Specific Aims

The University of Utah Department of Ophthalmology and Visual Sciences / John A. Moran Eye Center is initiating expansions in translational, clinical and flexible research resources by building out 15,368 net square feet (sf) existing shelled space. The new laboratory space (12, 295 net sf) is proposed to serve programs dedicated to understanding some of the world’s most severe vision disorders, including age-related macular degeneration (AMD), neovascular disease (NVD) and inherited retinal degenerations (RD). These programs have also identified new intervention modalities to prevent and treat disease. A new laboratory space model (flex-labs) is proposed to facilitate the transition from classical "R01-style" incremental studies to critical assessment of interventions. Quality-of-workplace enhancements for staff and support space are integrated (3,073 net sf).

1. **Translational research laboratories for retinal disease.**
   This aim proposes laboratory, clinical research and core support space for a new multi-investigator AMD-NVD-RD initiative led by Gregory Hageman. Dr. Hageman’s program addresses complement-related degenerative processes, focusing on the genetics, molecular structure, and cell biology of complement factor H (CFH), a major risk factor for AMD. Two more new faculty will pursue the human genetics and physiology of AMD-NVD-RD (Drs. Margaret DeAngelis and Mary Hartnett). Integrated clinical research lanes will facilitate AMD-NVD-RD patient recruitment for genetic, disease progression and tissue studies.
   (space 6952 net sf, fixed equipment 4 hoods)

2. **Flexible-use laboratories (flex-labs) for accelerated device and drug development.**
   New open-configuration laboratories are proposed to assist in qualifying translational science leads. These include studies of microdevices and nanomaterials for intracellular molecular delivery (Ambati, Baehr); qualification testing of drugs for modulating immune and matrix actions in AMD/NVD (Hageman, Ambati, Marc), retinopathy of prematurity (ROP; Hartnett), and glaucoma (Vetter, Krizaj).
   (space 2751 net sf, fixed equipment 2 hoods)

3. **Connectomics laboratories.**
   New transmission electron microscope (TEM) methods for visualizing terabyte-scale 3D neural wiring (connectomics) and tissue architectures (histomics) have been developed at the University of Utah. These tools allow high resolution profiling of normal, at-risk and diseased tissues at unprecedented speeds. Drs. Marc and Hageman will use the connectomics resource to build the first human connectomes: the retinal macula in health and disease. The cyberinfrastructure will support petabyte-scale data storage. A powerful extension of this functionality is the Connectomics Visualization Laboratory with terabyte scale community annotation tools. This is transformative shared technology for bioimaging.
   (space 1738 net sf, 1 clean hood)

4. **High-density tissue banking facilities for human ocular and syndromic disease profiling.**
   This aim provides large-scale tissue banking space with secure, redundant power. In degenerative eye diseases, pivotal information regarding the onset, progression and heterocellular propagation of dysfunctional events has increasingly come from human donor tissue. Dr. Hageman’s expertise also includes structural and molecular exploration of syndromic diseases.
   (space 854 net sf)

5. **Enhanced support, staff and student environments for research.**
   Staff and students are the engines of modern research. This aim provides for improved quality-of-life working conditions with bicycle commuting resources, staff showers, enhanced daylight for research administration and student space, operations space (communications closets) and administrative staff offices.
   (space 3073 net sf)

Significance. Ocular degenerative diseases have been studied for decades in single-investigator NIH programs but translational progress has been slow. The Moran Eye Center initiative proposes to colocate translational research and developmental teams focusing on AMD-NVD-RD. By cutting across classical R01 boundaries with shared high-level resources for discovery (connectomics, visualization) and qualification of intervention modalities (flex-labs), we expect to accelerate translational research, drug and device assessment, speeding transitions of interventions from lab to clinic. These improvements will significantly enhance the ability of the University of Utah Department of Ophthalmology and Visual Sciences / Moran Eye Center to deliver on its translational research mission.
Background and Significance

Background
The first John Moran Eye Center (JMEC I) building was completed in 1993. The research faculty rapidly outgrew that space, culminating in the need for and successful completion of the John Moran Eye Center II (JMEC II) in 2006. JMEC II includes Clinical and Research Pavilions bridged by an atrium. The Clinical Pavilion houses ophthalmic services and administrative, auditorium, library, IT and data records space. The Research Pavilion houses four floors (Levels 3-6) of research space for 12 faculty (9 faculty hold 15 federal awards), core research services (imaging, molecular biology, cold rooms, animal vision profiling); a barrier-style, secure AAALAC-accredited vivarium; plus high-grade glassware and sterilization services, optical / biomedical equipment repair and fabrication, and an enterprise scale receiving facility on Level 1. The constructions of JMEC I and II were supervised by the Moran Eye Center’s Executive Director Wayne Imbrescia, under the leadership of Dr. Randall J. Olson M.D., Chair of Ophthalmology and Director of the Moran Eye Center. Both facilities were designed by the award-winning FFKR Architects. This leadership, design and management team is in place for a new phase of growth. JMEC II was built with Research Pavilion Levels 1 and 2 shelled for laboratory services with infrastructure sufficient for expansion. The need for new space has come with unprecedented speed. The existing Moran Eye Center research programs have been very successful, with four new tenure-track faculty added since 2006, and three more planned by the end of 2009.

The Moran Eye Center funding profile includes one NSF and 14 NIH projects, including a National Eye Institute P30 Vision Core Grant. Adjunct and collaborating faculty members hold 5 additional NIH grants, and all participate in the University of Utah NIH Neuroscience Training Grant. This success, plus a strong graduate and postgraduate training base and the collaborative ethic of the Utah research community has energized the Moran Eye Center to undertake new, forward-looking translational research ventures. We identified human ophthalmic genetics and AMD-NVD-RD translational research as essential expansions to our portfolio. After an intense search, we recruited three candidates who will bring four additional NIH grants to the group and bring our annual direct funding to over $5.5M (see Grant Tables below).

- Dr. Gregory Hageman, Ph.D. (the incoming John Moran Presidential Professor) is one of the most highly sought researchers in vision. He will bring a large NIH R24 program.
- Dr. Margaret DeAngelis, Ph.D., (incoming Assistant Professor of Ophthalmology at Harvard) will bring her NIH-funded program on the human genetics of AMD.
- Dr. Mary E. Hartnett, M.D., Ph.D. (incoming Professor of Ophthalmology) will bring two NIH-funded retinal disease programs (AMD, ROP).

In addition, the Moran Eye Center will expand its research capacity for all faculty with connectomics resources, new investigational device and drug flex-labs, and tissue banking.

Significance
These proposed improvements serve research programs central to the NIH Roadmap for Re-engineering the Clinical Research Enterprise. Cell-specific genetic and system wide immune and vascular system molecular variants are agents of blinding disease. Of the Americans with AMD (1.7 million), diabetic retinopathy (4 million) and other diseases, over 2.4 million are blind or severely impaired (NIH NEI). Our programs seek discovery of molecular mechanisms of these diseases and qualification of new prophylactic or therapeutic interventions. The Moran Eye Center is committed to expanding translational efforts with new staffing and faculty (job creation), implementing new technology resources, and building new energy-optimized research environments that will concurrently improve workplace efficiency. The slow progress in evolving interventions from translational to clinical research partly arises from the sparse, disconnected distribution of such research teams across the nation and the virtual absence of laboratory resources and staffing for device or drug lead development in the translational research environment. The proposed improvements will achieve high and sustained impact by colocating a critical mass of translational research teams, by implementing a novel use of space and state-of-the-art technologies, and by providing an exceptional working environment for research staff. These resources will enhance translational science, provide a sustained influence on research missions by facilitating collaborative strategies, and serve as a model for the national goal of effectively linking translational and clinical research.
Improvement Plans

Goals

The buildout of shelled space of the Moran Eye Center has five improvement goals:

1. Translational research laboratories for retinal disease
2. Flexible-use space (flex-labs) for accelerated device and drug development.
3. Connectomics laboratories
4. High-density tissue banking facilities for human ocular and syndromic disease profiling
5. Enhanced staff and student environments for research

Design concepts

The designs for these improvements are grounded in the idea that optimizing resources leads to enhanced productivity. The designs specifically address the need to enhance and speed both discovery and development in translational research. Individual and shared space designs largely replicate current layouts, with enhanced features based on working experience in JMEC II. The faculty are extremely satisfied with the current JMEC II laboratory layouts and infrastructure.

Colocation of translational laboratories for retinal disease research. The catalytic power of direct interaction among scientists, staff, and students cannot be mimicked. Our design concept is that colocation of translational research programs provides the best opportunity to maximize their impacts. Three investigators with closely related NIH-funded programs addressing the molecular biology, genetics, immunology and physiology of AMD-NVD-RD will be placed on Level 2. Collectively, these diseases account for the majority of incurable blindness in the world. Our design is a frontal attack on their mechanisms.

Colocation of translational laboratories and clinical research for retinal disease. Our experience shows that integrating clinical research patient management into the translational research stream is the single greatest factor in recruiting and retaining patients in the research enterprise. Translational research programs critically depend on clinical research resources: patient recruitment, disease diagnosis and progression assessments, treatment and follow-up, phlebotomy, donor management, and tissue banking. As these practices differ greatly from routine clinical care, we propose to colocate clinical and translational resources, and separate clinical research patient management from the routine care stream. This will minimize inconvenience to patients and maximize their engagement with the translational research process. Dr. Hageman’s leadership will be especially valued as he has established one of the most successful donor recruitment programs in the world. This design is consistent with the objectives of the NIH Roadmap for Re-engineering the Clinical Research Enterprise (http://nihroadmap.nih.gov/clinicalresearchtheme) and the NIH CTSA program (www.ctsaweb.org). The University of Utah Center for Clinical and Translational Science is a recent CTSA awardee.

Open flex-labs. Our experience shows that lack of resources for qualification testing is the major barrier to successful translational-clinical research transitions. The design concept for these laboratories is based on the NIH Roadmap (http://nihroadmap.nih.gov/clinicalresearchtheme), which clearly notes that:

“Promising ideas for novel therapeutic interventions may encounter roadblocks in bench-to-bedside testing. While translation is sometimes facilitated by public-private partnerships, high-risk ideas or therapies for uncommon disorders frequently do not attract private sector investment. Where private sector capacity is limited or not available, public resources can bridge the gap between discovery and clinical testing so that more efficient translation of promising discoveries may take place.”

When a typical NIH-funded laboratory discovers target molecules, drugs or devices for potential therapeutic or prophylactic intervention, the “next step” spaces, equipment, staffing, expertise and support resources for assessing interventions through preliminary toxicology and efficacy programs are often absent. Moreover, it is often expected (or hoped) that industry will step into the gap. But a typical NIH research program develops only a small fraction of the data needed to qualify an intervention, while industry usually demands mature assessments. This gap is the target of our flex-labs. As will be described, the Moran Eye Center has a high rate of interventional device-drug development and this remodel will serve those needs.
**Connectomics and IT resources.** Connectomics is the single most transformative research initiative in neuroscience and translational retinal disease research. The motivation for these resource designs are based on developments at the University of Utah (Anderson et al. 2009, PLoS Biology 7(3): e1000074). The Marc laboratory at the Moran Eye Center, (funded by NIH NEI) in collaboration with the University of Utah Scientific Computing and Imaging Institute of Computing (funded by NIH NIBIB and NCRR) has developed the fastest commercial TEM system available for study of neural wiring (connectomics) and tissue architectures (histomics), operating at 5000 16-bit images and 150 Gb of data daily. The Moran Eye Center is committed to doubling this performance for translational research by equipping new space on Level 2 with this technology. This is equivalent to acquiring 100 Tb of raw imagery/year. Annually, the combination of raw, backup and processed data will require 300 Tb. We propose to provide petabyte-scale (1024 Tb) storage for translational research programs. This resource places special power, site stability, heat management and cyberinfrastructure demands on the JMEC II. The petabyte storage will use liquid-cooled racks integrated with building chilled water and raised floors for cabling (funded by the Moran Eye Center). A key feature of the Moran Eye Center connectomics initiative addresses the challenge of using terabyte/petabyte scale data. The Marc laboratory has developed community-based annotation environment that enables many scientists, students or citizens to interrogate, tag and extract data concurrently over network connections (Viking! © J.R. Anderson, University of Utah, 2009). The Connectomics Visualization Laboratory is a key element in shared usability and collective analysis. Direct connections between storage systems and the Visualization Laboratory (plus key investigator laboratories) will use 10-Gigabit fiber infrastructure to isolate high-demand science applications from secure hospital-managed networks dedicated to patient care. Management of IT services for research (our NIH P30 Vision Core Grant provides a terabyte of storage for every participating faculty member) and connectomics will be housed in Research IT space on Level 1.

**Tissue banking and emergency power.** Blood, ocular and syndromic organ tissue banking is central to modern proteomic and genomic analyses of disease mechanisms. Our design objectives are based on current needs for high density storage (Dr. Hageman is transferring 10 freezers from Iowa to Utah) and planned expansion. In addition, well-designed emergency power is one of the basic features of modern molecular biology laboratories and tissue banks. All freezers in the tissue banking facility require emergency power. We will install (at our own expense) thermal annunciators using wireless and ethernet pathways, providing regulatory compliance (e.g. FDA, AABB), and insuring the integrity of critical and rare blood and tissue samples.

**Colocation of research administration, students and staff.** The Moran Eye Center Research has developed an egalitarian culture by providing similar resources for faculty, students and staff. This is a design philosophy we intend to continue. Further, we are firmly committed to graduate student, postdoctoral fellow and staff safety and quality-of-life enhancements. We currently have extensive secure student (30 carrels) and postdoctoral (6 cubicles) spaces furnished with the same IT amenities as faculty spaces; break rooms are open-access, with white boards, projection and IT services; open-access core resources are distributed across Levels 3-6 of the Research Pavilion. Currently, the Academic and Executive Directors of Research, administrative staff, and the building manager are housed in less-than-optimal, dispersed locations: some are not even in the Research Pavilion. Recruiting three more faculty programs and staffing of flex-labs will bring new administrative challenges and put more pressure on student space. Our plan provides an opportunity to improve service impact by relocating Dr. Greg Jones (Executive Director responsible for translational research, technology advancement, intellectual property management, FDA compliance, etc.) and his administrative staff on Level 1 next to the new flex-lab space, freeing up 3 more postdoctoral carrels on Level 4. An additional 380 sf of secure student carrels with ethernet ports will be placed on Level 1 next to the Connectomics Visualization Laboratory. Though many groups embed students in their host laboratories, we have found that providing separate (optional) student and postdoctoral space promotes peer interaction and provides a haven from lab hazards. We are committed to maximizing compliance with the Occupational Health and Safety Act and encourage all faculty to assign students to JMEC II offices rather than dispersing them into lab bench space.

**Lighting and thermal controls.** The existing JMEC II has been an exceptional environment, with zone control heating and, in some cases, adjustable lighting. The ability to use high levels of natural lighting through large laboratory windows, control daylight for photosensitive procedures with dark blinds, and use adjustable task lighting in imaging environments has led to a significant reduction in overall power use in certain labs, and reduction in use of mercury-containing fluorescent tube lights. Similarly, zone thermal control improves the varied comfort needs of staff and enhances productivity. A clear example is a central staff member in the TEM facility who often works 7 days a week: he is a quadriplegic (polio) with very little body mass. Room temperatures adequate for full-sized personnel are devastatingly cold for him. The zone thermal controls in JMEC II allow an
optimal working environment for all staff, regardless of ADA status. We propose to provide similar local lighting and thermal controls to the greatest extent practical in the improvement plan for Levels 1 and 2.

Daylight and views. The existing JMEC II Research Pavilion is notable for its spectacular mountain views and excellent daylight access. Many vision laboratory functions require lighting control and those are placed in interior spaces. The expansion of Level 2 will largely replicate Levels 3-6, providing extensive window space for all laboratories. However, the improvement plan provides opportunities to maximize daylight use. Indeed, AMD-NVD-RD patients are especially averse to non-natural and reduced lighting environments. An open lab model on Level 1 will be used, allowing daylight to penetrate deeply into laboratory space. The research administration, student office and Visualization Laboratory space will use full or half height glass walls, allowing daylight to provide much of the ambient lighting. New high-brightness projection and screen shielding allow the Visualization Laboratory space to be well-lit while maintaining optimal computing and display conditions.

Alternative transportation. Patient and staff transportation and parking are key concerns of this plan. The Moran Eye Center has its own parking garage with adequate capacity for normal patient use, with staff and faculty subscription stalls. However, the existing JMEC II Research Pavilion is next to the University Medical Center end-of-line station for TRAX, Salt Lake City’s modern, clean, 100% wheelchair accessible light rail system. Operated by the Utah Transit Authority, TRAX passes are free to all University of Utah employees and students. TRAX is widely used by faculty, staff, students and patients: the Moran Eye Center in particular has a very high ridership. This greatly reduces motorized traffic and parking pressures. TRAX expansion to connect the University and Salt Lake International Airport is in progress (http://www.rideuta.com/mediaRoom). The TRAX service also supports bicycle ridership. To further encourage alternative transportation, the Moran Eye Center will assign space on Level 1 for secure bicycle storage as part of this improvement plan. This will be available to all Moran Eye Center employees, as will be the associated secure staff shower facility and personnel lockers. The Moran Eye Center is committed to optimizing the quality of working conditions for all.

Use of existing structure. This improvement will use existing structural walls and flooring. As JMEC II was explicitly designed to expand research capacity to meet demand, no modifications of that primary structure, including exterior shell, stairwells, elevator access, or primary HVAC, water, and gas services are required. Common collaboration areas off the atrium space adjacent to the research areas were completed as part of the building construction.

Integration into the University’s Master Plan. The Moran Eye Center is one node in a planned research corridor that bridges the Health Sciences and Main campuses, with the TRAX rail as a central feature, an effective campus shuttle and numerous pedestrian-friendly paths. This is consistent with the history of strong collaborations between the Moran Eye Center and undergraduate units such as the School of Computing, Physics and Mathematics. The planned improvements are in part the results of related NEI and NIBIB funding with Computing and Moran faculty as co-PIs. The goal of integration is more intensive, successful collaboration.

Specific Research Upgrade Plans: Level 1

Level 1 Current Use. This level houses ≈ 4200 sf of complete operations space for the Moran Eye Center, including enterprise-scale receiving dock, offices and materials management; glassware washing and sterilization; optical fabrication, biomedical device fabrication and repair, medical gas storage and general storage; and restrooms (see Line Drawings). The external and internal entryways to this section are secured with a key card access control system. The remaining 6538 sf is unfinished shell space. It is currently used for patient record/chart storage. The Moran Eye Center is converting these to electronic medical record (EMR) form and the space will be vacated within 6 months.

Level 1 Future Use. The 6538 sf of unfinished space will be converted to:
- flex-labs for translational research drug and device assessment (2751 sf)
- tissue banking space (414 sf)
- Connectomics Visualization Laboratory space (618 sf)
- Research IT space (320 sf)
- research administration offices (540 sf)
- additional student and postdoctoral offices (380 sf)
- expanded biomedical device fabrication and repair space (175 sf)
- optical fabrication (relocated from current finished space, 354 sf; the vacated 391 sf space will be used for secure bicycle storage.
- staff lockers and showers (410 sf)
Use of flex-labs. As part of our commitment to achieving the full promise of disease-related translational research, the Moran Eye Center will equip and staff this resource to assist faculty in transitioning their findings to developmental programs, without impairing their existing NIH-funded missions. The flex-labs will include space and resources designed to provide vision related assessments. These labs are equivalent to 5 bays of molecular biology bench space with additional closed space for vision assessment, toxicology and tissue culture. Vision assessment spaces will house existing equipment for electroretinography, mouse ocular imaging and mouse visual psychophysics. The planned immediate use includes animal model and tissue culture studies for six investigators holding nine NIH grants:

- Ambati - toxicity and efficacy studies of anterior chamber drug delivery micro-rings for AMD-NVD
- Ambati - toxicity and efficacy studies of nanoparticles for molecular therapy in NVD
- Baehr - toxicity and efficacy studies of ceramic nanoparticles for gene therapy in RD
- Bernstein - disease correlation studies of ocular and skin carotenoid measuring devices
- Hageman - toxicity and efficacy studies of CFH-related drugs in AMD
- Krizaj - toxicity and efficacy studies of calcium channel blockers in glaucoma
- Levine - toxicity and efficacy studies of anti-neoplasitics in RD
- Marc - toxicity and efficacy studies of glycan anti-inflammatory drugs in AMD-NVD
- Marc - toxicity and efficacy studies of retinoic acid analogues in RD
- Vetter - toxicity and efficacy studies of anti-inflammatory drugs targeting microglia in glaucoma
- Yang - toxicity and efficacy studies of gene therapies for Usher syndrome and related RDs

Use of Tissue banking space. The Level 1 tissue bank is our expansion space for continued translational research in retinal diseases. AMD-NVD-RD tissues are critical elements in the proteomic and genomic profiling of disease progression. Dr. Hageman’s stature in this area is special and his $12.9M R24 NIH project is predicated on successful accession and curation of ocular and syndromic tissues (e.g. liver samples). The University of Utah has its own Lion’s Eye Bank for acquiring corneal transplant tissue and modest research accessions. The Lion’s Eye Bank only provides “wet” tissue refrigerated storage and has no frozen tissue capacity. Dr. Hageman and the JMEC II tissue bank will take this association to a new level.

Use of the Connectomics Visualization Laboratory. The Visualization Laboratory will provide 8-16 ports of 10 Gigabit communications for visualizing, querying and annotating connectomics and histomics datasets acquired by our high-throughput TEM system and a new schema for confocal microscopy based on the Open Microscopy Environment standard (www.openmicroscopy.org). In addition, the Visualization Laboratory will be used to expand image analysis capabilities throughout the Moran Eye Center as part of our Vision Core. Host computers for expensive core imaging software will be based in the Visualization Laboratory. It is expected that all Moran Eye Center NIH-funded faculty will use this resource in their programs.

Use of Research IT space. The expanded role for IT in translational research addresses three critical factors. (1) Terabyte-petabyte-scale storage requires professional management. The Moran Eye Center will provide that staffing. (2) The storage places substantial pressure on power and cooling infrastructure and its management hardware should be isolated from general workflow. (3) Dissemination of terabyte-petabyte-scale data through 10 gigabit switches and demarcation from hospital networks requires specialized equipment. The Moran Eye Center will provide that equipment.

Use of Research Administration space. The Executive Director of Research (Dr. Gregory Jones) for the Moran Eye Center will have primary management responsibility for staffing and allocating flex-lab resources. To facilitate device and drug assessment and clinical application potential, Dr. Jones will also be the Moran Eye Center’s official FDA liaison officer and will guide Moran researchers in designing appropriate screening protocols for toxicology, efficacy, and vision testing. Dr. Jones is the official Moran Eye Center liaison with the University’s Technology Commercialization Office. Colocating him and his staff next to the flex-labs is intended to maximize the translational research impact of that space.

Use of Student and Postdoctoral Fellow space. The Moran Eye Center has allocated most of its existing student and postdoctoral fellow office space. We are major participants in the graduate programs of the Interdepartmental Neuroscience Program and the Combined Programs in Molecular Biology and are committed to high quality research opportunities. The recruitment of three more faculty to the Moran Eye Center, based on current student loads, is likely to quickly bring 12 more students and fellows into JMEC II. As the leadership of the Moran Eye Center views OSHA compliance and minimization of chemical hazard exposure to be key mission, we discourage the all-too-common practice of embedding students in areas requiring chemical hazard management plans. We view student office space as critical to a successful translational research model.
Use of Optical / Biomedical Device Fabrication space. Vision research requires miniaturized versions of clinical tools for equivalent assessment of small animal eyes - contact lenses, specialized fundus cameras, pressure monitors, etc. The Moran Eye Center has long maintained optical and biomedical device shops for clinical services and staffed them with career professional opticians and technicians. As part of translational-clinical research enterprise, we propose to colocate the professionals near the flex-lab space and make their services available to investigators engaged in drug and device assessment. These staff are eager to participate in translational research. In addition, the space allocated to the optical fabrication shop is currently a suboptimal working environment secluded from interaction with other staff and lacking any daylight access. By relocating the optical fabrication shop we are able to use the vacated space for secure bicycle storage with minimal modification.

Use of Staff Facilities. Enhancement of staff commuting and working conditions is key mission for the Moran Eye Center. Currently at least ten individuals bicycle-commute intermittently and many more would if shower and locker resources were available. We estimate, building wide, that the storage and showers would serve at least 25 staff daily.

Specific Research Upgrade Plans: Level 2

Level 2 Current Use. Level 2 is 12,573 sf (gross) unfinished shell space. It is currently used for surplus equipment and supply storage. The space will be vacated within 6 months.

Level 2 Future Use. Level 2 will be primarily used for conventional translational research laboratories, core services space, connectomics labs and clinical research lanes for three NIH-funded researchers who will join the Moran Eye Center between September 1-Dec 31 of this 2009. These investigators bring four NIH programs focusing on AMD-NVD-RD.

Dr. Gregory Hageman (2244 sf) will be the incoming John A. Moran Presidential Professor, has already signed his offer letter and his appointment is officially in progress. He is largely responsible for the high-impact discovery that genetic variants of CFH have differential risk values in atrophic AMD, ranging from highly protective to highly damaging. His $12.9M R24 program focuses on the development of complement-related therapeutics.

Dr. Mary E. Hartnett (1537 sf) will be an incoming professor and has verbally accepted our offer. The formal offer is in progress. She is a clinician-scientist with both research (2 NIH programs) and clinical responsibilities (retinal surgery). Her NIH-funded programs address endothelial integrity in NVD and ROP.

Dr. Margaret DeAngelis (1135 sf) will be an incoming Assistant Professor and head our human ophthalmic genomics program. She has agreed to return for her second recruiting visit and has verbally expressed her eagerness to accept an offer. She is an active collaborator with Dr. Hageman. Her primary NIH funded research addresses discovery of high-impact low-prevalence associations through comparison of concordant-discordant sibling gene patterns.

Use of Clinical Research Lanes and Offices (1436 sf). As noted above, patient care and most clinical research are traditionally isolated from research spaces. Translational research on AMD/NVD/RD presents a special situation. Such patients need intensive care as their vision degrades, and recruiting them for ongoing clinical assessment, genetic studies and tissue donor programs is an important and sensitive process. Drs. Hageman and DeAngelis are specialists in this area and the design of the clinical research lanes and staffing space are intended to maximize their impact. Our experience with these patients emphasizes the importance of direct relations with the researchers who will be integrated into their health care plan. Staffing of these resources is provided by the Moran Eye Center. In accordance with Joint Commission and IRB regulations, interview spaces for study monitors are included in the design.

Tissue banking (440 sf). Blood samples (for genetics), tissue samples (for genetics and proteomics) have become the central currency of AMD and NVD research. Dr. Hageman will be bringing 10 freezers of samples from the University of Iowa to the University of Utah. In addition, all three of the faculty on Level 2 and others in the Moran Eye Center (Baehr, Ambati, Bernstein) engage in blood and tissue banking for their programs. The freezer systems will be monitored individually and continuously with ethernet/wireless-based annunciators. We estimate that this bank configuration on levels 1 and 2 will suffice for at least 10 years.

Use of Connectomics and Petabyte Scale Storage (1120 sf). Modern TEM imaging is revolutionizing biology. High-throughput tools developed at the University of Utah now permit comprehensive high-resolution tissue analysis by acquiring and visualizing terabyte-scale datasets. Building the first human retinal connectome and ocular histome will be a central goal of the new translational research programs on Level 2. Level 2 will house a new JEOL JEM-1400 120 KeV TEM, power room, clean room with ULPA hood for sample management and
Phosphoimaging camera maintenance, TEM work area and data storage. Phosphoimaging cameras are extremely sensitive to environmental dust on the micron scale. The petabyte scale data storage space is designed to house enterprise scale server racks. At present, the Marc laboratory is populating two racks, each ultimately capable of hold 240 Tb with a head-box server and a hybrid RAID/JOBD design. The full use of the square footage, cooling and power in the storage space is planned to support 4 such racks or an equivalent NetApp FAS6080 1176 Tb system.

Use of the Core Services space (600 sf). The remaining interior space will house essential core services such as confocal imaging (an incoming Olympus FV1000 will be housed there), walk-in cold room, tissue culture facilities, shared equipment alcoves (Geldoc stations, centrifuges) and common work space areas. Cold rooms on levels 3-6 are fully subscribed and the core confocal facility on level 5 is at near full capacity. The expansion of capacity on Level 2 will meet the needs of both incoming faculty and overflow from current users.

Significance and Need

Grant Tables (Table 1 Active and Table 2 Pending): see inserted tables.

The Moran Eye Center is active and growing, with both clinical services and research missions. The research faculty includes 13 tenured/tenure-track scientists (5 full Professors, 5 Associate Professors, 3 Assistant Professors), 12 located in the JMEC II Research Pavilion. Four were hired since 2006. In 2009 we expect to bring in 3 more new faculty members (Hageman, Hartnett and DeAngelis). This will bring the total number of working laboratories to 15, the NIH+NSF active award count to 20, and our annual federal and foundation direct expenditures to over $5.5M and total expenditures in excess of $7M. This does not include the extensive contract income of several clinical research labs or the $1.2M in NIH consortium costs that will be run through the University of Utah as part of Dr. Hageman’s R24. In addition, the Moran Eye Center holds a large NIH NEI Core P30 grant that services these faculty and three adjunct faculty who hold four more NEI R01 awards.

Significance.

(1) The Moran Eye Center is committed to the translational-clinical research mission, as evidenced by our successful recruiting, even during recent times of retraction at other institutions. The recruitment of Drs. Hageman, Hartnett and DeAngelis is an exciting opportunity. This growth drives our need for new lab space.

(2) The faculty of the Moran Eye Center and colleagues at the University of Utah have developed productive research alliances (the Core P30 renewal for FY2010 will report nearly 200 publications over 5 years), demonstrating a successful evolution from classical single-investigator programs to highly interactive, interdependent projects. This kind of growth and new scientific ethic drives our need for flex-labs (see below).

(3) The Moran Eye Center has developed high-throughput TEM connectomics technology with transformative potential for translational research. This resource requires enterprise-scale data storage and drives our needs for expansion space on Level 2. Further, such large image datasets pose a new challenge: how do investigators explore and annotate them? The answer is “community markup” where secure image repositories are viewed by multiple users with network-enabled tools (e.g. Viking! © J Anderson 2009), while structured databases record annotations. This high-speed community method has the potential for becoming a new kind of collaboration. Our goal is to make the new Visualization Laboratory on Level 1 a primary research tool where dozens of investigators can concurrently assess and annotate connectome and histomics datasets.

(4) The improvement completes the Moran Eye Center. JMEC II is an ideal candidate for Extramural Facilities Improvement of shell space for research. The existing building and labs have proven to be exceptional. It is an excellent platform for high-technology equipment (TEM, electrophysiology, requiring VC-D performance). The Moran Eye Center views it as a flagship for translational research.

Need

Flex-labs for new research models. The new facilities will expand our research portfolio and improve existing research with new technologies and resources. The new laboratories and resources are designed to foster the translation of basic research discoveries into clinical application far into the future. Many of the researchers in the Moran Eye Center have disease-focus programs (Marc, Baehr, Bernstein, Ambati, Hageman, etc.) with extremely mature research growth (Marc has over 30y and Baehr over 20y of continuous NIH funding). These and other programs have moved aggressively to identify translational research opportunities in the areas of pharmacologic intervention (Marc, Ambati, Hageman, Krizaj, Jones), microdevice drug delivery (Ambati), nanodevice drug delivery (Ambati, Baehr), and gene therapy (Baehr, Yang). While the primary NIH programs are very successful and expected to remain so, the resources to begin animal testing on drugs and devices for ba-
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<td>ANGELUCCI, ALESSANDRA ASSOCIATE PROFESSOR</td>
<td>1R01 EY019743 01...03</td>
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<td>CONTEXTUAL EFFECTS IN VISUAL CORTEX: PATHWAYS AND MECHANISMS</td>
<td>ANGELUCCI, ALESSANDRA ASSOCIATE PROFESSOR</td>
<td>IOS-0848106</td>
<td>NSF</td>
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<td>INTRACEPTOR INTERFERENCE OF VEGF PATHWAYS</td>
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<td>$266,765</td>
<td>05/01/07 - 04/30/12</td>
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<td>THE ROLE OF SFLT IN CORNEAL AVASCULARITY</td>
<td>AMBATI, BALAMURALI ASSOCIATE PROFESSOR</td>
<td>5R01EY017950 01...05</td>
<td>NIH-NEI</td>
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<td>RPB</td>
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<td>01/01/09 - 12/30/12</td>
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<td>MAMMALIAN PHOTOTRANSDUCTION: ROLE OF cGMP AND CALCIUM</td>
<td>BAEHR, WOLFGANG PROFESSOR</td>
<td>5R01EY008123 19...23</td>
<td>NIH-NEI</td>
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<td>MEMBRANE PROTEIN TRAFFICKING IN PHOTORECEPTORS</td>
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<td>NIH-NEI</td>
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<td>07/01/08 - 06/30/13</td>
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<td>WYNN CENTER FOR THE STUDY OF RETINAL DEGENERATIONS</td>
<td>BAEHR, WOLFGANG PROFESSOR</td>
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<td>07/01/07 - 06/30/10</td>
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<td>BIOCHEMISTRY AND PHARMACOLOGY OF THE MACULAR CAROTENOIDS</td>
<td>BERNSTEN, PAUL PROFESSOR</td>
<td>5R01EY011600 05...11</td>
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<tr>
<td>Sibling Study of Age-Related Macular Degeneration</td>
<td>DeAngelis, Margaret New Asst Professor</td>
<td>1R01EY017362 01...05</td>
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<td>Genetic Epidemiology of Age-Related Macular Degeneration</td>
<td>DeAngelis, Margaret New Asst Prof (2.4CME)</td>
<td>1R01EY017362 01...05</td>
<td>NIH-NEI</td>
<td>460,142* 92,000**</td>
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<td>Career Development Award</td>
<td>Fu, Yingbin Asst Professor</td>
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<td>Role of Wnt/Frizzled Signaling During Eye Development</td>
<td>Fuhrmann, Sabine Asst Professor</td>
<td>5R01EY014954 06...10</td>
<td>NIH-NEI</td>
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<td>Development of Complement Modulating Therapeutics for AMD</td>
<td>Hageman, Gregory New Professor</td>
<td>5R24EY017404 01...04</td>
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<td>Alcon Award</td>
<td>Hageman, Gregory New Professor</td>
<td>ALCON Res Inst</td>
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<td>2009 - NO END DATE</td>
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<td>Mechanisms of Angiogenesis in Retinopathy of Prematurity</td>
<td>Hartnett, Mary New Professor</td>
<td>5R01EY015130 01...04</td>
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<td>Endothelial Transmigration in Neovascular AMD</td>
<td>Hartnett, Mary New Professor</td>
<td>5R01EY017011 01...05</td>
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<td>03/01/08 - 02/29/12</td>
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<td>Career Development Award</td>
<td>Jones, Bryan William Res Asst Professor</td>
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<td>01/01/08 - 12/31/12</td>
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<td>Regulation of Neurotransmission in the Retina</td>
<td>Krizaj, David Associate Professor</td>
<td>5R01EY013870 05...09</td>
<td>NIH-NEI</td>
<td>$220,501</td>
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<td>Calcium in Retinal Disease</td>
<td>Krizaj, David Associate Professor</td>
<td>FFB</td>
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<td>Role of CHX10 in Embryonic Retinal Progenitor Cells</td>
<td>Levine, Edward Associate Professor</td>
<td>2R01EY013760 05...08</td>
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<td>Structural Neurochemistry of Retinal Circuits</td>
<td>Marc, Robert Professor</td>
<td>5R01EY00257629...34</td>
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<td>$313,023</td>
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<td>Retinal Remodeling</td>
<td>Marc, Robert Professor</td>
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<td>Core Vision Research Grant</td>
<td>Marc, Robert Professor</td>
<td>5P30EY01480001...05</td>
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<td>07/01/05 - 06/30/10</td>
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<td>Development of Synaptic Pathways in Retina</td>
<td>Tian, Ning Associate Professor</td>
<td>5R01EY01234506...11</td>
<td>NIH-NEI</td>
<td>NCE</td>
<td>01/05/05 - 04/30/10</td>
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<td>NMDA Receptor and Synaptic Plasticity in Retina</td>
<td>Tian, Ning Associate Professor</td>
<td>5R03EY01586801...03</td>
<td>NIH-NEI</td>
<td>$125,000</td>
<td>09/01/05 - 08/31/09</td>
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</table>

*Harvard Portion; **Estimated Utah Portion

**Direct Collaborators / Adjunct Faculty Impacted (Users of Moran Vision Core, Connectomics, and Vivarium Resources)**

<table>
<thead>
<tr>
<th>Grant Title</th>
<th>Principal Investigator</th>
<th>Grant Number</th>
<th>Funding Source</th>
<th>Annual Direct $</th>
<th>Start-End Dates</th>
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<tr>
<td>Mechanisms of Retinal Axon Pathfinding</td>
<td>Chiien, Chi-Bin (Adj Professor)</td>
<td>5R01EY01287308...13</td>
<td>NIH-NEI</td>
<td>$250,000</td>
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<td>Retinal Neurogenesis</td>
<td>Vetter, Monica (Adj Professor)</td>
<td>2R01EY01227411...15</td>
<td>NIH-NEI</td>
<td>$250,000</td>
<td>07/01/08 - 06/30/13</td>
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<td>Equipment Supplement</td>
<td>Vetter, Monica (Adj Professor)</td>
<td>2R01EY01227411S1</td>
<td>NIH-NEI</td>
<td>$900,000</td>
<td>07/01/08 - 06/30/13</td>
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<tr>
<td>Catalyst for a Cure</td>
<td>Vetter, Monica (Adj Professor)</td>
<td>1R01EY01936301...04</td>
<td>Glaucoma Res FDN</td>
<td>$233,750</td>
<td>01/01/09 - 12/31/10</td>
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<td>A Vision Neural Prosthesis</td>
<td>Gregger, Bradley (Adj Asst Professor)</td>
<td>1R01EY01936301...04</td>
<td>NIH-NEI</td>
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<td>09/01/08 - 08/31/12</td>
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<table>
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<tr>
<th>GRANT TITLE</th>
<th>PRINCIPAL INVESTIGATOR</th>
<th>GRANT NUMBER</th>
<th>FUNDING SOURCE</th>
<th>ANNUAL DIRECT $</th>
<th>START-END DATES</th>
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<tr>
<td>REVOLUTIONIZING PROSTHETICS</td>
<td>GREGER, BRADLEY (ADJ ASST PROFESSOR)</td>
<td>FY05-0027.01</td>
<td>DARPA</td>
<td>$231,653</td>
<td>3/1/2008 – 3/31/10</td>
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<td>LARGE-SCALE COMPUTATIONAL RECONSTRUCTION OF 3D NEURAL SYSTEMS</td>
<td>TAZDIZEN, TOLGA (COLLAB ASST PROF)</td>
<td>5R01EB005832 01...04</td>
<td>NIH-NIBIB</td>
<td>NCE</td>
<td>08/01/05 - 05/31/10</td>
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Table 2. Pending awards affected by the improvement of resources

<table>
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<tr>
<th>GRANT TITLE</th>
<th>PRINCIPAL INVESTIGATOR</th>
<th>GRANT NUMBER</th>
<th>FUNDING SOURCE</th>
<th>ANNUAL DIRECT $</th>
<th>START-END DATES</th>
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<tr>
<td>SIBLING STUDY OF AGE-RELATED MACULAR DEGENERATION</td>
<td>DEANGELIS, MARGARET NEW ASST PROFESSOR</td>
<td>1R01 EY10867 01...05</td>
<td>NIH-NEI</td>
<td>$360,000</td>
<td>12/01/09 - 11/30/14</td>
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<tr>
<td>ASSEMBLY AND TRAFFICKING OF OPSIN AND G PROTEIN IN RODS AND CONES</td>
<td>FU, YINGBIN ASSISTANT PROFESSOR</td>
<td>PENDING</td>
<td>NIH-NEI</td>
<td>$200,000</td>
<td>04/01/10 - 03/31/15</td>
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<td>ROLE OF WNT/FRIZZLED SIGNALING DURING EYE DEVELOPMENT</td>
<td>FUHRMANN, SABINE ASST PROFESSOR</td>
<td>5R01EY014954 06...10</td>
<td>NIH-NEI</td>
<td>$250,000</td>
<td>09/01/09 - 08/31/14</td>
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<td>DEVELOPMENT OF SYNAPTIC PATHWAYS IN RETINA</td>
<td>TIAN, NING ASSOCIATE PROFESSOR</td>
<td>5R01EY012345 12...16</td>
<td>NIH-NEI</td>
<td>$250,000</td>
<td>12/01/09 - 11/30/14</td>
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<td>T-CELL RECEPTOR AND GANGLION CELL DEGENERATION IN GLAUCOMA</td>
<td>TIAN, NING ASSOCIATE PROFESSOR</td>
<td>1RC1EY020221 01...05</td>
<td>NIH-NEI</td>
<td>$250,000</td>
<td>12/01/09 - 11/30/11</td>
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<td>RETINAL SIGNALS IN PHPV</td>
<td>VETTER, MONICA (ADJ PROFESSOR)</td>
<td>1R21EY019390 01A1</td>
<td>NIH-NEI</td>
<td>$125,000</td>
<td>10/01/09 - 09/30/11</td>
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<td>GLIAL INFLAMMATION IN GLAUCOMA</td>
<td>VETTER, MONICA (ADJ PROFESSOR)</td>
<td>1RC1EY020350</td>
<td>NIH-NEI</td>
<td>$403,647</td>
<td>09/30/09 - 09/29/11</td>
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</table>
sic toxicology requires flexible-use space, equipment and facilities not available in investigator-managed labs or core services. Further testing for efficacy via animal visual psychophysics, animal physiology and tissue culture profiling likewise places special demands on labs not explicitly configured or equipped for translational testing. For example, collaborations between drug design labs at the University of Utah and the Marc Laboratory have identified anti-inflammatory glycan complexes as prophylactic lead compounds in AMD therapeutics. The space and resources needed for tissue culture-screening these reagents for safety, efficacy and further characterizing mechanisms is competing with that for other NIH-funded programs. Similarly, translational-to-clinical evolutions in other laboratories have been hampered because the requisite space and equipment resources are outside the scope of NIH programs. Rather than acquiring equipment, space and staffing de novo for every translational opportunity, we propose to proactively equip and staff shared flex-labs.

**New primary labs for new faculty.** Our commitment to expansion of AMD-NVD-RD translational research by bringing in three new faculty members puts tremendous pressure on existing resources. There is insufficient existing space to accommodate more than one of the new faculty. Our vision of colocating them is not possible without the requested improvements.

**Resource improvements: Connectomics-Histomics labs.** Connectomics is a transformative technology and our goal is to make it available to all interested faculty. The resources for connectomics (TEM facility, petabyte storage, Research IT and Visualization Laboratory) would create the a powerful resource at modest cost.

**Resource improvements: Tissue banking.** Translational research depends heavily on profiling genes and proteins of validated and characterized disease tissues. This is especially true of AMD and NVD risk factor associations and syndromic disease. Tissue banking is the core of such research and our need is determined by Dr. Hageman’s large incoming tissue collection and our expanded translational research initiatives.

**Funding status.** JMEC II was built and equipped without federal support, almost entirely by philanthropic resources. In addition, faculty and staff salaries are underwritten by the Department of Ophthalmology directly and not by University or Utah state funds. State funding provides less than 1% of the operating budget for the Moran Eye Center. The University of Utah does provide significant building O&M resources for JMEC II. The capitalization of research (TEM, confocal imaging, vivarium resources, core molecular biology and biochemistry equipment) was also carried out with philanthropic funding. The long-term NIH funding successes of the Moran Eye Center are in part due to leveraging its strong institutional commitment and equipment capitalization. However, like many other institutions, we have experienced donor fatigue and have saturated our ability to capitalize infrastructure. Utah’s state population (34th nationally) is half that of a major city like the Greater Houston metropolitan area. With such a small donor and tax base, it will take many years for foundation resources to recover. Similarly, state funding is directed to other imperatives and none will be available to the Moran Eye Center in the near term.

**Number of Users**

The Moran Eye Center research faculty and their personnel currently occupy levels 3-6 of JMEC II. This includes 12 of 13 Moran faculty, 15 graduate students, 8 postdoctoral fellows, 25 professional research staff, 2 research administrative staff, the JMEC II building manager, and a variable number of medical students (currently 2), residents/fellows (2), and undergraduate students (10). In addition, the Pavilion houses four full-time receiving dock professionals, two certified opticians in optical fabrication and one credentialed biomedical technician in biomedical device fabrication and repair. It is their desire and that of the Moran Eye Center administration that they engage more fully in translational research. Finally, the basement of the Moran Eye Center JMEC II Research Pavilion houses a full AAALAC-accredited, secure research vivarium, fully staffed by the University of Utah Office of Comparative Medicine directed by Dr. Jack Taylor, DVM. The three new faculty and their staff will be housed on JMEC II Level 2. The Executive Director of Research (currently housed in the Clinical Pavilion) and the administrative staff would be relocated to JMEC II Level 1 of the Research Pavilion. As noted below, the improvements to shelled space will also open up new staff positions to service the flex-labs, research IT and connectomics facilities. The planned expansion will increase the user base by 30-34.

**Impacts**

**Research resource and science impact.** The proposed expansion has significant benefits for nearly all the Moran Faculty. As shown in Tables 1 and 2, the JMEC II and proposed new faculty account for 20 federal and 7 private awards with a annual direct cost expenditures exceeding $5.5M. This does not include extensive contract funding or the significant NIH and private funding held by adjunct and collaborating faculty who will benefit greatly from these new resources. Of the 20 listed faculty (including our three new hires), most are housed in
JMEC II and a formal survey indicated that 60% will make immediate use of flex-lab resources (e.g. animal behavior, physiology, toxicology); 80% will use connectomics/histomics resources; and 55% will use new tissue banking resources. These resources and associations with our new colleagues in translational research provide increased leverage for maintaining our external funding, and provide new alliances for major new programs (e.g. Drs. Marc and Hageman are planning the world’s first human connectomics project for submission to the NEI).

The specific current and future research impacts include:

- **Hageman**: Establishment of the central team of a large R24 program in the Moran Eye Center to explore the concept that replacing or augmenting the complement modulating activity of the dysfunctional CFH protein should be effective in preventing or delaying the pathology associated with AMD and memnonoproliferative glomerulonephritis type II (MPGN II). The framework for this program includes improving and expanding repositories of tissues, plasma, sera, urine, RNA, and DNA from donors and well-characterized families and cohorts of patients with AMD, MPGN II, and other potentially related syndromic diseases. The outcome of these studies will serve as a platform for the identification of new biomarkers and drug targets that will hasten the development of clinically effective diagnostics and pharmaceutical agents for the treatment of AMD.

- **DeAngelis**: Establishment of a key laboratory to explore the human genetics of atrophic and neovascular forms of AMD. This laboratory is expected to be a pivotal partner in Dr. Hageman’s efforts, hence the desire for colocation. The central program in this lab is to recruit pairs of siblings for a molecular genetic search for genes having a role in the development of neovascular AMD. If successful, this work should provide substantial progress toward identifying the genetic causes of neovascular AMD.

- **Hartnett**: This laboratory will bring two major programs: AMD-NVD and ROP research. These programs focus on molecular mechanisms and sequelae of choroidal endothelial cell contact with the RPE prior to transmigration into the neurosensory retina (AMD-NVD) and the signaling pathways in ROP that terminate vessel growth. Like Drs. Hageman and DeAngelis, this investigator seeks molecular targets for intervention. Colocation will be of extreme benefit to all.

- **Flex-lab benefits**: As noted in IMPROVEMENT PLANS: Specific Research Improvements, many faculty are poised to exploit flex-lab development resources. Drs. Marc and B.W. Jones are exploring a new investigational drug with potential to protect against some of the inflammatory triggers in AMD. Rapid assessment of this drug and potential refinement based on targets identified by Drs. Hageman and DeAngelis would be immensely accelerated by effective toxicology and tissue-culture efficacy profiling. Drs. Ambati and Baehr are focusing on different micro- and nanoscale modalities for drug delivery of genes, proteins and small molecules. These studies involve animal physiology and vision assessment tools placed in the flex-lab space.

- **Connectome**: Connectomics and histomics are key tools in the future of translational research, providing the first high-throughput 3D analysis of neural and tissue architectures (Anderson et al., 2009). By building the very first integrated connectomics resource (TEM, petabyte storage, Visualization Laboratory), the Moran Eye Center is establishing the form that many other institutions are likely to follow.

The specific current and future employment impacts (job maintenance and/or creation) include:

- relocation of 3 new tenured-tenure-track faculty and their associated NIH-funded programs.
- relocation of 5 nonexempt staff personnel
- hiring of 10 new nonexempt research staff to support these laboratories
- recruitment of 12 new students and postdoctoral fellows
- hiring of 4 new full-time nonexempt staff for the connectomics lab, research IT, and flex-lab
- as connectomics and flex-lab utilization increases, future nonexempt staff hiring will increase

The specific quality of workplace and service impacts include:

- support of alternate transportation with bike storage, showers, and lockers available to staff (≈ 25-50 users)
- enhanced daylight and views for researchers and staff on Levels 1 and 2
- enhanced translational research/clinical research management of visually impaired patients

**Project Management and Institutional Commitment**

**Administrative Structure & Oversight**

The commitment to translational research at the Moran Eye Center is motivated by the exceptional JMEC II building, with related clinical care, ophthalmologic training and clinical research, translational and basic research missions mirrored in the Clinical and Research Pavilions, bridged by a shared atrium for transit and departmental gatherings. The Moran Eye Center is a pinnacle of excellence for the University of Utah.
The University of Utah ranks 16th in significant awards to faculty, 31st in federal research funding, 42nd in total research dollars received, and 28th in the number of faculty who are National Academy members, according to the Lombardi Program on Measuring University Performance among the nation’s public research universities for 2008. Though it is one of the smaller departments in a Tier 1 school, the Moran Eye Center consistently ranks in the top third of all ophthalmology departments in NIH funding, and near the top in the number of NIH grants held per faculty member. This year, the Moran Eye Center is ranked 17th of all 59 ophthalmology departments in NIH support and 14th among publicly funded institutions (data from http://report.nih.gov). However, the University of Utah Moran Eye Center’s per capita funding exceeds that of the number one department, the Johns Hopkins Wilmer Institute. Moreover, when Drs. Hageman, DeAngelis and Hartnett arrive, the Moran Eye Center’s total NIH funding level will shift its rank to between 4th and 7th in the nation.

The University of Utah is a national leader in technology transfer. In 2009, for the second year in a row, it was ranked second in the country at starting technology companies based on its research (The Association of University Technology Managers, AUTM). Several technology ventures have come from the Moran Eye Center (e.g. Signature Immunologics, Inc.). Creating flex-labs matches the University’s technology objectives as well as those of the NIH Roadmap for Re-engineering the Clinical Research Enterprise.

The University of Utah selected the present proposal from an internal competition for ARRA C06 applications, has hired architects (FFKR Architects) and mechanical contractors to help develop the proposal, and has established this improvement project as a top priority. As stated in the Certification of Title to Site, the University is committed to providing the funds needed to maintain the Moran Eye Center building as a viable research facility that will support the research endeavors of the faculty for at least 10 more years. The Principal Investigator is Randall J. Olson, M.D., John A. Moran Presidential Professor and Chairman of Ophthalmology, and Director of the Moran Eye Center. Dr. Olson, an award-winning surgeon and chairman, led the fundraising for the constructions of both JMEC I and II. Both constructions were managed by Mr. Wayne Imbrescia, Executive Director of the Moran Eye Center. The design for each project was developed by FFKR Architects, led by Mr. Rick Frierichs, Principal-in-Charge. The project architect for JMEC II was Russ Bachmeier. The research faculty liaison for the design of JMEC II was Robert E. Marc, Ph.D., the Calvin and JeNeal Hatch Presidential Chair in Ophthalmology and Academic Director of Research. This entire team is in place for this next phase of JMEC II improvement. In addition, Dr. Greg Jones Ph.D., Executive Director of Research, former State Science Advisor, winner of the 2007 Governor's Medal for Science and Technology (Utah) and named to the Top 100 Venture Entrepreneurs in Utah for 2008, will provide oversight for the construction and operations of the flex-labs.

The administration and oversight for this project is provided by Kristin Hill, the University Renovation Project Manager and designated facilities professional. She is a member of a 14-person Campus Design & Construction team that manages projects for the University from inception to completion. Additionally, Ms. Hill coordinates the efforts of allied professionals including the General Contractor, Architect, University Space Planning, Environmental Health and Safety, Facility Manager, and Plant Operations.

Institutional Commitment

Ongoing commitment to the expanded resources by the University of Utah Department of Ophthalmology / Moran Eye Center is manifest in the following ways

- **Equipment.** The Moran Eye Center equipped the entire JMEC II with its current TEM facility, two confocal microscopes (a third in the planning) and over $1,000,000 in cell biology, molecular biology and biochemistry resources. Service contracts for all of these resources is provided either by the NIH Vision Core Grant or direct departmental funds. No service charges are used for any capital resource as it is the policy of the Moran Eye Center to maximize rather than tax investigator funding. This will continue with the proposed build-out. Level 2 laboratories will be equipped by individual grant equipment transfers as well as $500,000-$750,000 in startup funds per new investigator. Equipping the new connectomics and flex-labs will come from philanthropic sources. Much of the equipment for the flex-labs (ERG, microcameras, etc) already exists.

- **Professional Staffing.** Administrative and building management staffing is funded entirely by the Moran Eye Center. The Moran Eye Center will staff the flex-labs and research IT.

- **Faculty support.** Like many ophthalmology departments, 50-70% of research faculty salaries come from NIH awards, with the remainder coming from the Department of Ophthalmology. However, new investigators are funded at 100% salary for their first three years by the Department of Ophthalmology.

- **Research:** In addition to extramural support, the University of Utah and Moran Eye Center provide competitive pilot and innovation intramural grants. The Moran Eye Center uses a rapid-response funding model to
accelerate translational-clinical research interactions. When a project manifests significant translational research potential as judged by a peer faculty committee, the Moran Eye Center will invest up to $50,000 in supplies and short-term staffing to accelerate the project.

- **Building maintenance and operations:** Collectively the University of Utah and the Moran Eye Center provide for building maintenance and operations costs. That will continue.

- **Vivarium:** The operations of the Moran Eye Center vivarium are funded by the University of Utah through the Office of Comparative Medicine. Per diem costs provide ongoing support and are among the lowest in the nation. The quality of care is exceptionally high.

**Design Considerations**

**Engineering Criteria**

Size (dimensions) and square footage Tables (see below with line drawings).

**Mechanical, Electrical and Plumbing Central Plant**

Construction on the John A. Moran Eye Center was completed in 2006. The proposed lab will occupy all of Level 2 and part of Level 1 of the six stories Research Pavilion. Part of Level 1 and all of Level 2 was shelled under original construction but the building's laboratory mechanical, electrical and plumbing systems were sized to fully accommodate the build-out of research laboratories in these areas. The proposed space will use the existing main building equipment, which was sized for this purpose, as well as existing ductwork and plumbing rough-ins, which were installed under the original construction. Specific design and performance is as follows.

**Existing Core Mechanical Systems**

- Heating and cooling: This is generated in the building’s central plant area located in the basement of the Clinical Pavilion tower. Dual centrifugal chillers generate chilled water. Dual heat exchangers served with campus high-temperature water (HTW) are used to generate hot water for heating the building. HTW is also used to generate steam for process use in the building. A gas-fired high-pressure steam boiler provides an additional level of back-up heating and steam generation for the building.

- Redundancy: Redundant supply air handlers and exhaust fans serve the Research Pavilion. The air handlers and exhaust fans are connected in a loop on each floor so that if one fan goes down the system remains functional via the second supply and exhaust fan.

- Energy: There are many energy saving features in this building, which reduce energy consumption to a much lower level than that specified by ASHRAE 90.1. The air handlers serving the Research Pavilion use a three stage cooling approach. The first stage of cooling is from air washers. The second stage uses water from the cooling towers to pre-cool the air before it enters the air washers. The third stage uses the water-cooled chillers, which are cooled by the cooling towers. Heat recovery coils are used to recover energy from the building exhaust, which is then piped in a runaround loop to the air handlers. The labs are 100% exhausted. Variable volume fume hoods are used. Each fume hood is equipped with a proximity sensor, which reduces the face velocity from 100 FPM to 60 FPM when no one is near the hood, a 40% reduction in exhaust. Exhaust capacity exists on each floor for approximately 12 six-foot hoods.

- Exhaust: The exhaust duct system is a manifold system using welded stainless steel ductwork. The main exhaust duct is already sized and installed in the shelled space.

- Supply: Supply air is provided from the variable air volume (VAV) air handlers. VAV reheat boxes are used to provide zone control. A minimum of 10 AC/hr is provided. The main supply duct is already sized and installed in the shelled space.

- Controls: The control system in the building is a Staefa DDC system

**Space System Requirements**

- Each space will be supplied by a VAV box and provided with an individual thermostat for temperature control.

- Spaces with fume hoods will be provided with VAV exhaust for each fume hood and the lab spaces will be controlled to operate under negative pressure.

- The Tissue Banking rooms and Petabyte Server room will be cooled using the building cooling system as its their source of cooling, and will be provided with chilled water fan coil units for back-up cooling. These units will be on emergency power and will be connected to the air cooled chilled water loop which will also be on emergency power.

**Plumbing Systems: Water Systems**
Separate domestic (potable) and laboratory (non-potable) water supply for hot and cold water is provided. Each system is located in the basement mechanical room and uses redundant heat exchangers and separate storage tanks. The piping mains are already sealed and installed in the shelled space.

Reagent grade water: Reagent grade water is generated in the basement central plant. Ultraviolet sterilization, filtration and deionizers are provided at the source reverse osmosis generator. The reagent grade water is stored in two large storage tanks in the basement and pumped in a continuous circulating loop throughout the Research Pavilion, with a loop already installed in the shelled space.

Piping Loop: In addition to reagent grade water, industrial (non-potable) cold water, industrial (non-potable) hot water, lab vacuum, lab air, and natural gas piping is looped on each floor.

**Plumbing Systems: Waste Water Systems**

Separate laboratory acid waste piping and non-laboratory waste piping exists. The acid waste system uses polypropylene piping. Acid waste is treated in an acid neutralization system before discharge into the sanitary sewer system.

**Fire Protection**

The entire building, including the proposed project, is provided with an automatic fire suppression system designed in accordance with NFPA 13. The existing space is equipped with sprinklers designed and installed for shelled space, and will be re-configured for the new design in accordance with NFPA 13.

**Electrical and Special Systems: Codes and Standards**

International Building Code (IBC).

International Fire Code (IFC).

National Electric Code (NEC)

Life Safety Code (NFPA)


Standards comply with the following where applicable for equipment and materials specified in the Improvement Plan.

UL Underwriters' Laboratories

ASTM American Society for Testing Materials

CBM Certified Ballast Manufacturers

FAA Federal Aviation Agency

IESNA Illuminating Engineering Society of North America

NFPA National Fire Protection Association

IPCEA Insulated Power Cable Engineers Association

NEMA National Electrical Manufacturer's Association

ANSI American National Standards Institute

IEEE Institute of Electrical and Electronics Engineers

ETL Electrical Testing Laboratories

LEED Leadership in Energy and Environmental Design

**Electrical and Special Systems: Power Distribution: Service and Distribution**

Building-wide system: The existing building service is feeding a 1600 amp 277/480 volt 3 phase vertical plug-in bus. Lighting will be circuited to a 277/480-volt panel board on each level. A fused disconnect is connected to the plug-in bus and circuited to a 150kVa dry type transformer on each level. The transformer provides service to 120/208 volt 3 phase 4 wire 600 amp distribution panel board on each level. This 120/208 volt service will provide power to standard receptacles and most lab equipment.

The new normal power panel for each lab will be located in the corridor adjacent to the lab it serves. The panelboard will be a door-in-door construction of the same manufacture as the existing building. 50% spare capacity will be provided for branch panels for future development. All circuits will be loaded to 80% of that allowed by NFPA 70. Voltage drop will be in accordance to the NEC.

Emergency power panels will be located in the electrical room for both life safety lighting and equipment power. Dedicated circuits will be used for ultra-low refrigerators and freezers and other equipment as required. Ultra-low temperature freezers and refrigerators will be circuited to the emergency power system.

All lab power circuits shall have a separate hot, neutral, and ground conductor. Each lab will have a separate ground bus mounted on the lab wall for use as a reference ground. This ground bus is connected to the main
service entrance ground bus. It is not a current carrying ground system but is used for a ground signal reference.

Lab Areas: Lab benches will have a wireway installed above the bench at the backsplash with receptacles mounted 12” on center. The wireway will accommodate normal and emergency power as required. Data outlets will be installed in the raceway as required. Receptacles and data will be installed at the knee space of the bench. GFI receptacles will be installed near sink locations. Convenience outlets will be provided along walls for general service.

Tissue Culture: Each tissue culture room will have 12 duplex receptacles. Four duplex receptacles will be circuited to emergency power. Fume hoods will be circuited to emergency power.

Connectomics Visualization Lab: Same power requirements as a convention lab with the added capability of teleconferencing and a small break room. Power will be added for projection equipment. Duplex receptacles will be added to the break room for refrigerator, microwave, coffee machine and other kitchen equipment.

Tissue Banking: Each freezer will be have a dedicated circuit on the emergency power system.

Offices: One duplex receptacle on each wall. Two data outlets on opposite walls.

Workroom: Duplex receptacles mounted above the counter on 4-foot centers.

Clinical Lane: Duplex receptacle on each wall. Data outlet at the desk.

Server Room: Receptacles circuited to emergency power as required.

Microscope and Camera Rooms: Power to the equipment circuited to emergency power as required.

Electrical and Special Systems: Emergency Power

There are two emergency power generators: a 400 kW 480-volt and a 1250 kW 480-volt diesel generator. The full daytime load impressed on the emergency power system was unknown, and BNA contracted with Wasatch Electric to attach a recording device near the connecting output of the two generators to measure the load on the system (Graphs 1 and 2). The generators are connected such that if normal utility power is not in operation and the larger 1250 kW generator does not start, the smaller 400 kW generator has the capacity of providing service entrance ground bus. It is not a current carrying ground system but is used for a ground signal reference.

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the load for the surgery floor and for life safety loads in the building. The future load that is anticipated for Levels 1 and 2 is 767 amps (this includes a ‘float’ of 200 amps for unexpected loads). Based on these calculations and the recordings (Graphs 1 and 2), the generators have sufficient capacity to provide emergency power service to levels 1 and 2.

**Lighting System**
The lighting system will be similar to that of current labs. Direct/Indirect lighting will be used in most spaces. Corridors will match existing finished construction. Emergency egress lighting will maintain 1 foot-candle along the path of egress. Lab spaces will have one fixture on emergency power. Lighting in the labs will also include under shelf task lighting.

<table>
<thead>
<tr>
<th>Area</th>
<th>Footcandles</th>
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<tbody>
<tr>
<td>Lab areas</td>
<td>50</td>
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<tr>
<td>Tissue Banking</td>
<td>30</td>
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<tr>
<td>Offices/Conference rooms</td>
<td>45</td>
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<tr>
<td>Visualization Laboratory</td>
<td>60 (Dimmed)</td>
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<tr>
<td>Workroom</td>
<td>50</td>
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<tr>
<td>Clinical Lane</td>
<td>50</td>
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<tr>
<td>Petabyte Server and IT Rooms</td>
<td>30</td>
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<tr>
<td>Microscope and Camera Rooms</td>
<td>40 (Dimmed)</td>
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</tbody>
</table>

**Lighting Control System**
Occupancy sensors will be used in office spaces. Conference rooms will be dimmed.

**Telecom/Data**
Tele/data will be raceway only. The cable tray will be mounted in the corridor and extend to the Communications Room on each floor. Outlets will have a 1 ¼” conduit installed from the outlet box to the cable tray with a pull rope installed.

**Fire Alarm System**
The building fire alarm system will be expanded and designed per the applicable IBC, NFPA 72, and PBS–100-2005 as required by code. The existing FCI® fire alarm control panel is located in the original building and the new portion of the fire alarm system will be added to this panel. Smoke detection will be installed in the following rooms: Mechanical Equipment, Electrical Closet, Telephone Closet, Laboratories, and corridors.

Minimum alarm sound level throughout the office space, general building areas and corridors shall be at least 70 dba.

Fire Alarm Command area, per IBC Section 911, shall contain the following equipment:
- Controls simultaneously unlocking stairway doors
- Sprinkler valve and water-flow detector display panel
- Schematic building plans indicating the typical floor plan and detailing the building core, means of egress, fire protection systems, fire-fighting equipment and fire department access

**Security Systems**
Entry doors on each floor are controlled electronically, and opened by card reader. Doors will be held closed with magnetic locks controlled by the existing security system.

**Architectural Criteria**

**Codes and Standards**
- Americans with Disabilities Act
- 1994 ADA Accessibility Guidelines
- 2009 International Building Code
- 2009 International Fire Code
- Division of Facilities Construction and Management, Design Criteria
- Utah State Fire Marshals Office
- University of Utah Design Standards

**Building Code**
- Occupancy: Group B Business
- Construction Type: Type I-B Construction
- Allowable Height: 160 feet, 11 stories
- Actual Height: 108 feet, 7 stories
- Allowable Area: Unlimited
- Actual Area: Typical lab floor is 14,236 GSF
- Fire Protection: Building is fully sprinklered

**Zoning**
The Level 2 build-out is designed with two general zones. The public-access clinical research zone is located near the front entrance. A reception/patient waiting area is located adjacent to the main entrance and all clinical
functions organized adjacent to this space. Clinical office space and secure file storage is located opposite the entrance but near the clinical functions. The building core is used for mechanical and electrical infrastructure and shared facilities including a cold room with associated prep-space and a large Tissue Bank room for -80°C freezers. The major lab spaces and their adjoining support rooms and offices are located around the perimeter of the building taking advantage of natural light and views to the surrounding landscape offered by the existing windows.

**Lab Planning**

The typical major lab spaces are designed on a 10'-6" module to accommodate 20’ long x 5’ wide lab benches with 5'-6" wide circulation spaces between. Lab benches are 36 or 30 inches high and 30 inches deep minimum. Each major lab is supported by additional office, work, and equipment spaces. All doorways into lab spaces are designed to clear 42”, providing adequate clearance for large equipment. Equipment zones are typically 36” deep.

**Connectomics-Histomics Laboratory**

The dedicated *Connectomics-Histomics Laboratory* includes an electron microscope suite, the Petabyte Server room, Clean Room and Workroom.

**Vibration Criteria**

Floor systems of the existing building are reinforced concrete and designed to stringent vibration criteria of 1,000 micro inches per second. The design of the floor system for existing electron microscope Suite is 250 micro inches per second. However, JEOL USA Ltd has made a formal site assessment and the vibrations at the proposed site on Level 2 were statistically indistinguishable from the values for the existing JEOL JEM-1400 site in Level 3. The JEOL facilities professionals agreed that no special floor stiffening will be needed.

**Architectural Finishes**

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<tr>
<th>Laboratories - Typical</th>
<th>Tissue Culture</th>
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<tbody>
<tr>
<td>Walls</td>
<td>Walls</td>
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<tr>
<td>Base 4” rubber base</td>
<td>Painted gypsum board</td>
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<tr>
<td>Floor VCT</td>
<td>Base 4” rubber base</td>
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<tr>
<td>Ceiling 2’ x 2’ lay-in acoustical panel</td>
<td>Floor VCT</td>
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<tr>
<td>Millwork Wood veneer base cabinets w/ epoxy resin tops; Wood veneer wall cabinets Stainless steel and phenolic shelving</td>
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<tr>
<th>Support/Equipment Rooms - Typical</th>
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<td>Room</td>
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<td>Biomed Shop</td>
<td>Painted gypsum board</td>
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<td>Confocal Imaging</td>
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<td>Power Room</td>
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<td>Petabyte Server Room</td>
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</table>
## Visualization Laboratory
- **Walls**: Painted gypsum board
- **Base**: 4” rubber base
- **Floor**: Carpet
- **Ceiling**: 2’ x 2’ lay-in acoustical panel
- **Millwork**: Wood veneer base cabinets w/ plastic laminate top; Wood veneer wall cabinets
- **Door**: 3'-0” solid core wood door and hollow metal frame

## Reception
- **Walls**: Painted gypsum board
- **Base**: 4” rubber base
- **Floor**: Carpet
- **Millwork**: Wood veneer base cabinets with wood veneer top
- **Ceiling**: 2’ x 2’ lay-in acoustical panel

## Waiting
- **Walls**: Painted gypsum board
- **Base**: 4” rubber base
- **Floor**: Carpet
- **Ceiling**: 2’ x 2’ lay-in acoustical panel

## Fundus Camera
- **Walls**: Painted gypsum board
- **Base**: 4” rubber base
- **Floor**: VCT
- **Ceiling**: 2’ x 2’ lay-in acoustical panel
- **Door**: Pair 3'-0” solid core wood doors and hollow metal frame

## Clinical Lane
- **Walls**: Painted gypsum board
- **Base**: 4” rubber base
- **Floor**: VCT
- **Ceiling**: 2’ x 2’ lay-in acoustical panel
- **Door**: Pair 3'-0” solid core wood doors and hollow metal frame

## File Storage / Work
- **Walls**: Painted gypsum board
- **Base**: 4” rubber base
- **Floor**: VCT
- **Ceiling**: 2’ x 2’ lay-in acoustical panel
- **Door**: Pair 3'-0” solid core wood doors and hollow metal frame

## Restrooms
- **Walls**: Painted gypsum board with ceramic tile wainscoat
- **Base**: Ceramic tile
- **Floor**: Ceramic tile
- **Ceiling**: Painted suspended gypsum board
- **Door**: 3'-0” solid core wood door and hollow metal frame

## Locker and Shower Rooms
- **Walls**: Painted gypsum board; ceramic tile
- **Base**: Ceramic Tile
- **Floor**: Ceramic Tile
- **Ceiling**: Painted suspended gypsum board
- **Millwork**: Solid surface counters; solid maple wood bench
- **Lockers**: 12” x 12” x 30” phenolic lockers
- **Door**: 3'-0” solid core wood door and hollow metal frame

## Bicycle Storage
- **Walls**: Painted gypsum board
- **Base**: 4” rubber base
- **Floor**: Sealed concrete
- **Ceiling**: None, exposed to structure
- **Door**: 3'-0” solid core wood door and hollow metal frame

## Equipment Storage
- **Walls**: Painted gypsum board
- **Base**: 4” rubber base
- **Floor**: Sealed concrete
- **Ceiling**: None, exposed to structure
- **Door**: Pair 3'-0” solid core wood doors and hollow metal frame

## Hallways
- **Walls**: Painted gypsum board
- **Base**: 4” rubber base
- **Floor**: VCT
- **Ceiling**: 2’ x 2’ lay-in acoustical panel

## Electrical, Comm Rooms
- **Walls**: Painted gypsum board
- **Base**: 4” rubber base
- **Floor**: Sealed concrete
- **Ceiling**: None, exposed to structure
- **Door**: Pair 3'-0” solid core wood doors and hollow metal frame

## Custodial
- **Walls**: Painted gypsum board; tile at sink
- **Base**: 4” rubber base
- **Floor**: Sealed concrete
- **Ceiling**: None, exposed to structure
- **Door**: 3'-0” solid core wood door and hollow metal frame
Line Drawings (see attached line drawings). The assignments on Level 2 represent new incoming faculty.

**Equipment**

The following equipment will be located on Levels 1 and 2 of the JMEC II. The chemical fume hoods will match existing equipment on Levels 3-6. The equipment assignments are:

- **Chemical fume hoods:** Hageman 2, Hartnett 1, DeAngelis 1, flex-labs 2. Mott Mfg 7321000 Pro Constant Volume Bench Fume Hoods w/ option S3 and service fixtures per provided drawing, 60” w furring panels w/ hinged access panels, black epoxy resin tops w/ cup sink & outlet. 6 ea, total $33,960.0
- **Clean hood:** Connectomics 1. Lasco Services Laminar Flow Hood: Work surface to filter height: 27”, Aluminum Framing with Powder Coat White Finish, Clear Acrylic panels on three-sides, 2’ x 4’ Fan Filter Unit, 4’ Teardrop Cleanroom Light, $3750.
- **Cold Room:** JMEC II provides one cold room per lab floor. It will serve Hageman, Hartnett, and DeAngelis. Environmental Growth Chambers Cold Room, 10 ft x 10 ft, 4 deg C, $62,000.

**PROJECT TIMELINE**

![FFKR Architects]

Moran Eye Center Levels 1 and 2

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Floor Plan

Level 1

Build-out Area
Enlarged Areas Separations (see other pages)

Building Entry Point

Moran Eye Center
Translational Research Laboratories

Level 1
Level 1 Build-out Net Square Feet: 6,538
Level 1 Gross Square Feet: 8,696

Drawing Scale: 1" = 20'-0"
Level 2 Build-out Net Square Feet: 8,830
Level 2 Gross Square Feet: 12,573

Moran Eye Center
Translational Research Laboratories

Plan Key

- Build-out Area
- Enlarged Areas Separations (see other pages)

Open to Lobby Below
Bridge to Clinical Pavilion

See enlarged area A
See enlarged area B
Level 2 Floor Plan - Enlarged Area A

Moran Eye Center
Translational Research Laboratories

Level 2

Drawing Scale: 1/16” = 1’-0”

Graphic Scale

Level 2 Build-out Net Square Feet: 8,830
Level 2 Gross Square Feet: 12,573

Plan Key

- Build-out Area
- Exit
- Security Point
- Floor Entry Point
- Fume Hood
- WDS Wall Display Surface
- 5’-0” Diameter
- Wheel Chair Turn
- Safety Shower/ Eye Wash
- EWC Electric Water Cooler

Equipment Area
Lab Offices
Lab Support
Open Lab Space
Services and Circulation
Clinical Research Space
Clinical Research Support

 existing

Existing Lobby

Build-out Area

Research Collaboration

Bridge to Clinical Pavilion

Passenger Elevator

Service Elevator

Passenger Elevator

Electric Water Cooler

Exit

Security Point

Floor Entry Point

Fume Hood

Wall Display Surface

5’-0” Diameter

Wheel Chair Turn

Safety Shower/ Eye Wash

EWC Electric Water Cooler

Level 2 Build-out Net Square Feet: 8,830
Level 2 Gross Square Feet: 12,573
Level 2 Build-out Net Square Feet: 8,830
Level 2 Gross Square Feet: 12,573

Moran Eye Center
Translational Research Laboratories
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<th>Room Name</th>
<th>Dimensions</th>
<th>Room Area Net sq ft</th>
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Total Area Net Square Feet of build-out **6,538**

Total Area Gross Square Feet **8,696**

*Room shape is irregular. Square footage is accurate. Maximum room dimensions are listed.*
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<th>Room Name</th>
<th>Dimensions</th>
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Total Area Net Square Feet of build-out 8,830

Total Area Gross Square Feet 12,573

*Room shape is irregular. Square footage is accurate.

Maximum room dimensions are listed