Biomark projects. Provide scientific oversight and develop a business plan that addresses needs of center users.
  - Core Technical Director 0.2 FTE ($15,600 plus benefits $6,708, remainder of salary from recharge of existing equipment). Work with Faculty director to integrate new and existing equipment, resources and staff, and oversee set up of CyTOF2.

- Specialist II 1 FTE ($70,128 plus benefits $30,155) Set up CyTOF; establish SOPs for instrument operation and sample preparation; work with monoclonal antibody core to test antibodies and panels; train CyTOF, C1 and Biomark users and provide training on Cytobank and other data analysis software; work with Fluidigm to establish data analysis workflow.

- **Equipment/Hardware – ($123,000)**
  - CyTOF Autosampler ($48,000) Bioanalyzer ($20,000) other assorted equipment for RNA prep ($20,000), Inverted Fluorescent Microscope ($20,000) Data server ($5,000)
- **Software – Enterprise Cytobank, Academic Startup Package ($60,000), FlowJo Enterprise tier** 2 ($38,000)
- **Renovation of lab space for CyTOF and for centralization of other equipment. $200,000** approx (Budget will depend on condition of allocated space) **Supplies** $20,000 (including beads, nebulizers, disposable plastic ware).

a. Maintenance Costs

- **FTE Year 2 to 4: –** transition FTE to recharge Yr2 $70,000; Yr3 $35,000; Yr 4 all FTE on recharge.
- **Equipment/Hardware** - $80,000 CyTOF and C1 service contracts for year 2 – support on recharge by year 3.
- **Software** Annual software license fees recover through recharge

f. Other Comments/Notes

- Could any existing sources (school, department of faculty) of funding be leveraged in support of this initiative?
  - Lewis Lanier has been awarded a shared instrument grant to purchase the CyTOF.
- Does this initiative overlap or expand on an existing facility? This initiative will incorporate equipment that is currently spread between different facilities in addition to the CyTOF, for more efficient management of that equipment and improved workflow.

III. Core Support Recommendations

1. Support for Uncompensated Core Activities

a. Statement of Opportunity/Need

- SSRFs that acquire new technologies (whether through shared instrumentation grants or long term demo/loaner instruments & instruments purchased with departmental or Core funds) should be able to apply for salary to support an appropriate amount of staff effort for rolling out new cutting edge instrumentation.
- Core staff provide expertise in areas that are not funded through recharge or grants should be eligible for salary support. These activities are integral to productive useful SSRFs, but this unfunded effort places an enormous strain on SSRFs. SSRFs with a proven record of providing these services should be eligible to receive salary support for this kind of activity. These activities include:
  - Assisting Investigators with writing grants
  - Providing expertise in response to inquires from the general community (consultation)
  - Teaching
  - Mentoring Junior Investigators, Postdoc and Clinical Fellows and Graduate students.
- A new grant should be created to support personnel support for implementation of next-generation equipment and for those SSRFs with a proven track record of providing non-recharge activities. Grants would fund implementation of new equipment for 1-2 years and/or be available to support non-recharge activities. In the case of demo/loaner instruments, potentially there can be a minimum timeline of 6 months to a year that the demo agreement has to be in place, but SSRFs should be able to apply for support for new DEMO instruments also.

b. Benefits/Impact on UCSF

- Make it easier to create new core facilities to share existing equipment and will expedite roll out new high-end instrumentation to the UCSF community;
- Facilitate rapid adoption of new technologies by large numbers of investigators and keep UCSF research at the forefront;
- Implementation of more applications and more time to train will result in more usage and greater long-term sustainability;
- Allow the core to better support the needs of the community and allow greater flexibility to respond to changing needs of research community;
- Grant writing expertise is beneficial in helping investigators obtain funding (which also benefits the core);
- Paying SSRFs for the work they do, and valuing this work will improve the job satisfaction/retention of core directors;
- Supporting teaching and mentoring - encourage/enable users to use new or existing core technologies.

c. *Challenges (e.g., Key people, process or policy changes)*
A new grant mechanism must be established. It could be managed through the ETAC/RRP or RAP mechanisms.

d. *Estimated Time for Implementation*
6 months

e. *Estimated Cost of Implementation and Maintenance: Total*

Assume $175,000 salary and fringe benefits per core director.

For grant writing and mentoring activities:_5% salary support for 20 facility directors = $175,000 annually

For teaching: 5% salary support for 10 courses per year = $87,500

For new curriculum development: 1-2 curriculum grants per year for $10K each = $20,000

2. <u>Recharge Support for SSRFs (Also submitted by Imaging Subcommittee)</u>

a. *Statement of Opportunity/Need*

- **Support Developing Recharge Rates.** Currently, most SSRFs are housed within departments and rely on departmental support for financial management, such as establishing and maintaining recharges. Departments are not always well suited to perform such services for SSRFs, and it may be worth centralizing such functions in a dedicated core office. A centralized administrator who is experienced with the recharge process who can help prepare recharge agreements for SSRFs and help expedite the recharge process would be highly valuable.
- **Redesign Recharge Proposal Review Process.** The current process to approve recharge proposals does not adequately support Core Services that rely on recharge income for financial stability. The current process can take from six months to one year for review and approval which delays SSRFs' ability to roll out new services rapidly and recover instrumentation costs and cover management costs.

b. *Benefits/Impact on UCSF*

- Information about recharge process and what is allowable on recharges will be centralized. Recharges will be better able to keep pace with the changing cost of core activities and core pricing changes will be more predictable to end users.
- Accurate financial recovery of costs

c. *Challenges (e.g., Key people, process or policy changes)*

- Hire a centralized recharge administrator (e.g. in Julie Auger's office).
- Assess the current processes and policies of the current recharge proposal review process with the Cost Policy & Recharge Office of Budget and Resource Management

d. *Estimated Time for Implementation*
6 -12 months

e. *Estimated Cost*

- <u>Implementation Costs</u>
  Implement Hyperion module for Recharge Management $250,000
- 1.0 FTE specialist in RRP $100,000
- <u>Maintenance Costs</u>
  FTE: $100,000 + 3% / yr

  Annual maintenance fee for Hyperion Module: $25,000

f. *Other Comments/Notes*

The cost of the resource could be shared by charging SSRFs for the recharge administrator. For instance, the NIC recharge supports 5% time for the financial analyst in the biochemistry office. Must also devise a mechanism for SSRFs that do not need recharge analyst support to opt-out of this service and therefore not pay for an unneeded centralized resource.

3. <u>Improve Visibility and Access to SSRFs (Also submitted by Imaging Subcommittee)</u>

a. *Statement of Opportunity/Need*
The current core equipment database (cores.ucsf.edu) does not work well for cataloging the existing equipment on campus nor is it accessible via a Google search . It is very difficult to search and it is not regularly updated. Further individual SSRFs provide specific training and education to users and often these teaching sessions are not widely posted. A new catalog of equipment and capabilities should be created. This website should be directly editable by core directors so it is easy to keep updated. Listing facilities by capabilities as well as by equipment would be valuable. Additionally, the university should fund a portion of a technician's salary at level 1 and 2 SSRFs to provide core consultancy services. Such individuals would serve as a point of first contact for users who are unsure of what options are available at UCSF and appropriate for their needs. Ease of core access could be promoted by having a single email that would be directed to all core consultants.

b. *Benefits/Impact on UCSF*
An accurate, easy-to-use, and regularly updated core database and website would improve core visibility and provide a single location for users interested in accessing a service to go. A core consultant email would similarly help users be routed to the appropriate core. This would increase core use, benefiting both researchers and SSRFs.

c. *Challenges (e.g., Key people, process or policy changes)*
Redesign cores.ucsf.edu; implement a core consultancy service.

d. Estimated Time for Implementation

e. Estimated Cost

- <u>Implementation</u> Costs
  Cores.ucsf.edu redesign $100K

- <u>Maintenance Costs</u>
  FTE
  10% technician salary at 10 SSRFs: $60k/yr

4. <u>Create a Career Track for Core Facility Directors, Managers and Staff</u>

a. *Statement of Opportunity/Need*
Core directors/managers offer a specialized niche at UCSF. Leading and managing a successful core facility requires that core directors/managers cultivate a unique skill set ranging from technical expertise in their area of scientific endeavor to business acumen. The institutional knowledge gained is invaluable. A formal career path (including consistent job designations) based on expertise will demonstrate to the SSRFs the value of core directors, managers and staff and help to retain expertise that is essential for UCSF to continue to be a leading institution. Such a career path should also include a formal training program with cross-training opportunities for junior staff members between different SSRFs to allow staff to gain a wider skill set and make this a more attractive career. Additionally organize a Core retreat where staff has the option to give talks about their SSRFs. Groups could be organized by large function of SSRFs, e.g. Genomics, Proteins, Cells, Instrument only, etc. This retreat could be used as an opportunity to announce available "lab rotations", which lab staff could apply for.

b. Benefits/Impact on UCSF
- Formally recognize Core personnel as resources critical to the success of research at UCSF
- Core facility directors/managers will feel valued and incentivized
- Staff can envision a career path at UCSF
- Long range retention of institutional knowledge
- More stable and coherent shared research environment

c. Challenges (e.g., Key people, process or policy changes)
- Associated HR policy changes
- Union issues?
- Other?

d. Estimated Time for Implementation:
6 months to one year

e. Estimated Cost of Implementation and Maintenance
- <u>Implementation Costs</u>:
  Time to align and reclassify staff: 1 FTE $100K

  Formal training and continuing education program for SSRF staff: 10% FTE +$10,000 for training course support. Total: $20,000

- <u>Maintenance Costs:</u>
  25% FTE plus Formal Training program = $45,000

5. <u>Create Bridge Funding Mechanisms for Researchers (Faculty and Core Staff)</u>

a. *Statement of Opportunity/Need*
Create mechanism (voucher system) to subsidize researchers to utilize the SSRFs while they are trying to get their research up and running. At present Core Exploratory awards are only available for new SSRFs or new users of SSRFs. Alternatively support hands-on-training and mentoring (e.g., K awardees could work within the core to perform their experiments/analysis under the direction of core staff with mentoring from the core director)

b. Benefits/Impact on UCSF

- Promote the research of junior clinical investigators and facilitate their ability to obtain future R01 funding;
- Enhance the understanding of cutting edge technologies by Junior investigators who are likely to be the driving force behind future acquisition of new technologies;
- Build strong relationships between junior investigators and SSRFs;
- Providing support for core staff for functions that are currently performed but not funded.

c. Challenges (e.g., Key people, process or policy changes)

- Establishing selection criteria

d. *Estimated Time for Implementation:* 3 months

e. Estimated Cost of Implementation and Maintenance

- <u>Implementation Costs:</u>
  Staff time to evaluate proposals/requests for funding
  Grants/Vouchers: $200K

- <u>Maintenance Costs</u>
  FTE: Staff time (quarterly) to evaluate requests for funding

IV. RRP Big Data Recommendations

a. Statement of Opportunity/Need:

Increasing emphasis is place on the ability to use "Big Data", but it is quite difficult to do it properly. There are many large databases in existence and others being created, which many researchers could use to answer new questions. Some of the databases, such as the VA and Medicare databases, have millions of patients (VA = 6.8 million), each with thousands of data points and text-based notes/reports. How you download the data and set up an analytic sub-database is as crucial to a proper outcome as the eventual statistical analysis. Learning how to do the downloads is extremely time consuming and becomes a barrier to doing unique analyses. Furthermore, many bench-to-bedside and hands-on patient researchers who do not have experience in such analyses have novel questions that they know could be answered using the databases.

In addition, the increased availability of genetic data allows researchers to ask novel questions in their field, but those who do not know how to do that have a big barrier. The combination of genetics with big data (Kaiser or VA Million Veteran Program) is doubly difficult. Full genetics plus thousands of data points allows gene environment interaction analyses.

Based on researchers that have done this on their own, there are three components/workers that are needed plus administrative support. Most groups do not have them. The time that it takes to develop the team is a huge waste of money and time, which becomes a major inertial barrier to doing the research. It also makes no sense to assemble a team for a limited/one time question that might be an important outcome in and of itself or crucial to support other concepts.

b. Benefits/Impact on UCSF:

An accessible group that has cumulative and growing knowledge of how to use big data would not only enable experienced groups to do better and faster work, but would facilitate new users to expand their research or test hypotheses to support their research. Such a group could allow rapid inquiries that would assist translational research and develop supportive data for grants, as well as helping established epidemiologists deal with bigger datasets.

c. *Challenges*

1. In our work so far, we feel you need an independent Principal Investigator with experience in big data running the program to assure that the requesting investigator gets what is needed from the downloads and analysis. Experience is needed to avoid the blind leading the blind. The programmers who actually pull out the data are rarely able to see the subtleties (for example in ICD-9 codes) and must work well with both the requesting investigator and the big data PI. May need more than one PI if program is heavily used, but by then would be charge back.
2. A person is needed to construct the data subset. That person needs to be able to work well with other people's concepts, pay attention to detail and learn from experience. Unfortunately, most biostatisticians fine it too boring, so a programmer with a feel for biology is needed.
3. A biostatistician who has worked with big datasets is needed to either do the analyses or more important to train biostatisticians who have not analyzed big datasets. Doing the analyses is easily handled by charge back. Training requires some support.
4. Requires a part time administrator.
5. PI(s) needs academic credit/recognition for this work.

d. Estimated Time for Implementation

Hiring could be done in 6 months. Toughest is recruiting and training #2.

e. Estimated Cost of Implementation and Maintenance

a. Implementation Costs
   i. FTE
      - 25% for PI must be covered during the startup. Likely at least Associate Professor level.
      - A data subset constructor may need to be hired full time with start up costs (including training) covered if we cannot find someone with experience.
      - Biostatistician could be full charge back for analyses, but needs some support for training and startup (20%).
      - Administrator at 20% need for startup. Needs core business experience. Obviously, the best arrangement is anther core administrator.
   ii. Equipment/Hardware: Two high-end workstations to start.
   iii. Software: Standard and statistical (e.g., Office and SAS).
   iv. Consulting:
   v. Other: The standard one-hour consultation model will not work. Likely need 2-3 hours with at least the PI and the data subset constructor. May also need the biostatistician there to assess training/work needs.

b. Maintenance Costs
   i. FTE
      - 10% PI. 20%
      - Data subset constructor.
      - 10% biostatistician.
      - 5% admin. To cover consultation.
   ii. Equipment/Hardware More needed only after we succeed.
   iii. Software: Yearly licenses.
   iv. Consulting

f. Other Resources/Notes

- Could any existing sources (school, department or faculty) of funding be leveraged in support of this initiative?
- The program could be in the Institute for Computational Health Sciences. They would have to give the academic credit for the services. More important, they would have to set it as a priority at the time they are starting up. They may need to take in a faculty member who is not at the level of computational science that they wish to focus on.
- The CTSI might also be a home for it but current services need to be expanded and supported.
- Does this initiative add to or expand on an existing facility? See above. Also, there are several investigators at the VA with experience (Salomeh Keyhani, Mary Whooley). Neil Risch has experience with the Kaiser database.

V. Imaging Recommendations

1. Funding Shared Instrumentation in Core Facilities

a. *Statement of Opportunity/Needs*
Three mechanisms to fund shared equipment instrumentation.

- Existing methods for funding shared equipment on campus such as RAP, ETAC, and PBBR, generally work well. ETAC has been a successful funding mechanism and should be continued. **Placing shared equipment funded by** these funding mechanisms **into SSRFs should be encouraged by including a letter of support from a core director stating that the core would house and maintain the equipment.** Extra weight should be given to requests that will be placed into a level 1 or 2 core (see http://rrp.ucsf.edu/sites/rrp.ucsf.edu/files/wysiwyg/Guide%20to%20UCSF%20Shared%20Research%20Facilities.docx for definitions of core levels) due to their university-wide visibility. A core directors committee could be formed to review equipment requests and to make it easier for PIs to identify appropriate SSRFs.

- **Create a mechanism to support personnel for establishing new SSRFs and for rolling out new cutting edge instrumentation in existing SSRFs.** In both cases the core or instrument is expected to break even in the long term, but before it is established, no funds from recharge are available to support implementation and roll out. To support these activities (when appropriate) the university should make a new grant available to fund a technician salary for 6 mos. - 2 years. This would provide a solution to the common problem where a PI has a high-end instrument that there is campus-wide demand for, but cannot provide adequate support to allow users from outside the lab to access the instrument (this is currently an issue with the UCSF cryo-electron microscopy facility). Because there is no current user base, a recharge will not bring in any money initially. Once the user base is established, the recharge is expected to support the staff salaries for managing the facility, but users cannot be attracted to the facility without staff.

- Similar concerns arise when acquiring next generation, cutting edge equipment that doesn't have a solid user base at the very outset and requires extensive training of the user base or installation and commissioning of the equipment. This is a costly endeavor that is not currently covered either by shared instrumentation grants that support equipment purchase or by the existing recharge model for core funding. To rectify these problems, **a new grant should be created to support personnel support for establishing new SSRFs or commissioning next-generation equipment.** Such a grant should allow funding of a technician salary for up to two years to support a new core, all the durations as short as three months should be considered for rolling out new equipment. For new equipment, funding of the first year or two of a service contract should also be considered as part of this grant.

b. *Benefits/Impact on UCSF*
- Ensure continued funding for shared equipment for core facilities and encourage shared equipment to be placed into visible core facilities, where it will be accessible to the university community.

- Funding core staff will make it easier to create new core facilities to share existing equipment and to roll out new high-end instrumentation to the UCSF community.
- Enable rapid adoption of new technologies by large numbers of investigators and keep UCSF research at the forefront.

c. Challenges (e.g., Key people, process or policy changes)

- Coordinate with RAP and PBBR (if possible) to change shared equipment grant language require letter from core director and to prioritize equipment that will be placed into level 1 and 2 SSRFs.
- Continue funding the ETAC / RRP shared equipment awards.
- Form a core directors committee (could be virtual with discussions by email)
- A new grant mechanism must be established to fund staff. It could be managed through the ETAC/RRP or RAP mechanisms.

d. *Estimated Time for Implementation*
6 months

e. *Estimated Cost of Implementation and Maintenance*

- Implementation Costs
  Minimal
- Maintenance Costs
  ETAC/RRP awards: $1-2 million / yr
  Staff funding, assuming two 1 year technician positions funded on average: $120k/yr.

2. <u>Recharge Support for SSRFs (also submitted by Core Support Subcommittee)</u>

a. *Statement of Opportunity/Need: Currently, most SSRFs are housed within departments and rely on* departmental support for financial management, such as establishing and maintaining recharges. Departments are not always well suited to perform such services for SSRFs, and it may be worth centralizing such functions in a dedicated core office. Furthermore, the existing recharge process can be very slow (months to get new recharge rates approved) and can hinder rolling out new services rapidly. A centralized administrator who is experienced with the recharge process who can help prepare recharge agreements for SSRFs and help expedite the recharge process would be highly valuable.

b. *Benefits/Impact on UCSF*
Information about recharge process and what is allowable on recharges will be centralized. Recharges will be better able to keep pace with the changing cost of core activities and core pricing changes will be more predictable to end users.

c. *Challenges (e.g.,, Key people, process or policy changes)*
A centralized recharge administrator (e.g. in Julie Auger's office) would need to be hired.

d. *Estimated Time for Implementation*
6 mos.

e. Estimated Cost of Implementation and Maintenance

- <u>Implementation Costs</u>
  Minimal

- <u>Maintenance Costs</u>

    i. FTE
    $80k / yr

f. Other Comments/Notes
- Charging SSRFs for the recharge administrator could reduce the cost; for instance, the NIC recharge supports 5% time for the financial analyst in the biochemistry office.

3. <u>Support for Core Pilot Grants</u>

a. Statement of Opportunity/Need:
Institute grants to support initial core usage by labs that do not currently have sufficient funding to access the core, with the goal of generating preliminary data that can be used to support a grant application to support ongoing core usage.

b. *Benefits/Impact on UCSF*

- This will make it easier for new faculty and new core users to get access to core facilities.
- It should increase the number of core users.

c. *Challenges (e.g.,, Key people, process or policy changes)*
A new grant mechanism must be established. It could be managed through the ETAC/RRP or RAP mechanisms.

d. *Estimated Time for Implementation*
6 mos.

e. Estimated Cost of Implementation and Maintenance

a. Implementation Costs

i. FTE
$10,000

ii. Equipment/Hardware

iii. Software

iv. Consulting

v. Other (fill-in)

b. Maintenance Costs

i. FTE
$5,000 / yr

ii. Equipment/Hardware

iii. Software

iv. Consulting

Other (fill in)
20 grants at $5000 ea. : $100k/yr

4. <u>Improve Visibility and Access to SSRFs (also submitted by Core Support Subcommittee)</u>

a. *Statement of Opportunity/Need*
The current core equipment database (cores.ucsf.edu) does not work well for cataloging the existing equipment on campus. It is very difficult to search and it is not regularly updated. A new catalog of imaging equipment and capabilities should be created. This website should be directly editable by core directors so it is easy to keep updated. Listing facilities by capabilities as well as by equipment would be valuable. Additionally, the university should fund 10% of a technician's salary at level 1 and 2 SSRFs to provide core consultancy services. Such individuals would serve as a point of first contact for users who are unsure of what imaging options are available at UCSF and appropriate for their needs. Ease of core access could be promoted by having a single email (e.g. imaging@ucsf.edu) that would be directed to all core consultants.

b. *Benefits/Impact on UCSF*
An accurate, easy-to-use, and regularly updated core database and website would improve core visibility and provide a single location for users interested in accessing a service to go. A core consultant email would similarly help users be routed to the appropriate core. This would increase core use, benefiting both researchers and SSRFs.

c. *Challenges (e.g.,, Key people, process or policy changes)*
Redesign cores.ucsf.edu; implement a core consultancy service.

d. Estimated Time for Implementation

e. Estimated Cost of Implementation and Maintenance

- <u>Implementation Costs</u>
  Cores.ucsf.edu redesign $100k?

- <u>Maintenance Costs</u>
  FTE
  10% technician salary at 10 SSRFs: $60k/yr

5. Microscopy **<u>Image Analysis Core</u>**

a. *Statement of Opportunity/Need*
A microscopy image analysis core would be strongly beneficial to the university and the university should support the development of such a core by providing 50% salary support for five years. This would be complementary to the existing biomedical imaging analysis core (QUIPC) and would complement UCSF's strengths in microscopy image acquisition by providing researchers access to staff that are experts in image analysis. Similar to existing imaging SSRFs, this core would not directly provide data analysis services but would provide consulting and training on existing image analysis software (both commercial and academic) as well as development of new software tools where there is a significant unmet need. Harvard Medical School developed such a core 18 months ago (http://idac.hms.harvard.edu/); it employs two scientific staff that has Ph.D.'s in computational biology and a computer scientist (with an MS). The Harvard core currently charges $100/hr for simple software development, such as adapting an existing tool, or developing simple analysis scripts. More complicated development is subsidized and charged at tiered rates from $1000 - $2500. They currently benefit from a ~80% subsidy and so it is likely that the UCSF core would have to charge higher rates or employ fewer staff. With a director at the Adjunct Assistant Professor level and an assistant at Specialist IV we estimate total salary costs of $250,000 per year, including benefits. With a 50% subsidy and only two staff, consulting rates of $100/hr are probably feasible.

The Harvard core has been very successful so far; they report waits of a few weeks to a month for their services. The co-director of that core is strongly supportive of developing a similar core at UCSF and has offered to help identify potential candidates, should we proceed with the core, as well as to share expertise. They are potentially willing to share software they have developed and to have a shared software repository so that both SSRFs can share tools they develop.

b. *Benefits/Impact on UCSF*
The existing imaging SSRFs at UCSF do not have the expertise or staff to support more than rudimentary assistance in image analysis. As a result, the ability to acquire image data now vastly outstrips the ability to analyze it. It is now routine for users of the NIC to acquire hundreds of gigabytes of image data and then struggle to analyze it. An image analysis core would provide professional support for these problems, substantially improving the ability of UCSF researchers to undertake complex image analysis tasks.

c. *Challenges (e.g.,, Key people, process or policy changes)*
A core director and core assistant must be hired, and space would need to be found for the core facility.

d. *Estimated Time for Implementation*
1 year to hire director; five years from establishment to break-even, sustainable operation.

e. *Estimated Cost of Implementation and Maintenance*
    a. <u>Implementation Costs</u>

        i. FTE
        search support $10k

ii. Equipment/Hardware
$50k

iii. Software
$50k

iv. Consulting

v. Other
Space renovation $50k

b. Maintenance Costs

i. FTE

Director at $150k / yr; Assistant at $100k / yr (including indirects)
50% support for 5 years: $575k

ii. Equipment/Hardware

iii. Software
$10k

iv. Consulting

f. Other Comments/Notes

- Could any existing sources (school, department of faculty) of funding be leveraged in support of this initiative?
- Partnering with existing compute clusters and other high performance computing resources should minimize hardware costs.

6. Core Infrastructure and Support

a. *Statement of Opportunity/Need*

There are currently several core infrastructure needs that are not consistently met at UCSF, including space and IT support. These include:

i. **At a minimum, all imaging SSRFs should have gigabit network connectivity.** Imaging SSRFs produce large amounts of data (GB – TB per day) and managing this data and distributing it to end-users can be a challenge. . There should be a representative of core facilities (or just of core facilities generating large amounts of data, such as imaging and genomics SSRFs) at **future discussions of campus-wide data storage and high performance computing.**

ii. **Increase support for machining and engineering.** While there is not sufficient demand to merit a dedicated machine shop at UCSF, several SSRFs have intermittent needs for machining, electronics fabrication, and engineering consultation (mechanical, electrical, and optical engineering) that are not currently met. Maintaining a list of outside companies that are willing to work on low volume, one-off jobs typical of these needs, and accustomed to working with academics would be beneficial to imaging SSRFs at UCSF. If there is sufficient demand, it may be worth setting up a preferred vendor or a retainer agreement for some of these services.

iii. **Add representation from core facilities on the university space committee.** How space is managed at UCSF is currently in flux, and the new space policy will require justifying the economic utility of research space, by measuring indirect costs per square foot for research space. This poses a potential problem for core facilities, as while core facilities are a critical part of the UCSF research infrastructure and enable UCSF researchers to be competitive in applying grants, they do not directly bring in substantial amounts of indirect funding. This should be recognized in the UCSF space policy, either by mapping grants from core users to the core, or by developing an alternative assessment for space used by core facilities.

iv. **Consolidate space, both within and between SSRFs.** Several SSRFs have instruments in many different rooms, as equipment has been acquired and placed wherever space was available. This results in inefficient use of core resources as core staff must constantly move between instruments to help users. Consolidating all instruments within a core in contiguous space would result in improved efficiency. Similarly, consolidating multiple SSRFs within a single space can work well. For instance, the Nikon Imaging Center and Center for Advanced Technology have long shared a single room at Mission Bay. Such sharing makes efficient use of space and also results in interchange of expertise between core directors and users, making the shared centers an intellectual crossroads of sorts. Holding yearly meetings with core directors to discuss space needs and to identify opportunities in which multiple SSRFs would benefit from sharing space could facilitate space consolidation.

b. *Benefits/Impact on UCSF*

- Improved access to data generated by core facilities; minimize duplication of computation resources
- Improved access to engineering / fabrication services for SSRFs and researchers.
- Better use of space for core facilities; improve coordination within and between SSRFs

c. Challenges (e.g.,, Key people, process or policy changes)

- Work with ITS to ensure proper connectivity for SSRFs.
- Core representative(s) on data storage, high performance computing, space committees

d. Estimated Time for Implementation
   6 mos.

e. Estimated Cost of Implementation and Maintenance
   Minimal

VI. Mass Spec Recommendations

The mass spectrometry (MS) subcommittee began the vetting process by first reviewing the MS-themed responses from the initial campus feedback submission Open Proposal forum. Three initiatives were identified to pursue in detail: 1) an investment pool to support MS core facility operations, 2) invest in bioinformatics resources to store and analyze MS data, and 3) establishing a lipid MS unit. Next, the subcommittee performed a campus-wide inventory of all MS facilities that included location, PI, and number of mass spectrometers and HPLC systems. The inventory allowed for estimation of expenses for implementation and annual maintenance for initiatives 1 and 2 based on current UCSF salaries, equipment cost estimates, approximate annual service contract costs and software licensing fees. Estimates for implementation and maintenance expenses for initiative 3 were determined by current UCSF salaries, equipment cost estimates and projected software licensing and consultation fees.

1. Invest in Bioinformatics Resources to Store and Analyze Mass Spectrometry Data

a. Statement of Opportunity/Need

Invest in resources that will facilitate storage and analysis of data to support the bioinformatics requirements of mass spectrometry core facilities. Support includes funding for hardware, software, infrastructure, systems administrators, and bioinformaticians and statisticians.

b. Benefits and Impact on UCSF

- Core directors/managers can focus on providing MS services rather than on maintaining servers, backing up instrument hard drives, archiving data.
- A resident biostatistician dedicated to campus MS efforts would greatly facilitate turn around time regarding data analysis intensive research projects.
- A resident bioinformatician would also be warranted, as large MS data sets require significant data-mining, network analysis and integration with other types of 'omic' data sets such as genomics and metabolomics.
    - MS SSRFs will remain competitive and state-of-the-art.

c. Challenges

- Key people: Administrators at the campus level (Chancellor, Vice Chancellors, School Deans), Department Chairs, Finance Directors, Faculty, MS Core Directors.
- Process/policy changes: A commitment from the campus level to financially support mass spectrometry core facility bioinformatic needs.
- Identification of funding sources.
- Two possible – although not mutually exclusive – solutions: Cloud-based and/or server-based at UCSF.
- If server-based at UCSF proper infrastructure (space, wiring, climate control, security) needs to be identified and put into place.
- If Cloud based, proper vetting and training of campus investigators in the use of these newer software tools would be required
- Sustainability

d. Estimated Time for Implementation

- 12-18 months

e. Estimated Cost of Implementation and Maintenance

i. Implementation Costs

1. for Server-based Solution at UCSF

- Systems Administrator (60% FTE): $64,800[a]
- Biostatistician (20% FTE): $24,000[b]
- Bioinformaticist (20% FTE): $24,000[b]
- Hardware (servers, racks, cables, etc.): $150,000
- Software Licenses: $150,000[c]
- **Total: $412,800**

2. Implementation Costs for Cloud-based Solution at UCSF
   - Systems Administrator (60% FTE): $64,800a
   - Biostatistician/Informatician (20% FTE): $24,000b
   - Bioinformaticist (20% FTE): $24,000b
   - **Total: $112,800**
3. Annual cost, $90,000 plus 20% fringe.
4. Annual cost, $100,000 plus 20% fringe.
5. Annual cost
6. Cloud-based solution assumes use of free, open source sites, e.g., chorus.org and panoramaweb.org.

ii. Annual Maintenance Costs

1. for Server-based Solution at UCSF
   - Systems Administrator (60% FTE): $64,800
   - Biostatistician (20% FTE): $24,000
   - Bioinformaticist (20% FTE): $24,000
   - Software Licenses: $150,000
   - Hardware (additional server blades, racks, cables, etc.): $100,000
   - Service Contracts: $50,000
   - **Total: $362,850**

2. Annual Maintenance Costs for Cloud-based Solution at UCSF
   - Systems Administrator (60% FTE): $64,800
   - Biostatistician/Informatician (20% FTE): $24,000
   - Bioinformaticist (20% FTE): $24,000
   - **Total: $112,800**

f. 6. Other Comments/Notes

- Negotiate with software vendors to offer multiple year licenses purchases at a reduced price.
- Leverage a portion of IDC to support campus MS bioinformatics infrastructure.
- Supplement annual costs with grant funding and recharge mechanisms when possible.
- Solicit hardware and software vendors as corporate sponsors of UCSF mass spectrometry bioinformatics. Corporate donations would be applied to annual maintenance costs.

- Is a Cloud-based solution cheaper and effective solution rather than servers located and maintained at UCSF? Would it be best to implement both solutions?
- How would we train campus investigators in the use of either Cloud or on-site software for MS data analysis?
- Would leveraging with ITS reduce costs?

2. Investment Pool to Support Mass Spectrometry Core Facility Operations

a. Statement of Opportunity/Need

- To support routine operations of mass spectrometry core facilities, UCSF needs an investment pool to fund instrument maintenance contracts, personnel costs and new equipment purchases.
- The fee-for-service recharge and federally sponsored grant mechanisms do not facilitate long-term sustainability of mass spectrometry core facilities.

b. Benefits and Impact on UCSF

- Core directors/managers can focus on providing MS services rather than on fund raising.
- MS SSRFs will remain competitive and state-of-the-art.

c. Challenges

- Key people: Administrators at the campus level (Chancellor, Vice Chancellors, School Deans), Department Chairs, Finance Directors, MS Core Directors.
- Process/policy changes: A commitment from the campus level to financially support mass spectrometry core facilities.
- Identification of sources to fund the investment pool.
- Sustainability

d. Estimated Time for Implementation

- 12 months

e. Estimated Cost of Implementation and Maintenance

I. Annual Implementation Costs[a]
- Service contracts: $1,385,000[b]
- Personnel: $568,309[c]
- New equipment: $930,000[d]
- Total: $2,883,309

II. Based on the current (June 2014) Campus Mass Spectrometry Facility Inventory
III. $45K per MS contract, $10K per HPLC contract.
IV. One Specialist, Step 1 per facility ($67,656 plus 20% fringe benefits).
V. Campus purchases one new mass spectrometer ($850K) and HPLC ($80K) per year. SSRFs would apply for these funds through an internal grant mechanism (RAP).

f. Other Comments/Notes

- Negotiate with vendors to provide a service contract "package deal" whereby multiple service contracts are purchased at an overall reduced price.
- Leverage a portion of IDC to support campus MS facilities.
- Supplement the investment pool with grant funding and recharge mechanisms when possible.
- Solicit MS and HPLC vendors as corporate sponsors of UCSF mass spectrometry research. Corporate donations would be deposited into the investment pool.

Campus Mass Spectrometry Facility Inventory
Current as of June 2014

Facility	PI	Location	Mass Spectrometers	HPLCs
Sandler-Moore Mass Spectrometry Facility	Susan Fisher	Parnassus Heights	4	6
Gladstone Mass Spectrometry Facility	Nevan Krogan	Gladstone Institutes	2	2
National Bio-organic Biomedical Mass Spectrometry Resource Center	Al Burlingame	Mission Bay	8	8
Metabolomics/Environmental Chemicals Mass Spectrometry Facility	Roy Gerona	Parnassus Heights	3	2
Small Molecule Discovery Center	Jim Wells	Mission Bay	1	1
Drug Metabolism and Pharmacokinetics Facility	Les Benet	Parnassus Heights	2	2
Drug Studies Unit Dept. of Bioengineering and Therapeutic Sciences	Yong Huang	Parnassus Heights	5	5
		Total	25	26

3. Lipid MS Core

a. Statement of Opportunity/Need

Mass spectrometry (MS) and technical capability to quantify and identify all types of biological lipids present in healthy and diseased tissue samples, body fluids, and cell extracts. Opportunity is to establish a **Lipid MS Core** that enables UCSF leadership in the study of lipids and their roles in processes that span all aspects of the biomedical sciences.

b. Benefits/Impact on the UCSF

The UCSF research community has a wide-ranging need for access to MS instruments and expertise for the quantification and identification of lipids. Lipids are the major constituents of all cell membranes, are essential energy stores, function as intracellular and intercellular signaling mediators, and as essential modifiers of protein function. Lipid levels in cells and in circulatory and interstitial fluids change during development, during responses to environmental stresses, under conditions of altered diet, and in a wide range of immunological, neurological and other disease states. As well as many hundreds of known lipids, new lipids are continually being identified and new functions for well known ones are still being defined. As a result, there is a deep need to be able to accurately measure and identify all lipid types. More than a dozen PI's have expressed an immediate need for or interest in lipid MS (including Coughlin, Cyster, Derisi, Jan, Koliwad, Locksley, McCune, Sil, Shannon, Walter, Weiss) but we believe these represent only 'the tip of the iceberg' and that there is a larger need for this type of analysis that would be rapidly utilized by a wide range of researchers if the technology and expertise were sufficiently accessible.

c. Challenges (e.g., Key people, process or policy changes)

Currently there is no instrument available at UCSF for targeted lipidomic studies. This contrasts with several MS instruments that are available for protein MS and a small number of instruments being used for metabolomic studies. Occasional work has been performed on existing instruments on an ad hoc basis, such as in collaboration with Dr. Yong Huang director of the Drug Studies Unit in the Department of Bioengineering and Therapeutic Sciences. However, more typically UCSF investigators are forced to perform their lipid MS studies with collaborators at other institutions. For example Cyster measures oxysterols with David Russell at UTSW; Koliwad measures a diverse set of metabolic lipids with Daniel Nomura at UCB; Shannon measures palmitoylation with Ben Cravatt at UCSD.

Challenges are obtaining the necessary instrumentation, placing the instrument(s) in the most appropriate UCSF location, supporting a full time operator with expertise in the area of lipidomics, having the bioinformatics capability for lipid MS analysis, and maintaining the service contract on the instrument(s) and related equipment such as HPLCs.

d. Estimated Time for Implementation

Depends on strategy taken. One approach would be to team up with Dr. Yong Huang and house new instrumentation in the Drug Studies Unit in the Department of Bioengineering and Therapeutic Sciences. Dr. Huang has extensive experience with measurements of a range of small molecules and has collaborated with a number of UCSF investigators as time and resources have permitted on the targeted analysis of a small number of lipids. Alternatives would be to incorporate the Lipid MS Core within an existing Core that is focused on protein MS. Either approach should allow rapid installation of instrumentation with sufficient expertise available for initial operation. This could then be

followed in the ensuing several months by recruitment of a dedicated Lipid MS Core director who has a background in MS analysis of lipids or related small molecules.

e. Estimated Cost of Implementation and Maintenance

Implementation Costs

- FTE: ~100K/yr
- Equipment/Hardware: Example of an appropriate instrument –
  - AB SCIEX QTRAP 6500 – ACA/OMICS, SHIMADZU HPLC, plus Solexion Device: ~$600K (per instrument)
- Software: LipidView ~$15K
- Consulting: $10K

Maintenance Costs

- FTE
- Equipment/Hardware: TBD
- Software: Licensing fees TBD
- Consulting: TBD