5. Departmental Plan

5.1 Vision Statement

To reveal the patterns of diversity found among animals and the processes that generate such diversity through evolutionary, physiological and developmental approaches.

5.2 Hiring Plan 2000- 2005

5.2.1 Introduction and Overview

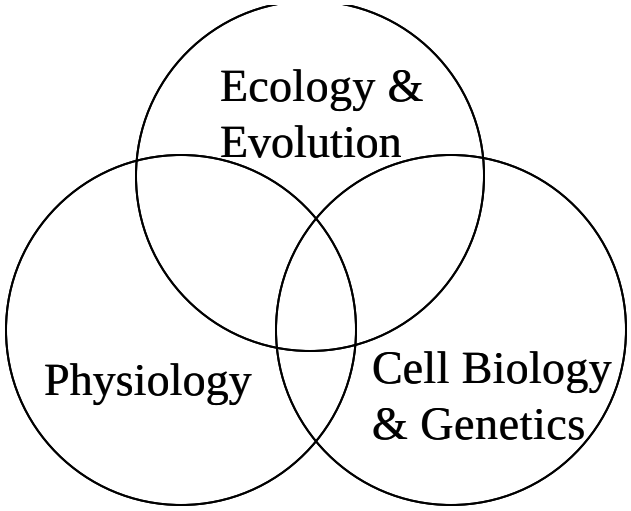

Figure 1. Life Science Disciplines

The Department of Zoology at the University of British Columbia is currently one of the strongest and most broadly based life science departments in the country. Our Department, and life sciences generally consists, of three overlapping discipline areas: **ecology and evolutionary biology**, **physiology, and cell biology and genetics.** As indicated by the vision statement above, the main theme for the department's development in the foreseeable future will be organismal variation, development and evolution. The three major foci in the department represent different challenges and opportunities.

The ecology and evolution group is an area of historical strength that has greatly increased strength and depth in evolutionary biology, especially in its theoretical aspects. This development complements the great strength of the Botany evolution group in molecular phylogenetics, and gives UBC what is probably the strongest combined evolutionary group in the country. It is important that the strength in evolutionary biology be balanced by strength in field ecology. This plan provides for replacement of existing strength in that area.

The cell biology and genetics group in the department is rapidly developing strength and is interacting strongly with cell biologists in other departments. In this area the proposed appointments are primarily shared appointments with other units, recognizing and building on the trend toward inter-unit cooperation that has already been developed. In particular the department has strong ties to the Biotechnology Laboratory, the Neurosciences Program, and to the Department of Microbiology and Immunology. Proposed hiring in cell biology, genetics and molecular physiology must be seen in a faculty and campus wide context.

Physiology is the most diverse and integrative component of the department. It includes both reductionist analysis of organismal function, as well an integration of organismal function at the highest level of interaction with environmental and ecological factors There is increasing integration between molecular and cell biology with the more strongly reductionist elements of physiology. This is especially true for the neurobiologists who interact strongly with researchers in the Neurosciences program and with CORD, a research group focused on neural repair and development that arose within the department. At the other end of the physiology spectrum, the comparative physiologists who study organismal integration and adaptation from a comparative standpoint. Comparative physiology has been a historical strength in the department. This plan provides for renewal of integrative and comparative physiological studies and their stronger integration with evolutionary biology and ecology, which, of course, are key for understanding organismal diversity and population biology.

The department has 38 faculty members totalling approximately 33.5 FTE. This plan assumes that our faculty complement will experience little net growth.

5.2.2 Retirement Pattern and Positions available:

As detailed in Appendix 4.1, the department has had five recent retirements. Two positions have not been filled, and a third unfilled position has been created by resignation of Dr. Chris Airriess, Assistant Professor. In the next five years five further retirements will occur, three in 2002 and two in 2003. This plan will focus on eight positions and includes the CRC chair proposals that were put forward during summer 2000.

5.2.3 Searches currently underway:

1. Physiology – replacement position for Dr. Airriess. The competition has closed and a short list has been prepared. Interviews will take place in September. The advertisement is broadly worded. The position will probably be filled by an evolutionary or environmentally oriented comparative physiologist.

2. Field Ecology Position – The competition has closed. A short list is being prepared and interviews will take place during term 1 of the 2000/01 academic year. The goal is to recruit an experimental field ecologist.

5.2.4 Position Summary

Positions are summarized in the list below and associated with the major research groups within the department in section 4.2.6. below. Nearly all of these positions were written up as initial CRC chair proposals. The two areas of the department that are in greatest need of new faculty to maintain the teaching program are physiology and ecology. In both of these areas needs are acute. This hiring plan will provide for the maintenance of strength in both areas. We anticipate that student load in life sciences will stay about as it is now for the next few years. The teaching requirements within each of the main research areas are broad and general enough that there should be no problem covering present or foreseeable teaching needs from the positions noted below.

One of the striking features of this set of positions is the degree of interaction between appointments in the different areas of the department as shown in section F below. Interaction between researchers in different areas of the department is increasing and the possibility for interactions with researchers in different units across campus is also very important, especially for researchers in cell biology and molecular physiology.

Summary of proposed positions		
Position	Brief Description	Theme(6), Core(5) or both(2)
1. Field / Experimental Ecology	This position is important to maintain teaching and research strength in this important area. This position has been advertised; the competition closes 30 September.	This is a Zoology Core Position 2000
2. Evolutionary or environmental Physiology	This is a replacement position and is a key position for the rejuvenation of the historically strong physiology group that has had a key role in the development of the Department's research reputation over the past 30 years.	This is a zoology core position. 2000
3. CRC Senior Chair in Biosystematics - Centre for Biodiversity Research (A joint initiative of the Departments of Zoology, Botany and Microbiology.)	This is the CRC Chair position that is essential for the development of the Biodiversity Research Centre and its fundraising initiative. Dr. Dolph Schluter has been proposed for this chair.	This is a key position for the FOS Environment Theme 2000
4. Neural Development Position – C. Elegans (50%) Shared with Biotech Laboratory	This position will be created by the awarding of a CRC chair to Dr. Snutch. It is an important chair linking the Biotech laboratory and cell biologists and molecular physiologists in several departments. It complements the strength present in the C. elegans knock out facility (Biotech and Zoology).	This position part of the a FOS Theme Bioinformatics and Functional Genomics 2000
5. CRC Junior Chair Subcellular biology – cytoskeleton etc. (50%) Shared with Microbiology and Immunology	This shared position provides further interaction between cell biologists in an important area in modern biology.	This position is part of the FOS Bioinformatics and Functional Genomics theme. 2002

6. Genetic Basis of Evolutionary Change	This position and the one following form a complementary pair of positions that will enable us to really look 'under the hood' at what is happening during the evolutionary process. They are new departures in strong areas of the Department.	Zoology core position 2002
7. Evolution /Development -- Stickleback or Zebrafish development .	This is a very important position linking evolutionary and developmental biology. The objective is to hire someone looking at how patterns of gene expression change in response to evolutionary selection.	This is a Zoology Core/ FOS Theme position in the Bioinformatics and Functional Genomics theme. 2004
8. Environmental Physiology – Adaptation	This position and the one following will allow us to maintain strength in physiology while moving in new directions.	This is part of the FOS Environment theme. 2004
9. Field Physiology –animal remote sensing	The goal here is to strengthen whole animal studies in the department using recent advances in electronics and communication to study unrestrained animals in the field	Zoology core position. 2002
10. Evolutionary Biology – field experimentalist	This position, along with numbers 6 and 7 above bring the evolution group to critical mass and serve to anchor theoretical work in concrete observation.	This is a Zoology core position. 2003
11. MRI Imaging Centre Director – possible appointment in Zoology	This chair may or may not come to zoology, depending on the interests of the appointee. The area of non-invasive observation in physiology that this technical area represents will be an increasing important research methodology for whole animal research.	This is a FOS Theme position in the Neurosciences and Cognitive Systems. 2001
12. Developmental Neurophysiology	This program ties cell biologists and molecular physiologists in Zoology, Cord, neurosciences together. The area is important and one in which we are reaching critical strength	This is a Zoology Core/ FOS Theme position in Neurosciences and Cognitive Systems. 2001

13. Conservation Biology	This position would round out the ecology and environmental groups and is a critical common area for both groups and one that is of increasing political and economic importance.	This is a FOS Environmental Theme position. 2003

5.2.5 Positions by group

In this classification of positions are related to existing major subgroups within the department with repetition as needed. Those that are most directly related to the group in question are indicated in bold font, those less relevant, but still pertinent in normal font.

1. Ecology **Field (Experimental) Ecology (1)** **Bio – Systematics Chair (3)** **Empirical Evolution (10)** **Conservation Biology (13)** Genetic Basis of Evolution (6) Environmental Physiology (8) Field physiology (9)	**2. Evolution** **Empirical Evolution (10)** **Bio – Systematics Chair (3)** **Genetic basis of Evolution (6)** **Evolution/ Development (7)** **Evolutionary Physiology (2)** **Conservation Biology (13**
3. Physiology **Evolutionary or Integrative Physiology (2)** **Environmental Physiology (8)** **Field Physiology (9)** Developmental Neurophysiology (12) Neurodevelopment in model organisms (4)	**4. Cell Biology/ Development/ Genetics** **Neurodevelopment in model organisms (50%) (4)** **Subcellular biology (50%) (5)** **Evolution/ Development (7)** **Genetic basis of Evolutionary Change (6)** **Developmental Neurophysiology (12)** Evolutionary or integrative Physiology (2)

5.2.6 Positions Assigned to existing or new slots

Position	Slot	Available
1. Field Ecology	McPhail	Open – Advertised
2. Evolutionary or Integrative Physiology	Airriess	Open -Advertised
3. Biosystematics	CRC Senior Chair	Round I ‘awarded’
4. Neural Development (1/2) Shared with Biotech	Snutch (1/2) – Snutch Senior CRC chair	OK if Snutch awarded senior CRC Chair
5. Subcellular biology (50%)	Bridge to Kasinsky slot CRC Junior chair shared with Microbiology	Round I ‘awarded’ Permanent slot 2006
6. Genetic basis of Evolutionary change	Liley	Jan 2002
7. Evolution / Development	Carefoot	Dec 2003
8. Environmental Physiology - Adaptation	Randall	Dec 2003

9. Field Physiology	Hochachka	July 2002
10. Empirical Evolution	Krebs	Jan 2002
11. MRI Imaging Centre Director	CRC Senior Chair	Possibly in Zoology 2001
12. Developmental Neurophysiology	Holm	Open
13. Conservation Biology	Possible new pos	Probably 2003 or later

5.2.7 Position Details

5.2.7.1 Field/ Experimental Ecology (Ecol) (McPhail slot)

The two pivotal issues for biology in the 21st century will be the use of agricultural biotechnology and the pacts of humans on global ecological function. Experimental ecology lies at the forefront of the latter field. We need to explore the consequences of habitat fragmentation and the introduction of exotic species experimentally, and to understand how disturbances alter the structure of food webs. We currently have an excellent international reputation in experimental ecology in Zoology at UBC and, we believe, the strongest pure ecology research group in Canada. A new position in this field would complement our existing faculty in ecology and evolution ideally, and would help us maintain this strong international reputation.

We seek an experimental ecologist working on populations and communities facing biotic and physical disturbances. We expect the appointee to solve ecological problems by experimental manipulation, and to have a strong organismal interest to contribute to the Centre for Biodiversity Research

In the spring of 1999 we interviewed six candidates for this position, and we identified an outstanding couple in this research area, Drs. Sharon Lawler and Marcel Holyoak, currently at the University of California at Davis, as our preferred candidates. We were unable to recruit them and the position has been readvertised as a single position

Rationale for the Position

We are about to lose our best-known scientist, Dr. Charles Krebs, through retirement, and we have also lost two other well-known scientists in this area this year to retirement, Drs. Geoff Scudder and Don McPhail. We feel this position will complement and sustain our present excellence in ecology and evolutionary biology, help us meet one of the major biological challenges of the 21st century, and it will fill a critical gap that is appearing in our faculty through retirements. Experimental ecology has been one of the principal strengths of the Zoology Department at UBC over the past 30 years. This position will strongly complement existing faculty in the Department of Zoology and the Biodiversity Researh Centre and the appointments in empirical evolutionary biology and field physiology and environmental physiology outlined below.

This postion will require start-up funding (~75 K$). Space will come from retirements

5.2.7.2 Evolutionary or Integrative Physiology (Airriess slot)

The past decade has been dominated by advances in cell and molecular biology. We have learned much about the chemical and physiological function of single cells and cell organelles. We have also learned that this information, in and of itself, does not begin to elucidate the physiological processes that emerge as cells aggregate to form tissues, organs and organ systems. It has become apparent that the major challenge facing biologists in the next several decades will be:

◆ to elucidate how the cells of multi-cellular organisms co-operate to produce the characteristics we associate with Life

◆ to utilize this information to understand how these processes are modified to allow animals to utilize different niches and survive in different environments, this is the true basis of biodiversity

◆ to elucidate how these different processes have evolved and understand the mechanisms that have produced such diversity

To this end we are proposing positions in either of these areas.

Integrative and Comparative Physiology

Among the characteristics that define life is the ability of organisms to process energy, grow, develop and reproduce. To spearhead efforts to integrate research in these areas from the biochemical and cell level to the ecosystem level will require a senior scientist with a broad background and sweeping vision. This individual will need to excite, co-ordinate and focus junior researchers at disparate ends of the biological hierarchy and manage the type of collaborative effort that will lead to hallmark advances in the next decade. They must be familiar and comfortable with the tools being used across this spectrum and able to construct effective collaborations between individuals with different interests.

Evolutionary Physiology

We need an individual with an interest in the study of the evolution of physiological function. This individual would act as an interface between those studying evolutionary biology at both smaller and grander scales and the core group of comparative physiologists working at the organ system/whole organism level. We envisage hiring an individual whose primary interest is in the use of phylogeny and evolutionary biology to interpret adaptive mechanisms at the physiological level. This individual would use experimental approaches to test adaptive significance of physiological traits as well as to explore the evolutionary origins of these same mechanisms. (See also Chair in Genetic Basis of Evolutionary Change and Chair in Empirical Evolutionary Biology).

5.2.7.3 CRC Chair in Biosystematics -- Centre for Biodiversity Research (A joint initiative of the Departments of Zoology, Botany and Microbiology.)

We seek a Chair in Biodiversity to pursue the core aims of the Centre: to document Canada's biodiversity, to identify and monitor threatened species and habitats, and to advise on methods to mitigate threats to this biodiversity.

The Need***: Hundreds, perhaps thousands, of biological species are disappearing annually. A substantial fraction of the Earth's biota is likely to be lost over the next century, and some environmental changes, such as global warming, may soon create climates outside the envelope experienced to date. In response to this realization, the Canadian government promoted the Rio de Janeiro Biodiversity Convention of 1992 and has recently published the National Biodiversity Policy. However, there is an urgent need for new research and for expert advice on what and where biodiversity occurs.***

There is now a worldwide shortage of biologists trained in biosystematics and hence there is a problem in identifying and understanding the diversity of organisms. Training in biosystematics, therefore, is one of the major areas that the Centre will address with the creation of a Chair in this field.

The Objectives***: The Chair in Biosystematics will address the following:***

Document and assess the biota of Canada: this will require a thorough understanding of the nature of biodiversity at each of the four major levels (genes, species, habitats, and ecosystems). Train students in these disciplines.

Develop a molecular species identification facility. Modern techniques to identify differences in species and races within species use DNA techniques. We will develop a molecular facility to conduct this research and the housing for the facility.

Public Education. The Centre will house biological collections and the research labs for the Chair in Biosystematics. The Chair will give public lectures on biodiversity issues in British Columbia and Canada.

Assets: There is already at UBC a core group of 16 scientists in Zoology and Botany that have expertise in ecology, genetics, evolution, and mathematics and these form the focus of our Centre for Biodiversity Research. In addition there are other scientists within these departments and also Microbiology, Earth and Ocean Sciences and Mathematics that form an extended group of 35 scientists. We also have multidisciplinary initiatives with the Fisheries Centre, Sustainable Development Research Institute, and the Centre for Applied Conservation Biology in Forestry. The depth of this expertise in biodiversity related issues is without equal in Canada. The group is one of the strongest in the world.

There are biological collections in Insects, Fishes, Plants, Mammals, Birds and marine Protozoa that are unique in Canada and provide an invaluable start for studies in Canadian biodiversity.

The current fund-raising is designed to provide support for the Chair. It will provide for support staff (research associates), operating expenses and care of biological collections, and renovation of housing for labs and collections.

5.2.7.4 C. Elegans (Neuro Development/ Genetics) Shared with Biotech (50% position , Snutch slot)

Research Focus - Linking functional genomics, cell biology and development. Focusing on various aspects of the developing nervous system in the nematode model organism, *C. elegans.*

Research in developmental biology is one of the major focuses of modern life sciences. Our understanding of cellular processes in a developing organism has increased at an astounding rate. This new information is the direct result of modern techniques in molecular biology. For example, the entire genome, approximately 100 million base pairs, of the nematode *C. elegans* has been completed and this information gives us a database to be used for the study of animal development and physiology. At the same time, developmental neurobiology has emerged as an area where major breakthroughs can be expected to come over the next several decades. The nematode, as a model organism, with its completely sequenced genome, strong genetics, completely mapped developmental lineage of all cell types and complete neuroanatomical and physical map (of all 302 neurons) offers an unprecedented opportunity to explore many basic questions in neurobiology. These include neural path-finding, circuitry development, gating of ion channels, synapse formation, olfaction, establishment of neural-muscular junctions, neural net formation, synaptic vesicle formation/trafficking, behavior and many other topics.

Impact

This chair is an important addition to the existing community of *C. elegans* researchers and to the strong community of neuroscientists on campus that is currently under-represented at the level of model organisms. S. Jones and M. Marra of the Genome Center and T. Snutch and D. Moerman of the BTL/Zoology all have considerable experience using C. elegans as a genetic model system, but not in the area of neurobiology *per se*. Thus the candidate will be an important link to promote synergy between the *C. elegans* researchers and the neuroscience community. Other members of the Vancouver *C. elegans* community, including D. Baillie (SFU), P. Candido (Biochemistry), K. Rankin (Psychology) and A. Rose (Medical Genetics) will benefit from a strong colleague using the nematode and interested in developmental and neurobiological questions. In addition, this chair will be able to take advantage of the BTL's Reverse Genetics Core Facility (Worm knockout facility). This facility was initiated to take advantage of the unique science opportunities surrounding the completion of the *C. elegans* genome and will provide mutant (knockout) worms to both the local and international research community. Finally, this chair will be able to interact with the neuroscientists in both the Faculty of Science and the Faculty of Medicine. These include, V. Auld (Zoology), W. Tetzlaff (Cord/Zoology), J. Steeves (Cord/Zoology), J. Roskams (CMMT), S. Vincent (Neurosci), L. Raymond (Neurosci), T. Murphy (Neurosci), T. O'Connor (Anatomy) and many others.

Plan

This chair would be a cross appointment between the BTL and Zoology. This appointment could be at the junior or senior level. Two possible candidates at the more senior level are Jim Thomas (Genetics/UW) and Eric Jorgenson (Biology/Utah). The

former works on signal transduction in neurons, potassium ion channels and neural-muscular reflex arcs. The latter works on neural glutamate receptor and neuronal path finding. Dr. Jorgenson was responsible for the development of *in situ* patch clamping to individual neurons and muscles in the nematode.

This position was initially approved as a CRC junior chair. The position was then used to make a retention chair for Dr. Snutch. Snutch's present slot will be used to fund this as a normal position.

5.2.7.5 CRC Subcellular biology –Shared with Microbiology and Immunology (50% Position) to go to Kasinsky slot in 2006.

Research Focus - on the dynamic nature of intracellular components.

This chair is targeted towards a sub-cellular biologist with an interest in the cellular cytoskeleton, cell adhesion, the organization of signaling molecules by this intracellular scaffold, cell migration and the extracellular matrix. This person should have expertise in the use and development of cutting edge microscopy and imaging techniques to study protein localization, cell movement and interactions inside of and between isolated cells, thereby providing a unique expertise and complementing the expertise of other Cell Biologists currently at UBC.

Impact

This research chair will augment the development of an interdisciplinary research group in Cell Biology that has formed at UBC that contains members from both the Faculties of Science and Medicine and will strengthen links between the cell biology group and the Dept. of Microbiology & Immunology. We will seek out the best subcellular biologist who may work in cells of the immune system, the nervous system or a model organism.

It is anticipated that the subcellular biologist will have major interactions with the interdisciplinary centre of excellence in Immunology at UBC. There is a current CFI initiative to create a new Facility of Integrated Immunology to bring together all immunologists on campus in an open-plan lab space organized around the development of complementary and integrated cutting edge technologies (mass spectrometry, gene array analysis, transgenic mouse facilities, and imaging facilities). The creation of this truly multidisciplinary research unit, which will cross the faculties of Science, Medicine and Dentistry and will develop cutting edge technologies, fulfills two major goals of the academic plan. This centre will extend current technology to allow dissection of the immune system at the single cell level and generate attomole sensitivity. The chair in subcellular biology would bring in leading edge microscopy technology that would not only benefit the advance of immunology, but would also provide links with many other research units. Additional collaborations would be forged with Bioinformatics and Medicinal Botany as we seek to understand protein-protein interactions on a genome wide scale and to identify natural compounds that may prevent or enhance cell signaling pathways. We also anticipate interactions with the *C. elegans* Reverse Genetic facility, as many intracellular proteins involved in fundamental biological processes such as cell movement and signaling are likely to be evolutionarily conserved. This chair is thus a natural fit with the Cell and Developmental Biology focus being developed by Botany, Zoology and the Faculty of Medicine. The

applicant will have access to the UBC EM facility which has electron microscopes, two confocal microscopes and a variety of other fluorescent and light microscopes.

Plan

To obtain a junior chair for a "rising star" in the field of subcellular biology. Our plan is to recruit a subcellular biologist from a world class cell biology laboratory. No-one individual has yet been identified for this position. However, Paul Kubes (U. Calgary) who studies the migration of immune cells using 'real time' video recordings is one possible candidate for this position, although he may need a more senior chair.

This position has been approved as a CRC chair.

5.2.7.6 Genetic Basis of Evolutionary Change (Liley Slot 2002)

The explosive growth of sequence data from the genomes of a variety of organisms provides unparalleled opportunities to unveil the steps that evolution has taken. In a number of landmark studies, investigators have revealed the genetic changes that give crop tomatoes their sweetness, that differentiate modern corn from its ancestor (teosinte), and that reproductively isolate certain species of fruitfly. These studies involve a number of genetic techniques, including quantitative trait loci (QTL) analyses, candidate marker searches, and genetic introgression methods.

Despite the many strengths of the evolutionary group at UBC in the Departments of Botany, Zoology, Forest Science, and Mathematics, we do not currently have an evolutionary biologist who focuses on uncovering the genetic alterations responsible for evolutionary change. This will be a burgeoning area throughout all of biology, in particular within evolutionary biology, over the next few decades as a result of the increasing detail of genetic maps. Hiring a biologist that has expertise in the statistical, cross-breeding, and molecular methods required to find these genes will (1) ensure that the group stays abreast of novel developments in this critical area, (2) help promote linkages between different core areas within the departments (e.g. between the molecular and evolutionary groups within the Department of Zoology), and (3) would assist on-going research in several departments.

Research at UBC has revealed ecologically and evolutionarily important changes in such things as stickleback morphology (Drs. McPhail, Schluter, and Taylor of the Department of Zoology), growth and quality characteristics of tree species (Drs. Aitken and Ritland of the Department of Forest Sciences), and mode of reproduction in plants and fungi Drs. Whitton and Berbee of the Department of Botany). Understanding how such morphological shifts are accomplished by genetic changes would greatly enrich these research activities at UBC. Furthermore, there are several mathematical, computational, and statistical questions that arise in the search for these genes. This hire could therefore increase connections among the life science and Math, Statistics, and Computer Science departments. Finally, given that unravelling the genetic basis of evolutionary change will be a growth area within biology. This hire would ensure that our undergraduate and graduate students continue to receive excellent training in the techniques and concepts at the core of modern biology.

This position is closely linked to the development / evolution position described below.

5.2.7.7 Evolution / Development Stickleback or Zebrafish development (Holm slot)

Research background: When we look at the adaptation of living organisms to their environments we se the results of natural selection, but we can not tell how these adaptations came about. The explosive growth of sequence data form the genomes of various organisms, and the availability of 'gene chips' allowing simultaneous analysis of an entire complement of genes, provide unparalleled opportunities to unveil the steps that evolution has taken. Despite its stature as the premiere evolution group in Canada, and one of the best on the continent, the evolutionary biology group at UBC has not had a biologist focusing on uncovering the genetic alterations responsible for evolutionary change. This is a burgeoning area; these investigators are now beginning to provide functional explanations that guide work in other areas of biology. We seek a researcher who can promote linkage between the evolution group and developmental biologists. In particular UBC researchers are finding ecologically and evolutionarily important differences in fish morphology (McPhail, Schluter, Taylor in Zoology), the growth and wood quality of different tree species (Aitken and Ritland, Forest Sciences) and mode of reproduction in plants and fungi (Whitton and Berbee, Botany). Understanding the genetic differences behind phenotypic shifts has become a very important and is an area that this department is well situated to develop. This position is designed to complement position 6 described above.

The sort of person we envision is exemplified by Dr. Caroline Peichel, currently a post-doc in developmental biology at Stanford, who has developed extensive molecular genetic analysis in sticklebacks, the experimental organism uses very effectively in evolutionary studies my McPhail, Schluter and Taylor in the UBC Zoology evolution group. She has carried out extensive sequencing and library studies and has identified 500 genes, including structural components of bone and cartilage, ligands and receptors from major signaling pathways that control embryonic patterning (BMPs, Wnts, Hedgehogs), major transcription factor families (Hos complexes, pbx, steroid hormone receptors), and genes involved in pigment and melanocyte development. Developmental studies on zebrafish, the model teolost would also be very relevant. This position would interact strongly with developmental and cell biologists in a variety of departments (e.g. Moerman and Brock in Zoology, the Biotechnology Laboratory, the UBC Cell Signaling group).

Substantial start-up funding is needed (>100K$). Space would need to be provided in the central core of the Biological Sciences building after completion of the new Biotechnology building is completed.

5.2.7.8 Environmental Physiology – Adaptation (Randall slot Dec 2003)

It was only to year ago that the human population started to have a greater impact in causing environmental change than other factors such as volcanic activity. Now environmental change, occurring at increasing rates, is dominated by the actions of humans. Because the majority of humans live close to rivers or oceans, estuaries and coastal regions are the major sites of human impact on aquatic sytems. These regions have become eutrophic, hypoxic or even anoxic resulting in marked reduction in biomass

and biodiversity. An appointment in environmental physiology investigating the functional relationship or organisms to their environment is central to understanding how environmental change will affect biological communities. Understanding how individual organisms respond to extreme conditions not only gives insight into the capacity of animals to respond to these changing conditions, but also develops a database to aid in predicting the effects of environmental change on populations. This information is central to the development of all forms of aquaculture. A world-class aquatic facility is available at the West Vancouver Laboratory, and additional facilities are available at Bamfield Marine Station

The Zoology Department at UBC was a world leader in this field. The group requires rebuilding and replacement of senior people with young people working in new and exciting areas.

5.2.7.9 Field Physiology – Remote sensing in Animals (Hochachka slot)

Integrative physiology has long been a strength of UBC Zoology, but has largely been practiced in the laboratory. Advances in electronics and in computer science, especially minaturization and wireless communication, make it possible to conduct rigorous physiological studies on animals behaving normally in their natural environment. This will allow zoologists to speak with authority about the effects of environmental changes on many diverse species. Remote monitoring consists of two types of sensors, those attached directly to the animal that provide that provide physiological, behavioural and local environmental data, and those that are satellite based, providing data on animal movement and distribution as well as changes in environmental factors on a large sacle. The simultaneous collection of these types of data will allow zoologists to examine questions at various levels of organization. For instance, from the same data set, a researcher and collaborators can investigate osmoregulation of salmon as they encounter changing salinity, and also examine the effect of global climate change and increasing ocean temperature on salmon feeding ecology and distribution. Zoology and UBC would benefit from the interdisciplinary nature of an integrative or adaptational physiologist remotely monitoring aquatic vertebrates that would provide a strong link to areas of current strength in Zoology: physiology, aquatic biology, ecology and evolutionary biology, as well as to a number of other UBC Departments or research groups.

Collaborations would be required in several areas: Electrical Engineering to take advantage of rapid developments in miniature, low-power electronics for incorporation into tools for remote monitoring; Computer Science, Applied Mathematics: continuous, remote monitoring results in high volumes of data that require sophisticated techniques of data compression, visualization and analysis. UBC Fisheries Centre, Fisheries and Oceans Canada: Collaboration will be needed on management of aquatic ecosystems and predator-prey interactions. Geography, Forestry: These departments have expertise in remote environmental sensing and analysis of habitat use, especially through use of Geographic Information Systems. Medicine: Key aspects of medicine in the 21st Century will be medical informatics and telemedicine. The technology that will allow remote connection of physicians and patients is identical to that needed for remote monitoring of free-ranging animals. Private Sector Electronics Firms: Satellite and other types of

wireless communication are growing rapidly in BC and there are opportunities for new interprises in developing commercial technologies for remote monitoring.

5.2.7.10 Empirical Evolutionary Biology – field experimentalist (Krebs slot)

We propose a position in empirical evolutionary biology for a **evolutionary biologist** with a strong **experimentally based program** who would complement the expertise in theory and molecular phylogenetics already in place in the Departments of Zoology and Botany at UBC. UBC now boasts one of the best evolutionary biology groups in the world and the best in Canada. This strength is based on theoretical work in the Zoology Department and on molecular phylogeny in the Botany Department. This expertise needs to be complemented by addition of empirically based scientists. New techniques have come into the field recently and a new realization of the importance of field work permeates the discipline. We propose hiring an empirical evolutionary biologist with emphasis in the selection process choosing the individual with the most exciting research program with a strong field-based component. This hire would bring the evolutionary biology group to critical mass, further enhance our international reputation in the field and stimulate the ecology and biodiversity initiatives in the Zoology Department.

Evolutionary biologists at UBC are attached to several departments, including Zoology, botany, forest genetics and mathematics, and represent several sub-fields of the discipline. Zoology has strength in theoretical evolutionary studies. To complement this we would add strength in the empirical study of evolution. The study of the process of evolution has a strong tradition of close interaction between theoretical and empirical work that has led to rapid progress, particularly at universities that have had strong representation in both areas.

Exciting progress is not being made in several aspects of field evolutionary biology, such as the measurement of natural selection in the wild, the elucidation of fundamental processes of speciation, discoveries about the basics of evolution of diseases and their co-evolution with hosts, and work on topics as diverse as evolution in spatially structured populations, the evolution of species ranges, and the evolution of mating systems and the genome. Most of these topics are studies at UBC largely in theory; an empiricist with a specialty in any of these areas would greatly enhance the group.

Evolutionary biology is a rapidly growing field, and large numbers of extremely qualified people are available. We therefore have the opportunity to hire the best-qualified, most dynamic researcher in the field by a broad search. Because this individual will have a strong field component to her research, this position will strengthen the already strong ecology group at UBC as well as also greatly enhance the Biodiversity Centre initiative. Start-up funding for an excellent candidate in this field would need to be 100-150K$.

5.2.7.11 CRC Chair -- MRI Imaging Centre Director – possible appointment in Zoology

One Senior Chair (for director of the Medical and Biological Functional Imaging Centre)

Interdisciplinary Centre (Impact and Focus): The Medical and Biological Functional Imaging Centre has been established at UBC and the Vancouver teaching hospitals with leading edge technology for in vivo magnetic resonance imaging and spectroscopy. It consists of a high field (3 or 4 Tesla) wide bore magnetic resonance scanner for research on human subjects, a very high field (9.4 Tesla) medium bore magnetic resonance scanner for research on animals ranging in size from transgenic mice to primates, and an image analysis laboratory. The Imaging Centre will be located on the UBC campus at the Koerner Pavilion of UBC Hospital. The imaging centre aims to extend non-invasive imaging of biological structure and function in humans and animals to the current technical limits and to apply this technique to clinical and fundamental research.

Perceived need: The Medical and Biological Functional Imaging Centre recently obtained sufficient funding (~11.5 M $) from CFI, BCKDF and the Blusson Endowment for purchase and installation of the two scanners and the imaging analysis instruments. The CFI award for the Centre was contingent upon UBC's commitment to hiring of a director who is a recognized, senior individual, appointed t the Full Professor level. The Director should have an international reputation in research with functional magnetic resonance and spectroscopy at high magnetic field strengths. We propose that the director should have a joint position between the Faculties of Science and Medicine (With Zoology and/ or Physics and Radiology as departmental affiliations). We propose the inclusion of a junior chair to establish the centre with necessary critical mass for core competence and for future innovation. A Seminar series, "Frontiers of Magnetic Resonance Imaging and Spectroscopy" has been initiated at UBC to bring internationally recognized experts in *in vitro* magnetic resonance to UBC for consultation. So far, five senior researchers have arranged to come to UBC in January and February 2000. These are potential candidates for the Director position.

Participants and Benefactors of the Functional Imaging Centre Include: The principal users represent widely disparate disciplines from across UBC and the Lower Mainland Community (from radiology, paediatrics, physics, computer science, surgery, biomechanics, zoology, psychology and neuroscience). Examples of some research programmes funded and ready to proceed on the human scanner include: Mechanisms of schizophrenia (Peter Liddle, and colleagues, Psychiatry), Neurodevelopment and paediatric central nervous system disorders (Brain Mapping Group, BC Children's Hospital); Mechanisms of multiple sclerosis (Don Paty and colleagues, Neurology, Radiology; Studies of speech perception and word learning (Janet Werker, Psychology); Organization of the Cerebral cortex (Max Cynader and colleagues, Brain Research Centre), Degenerative changes after neurotrauma (John Steeves, CORD). Research programs planned for the small bore scanner include: Models ofr defense afainse hypoxia (Peter Hochachka, Zoology); Studies of the visual cortex (Max Cynader and colleagues) Studies of CNS Myelin after local administration of immunological agents designed to reduce myelin in order to promote neural regeneration in animals (John Steeves and colleagues, CORD) and studies of transgenic mice (Anthony Phillips and colleagues, Psychology).

Available Infrastructure Support: Through the leadership of the Dean of Science, all of the above academic units (e.g. CORD and the Brain Research Centre) are ready and will to provide (or have already committed to providing) the necessary space, start-up

funding, recruitment costs and ongoing infrastructure support that are necessary to create and maintain a world-class Medical and Biological Imaging Centre at UBC.

5.2.7.12 Developmental Neurobiology

The field of developmental neurobiology is one of most rapidly expanding branches of life sciences in the last and in the forthcoming decade. The field of developmental neurobiology or neurophysiology investigates how the basic circuitry of the nervous system is put together and how this circuitry changes as the animal develops and ages. The research in this field covers a wide spectrum of model organisms ranging from C.elegans, Drosophila, zebrafish, mice, rats, and chickens. Neuroscience research is a strength at UBC and the field of developmental neurobiology has with recent hirings become a strong cluster within the neuroscience community. The advent of genomic data from *C. elegans* and Drosophila followed closely by the human, mouse, fugu, and zebrafish genomes in the next few years represents an incredible opportunity to study the development and physiology of all animals and in particular their nervous systems. This is due to the levels of conservation of these developmental pathways, such that the proteins (and genes) involved in C.elegans, Drosophila and zebrafish development are identical to those used in mammalian (including human) development. Therefore we can take advantage of simple and experimentally amenable systems to understand the underlying principles of nervous system development and apply this knowledge. By understanding how the nervous system wiring develops and how this circuitry changes during development and aging, we will be able to understand the underlying mechanisms behind a wide range of diseases. These include Parkinson's, neural trauma and spinal cord injury, Alzheimer's, and stroke to name a few.

This appointment in Zoology would have direct links to other researchers across campus. In particular this position would become an active member of the Cell Biology Unit, CORD and the Neuroscience program. There exists a strong and young group of developmental neurobiology researchers on campus who use a variety of model organisms to investigate the mechanisms that underlie nervous system development. This group includes Dr. Jane Roskams (CMMT), Dr. Tim O'Connor (Anatomy), Dr. Wolfram Tetzlaff (Zoology/CORD) and Dr. Vanessa Auld (Zoology). This group is cross disciplinary, integrates scientists across faculties and represents an exciting and expanding field of research. Each member of this group shares collaborations, graduate students and journal clubs. As well each group maintains significant international collaborations with other researchers in the U.S., Germany, England, Japan, and Israel. The neural developmental position would also complement many other members of the Cell Biology Unit at UBC including researchers working on cell signaling in the departments of Zoology, Microbiology/Immunology, Biochemistry, Biotechnology and the Biomedical Research Center. Other members of the Cell Biology Unit who work in the field of developmental biology that would benefit from this position include members from Botany, Agriculture, Dentistry, and Anatomy.

5.2.7.13 Conservation Biology

Summary. There is an urgent need to test some of the central theories in biodiversity conservation. Field experiments need to be done to see if the conservation strategies for different taxa are convergent or divergent, and the circumstances for different outcomes. This would entail GIS studies on distribution, detailed investigation of biologies, habitat requirements, population parameters, and familiarity in all conservation problems and possible solutions. There is an need to investigate real landscape level problems in a realistic manner, integrating biodiversity conservation issues with economic and sociological needs in well defined circumstances. Optimization of strategies need to be explored, along with actual decision making with respect to the allocation of land and resources. British Columbia leads the way in some of this land and resource decision making in Canada, and has an excellent GIS data base on ecosystems and landscape features. However, as elsewhere in Canada, there is a lack of cross taxa comparisons with respect to biodiversity conservation decision making. This chair would fill this void, and bring new tools and new approaches to this important and somewhat controversial field.

Proposal.

A chair in biodiversity conservation would strengthen current efforts to conserve biodiversity in Canada, and would position UBC to lead in this field in British Columbia, Canada and internationally. This position would link with one in Biosystematics at this Centre and another in the Centre for Applied Conservation Biology, Faculty of Forestry.

Following the passage of the Interaction Convention on Biodiversity in 1992, and the subsequent ratification of this United Nations legally binding treaty, the Government of Canada has been working towards an improved protective framework for conserving biodiversity. The Canadian Biodiversity Strategy calls for a central thrust in education and research, and calls for active participation from the academic community.

Biodiversity is at the centre of public attention. There is a great need to understand its role in our environment and there is still very little known about its function. We lack a central thrust in field testing of some of the central theoretical issues. Field experiments are needed to see if the conservation strategies for different taxa are convergent or divergent, and the circumstances for different outcomes. This would entail GIS studies on distribution, detailed investigation of biologies, habitat requirements, population parameters, and familiarity in all conservation problems and possible solutions. There is an urgent need to investigate real landscape level problems in a realistic manner, integrating biodiversity conservation issues with economic and sociological needs in well defined circumstances. Optimization of strategies need to be explored, along with actual decision making with respect to the allocation of land and resources.

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We recommend a broad search for an excellent scientist with biodiversity research expertise, and interest in the above-mentioned area of investigation. Field testing

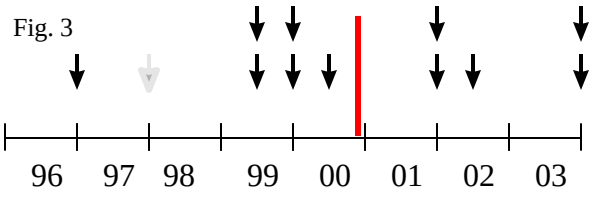
methodology and time frame suggests that an invertebrate biologist with specialization in either entomology or marine biology would be best suited for this position.

The individual hired for this position should be willing to take an active role in the Centre for Biodiversity Research, and collaborate with researchers in the Centre for Biodiversity Research, and the Centre for Applied Conservation Biology. It is anticipated that the biological collections in Botany and Zoology would be essential reference for the research entailed.

5.2.8 Appendices

5.2.8.1 Appendix I Retirement Pattern:

Fig. 3



This figure shows the pattern of retirements in the recent past and near future. The vertical bar indicates the present date

The Department currently has 38 professors (approx. 33 FTE) and 6 instructors (4.75 FTE). As shown in the table of projected retirements below (Appendix 1), we will lose 10 and 1/3 professorial positions between Dec 96 and the end of 2003 and one Instructor (thick arrow, Fig. 3). As shown below, we are holding our strength generally. There is then a 2 ½ year gap between the end of 2003 before the next set of 12 retirements starts in mid 2006. These retirements result in nearly complete loss of our present strength in organismal biology, and threaten significant reduction in strength in physiology and ecology.

Table 1. Retirement Schedule 1996- 2003 -12 Retirements

1996 Dec	Perks	Endocrinology, Physiology	Full appointment, replaced by Airriess
1997 Dec.	Vizsolyi	Vertebrate physiology Laboratory instructor	full appointment Replaced by Lacombe
1999 July	Lewis	Zoogeography, Zooplankton ecology	1/3 appointment - 2/3 Oceanography not replaced
1999 July	Scudder	Evolution, entomology comparative anatomy	full appointment replaced by Panté
1999 Dec.	McPhail	Fish Biology, evolutionary biology, zoogeography	full appointment not replaced
1999 Dec.	Phillips.	Cell physiology, epithelial transport insect physiology	full appointment, replaced by Auld
2000 July	Holm	genetics, cell biology	full appointment not replaced
2001 Dec.	Krebs.	Population Ecology, small mammals	full appointment
2001 Dec.	Liley	Behaviour, reproductive physiology, fish	full appointment
2002 July	Hochachka	Physiology , adapation, intermediary metabolism, vertebrates	full appointment
2003 Dec.	Carefoot	invertebrates, environmental	full appointment

		physiology,	
2003 Dec.	Randall.	physiology, cardiovascular, fish	full appointment
2006 July-2009 Dec	13.5	12 professors 1.5 instructors	

5.2.8.2 Appendix 2. Appointment Pattern:

Name	Date	Particulars
Auld	94	Neurobiology – physiology / genetics
Otto	95	Evolutionary Biology - theory
Whitlock	95	Evolutionary Biology – population genetics
Tetzlaff	95	Neural Regeneration CORD appointment molecular physiology / cell and developmental biology
Taylor	96	Evolutionary Biology – Fish Biology
Airriess	96	Molecular Physiology endocrinology developmental biology – resigned as of June 2000
Lacombe (instructor)	98	Vertebrate physiology teaching lab
Döbeli	Jan 99	50% appointment – shared with Mathematics. New appointment slot – Mathematical Ecology
Panté	Jan 00	100% appointment in Scudder F slot

5.2.8.3 Appendix 3 Gain / Loss by discipline area

Area	Losses	Gains	Net Gain (Loss)
Organismal Biology	Scudder (99) McPhail (99) Lewis (1/3) (99)	Taylor (96)	(1.33)
Evolutionary Biology	Scudder (99) McPhail (99)	Whitlock (95) Otto (95) Taylor (96)	1
Physiology	Phillips (99) Perks (96) Vizsolyi (97)**	Auld (94) Airriess (96) Tetzlaff (95)* Lacombe (98)**	1
Cell Biology	Holm (00)	Panté (00)	0
Ecology	Lewis (99) (1/3)	Döbeli (1/2) (99)	0.17
* Endowed Chair – reduced teaching, ** Instructor positions teaching only			

5.3 Departmental Organization

The Department of Zoology at UBC is a large, diverse department. One of the consequences of this is that there are legitimate internal tensions between the department's various constituencies. In particular, these come to the fore in discussions of common infrastructure resources, e.g. Animal Care, that has been subsidized by the department, though only used by only a few members of the department vs. Support for culture of Drosophila, which has never been supported by the department even though the number of people using flies now is as great or greater that the number using the animal care facility.

At a broader level these issues divide faculty on level or organization lines. Those individuals whose research is focused at the suborganismal level have substantial needs for molecular biology infrastructure. This has led to the suggestion that the department should consider separation into two departments, a Zoology Department and a Cell Biology Department.

Distribution of Zoology Faculty to form two groups based on level of organization		
Suborganismal	Organismal and Superorganismal	
Brock (1)	Adamson(1)	Myers, Neill, Walters (1)
Matsuuchi(1)	Gass(1)	Redfield(1)
Auld(1)	Jones(1)	Otto(1)
Steeves(1)	Hochachka(1)	Whitlock(1)
Tetzlaff, Horner (1 total)	Kasinsky(1)	Schluter(1)
Gosline(1)	Pitcher, Pauly, Doebeli(1)	Smith(1)
Moerman(1)	Milsom(1)	Sinclair(1)
Grigliatti(1)	Taylor(1)	Krebs(1)
Berger(1)	[Physiogist]	[ecologist]
Pante(1)	Carefoot(1)	Blake(1)
[Roskams(0.5)?]	Liley(1)	

The idea of forming a Cell Biology Department is attractive because cell biologists are spread across a half-dozen departments, and in no case are there sufficient numbers to form a critical mass. One of the consequences of this is that cell biologists have been very active in formation of alliances and linkages at a research level between departments and faculties. Carrying the approach farther would lead to the formation of some sort of virtual structure for cell biology that transcends department and faculty lines.

This leaves several options:

- Remain as a unified vertically integrated Zoology Department
- Encourage the formation of virtual structures to deal with the communication and infrastructure needs of cell biologists spread across several departments in three faculties. Change internal organization so that the research, infrastructure needs and educational needs of ALL SUBGROUPS can be more effectively acted on. This substructure needs to have power to act as well as to recommend.

- Develop an umbrella organization (e.g. College of Life Sciences) that might provide for better integration of the needs of several groups of faculty in different programs.
- Form a new Cell Biology Department starting with a nucleus of cell biologists from the Department of Zoology. The Zoology Department would remain as a strong integrated Zoology Department with an emphasis at the organismal and super organismal levels. It would have about 22 Faculty.

The possibility of forming a Cell Biology Department from the nucleus of suborganismal biologists in the Zoology Department is problematic because the size of the group would be below the minimum department size (15). This would require the addition of cell biologists from another department (Botany, Microbiology and Immunology, or Anatomy) to make it viable, and would thus require the reorganization of more than one department. The present physiology group in Zoology would be divided between both departments with approximately equal numbers of individuals going to the suborganismal group and the organismal group. This is politically difficult; as the university administration is not favourably disposed toward reorganization of Departments.

Loss of the suborganismal biologists to another department would still leave a very strong integrated zoology department of about 20 faculty FTE.

5.3.1 Arguments for remaining as a vertically integrated Zoology Department

There are some very fundamental arguments for remaining as a vertically integrated Zoology Department

1) **Scientific arguments**
    a) Many interesting and important biological problems transcend a single level of organization.
    b) There is a common theme of animal biology that informs work in all areas of the Department and provides a cohesive theme throughout the Department.
    c) Recent developments in molecular biology and comparative genomics will lead over the next years to an intense re-examination of questions of organismal integration. Once molecular biological techniques are established, the two obvious areas of interest are developmental and physiological regulation. Similarly, advances in evolutionary biology, pioneered in this department, are now poised to ask how the differences in behaviour and structure of organisms that arise in response to selective pressure are rooted in developmental and physiological processes
2) **Infrastructure Arguments.** Rather than dividing the department so that a better focus on infrastructure needs can be obtained, the alternative and better solution is to increase the size of the infrastructure pie. All sectors of the department need to pursue CFI funding and other means of increasing the admittedly inadequate departmental infrastructure to the benefit of all sectors of the department.

5.3.2 Arguments for formation of a Cell Biology Department.

On the other hand some strong arguments can be made for formation of a Cell Biology Department starting with a nucleus of cell biologists from the Zoology Department.

1) **Scientific merits.**

   a) Having colleagues that work in a similar research area allows for the creation of a critical mass.

      - Note: The members currently in the sub-organismal group represent widely different areas of research so its impossible to create a critical mass in our current state. As a result, members of this subgroup have reached out to others on campus and formed strong scientific liaisons with members OUTside of Zoology. This in turn has weakened the bonds of these individuals with Zoology and allowed them to concentrate energies to projects that are not related to the department. Even if the department doesn't realign, the energy, enthusiasm and service of many of these individuals is already lost.

   b) Colleagues can then have high level scientific discussions among themselves which will promote the development of innovative ideas and encourage new approaches. What we currently have are departmental colleagues who we can talk to at relatively shallow levels about our research. Over time, discussions are more often avoided than pursued. A larger group of faculty working in the same or similar research areas would increase the chances of more than one 'critical mass' forming.

   c) Graduate students will have classmates, fellow students, postdocs and research associates to talk science with and gain the advantage of the experience of senior/older members. Better career counselling and a better graduate experience would occur.

2) **Infrastructure advantages.** The more department members that work in the same or similar research areas, the greater the chance that the infrastructure needs of the different members will be the same. Having similar infrastructure needs allows the group to become better equipped. Having better resources allows department members to do more competitive research, publish more papers and obtain more research grants. In the larger department, with limited resources, each interest group is always at odds with the others as they compete for what money is available. Moreover, the members of the various groups often do not know what type of equipment is essential for research in a different discipline and this leads to arguments.

   - Note: A good example of a smaller department that is very successful in terms of its infrastructure the Micro/Immunol Dept. Although there is a division between the bacterial and Immunological members of that department in terms of research interests, all members use the same molecular/biochemical/cell biological equipment. What limited departmental funds that are available are often used to buy items needed by all. This department has also been very successful applying

for equipment grants and part of it is because the need for the equipment is obvious and because they have more than 3 individuals with similar equipment needs.

3) **Graduate education.** A more highly focussed department should enhance the graduate experience of the students. It would (and has) allow for the establishment of discipline specific courses. For example three years ago the Cell/Genetics group has put in place a non-seminar, graduate Cell Biology course that attracts students from many different departments across campus. The Evolution group in the department has done the same thing.

4) **Undergraduate Teaching –** There would be virtually no effect as the Biology Program would continue as at present. Procedures for interdepartmental sharing are already in place.

5) **It can be argued that the Department is already effectively divided along suborganismal / organismal-superorganismal lines:**

- Dept. members scientifically interact with limited subgroups of faculty
- Most scientific interactions are outside of the Zoology department
- Members serve on limited subsets of graduate student's committees.
- We attend very different seminars.
- We attend different Journal Clubs.
- We attend different scientific meetings.
- We apply to very different granting agencies.
- We review for different journals
- We serve on grant review panels that are very different
- We don't use the same equipment; We need different infrastructure. (This will change as Ecology and Evolutionary studies become more molecular).
- We need different departmental services.
- We advise different students.