10. FACILITIES AND OTHER RESOURCES

Facilities:

A. Laboratory
The PI has approximately 1200 ft^2 of laboratory space. Facilities include electricity, water, gas, vacuum hood and access to the University's ethernet computer network. This lab space is divided into three main areas: a main research lab (around 800 ft^2, a smaller lab used for radioactive based work and gel electrophoresis (houses also FPLC and phosphorimager systems) and a smaller culture room with incubator shakers and incubators. All three rooms are located on the same floor and in close proximity to each other. The neighboring lab is that of Dr. Allison Abbott, a *C. elegans* micro RNA expert. She has kindly made her expertise, lab, stocks, strains and equipment available to us for the *C. elegans* aspect of this proposed work.

B. Clinical
N/A

C. Animal
N/A

D. Computer
Four PC's, three laser printers, a Mac G4 Powerbook are available in the PI's lab and office. All computers are linked to the Internet and University's computer and library facilities. In addition the Department of Biological Sciences has a computer laboratory housing over 10 computers and state-of-art facilities for graphic preparation, poster printing and presentation.

E. Office
The PI's has an office (150 ft^2) located next to the research labs. A neighboring office is used by her graduate students. In addition, departmental conference and seminar rooms are located nearby for conducting group lab meetings etc.

F. Other

1. Profile of the students of the applicant school/academic component

As an institution providing undergraduate training for a significant number of the nation's research scientists, Marquette University is eligible for preferential consideration as described in the AREA program announcement. During the period 2005 – 2009 (the most recent timeframe for which nationally comparable data is available), Marquette University ranked among the top 8% of institutions whose undergraduates go on to complete the Ph.D. A total of 230 students from Marquette University went on to receive the doctorate degree during that period. (Source: http://webcaspar.nsf.gov utilizing the NSF Survey of Earned Doctorates/Doctorate Records File data source accessed 4/1/2011. Please note that professional degrees such as the M.D., D.D.S., O.D., D.V.M., and J.D. are not covered by the survey of earned doctorates.) Of these 230 students, 78 received a doctorate degree in a "health-related science."
Within the Department of Biological Sciences, there are strong, extramurally-funded research programs in the areas of molecular and cell biology, developmental biology, genetics, neurophysiology, muscle physiology, and plant biology. Marquette's places a strong emphasis on the "teacher-scholar" model where active research programs and strong teaching commitments are viewed as complementary endeavors that provide an excellent training environment for our undergraduate and graduate students.

2. Description of the special characteristics of the school/academic component that make it appropriate for an AREA award.

(1) Provide support for meritorious research

Marquette University and the Department of Biological Sciences strongly support research by faculty and students. Meritorious research is supported and recognized at Marquette at a number of levels. The University has established endowed faculty fellowships termed the *Way Klingler Faculty Development Awards*. These include the *Way Klingler Young Scholar* awards, which are awarded to junior faculty (one semester sabbaticals) to provide teaching relief to advance their research program prior to the tenure process. *Way Klingler Fellowships* competitively awarded to tenured faculty, are 3-year fellowships designed to support senior faculty and advance their research programs. The University also has a number of summer research fellowships to support faculty without research funding to aid and promote their research activities during summer months. The College of Arts & Sciences can also provide bridge funding to aid researchers who are between grants. Through the Office of Research and Sponsored Programs and the Comptroller's office, the University provides full assistance with the grant submission process, grant account management services and purchasing assistance. The University/Graduate School supports our graduate (PhD) program and provides a number of TA and RA positions (plus health insurance) to financially support our graduate students for the 9-month academic year.

In recognition of the importance of research to our careers as scientists and educators, the University administration allows faculty to spend 50 % of their time teaching and 50 % pursuing research, while paying our full academic salaries (9-month). I have a modest teaching load of one undergraduate class per year (Spring semesters, 24 students) and one graduate class each fall semester (alternates between 2-credt class and 1-credit seminar class) and thus I am allowed 50% of my time to pursue research and scholarship activities. The University has provided me with over 1200 ft^2 of laboratory space, and 150 ft^2 of office space.

At the department level research is support and valued at a number of levels. Research accomplishments (funding and publication activities) represent essential elements of the tenure and promotion process. Research is also seen as an important aspect of ones teaching mission at Marquette. The Department also has a Committee on Research with funds to support the joint purchase of larger instruments and a limited pool of funds for research support. The department budget also has funds to support the travel of faculty to one conference each year (to maximum of $1000) and provides funds to graduate students to attend and present at conferences (1-2 times during their tenure) in our department. In addition, the department has a full machinist, electrical/computer specialist, purchasing stockroom and full administrative support staff.

(2) Strengthen the research environment of schools that have not been major recipients of NIH support

After completing my formal academic training in a medical school-based research group in Germany, I actively sought an academic position in the U.S. in an institution that paid serious attention to the education and training of their undergraduate and graduate students, while at the same time fostering a productive research-oriented environment. The Department of Biological Sciences at Marquette University is such an environment with an education mission centered on a "scholar-teacher" model, where the research and teaching aspects of our efforts are equally emphasized, as they are seen as complementary. Our department has a strong history in quality research and teaching, both at the undergraduate and graduate level. It is the expectation that faculty maintain active and funded research programs and create a stimulating and productive research environment for the education and training of our undergraduate students. Marquette's Department of Biological Sciences strives to provide their students with the teaching environment of a strong liberal arts college, while at the same time providing them with meaningful and innovative research opportunities traditionally found more at larger research institutions.

Research funding is therefore vital if we are to continue to afford our students such wonderful learning experiences. A key element of the research experience provided to our students is the close integration of our undergraduate and graduate programs. Each faculty member runs a small research group (traditionally 2-5 members), primarily composed of undergraduate and graduate students, with team mentoring strongly emphasized. Undergraduate students therefore work alongside the graduate students, both are closely mentored directly by the faculty themselves. Our graduate program is relatively small with approximately 25 students, which allows for maximum mentoring opportunities between faculty and student and allows for the creation of a research-oriented educational environment.

I firmly believe that for a well-round scientific education, our undergraduates need to go beyond formal classroom-based courses during their tenure at Marquette and become actively involved in independent research projects. Our department's strong commitment to research, where each faculty member maintains an independent research program, affords this possibility to our students. As a relatively small department (19 faculty), the activity of each research laboratory has a significant impact on the choices and spaces that are available to both undergraduate and graduate students. Procurement of extramural funding is essential if I am to continue to sponsor student research in my laboratory. The AREA grant will also provide funds that are necessary for the continuation of the proposed research project. Undergraduate researchers will be recruited to join our team, both during the academic year, as well as during the summer months. In addition, the requested funds will enable me to participate in national and international meetings with my students. I believe the opportunity to attend conferences can be a transformative experience for my students. It enhances their communication skills, gives them an opportunity to present their data to a wider scientific community and allows them to network and opens their eyes and minds to many aspects of scientific research and careers. In addition, publications that result from work funded by this AREA application will increase the visibility and stature of Marquette as a research institution, which will help us improve the quality of our graduate program.

3) Expose available undergraduate and/or graduate students in such environments to research.

The Department of Biological Sciences at Marquette University strongly emphasizes laboratory and research training for their undergraduates. This is demonstrated in our laboratory courses, independent research projects, summer research program, and paid laboratory positions. Our department offers seven upper-division, stand-alone (i.e. are not run as a component to a lecture course) laboratory courses (3-credit courses). Our undergraduate majors are required to take 3 of these laboratory courses as part of their major requirements. These lab courses are faculty-taught, run with 2 graduate students as TA's and have an assigned laboratory coordinator for assistance in prepping and set up. I currently teach the "*Experimental Cell Biology*" laboratory course (24 student enrollment limit) every Spring semester. Up until now I have run this course as a "cook-book" based course, with students following weekly protocols clearly defined for them, on time-tested experiments, which work every semester. This coming academic year, however, I intend to totally revamp the course and turn it into an innovative research-based course. Students will be assigned a novel project at the beginning of the semester and they will have to follow it through to completion by the end of the semester. This coming year we shall use Aim31 as a model protein, and the students will use site directed mutagenesis to create many of the *aim31* mutants proposed in this application. Through designing their own mutagenesis strategy, students will be introduced to the important concept of protein sequence/structure/function, and the project will enable them to learn many important molecular biology skills (primer design, mutagenesis, PCR, cloning, transformation, plasmid DNA preparation, DNA sequencing). Students will then express their mutant *aim31* derivatives in yeast and perform growth complementation analysis. I am very much looking forward to running this class, as it will give the students a much more realistic research training experience. Instead of repeating time-tested experiments that students before them have done in previous years, the students will now be using time-tested methodologies to make their own new discoveries and contribute meaningful way to the proposed research project.

Undergraduate researchers in my research lab have been critical to the Aim31 project until now and will continue to be. It is important to note that this Aim31/Hig1 project was initiated in my lab as a result of an observant and talented undergraduate Andrew Furness (currently PhD student at UC-Riverside, CA). Andrew, followed a second talented undergraduate, Micaela Robb-McGrath (to attend Univ. Maryland Medical School) played an instrumental role in the generation of much of the preliminary data underpinning this application. Our research assistant in our group, Vera Stroglova plays a key role also, not only for her research, but also the mentoring and training she gives the students entering the lab. The proposed project will continue to provide multiple research and mentoring opportunities for undergraduate and graduate students, so the tradition of a strong mentoring team environment in my lab will continue.

Since joining Marquette, fifteen undergraduate students have performed independent research in my laboratory and I personally have directly mentored each of these students. Undergraduate students can become active in independent research in my lab either as (i) employed research assistants, or more frequently by (ii) taking a BIOL4995 (3-credit, Independent Research course) or (iii) participating in our departmental 10-week long undergraduate summer research program (jointly funded by NSF, our College of Arts & Sciences, and individual faculty research grants). The availability of AREA funds therefore will enable me to mentor a summer undergraduate student. For BIOL4995 independent research projects, students are assigned their own research project in the lab and are required to submit a formal research proposal early during the semester, describing their problem and their approach to solve it. During the semester students are assessed for laboratory techniques, experimental design, data interpretation and technical writing skills. Students also participate in weekly lab meetings, usually presenting at least once during the semester, and often more. The department has an annual Biology Research Day, where undergraduates present their research in poster or research talk format.

In several cases this research experience has been the determining factor in their decision to attend graduate school or pursue research opportunities as a medical student. These students include Mark Schramp* (PhD, UC Berkeley, currently post-doc UW-Madison), Matthew McCauley* (MD student, AZ), Jeremy Bushman (MD intern, Michigan), Mary Kroetz (PhD, Yale), Leah Carbonneau (PhD, UW-Madison, currently: Postdoc, Univ. of Colorado), Brigid Dolan*, (MD, Brigham and Women's Hospital, Boston), Brendan Corcoran (PhD, unknown), Katie O'Sullivan (MD, Internal medicine), Andrew Furness* (PhD, UC-Riverside) and John Verre (MD, Medical College of Wisconsin), Megan Otero (volunteering American Peace Corp, will attend grad. school next year), Micaela Robb-McGrath* (will attend med school, Univ. Maryland). (*denotes co-author on research paper published/in preparation.

My graduate teaching responsibilities alternate each Fall semester between a 2-credit lecture course – "Eukaryotic Protein Trafficking" and a 1-credit seminar based course on "Mitochondrial Biology: Metabolism and Diseases". At the graduate level, I have trained 9 Ph.D. students and 1 M.S. (Diplom) student at Munich University, Germany, 4 of whom currently hold academic positions (Johannes Herrmann, Univ. Kaiserslautern, Germany; Kai Hell, Univ. of Munich, Germany, Cristina-Maria Cruciat, Univ. Heidelberg Germany, and Heike Fölsch, Northwestern Univ., IL) and the others are all employed in either Biotech industry, patenting or scientific journalism fields. To date I have also trained 4 PhD students at Marquette (Valerie Everard-Gigot (Instructor at Marquette), Sonika Saddar (Post-doc, Univ. of Texas Southwestern Medical Center), Lixia Jia (Post-doc, Washington University, St. Louis, MO), and Sherréa Herod (Forensic Scientist-Wisconsin Crime Lab). I am currently training 3 Ph.D. students (Jasvinder Kaur, will graduate Dec. 2011 and will post-doc in UC-San Francisco) and two first year graduate students, Sneha Potdar and Joshua Garlich, together with a very talented technician/research associate, Vera Strogolova.

In recognition of my sincere commitment to both the teaching and research aspects of my position and mission at Marquette, I received the Robert and Mary Gettel Teaching Excellence Award from Marquette University in 2008, and the Lawrence G Haggerty Research award this year (March 2011). I am the first faculty member ever at Marquette to receive both the teaching and the research awards.

11. EQUIPMENT

The following major equipment items are located in the PI's laboratory

Beckman Optima MaxE, table top analytical ultra-centrifuge plus rotors (3)
Beckman Optima L-90 K, floor ultracentrifuge
Beckman Avanti J-25, floor centrifuge plus rotors (2)
Amersham Pharmacia FPLC system, with computer and fraction collector & multiple columns
Hereaus Stratos refrigerated table top, high-speed centrifuge and rotors (2)
Beckman Allegra 25R refrigerated table top, high-speed centrifuges (2) and rotors (4)
New Brunswick refrigerated shaking incubator, floor model (2)
New Brunswick table top incubator shaker (1)
Thermo Savant Speed-Vac drying system
Beckman-Coulter Duo 800 UV Spectrophotometer
Biorad gene pulser
Biorad isoelectric focusing unit
Laminar Flow Sterile Hood UV and visible spectrophotometers (2)
DNA electrophoresis units: mini (3), large (4)
Refrigerators (3), -80 °C Freezer (2), -20 °C Freezers (3)
PCR machine (Biometra), pH meter, Analytical and top loading balances
Electrophoresis power supplies (8) Protein electrophoresis chambers: mini (2), midi (5)
Semi-dry blotting chambers (4)
Individual work stations (10) (benchtop microcentrifuge, thermoblock, vortex, set of micropipettes)

Other items of large equipment which are communal to Department are:
The Biological Sciences Department has full microscope suite (confocal and fluorescent microscopes), 3 Castle autoclaves, UV gel documentation system, scintillation counters, laminar flow cabinets, 2 incubator shakers, a darkroom, a cold room, a constant temperature room, 2 crushed ice machines and a Storm ® Phosphoimager system. All of these communal facilities are located on the same floor as the PI's lab, with the exception of the cold room and UV documentation system, which are on the next floor. A microscopy suite, (fluorescent and confocal microscopes) is available in the department for common use. In addition, the Biological Sciences Department has fully equipped machine and electronics shops, with a full-time machinist and electronics technician.

C. elegans specific equipment and expertise:
Next door to our lab is that of Dr. Allison Abbott, a *C. elegans* researcher who studies microRNAs. She has kindly agreed to provide technical expertise, necessary reagents (strains and all RNAi *E. coli* stocks) and equipment (dissecting microscopes, incubators) for the *C. elegans* part of the proposed research.