Find Your Inspiration

Dominican University of California, in partnership with the Buck Institute for Age Research, the premier and internationally acclaimed research center focused on age-related diseases, launched in fall 2008 a new Master of Science in Biological Sciences, the first graduate degree program of its kind in the nation.

Students accepted into this intensive research-oriented Master of Science in Biological Sciences program will investigate some of the most pressing and timely scientific issues of the day.

The program, taught by faculty members from both Dominican and the Buck Institute, affords students the opportunity to work directly with scientists and to conduct research at the Buck Institute’s laboratories in nearby Novato, California.

Imagine Career Possibilities

This interdisciplinary research program combines genomics, proteomics, genetics, biochemistry and physiology in various model systems. It is geared for those who wish to pursue careers centered around the aging process and detecting, preventing and treating age-related conditions, including Alzheimer’s and Parkinson’s diseases, stroke and arthritis.

Students study genetics, biochemistry, molecular biology and age-associated diseases. They also delve deeply into the career disciplines of biotechnology, including genomics, proteomics, protein interaction networks and bio-informatics.

Envision the Process

Successful candidates in the two-year, full-time Master of Science in Biological Sciences program will have completed 36 units to be awarded their graduate degree. Academic units are divided between coursework, seminars and research. Another 3 units go toward a student’s graduate thesis, which focuses on original research. Students will defend their research in writing and in an oral presentation. They will also be encouraged to present their findings at major conferences and in peer-reviewed publications.

Features of the program include:

• Participation in one of the most innovative graduate science programs in the country.
• An opportunity to study with nationally and internationally acclaimed scientists, researchers and professors.
• Opportunities to present findings at national and international conferences and to publish in peer-reviewed journals.
• An intellectually vibrant setting that promotes rigorous study yet encourages collaboration among colleagues.

Achieve Success

Graduates of the Master of Science in Biological Sciences will have acquired:

• An in-depth understanding of biological topics pertaining specifically to their research.
• The skills to conduct original scientific research.
• An ability to communicate their findings at conferences and in peer-reviewed publications.
• The academic credentials to continue graduate studies, whether their objective is to obtain a doctorate or a medical degree.
• The professional credentials to pursue a rewarding career in scientific research.

Easy Access

Dominican University of California is conveniently located near the 101 freeway in central San Rafael and is easily reached by car or public transportation. Our beautiful campus is 12 miles north of San Francisco and just a short drive from Napa or the East Bay. Public transportation is readily accessible — the Larkspur Ferry Terminal is within three miles and the Golden Gate Bus Terminal is a mile from campus.

When driving on Highway 101, take the Central San Rafael exit, turn east on Mission Avenue, then left on Grand Avenue to Acacia Avenue (about one mile). Free parking is available at the University parking area at the corner of Grand and Acacia.
Program Description

The Master of Science in Biological Sciences is a research intensive program designed to address one of the most important topics of our times. The program goal is to train students for scientific careers focused on biomedicine, including understanding the aging process, as well as detecting, preventing, and treating age-related conditions such as Alzheimer’s and Parkinson’s disease, cancer, stroke, and arthritis. Students in this program will be trained as scientists in interdisciplinary research encompassing genetics, biochemistry, molecular biology, age-associated diseases and disciplines of biotechnology including genomics, proteomics, protein interaction networks and bio-informatics.

Envision the Process

The Master's Degree program requires a successful completion of 36 graduate units. The proposed categories are listed below.

- 12 units course work
- 4 units graduate seminar
- 17 units graduate research
- 3 units graduate thesis

The program is taught by renowned faculty in the areas of biomedicine. Transfer credits of 3-6 units may be accepted for students who have completed graduate level courses at another accredited institution.

Student Learning Outcomes

At the completion of the Master of Science Degree in the Department of Natural Sciences and Mathematics, each graduate will have acquired:

- An understanding of selected topics in biology pertaining to research interests.
- The skills to conduct original scientific research and the ability to disseminate findings through public forum(s).

Learning Outcomes

1. Demonstrate knowledge in areas of biology relevant to research interests.
2. Identify research questions on a current issue in biology, critically analyze the relevant literature, and prepare a comprehensive written review.
3. Develop specific hypotheses pertaining to a research problem.
4. Devise and conduct experiments to test hypotheses.
5. Statistically analyze and interpret research data.
6. Discuss, both orally and in writing, the relevance of research data to the original hypotheses and to the general field of interest.
Curriculum

**BIO 5001/5002/5003/5004 Graduate Seminar (1 unit each)**

Total: 36 units

1. Completion of 36 units of the program, with a minimum grade of a ‘B’ or Pass.

2. Completion of an original research thesis approved by the two members of the student’s graduate committee including thesis (research) supervisor and an additional faculty member selected in consultation with the advisor and the department chair.

3. Successful completion of both a written and oral presentation of research.

4. Presentation of research findings at a national/international conference and/or publication in a peer-reviewed journal is strongly encouraged.

The program will be taught by faculty in the Department of Natural Sciences and Mathematics or adjunct faculty from the Buck Institute for Age Research. Transfer credits of 3-6 units may be accepted for students who have completed graduate level courses at another accredited institution.

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<th>Second Semester: Spring</th>
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<tr>
<td>BIO 5100 Ethics and Accountability in Biological Research 3 units</td>
<td>BIO 5200 Advanced Molecular Biotechnology 3 units</td>
<td>BIO 5300 Advanced Biochemistry 3 units</td>
<td>BIO 5400 Graduate Special Topics 3 units</td>
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<td>Bio 5901 Thesis 3 Units</td>
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Total units: 9

Total units: 9

Total units: 9

Total units: 9
Biological Sciences
MASTER OF SCIENCE

www.dominican.edu

Faculty

Dr. Sibdas Ghosh, PhD
Dr. Ghosh earned his PhD at the University of Waterloo, Canada and holds the MSc from University of Reading, United Kingdom; BSc from University of Lancaster, United Kingdom; BSc from University of Calcutta, India. Dr. Ghosh’s research interests are the effects of environmental stress on gene expression and on the dynamics of protein synthesis in the photosynthetic apparatus; the molecular aspects of membrane turnover; plant microbial interactions; and methods development in bioanalytical and separations chemistry.

Dr. Maggie Louie, PhD
Dr. Louie earned her PhD in Biochemistry and Molecular Biology, with an emphasis on Cancer Biology from University of California, Davis in 2004. Her current research is focused on understanding the development and progression of hormone refractory breast cancer. Dr. Louie’s research is focused on how cadmium, a toxic metal found in contaminated food and water and cigarette smoke contributes to the development and progression of breast cancer. Hormone responsive cancer is typically treated with hormone ablation therapy or endocrine therapy to block the ER.

Dr. Vania Coelho, PhD
Dr. Coelho completed most of her doctorate research while she was working as a visiting scientist at the National Museum of Natural History, Smithsonian Institution. After completing her doctorate, Dr. Coelho held a post-doctoral research scientist position initially and later an associate research scientist position, at Columbia University. Dr. Coelho’s research focuses on ecology and evolutionary biology of marine invertebrates. Her research interests include benthic community ecology, population biology, behavior, systematics of crustaceans, and coral reef ecology.

Dr. Mohammed El Majdoubi, PhD
Dr. El Majdoubi holds a BS in Physiology (1991), an MS (1992), and a PhD in Neuroscience & Pharmacology (1996) from the University of Bordeaux, France. Dr. Majdoubi worked at the University of Pittsburgh as a Research Associate; in 2000 he joined the University of California San Francisco (UCSF) as a Visiting Scholar, then as an Assistant Research Endocrinologist and director of the Morphology and Cell Imaging Core in the Center for Reproductive Sciences. His current research is focused on mouse embryonic stem cells as an in vitro model of the differentiation and development of hormone-secreting neurons.

Dr. Diara Spain, PhD
Dr. Spain joined the faculty as an assistant professor in the fall of 2002. She holds a Bachelor of Science degree in biology education from North Carolina Agricultural and Technical State University in Greensboro, North Carolina. Her PhD is in biology, with an emphasis in marine invertebrates, from the University of North Carolina at Chapel Hill. Currently, her research focuses on functional morphology and locomotion in echinoderms. Other research interests are skeletal support systems, and locomotion in soft-bodied animals.

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Email: graduateprograms@dominican.edu
Online: www.dominican.edu
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Dr. James Cunningham, PhD
Dr. Cunningham joined the department in 1991 and served as the chair of the department from 1998 through 2001. Dr. Cunningham holds a position as research associate in the Department of Mammalogy and Ornithology at the California Academy of Sciences, San Francisco, California. Prior to joining the Dominican faculty Dr. Cunningham taught biology at San Francisco City College, College of San Mateo, College of Marin, College of Notre Dame, Cosumnes River College, and Golden Gate University. Dr. Cunningham’s research interests include studies of the vocal behavior and social organization of birds. He is also interested in the growth rates of birds and how this relates to energy allocation during breeding.

Dr. Julie K. Andersen, PhD
Dr. Julie Andersen studies the molecular and cellular mechanisms that give rise to Parkinson’s disease (PD). Andersen, among others, has shown that the neuronal death associated with Parkinson’s may be caused by an increase in oxidative stress within nerve cells, and that the development of Parkinson’s could involve environmental factors as well as genetic predisposition to the disease. Internationally renowned for her work on Parkinson’s disease, Andersen’s work includes examining the regulation of iron levels in newborns and their subsequent susceptibility to Parkinson’s, environmental exposure to the herbicide paraquat as a risk factor for Parkinsonian neurodegeneration, the effects of decreases in antioxidant levels (specifically glutathione) associated with the onset of Parkinson’s, and the consequences of the age-related increase in an enzyme involved in dopamine metabolism (monoamine oxidase B).

Dr. Chris Benz, MD
A primary goal of the Benz lab is to understand the link between aging and breast cancer-- why the incidence of breast cancer increases with age, how the biology of breast cancer is impacted by normal aging, and how to use this information to improve breast cancer prevention and treatment. The Benz lab focuses on several clinical types of breast cancer including those that overexpress the estrogen receptor (ER), an age-associated mechanism that drives the most rapidly increasing form of breast cancer worldwide, and a proven target for breast cancer prevention and treatment with effective agents like antiestrogens and aromatase inhibitors. Dr. Benz and colleagues also continue to build on their two decades of effort to understand and design treatments against another more clinically aggressive form of breast cancer that overexpresses the ERBB2/HER2 oncogene.

Dr. Martin D. Brand, PhD
Mitochondria oxidize nutrients to release energy, and capture that energy to make ATP. Dr. Brand is particularly fascinated by variations in the efficiency of this process. This leads naturally into study of the efficiency, of how its regulation and its effects on cells and organisms can be described quantitatively, of its mechanism and its functions, and of how we might be able to alter it to affect conditions such as obesity, degenerative diseases and normal aging. The inefficiency is caused by leaks of protons across the mitochondrial inner membrane. He is investigating basal proton leak catalysed by non-specific processes and inducible proton leak catalysed by specific uncoupling proteins (UCP1, UCP2 and UCP3). Dr. Brand and colleagues are interested in the mechanism of proton transport by these proteins, and how they are regulated by nucleotides, fatty acids, free radicals and other molecules to produce relevant responses to physiological signals.
Dr. Dale Bredesen, MD
The Bredesen laboratory focuses on the molecular processes that control intrinsic cell death pathways. Cell suicide is a vital mechanism for development and maintenance in metazoans, and the loss of the tight regulation of cell death can result in a wide variety of diseases. Cancer develops when cells fail to commit suicide and continue to grow and survive, but too much cell death in particular tissues can also be deleterious, such as occurs with neurodegenerative diseases like Alzheimer’s disease. It was long believed by many that a single program—apoptosis—was responsible for programmed cell death. However, alternative pathways have recently been described, including one that the Bredesen lab dubbed paraptosis. These programs display complementarity and may therefore act as fail-safe mechanisms to ensure that cell death occurs when and where required. Proteomic, genomic, and computational analyses of this novel cell death program suggest that it is a response to hypertrophic cellular stimulation, and thus may be important in preventing autocrine loop-induced neoplasia.

Dr. Judith Campisi, PhD
The Campisi lab strives to understand several fundamental aspects of the aging process. The Campisi laboratory works primarily with human and other mammalian cell cultures and mouse models to study the evolutionary, cellular and molecular relationships between aging, tumor suppressor mechanisms and the development of cancer. The laboratory also studies nuclear structures such as telomeres, and nuclear processes such as DNA repair and transcription, to understand how genetic and epigenetic damage leads to aging and cancer phenotypes. A recent focus of the Campisi lab is to identify links between mitochondrial function and cellular responses that can affect the development of aging phenotypes and age-related diseases in tissues and organisms.

Dr. Lisa M. Ellerby, PhD
Dr. Lisa Ellerby studies cell death mechanisms and polyglutamine expansion disorders, such as Huntington’s disease (HD), Kennedy’s disease and Machado-Joseph disease. The Ellerby lab is particularly interested in the relationship between protease action and cell death, and has shown, through their characterization of transgenic animal and cellular models, that seven of the eight polyglutamine expansion disease proteins are cleaved by caspases (specialised proteases that trigger cell death). At the forefront of Huntington’s research, Dr. Ellerby is dedicated to finding effective treatments that can be applied to all polyglutamine expansion diseases. By examining the sequential cleavage of the huntingtin protein, potential drug targets may be uncovered that could eventually lead to a cure for this debilitating illness. Dr. Ellerby is also involved in the development of methods that attempt to stimulate nerve cell growth to replace those that have been lost in Huntington’s sufferers.

Dr. Bradford Gibson, PhD
Dr. Gibson’s research focuses on discovering the molecular details of biological processes associated with aging and age-related diseases. Combining biology, chemistry, and technology, Gibson specializes in using mass spectrometry to characterize protein and carbohydrate structures, along with their expression changes and interacting networks. In recent years, Gibson and his team have focused primarily on identifying and characterizing proteins in the mitochondria, a sub-cellular organelle involved in energy production and other cellular functions. They are responsible for one of the most comprehensive databases of mitochondrial proteins that are being examined in relation to aging and disease. In addition, they are developing new proteomic methods for identifying sites of a protein modification that plays key roles in the regulation of protein function in normal and pathological states.
Dr. Matthew Gill, PhD
Dr. Matthew Gill studies the endocrinology of aging in the nematode Caenorhabditis elegans. Gill's work aims to capitalize on the discoveries that have been made in the genetic analysis of aging in the worm by using a chemical and biochemical approach to study the endocrinology of lifespan determination with particular focus on hormones, small molecules and the process of dauer formation. During development the nematode can enter an alternate larval stage, the dauer larva, which in its natural habitat allows it to survive harsh environmental conditions. Genetic analysis of dauer formation has identified a complex network of genes that regulate this process and a number of these genes define an insulin-like signaling pathway that also acts to determine adult lifespan.

Dr. David A. Greenberg, MD, PhD
Dr. David Greenberg studies mechanisms that the brain uses for protection and self-repair in stroke, and in neurodegenerative diseases like Alzheimer’s disease. Two general mechanisms are being investigated in the Greenberg lab: increased expression of neuroprotective proteins and the production of new nerve cells (neurogenesis). The underlying hypothesis is that evolution has selected biological strategies that promote neuronal survival, and that these can be adapted for therapy. Examples of protective proteins under study include vascular endothelial growth factor (VEGF), which stimulates the growth of new blood vessels in the brain after stroke, but also protects neurons directly, and neuroglobin, an oxygen-binding protein that confers relative resistance to reductions in oxygen or blood supply. Both of these proteins are up-regulated during stroke, and help to reduce the extent of stroke-induced brain damage.

Dr. Robert E. Hughes, PhD
Dr. Robert Hughes utilizes yeast cell-based molecular methods to examine protein interactions that are important in neurodegenerative disorders, such as Huntington’s disease. The ultimate goal of the Hughes lab is to use the biochemical tools available in yeast to identify and develop novel therapeutic compounds that will modulate key protein interactions involved with neurodegeneration. With a background in protein biochemistry, Hughes is interested in how proteins fold into the correct shape and the disastrous consequences of when this folding goes awry. Incorrect folding leads to an inability of the protein to perform its specific job, and often results in the aggregation (clumping) of mis-folded proteins.

Dr. Pankaj Kapahi, PhD
The Kapahi lab strives to understand the basic biological mechanisms involved in the aging process. Using an interdisciplinary approach, which combines fly (Drosophila melanogaster) and worm (Caenorhabditis elegans) genetics, genomics, biochemistry and physiology, Kapahi and his team address how gene-nutrient interactions shape lifespan. Dietary restriction (DR) represents one of the few interventions known to extend lifespan in a variety of species, from yeast to mammals. DR also slows down the progression of number of age related diseases including cancer, neurodegeneration and diabetes in rodents. DR entails a reduction in nutritional level without causing malnutrition that is thought to cause a metabolic shift from a state of reproduction and growth to one of repair and maintenance within the organism, resulting in increased longevity.

Dr. Gordon J. Lithgow, PhD
Dr. Gordon J. Lithgow is dedicated to understanding the basic biological mechanisms involved in the aging process. By using the microscopic nematode worm, Caenorhabditis elegans, Lithgow and his team address the molecular, metabolic and evolutionary aspects of lifespan determination and aging rate. Many molecular processes are conserved between simple animals and more complex organisms, thus the Lithgow lab’s work yields information that may be applicable to understanding human aging and age-related diseases. Known worldwide for his work establishing links between stress responses and longevity, Lithgow’s current research interests include the roles of insulin signalling and molecular chaperones, the regulation of the heat shock response, cell cycle checkpoint pathways and the evolutionary cost of long life.

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Online: www.dominican.edu
Dr. Simon Melov, PhD

Dr. Melov studies the damaging effects of reactive oxygen species (free radicals) generated from the mitochondria, the powerhouses of the cell. Damage caused by these reactive molecules is believed to be a key contributor to the pathobiology of aging, and is implicated in a number of age-related conditions, such as cancer and Parkinson's disease. A variety of interdisciplinary approaches are used to gain insights into mitochondrial dysfunction and aging which is carried out via collaborations with the Nicholls, Gibson, Lithgow, Campisi, and Vijg laboratories within the Institute. The Melov lab is also using microarray technologies to generate gene expression profiles. This methodology simultaneously measures the levels of thousands of genes and is being used to generate profiles of normal aging in multiple species, and to investigate whether antioxidant treatment can retard aging rate, as well as illuminate how the transcriptome of aging varies between species.

Dr. David G. Nicholls, PhD, FRSE

Dr. David Nicholls studies the biochemistry and physiology of the mitochondrion, the 'powerhouse' of the cell. Most of the knowledge available on these sub-cellular structures has been gained by the study of mitochondria isolated from cells, but the Nicholls lab now focuses on developing novel techniques that allow the precise examination of mitochondrial bioenergetics in intact cells. The motto is 'leave the mitochondrion in the cell'. This is now possible because of improved methods for monitoring mitochondrial membrane potential changes and a novel 'cell respirometer' allowing respiration of intact cells attached to coverslips to be monitored continuously.

Dr. Ram Rao, PhD

Dr. Rao collaborates with Dr. Dale Bredesen on two areas of research: Endoplasmic Reticulum stress and mechanisms of age-associated neurodegenerative diseases. Neurodegenerative disorders such as Alzheimer's disease, Parkinson's disease, Huntington's disease, Amyotrophic Lateral Sclerosis (ALS) and prion protein diseases all feature misfolded proteins and their aggregates that appear to play a role in disease pathogenesis. Prolonged stress leads to organelle damage and dysfunction and ultimately leads to cell death. We have been investigating the biochemical pathways that couple misfolded proteins to the cell death programs. These studies have led to the identification of several new proteins that function in this link for example, valosin-containing protein, apoptosis-linked gene 2 (ALG-2), and p23 that therefore represent potential therapeutic targets.

Dr. Xianmin Zeng, PhD

Dr. Zeng chose human embryonic stem cells (hESCs) as her major research interest because of the great potential of hESCs in regenerative medicine and developmental biology. One of her laboratory's focuses is the use of hESCs as a potential treatment for Parkinson's disease (PD). This requires an understanding of the molecular and cellular mechanisms that regulate dopaminergic differentiation of hESCs. The Zeng lab is particularly interested in understanding the relationship between transcription factors and neuronal fate, and developing methods for isolating dopaminergic precursors from human embryonic stem cells for transplantation therapy of PD.

Explore the challenges and rewards of this degree program.
For more information, or to arrange for a visit, contact the Office of Admissions.
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Email: graduateprograms@dominican.edu
Online: www.dominican.edu
Tuition and Financial Aid Information

Tuition Information
Tuition for the 2008-2009 academic year is $820 per unit with a $100 non-refundable registration fee per semester.

Tuition and fees are subject to change at the discretion of the Board of Trustees.

Financial Aid Information
To apply for financial aid each student must annually complete and file the Free Application for Federal Student Aid (FAFSA). The online FAFSA is available at www.fafsa.ed.gov and once submitted online is processed within three weeks. Financial aid eligibility is determined through information the applicant provides on the FAFSA and the applicant must also provide any other documents as requested by the Dominican Financial Aid Office. A financial aid award notification letter is sent to admitted students who have provided all required documents.

Grants
Dominican grants are available to graduate students who qualify based on financial need as determined by FAFSA data. Grants are awarded per academic year and recipients must be enrolled for 9 units each semester.

Scholarships
A limited number of scholarships are available to graduate students at the discretion of the faculty program director and in coordination with other forms of financial aid. Scholarships are awarded per academic year and recipients must be enrolled for a minimum of 6 units each semester.

Students may be eligible for a full-time training assignment at the Buck Institute, with an accompanying scholarship payment of $1,833.33 per month (annual equivalent of $22,000) paid directly to the student by the Buck Institute. Students electing this option will be required to train full-time at the Buck Institute in the periods between academic semesters, in addition to the academic semester laboratory training.

Student Loans
United States citizens and permanent residents enrolled at least half time (6 units) in a graduate program are eligible to apply for low-interest federal student loans. Students are considered for subsidized and unsubsidized student loans, and may also apply for a credit based GRAD PLUS loan as an additional resource.
Steps to Enrollment

1. **Complete graduate application**
   - Complete the application online at www.dominican.edu and the $40 application fee is waived.
   or
   - Complete the printed graduate admission application and mail it along with a $40 check. Please make checks payable to Dominican University of California, to:
     Office of Admissions
     Dominican University of California
     50 Acacia Avenue
     San Rafael, California 94901

2. **Send official transcripts.**
   A separate official transcript from every college/university attended must be sent to the Office of Admissions in a sealed envelope.

3. **Submit remaining program specific admission documents.**

4. **Apply for financial aid online.**
   Visit www.dominican.edu/admissions/aid/howapply
   Complete and submit the online Free Application for Student Aid (FAFSA)

   *Financial aid notification letters will be sent only to admitted students who have submitted all required documents.*

**Admitted Students**

5. **Sign and return the financial aid award letter to the Financial Aid Office at Dominican.**

6. **Reserve space in the program by submitting the tuition deposit.**
   The letter of admission provides details on how to reserve a space in the program. Payment is by check or contact the Office of Admissions at 415-485-3280 to pay by credit card.

7. **Contact faculty program director to schedule an advising and registration appointment.**