

THE UNIVERSITY

OF IOWA

GENERAL CATALOG

74/76

THE UNIVERSITY OF IOWA IOWA CITY, IOWA

BULLETIN

and Ph.D. degrees are taken in one of the participating departments; degrees are not now offered in genetics. However, a proposal to grant the Ph.D. degree in genetics was under consideration at the time of *Catalog* publication; questions about the status of the proposal should be addressed to the chairman of the Interdisciplinary Committee for Genetics.

Undergraduate students who want to prepare for graduate study in genetics should complete an undergraduate degree with a major or emphasis in science. Most of the present students in genetics were prepared in botany and zoology.

Aided by a Biological Sciences Development Award from the National Science Foundation, the University has recently increased its faculty in genetics. The program depends primarily upon these several geneticists, especially for teaching, but involves a number of other scientists whose research includes genetics.

Faculty Roster

Professors Conway (Biochemistry), Frankel (Zoology), Milkman (Zoology), Mohler (Zoology), Six (Microbiology), Winokur (Psychiatry), Zellweger (Pediatrics); *associate professors* Carlson (Botany), Hegmann (Zoology), Ionesescu (Pediatrics), Menninger (Zoology), Surzycki (Botany), Tsuang (Psychiatry); *assistant professors* Donelson (Biochemistry), Feiss (Microbiology), Gussin (Zoology), Newlon (Zoology), Soll (Zoology), Schrott (Internal Medicine), Walker (Microbiology).

Courses

Biochemistry

99:131 Molecular Genetics 3 s.h.
Same as Zoology 37:171.

Botany

2:102 Genetics 3-4 s.h.
Same as Zoology 37:109.
2:128 Fundamental Genetics 3 s.h.
Same as Zoology 37:128.
2:129 Fundamental Genetics Laboratory 1 s.h.
Same as Zoology 37:129.
2:104 Cytogenetics 3 s.h.
2:160 Genetics of Cell Organelles arr.
2:161 Eukaryotic Cell Biology 3 s.h.

Microbiology

61:170 Microbial Genetics 3-4 s.h.
61:270 Topics in Molecular Biology 2 s.h.

Zoology

37:109 Genetics 3-4 s.h.
Same as Botany 2:102.
37:128 Fundamental Genetics 3 s.h.
Same as Botany 2:128.
37:129 Fundamental Genetics Laboratory 1 s.h.
Same as Botany 2:129.
37:131 Evolution 4 s.h.
Same as Botany 2:131.
37:160 Advanced Genetics 4 s.h.
37:162 Population Genetics 3 s.h.
37:163 Behavioral Genetics 3 s.h.
37:165 Quantitative Genetics 3 s.h.

37:171 Molecular Genetics 3 s.h.
Same as Biochemistry 99:131.
37:172 Topics in Molecular Biology 2 s.h.
37:173 Molecular Genetics Laboratory 1 s.h.
37:175 Topics in Evolutionary Genetics 1-2 s.h.
37:215 Genetics Seminar 0-2 s.h.
Same as Botany 2:204, Microbiology 62:215.
37:260 Developmental Genetics 2 s.h.
37:263 Seminar: Behavioral Genetics 1 s.h.

Geography

Department Chairman: Clyde F. Kohn
Degrees offered: B.A., B.S., M.A., Ph.D.

Vanished is the legendary encyclopedia-geographer crammed with isolated bits of information ranging from the capital city of Mauritania to the annual Yakima Valley apple production or the height of the highest mountain in Outer Mongolia. Modern geography is concerned more with the spatial aspects of human behavior than with the memorization of rainfall data, crop production or the length of rivers. Students who elect courses in geography soon find that geographic insights and methods of inquiry are related to the solution of many of the complex problems confronting modern societies, such as air and water pollution, traffic problems, the development of ghettos in large cities, distribution and availability of natural resources rapidly increasing populations and conflicts between nations. Increasing numbers of undergraduates are discovering that a major in geography provides them with concepts and methods for organizing cities, market regions, school districts or other human institutions.

Much of modern geography is problem-oriented. It is scientific as well as humanistic in its approach to the solution of these problems. It is involved with two basic considerations: the best means to obtain accurate facts or data; and the tools and techniques necessary for analyzing these data to see if they verify or alter existing explanations for the facts as they are observed.

Modern technology has come to the aid of the profession in achieving both of these goals. Satellite instrumentation, such as radar, infrared and visible light cameras, is being used to gather information for understanding and solving a wide range of human problems. The computer has proved to be a priceless aid in analyzing these data, which are contributing to the planning of urban areas, the development of better policies and practices for the use of resources, the solution of pollution and other environment-man problems, the easing of internal and international conflicts, and many other endeavors. Today's geography is man-centered and contributes to the decision-making processes involved in determining how man can improve the quality of life in this complex age.

Career opportunities for undergraduate majors in geography exist in various branches of government and in business. There is a demand for persons capable of dealing with resource management, economic development, market area analysis and other problems related to the distribution and spatial interaction of physical, economic, social and political phenomena in the world as a whole or in major parts of it.

There is also a growing demand for young people concerned with man's perception of and subsequent interactions with his

total environment. Courses in geography are commonly required of students preparing to enter the teaching profession at the elementary and secondary school levels, of students who want to work in urban and regional planning, and as a background for many related professions, including law, hospital administration and transportation engineering.

The Undergraduate Program

The Geography faculty has developed an undergraduate program which contributes to the liberal education of all undergraduate students; it provides innovative and relevant preparation of undergraduate majors for careers in which an understanding of geography is basic, and it joins in significant interdepartmental programs involving regional, urban and environmental components.

Several geographic themes and principles compose the intellectual framework of the discipline and serve as unifying threads through all courses constituting the Department's program. The emphasis is on the spatial aspects of human behavior, environment-man relations, the spatial organization of territory for achieving institutional goals and the geography of particular parts of the world, such as newly developed regions.

Students electing to major in geography will be exposed to concepts and methods of inquiry in physical, economic, social and political geography, especially as they relate to urban areas. They will be taught how to state problems from a geographic point of view, where and how to find relevant data for analyzing these problems, how to relate their findings to existing theories and how to apply their findings to real-world situations.

Geography courses open to undergraduate students may be taken in any order or simultaneously; no undergraduate course in geography has any prerequisites. Most courses below the 100 level are open to freshmen.

Students majoring in geography must meet the general College of Liberal Arts skills and core requirements. Credits earned in 44:1 Introduction to Human Geography, 44:2 Natural Environment and Man, 44:11 Introduction to Social Geography, 44:19 Natural Environmental Issues, 44:30 Introduction to Economic Geography and 44:35 Introduction to Urban Geography may be applied toward the social science core requirement.

The Bachelor of Arts and Bachelor of Science degree programs both require 26 semester hours of coursework in geography, at least 15 semester hours of which must be taken in 100-level courses including 44:108 Introduction to Quantitative Methods in Geography, 44:138 Spatial Organization and 44:150 Undergraduate Seminar for Geography Majors. If possible, these three courses should be taken in the order indicated. With his or her adviser's permission, the student may substitute for 44:108 an appropriate course in statistics, such as 22S:102 Introduction to Statistical Methods, or its equivalent.

Students in the B.S. program must also complete 22M:25 Calculus I or its equivalent, or 22C:7 Introduction to Computing with Fortran.

Students who want professional careers in geography or related areas are urged to complete the B.S. program; others may elect the B.A. program. Those contemplating careers in foreign service should become proficient in the appropriate foreign language.

As early as possible, undergraduate majors should consult with the chairman of the department for assignment to a faculty

adviser who will help plan study programs best suited to individual needs and interests. For example, for students especially interested in physical geography or in problems relating to the natural environment and man, the following cluster of courses, in addition to 44:1 Introduction to Human Geography and 44:2 Natural Environment and Man, is recommended: 44:19/119 Natural Environmental Issues, 44:30 Introduction to Economic Geography, 44:101 Introduction to Weather and Climate, 44:120 Natural Hazards, 44:121 Stream Processes and Landforms, 44:122 Natural Resources of the United States, 44:123 Geography of Natural Resources, 44:180 Field Techniques in Natural Environmental Problems and 44:191 Energy in Contemporary Society.

Students interested in problems related to urban growth and development and the formulation of urban and regional policy, or who are considering careers in urban and regional planning, might in addition to 44:1 and 44:2 elect 44:11 Introduction to Social Geography, 44:30 Introduction to Economic Geography, 44:35 Introduction to Urban Geography, 44:115 Political Geography of Cities, 44:116 Political Ecology, 44:130 Location of Services, 44:132 Industrial Location, 44:135 Urban Geography, 44:136 The Inner City, 44:137 Metropolitan Growth and Development, 44:161 African Development and 44:191 Energy in Contemporary Society. Other clusters may be designed by the student with the help of his or her adviser.

The Graduate Program

The goals of the Department at the graduate level are to prepare students to carry on creative and productive research in geography involving the use of theory, modeling and formal verification methods; to prepare students for positions in research, teaching or some area of applied geography; and to help students develop their ability to apply knowledge of facts, theories and methodology to specific societal programs. The achievement of these goals is demonstrated in large measure by the demand for Iowa graduates to fill positions on college and university faculties, in research-oriented institutions and in business and government.

The graduate program at Iowa is concerned with the locational analysis of physical, economic, social and political phenomena; the spatial aspects of human behavior; and the interaction of man and his environment.

The Department offers specialized instruction in the teaching of geography at the college level (44:206 Teaching College Geography and 44:306 Research Seminar: The Teaching of Geography) for those interested in academic careers. Opportunities are provided for all graduate students to gain practical teaching experience through service as departmental teaching assistants or through other supervised teaching duties. Graduate students who plan to become college teachers are strongly encouraged to complete 44:206 Teaching College Geography.

Master of Arts

The Department offers two programs leading to the Master of Arts degree, with and without thesis. All students whose objective is the Master of Arts degree are required to complete a minimum of 30 semester hours of graduate work including 44:201 Geographical Analysis and 44:208 Quantitative Analysis I. The remainder of both programs must be composed of graduate-level courses or research seminars as approved by the facul-

ty or the student's adviser. A maximum of six semester hours of credit may be earned by the satisfactory completion of a thesis for those who wish to take the Master of Arts degree with thesis. All students must pass a final examination.

Doctor of Philosophy

Students whose degree objective is the Doctor of Philosophy are required to complete 44:201 Geographical Analysis and 44:208, 209 Quantitative Analysis I, II, preferably during their first year in residence. However, the student may meet these requirements with a satisfactory performance in written examinations during the first week of the first semester for which he or she registers.

All doctoral students must also complete two research seminars, preferably during their second year in residence, under the direction of different faculty members. They are also required, unless excused by the faculty, to register for 44:350 Staff Seminar each semester while in residence. During the academic year, one semester hour of credit will be awarded each semester on a satisfactory/unsatisfactory basis for this course. The remainder of the Ph.D. program includes appropriate graduate courses, seminars and research in geography, depending on the interest of the student; courses in disciplines closely related to the student's objectives and interests; and courses which satisfy the tool requirements.

Programs for students who wish to study for the Ph.D. in geography are established separately for each student. For this reason, as soon as possible after beginning graduate work, doctoral students are urged to declare a general area of specialization within the discipline and to secure a faculty adviser. During the second year in residence, if possible, the doctoral student should declare a specific field of specialization within his or her general area of interest.

Preferably during his or her second year in residence, and not later than the fifth semester, the doctoral student, with the approval of his or her adviser, must submit an original research paper to the faculty, which will pass upon the merits of the research thus demonstrated. The student becomes a Ph.D. candidate when this qualifying paper has been accepted.

Research tool requirements for Ph.D. candidates are of two kinds. One is the course 44:208 Quantitative Analysis I; the other may be satisfied by completing any other appropriate course, as approved by the faculty at the time the student declares his or her specific area of specialization.

Candidates for the Ph.D. degree are required to pass a comprehensive examination consisting of written and oral parts, demonstrating analytical proficiency in a major area of specialization and a general knowledge of the discipline, including both content and methodology. Upon passing the comprehensive examination, the doctoral candidate will prepare a research design to be presented before the staff seminar. After the design is approved by the faculty, the candidate is expected to conduct the necessary research and analysis, and to present his or her findings in an approved dissertation which must be defended in a final oral examination.

All doctoral candidates are expected to have supervised experiences as classroom instructors and research assistants before being awarded the Ph.D. degree.

Graduate Admission

In determining the admission of a student to the graduate pro-

gram, the Geography Department considers the total record of each student individually. In addition to the general rules and regulations set forth in the *Manual of Rules and Regulations of the Graduate College*, the Department considers the student's undergraduate grade-point average, especially during his or her junior-senior years; scores on the Graduate Record Examination Aptitude Test; letters of recommendation from those with whom he or she has taken courses; and an essay in which the applicant sets forth the reasons for wanting to continue his or her study of geography at The University of Iowa. An applicant with an undergraduate grade-point average between 2.5 and 2.75 will be admitted for the M.A. degree on condition only and must achieve a grade-point average of 2.75 or better on the first 12 hours of graduate work, as approved by the Department, in order to remain as a graduate student. Foreign students and others from undergraduate institutions which evaluate students on a basis other than grade-point averages will be considered according to their relative academic standing in their respective institutions.

Innovations in Teaching

In recent years, faculty members have initiated some interesting changes in their teaching strategies, in order to improve their instruction and to develop greater student interest and participation.

Courses have been re-oriented, from an emphasis on a body of knowledge to be learned to the development of problem-solving abilities. In some instances, lectures are no longer the focus of a course. Rather, lectures and reading assignments are built around the activities to be performed in discussion-laboratory periods. Teaching units in which computers are used to manipulate the parameters of spatial models have been introduced in several of the undergraduate and graduate courses.

Research Productivity

Since its origin, the Department has made significant contributions to the advancement of research in geography. It was among the first in the country to adapt scientific methods to geographic research, to use quantitative methods in the analysis of the location and distribution of natural and cultural phenomena over the earth's surface, and to develop mathematical models and geographic theory. Its faculty is currently interested in problems such as the political-spatial organization of cities, development of preference structures for spatial choice patterns, energy resources and their utilization, patterns and processes of economic development and nation-building in Africa, spatial organization of political systems, the interrelations of the natural environment and man, the development and distribution of fluvial and glacial landforms and mass movement, the natural resource base and urban spatial analysis.

Rating of Department

In its recent evaluation of graduate departments, the American Council on Education ranked the Iowa Department of Geography as "strong." The Department was also included in the ACE's list of 15 "leading" departments of geography in the nation.

The Faculty

Individual faculty members participate in University, local, state, national and international groups whenever significant use can be made of their special professional competencies. They give time and energy to professional organizations and have served as executive officers, members of governing boards and review and consulting editors for the Association of American Geographers, the National Council for Geographic Education, the Regional Science Association, the International Geographical Union and the National Council for the Social Studies.

Relations with Other Departments

In both their instructional and research efforts, members of the Geography faculty work closely with their colleagues in other departments within the College of Liberal Arts, as well as in other divisions of the University, and especially with the Institute of Urban and Regional Research. The Department's interest in problems relating to the environment and man, for example, has led to cooperation in the establishment of interdisciplinary courses and research projects with other departments in both the natural and social sciences, as well as in the colleges of Engineering, Medicine and Law.

The Map Library

Housed on the third floor of the Main Library, the Map Library contains more than 60,000 maps, a total of 1,850 atlases and reference works, and about 60,000 aerial photographs, primarily of Iowa. The map collection in the Library is a depository library for maps of the U.S. Army Topographic Command, formerly Army Map Service. The Geology Library contains approximately 50,000 maps, including both geologic maps and U.S. Geological Survey topographic maps. The Department of Geography has its own collection of topographic maps, maps of large urban centers and aerial photographs for use by students in working out laboratory exercises.

In recent years, the Department has been fortunate in receiving grants for supporting research and service activities. Many of these grants include funds for supporting research and other assistants.

Faculty Roster

Professors Dueker, Horton, Kohn; *associate professors* Lindberg, McNulty, Reynolds, Rushton, Salisbury; *assistant professors* Granger, Honey.

Courses

Primarily for Undergraduates

- 44:1 Introduction to Human Geography** 4 s.h.
Application of geographic principles to contemporary, social, economic and political problems; urban growth; problems of the ghetto; diffusion of innovations; territoriality and perception.
- 44:2 Natural Environment and Man** 4 s.h.
Spatial distribution of the world's natural resources including climate, water, landforms, soils, vegetation and minerals; man's role in defining nature of resource base; regional problems in resource use, environmental pollution and natural hazards.
- 44:11 Introduction to Social Geography** 4 s.h.
Spatial considerations of population growth and distribution; minorities within a population; poverty; housing; social organization and disorganization; social sys-

tems including education, religion, recreation, medical and social services; diffusion of ideas and traits over space.

- 44:19 Natural Environmental Issues** 2 s.h.
Issues arising from man's use of natural environment and related problems resulting from expanding world population; air, water and land pollution; population pressures on agricultural resources; energy and mineral resource requirements versus quality of environment.
- 44:30 Introduction to Economic Geography** 4 s.h.
Location and spatial organization of world's major types of economies; agriculture, energy and minerals, manufacturing, transportation; trade and service centers.
- 44:35 Introduction to Urban Geography** 4 s.h.
Processes of urbanization and city growth; spatial structure and pattern of urban activities; geographic considerations of contemporary urban problems; the city and its physical setting; comparative urban studies.
- 44:100 Readings for Undergraduates** arr.
Supervised readings in geography; permission of instructor required before registration.

Courses for Undergraduates and Graduates

- 44:101 Introduction to Weather and Climate** 3 s.h.
Spatial distribution of weather elements, wind circulation, air masses, storms and general world climatic conditions including air pollution and climatic change; laboratory work in study of weather maps and climatic data.
- 44:106 Geography in the School Curriculum** 3 s.h.
Concepts and content of geography essential to effective educational programs; methods of geographic inquiry; use of audiovisual media in teaching geography.
- 44:108 Introduction to Quantitative Methods in Geography** 3 s.h.
Applications of mathematical and statistical techniques in geography.
- 44:115 Political Geography of Cities** 3 s.h.
Political organization of urban areas and the problems and impact of reform; locational decisions and conflict situations in metropolitan areas.
- 44:116 Political Ecology** 3 s.h.
Social science perspectives on relationships between the political behavior of individuals, groups and systems, and the structures of their social, cultural, political and economic environments; theories of political and spatial organization based on assumptions of political and economic rationality.
- 44:119 Natural Environmental Issues** 2 s.h.
Issues arising from man's use of the natural environment and related problems resulting from an expanding world population; air, water and land pollution; population pressures on agricultural resources; energy and mineral resource requirements versus the quality of the environment.
- 44:120 Natural Hazards** 3 s.h.
Man-environment relationships under extreme environmental conditions; causes, characteristics and consequences of extreme events such as earthquakes, tornadoes, blizzards, droughts and floods; human adjustments to these events, ranging from immediate responses like denial of occurrence and evacuation to long-term responses like forecasting, flood control, zoning and insurance.
- 44:121 Stream Processes and Landforms** 3 s.h.
Characteristics of drainage basins and alluvial landforms; the role of running water and mass movement in shaping the form of the land surface; floods and their interrelationships with land use.
- 44:122 Natural Resources of the United States** 3 s.h.
Nature and patterns of regional differences in the natural resource base for agriculture and industry including land, water and minerals; environmental problems and conflicts arising from resource development.
- 44:123 Geography of Natural Resources** 3 s.h.
Definition, evaluation and exploitation of natural resources as developed through time and within different cultural settings.
- 44:130 Location of Services** 3 s.h.
Problems in the effective spatial organization of public and private facilities; central place theory; modeling spatial choices between service sites; spatial outcomes of alternative behavioral strategies for reorganizing service systems; location-allocation algorithms and their use in planning and evaluating the spatial delivery of social and economic services.
- 44:132 Industrial Location** 3 s.h.
Theory and practice of manufacturing location and its application to different industries and types of economy; investigations of selected case studies.
- 44:135 Urban Geography** 3 s.h.
Models of urban growth and urban forms; spatial patterns of selected activities; processes that generate these patterns; current problems.

- 44:136 The Inner City** 3 s.h.
Residential segregation of minorities; spatial structure of ghetto areas; environmental quality of inner city neighborhoods; spatial aspects of problems of economic and social stress.
- 44:137 Metropolitan Growth and Development** 3 s.h.
Historical and contemporary forces affecting the development of metropolitan areas; contextual and spatial perspective of forces of change; population processes and spatial population forecasting; value orientation, change and conflict; policy issues.
- 44:138 Spatial Organization** 3 s.h.
Approaches to spatial analysis of human activities and natural processes.
- 44:139 Urban Problems** 3 s.h.
Geographical perspective on problems of urban life; processes involved and policy implications of such topics as sprawl, redevelopment, housing, segregation, transportation, crime, health care, air pollution.
- 44:141 United States and Canada** 3 s.h.
Methods of analysis of regional economic and social development with specific application to regions of United States and Canada.
- 44:150 Undergraduate Seminar for Geography Majors** 2 s.h.
Participation in a term project and preparation of a documented report. Prerequisites: 44:108 and 44:138, or equivalents.
- 44:161 African Development** 3 s.h.
Problems of economic, political and spatial integration in Africa; patterns and processes of economic development and nation-building. Same as Political Science 30:146 and American Civilization 45:162.
- 44:162 The Third World** 3 s.h.
Geographical patterns and processes of underdevelopment; spatial implications of colonialism and neocolonialism; alternate concepts of spatial planning in the third world.
- 44:165 The Changing World** 3 s.h.
Conceptualization of the world as an increasingly interconnected system; similarities and differences in the ways diverse regions are participating in the changing world.
- 44:170 The World of Wine** 2 s.h.
Production, distribution and consumption of wines throughout the world with emphasis on quality of wine as related to landforms, soils, weather conditions; viticultural practices in the different grape-growing areas.
- 44:180 Field Techniques in Natural Environmental Problems** arr.
Mapping and survey techniques as applied to natural resources; problems in resource evaluation and management in their field settings.
- 44:190 Perspectives of Man-Environment Issues** arr.
Relationships between man's social behavior and biological and physical aspects of his environment; impact of technology on environment; technological, economic, political and behavioral solutions to environmental problems; same as Anthropology 113:191.
- 44:191 Energy In Contemporary Society** 3 s.h.
Technical, legal, economic and behavioral issues in energy production, delivery and use; emphasis on cross-disciplinary implications of energy systems. Prerequisites: junior, senior, professional or graduate status. Same as Mechanical Engineering 58:191 and Law 91:191.

Courses for Graduates Only

- 44:200 Readings** arr.
Graduate students who have interest in pursuing specific topics of their choice may do so by registering for supervised readings in geography. Permission of instructor required before registration.
- 44:201 Geographical Analysis** 4 s.h.
Past and present philosophies of geography in light of methodological developments and philosophies of science in general; review of research methodologies.
- 44:206 Teaching of College Geography** 3 s.h.
Roles of college faculties; goals and objectives of geography teaching; alternative instructional methods; evaluation systems; emphasis on application in the college classroom.
- 44:208 Quantitative Analysis I** 3 s.h.
Problems of drawing inferences from data in studies using simple measures; research design; commonly-used measures of statistical and spatial association; logic of statistical inference and hypothesis testing; simple correlation and regression analysis; introduction to computer modeling. Prerequisite: introductory statistics or consent of instructor.

- 44:209 Quantitative Analysis II** 3 s.h.
A continuation of 44:208. Statistical and mathematical analysis in current geographical research with emphasis on problem formulation and research design; multiple correlation and regression; analysis of variance; testing causal models; selected topics in multivariate analysis, scaling and network analysis. Prerequisites: 44:201 and 44:208 or consent of instructor.
- 44:215 Locational Analysis of Political Behavior** 3 s.h.
Locational basis of political and quasipolitical behavior at individual and various systems levels; spatial dimensions of electoral behavior; aspects of political modernization; urban public policy-making. Prerequisite: 44:201, 44:209 or consent of instructor.
- 44:216 Behavioral Analysis in Geography** 3 s.h.
Various behavioral model-building strategies pertaining to spatial behavior and spatial structure with emphasis on environmental perception approaches. Prerequisite: 44:201, 44:208 or consent of instructor.
- 44:226 Seminar: Urban Transportation Issues** 3 s.h.
Same as Urban and Regional Planning 102:226.
- 44:227 Seminar: Urban Information Systems** 2-3 s.h.
Same as Urban and Regional Planning 102:227.
- 44:230 Locational Analysis of Economic Behavior** 3 s.h.
Classical theories for location of economic activities contrasted with alternate approaches of spatial analysis school of economic geography; contemporary efforts to develop behavioral models of decision-making contrasted with mathematical programming and heuristic programming approaches to solutions of spatial allocation problems. Prerequisite: 44:130, 44:201, 44:209 or consent of instructor.
- 44:235 Spatial Structure of Residential Areas** 3 s.h.
Behavioral processes as related to spatial patterns of residential areas; processes of residential site selection and attributes of residential areas; linkages between residential areas and other elements of urban areas. Prerequisite: 44:201, 44:208 or consent of instructor.
- 44:236 Travel Behavior in Urban Areas** 3 s.h.
Theoretical and conceptual basis of urban travel behavior; current models of travel behavior; interaction between intra-urban spatial structure and travel behavior; new research strategies and experimental behavioral models helpful in gaining insight into urban travel behavior processes. Prerequisite: 44:201, 44:208 or consent of instructor.
- 44:237 Urban Spatial Analysis** 3 s.h.
Processes and policy considerations related to urban growth and change; theoretical and operational strategies employed in identifying and forecasting change in urban morphology and activity locations within cities. Prerequisite: 44:201, 44:208 or consent of instructor.
- 44:251 Environmental Systems Analysis** 3 s.h.
Environmental systems using mathematical-physical models of the interrelations between the natural environment and man using optimization, time series analysis, benefit-cost analysis and simulation techniques. Prerequisite: 44:208 or consent of instructor.
- 44:261 Geographical Perspectives on Development** 3 s.h.
Theoretical and empirical studies of the development process with special emphasis on spatial implications of socioeconomic changes attendant upon development. Prerequisite: 44:201, 44:208 or consent of instructor.
- 44:275 Urban Growth in Developing Countries** 3 s.h.
Cross-cultural and interdisciplinary analysis of problems associated with urbanization and development in the developing nations. Same as Anthropology 113:275, Economics 6E:275, Social Work 42:275, Sociology 34:275 and Urban and Regional Planning 102:275.
- 44:280 Field Techniques in Physical Geography** arr.
Sampling procedures and collection of field data in physical geography together with laboratory analysis of data.
- 44:306 Research Seminar: The Teaching of Geography** arr.
- 44:308 Research Seminar: Quantitative Methods, Computer Methods and Modeling** arr.
- 44:311 Research Seminar: Geographic Analysis of Social Behavior** arr.
- 44:315 Research Seminar: Locational Analysis of Political Behavior** arr.
- 44:316 Research Seminar: Space Perception** arr.
- 44:318 Research Seminar: Pleistocene** arr.
- 44:319 Research Seminar: Physical Geography** arr.
- 44:320 Research Seminar: Natural Hazards and Problems** arr.

44:330 Research Seminar: Geographic Analysis of Economic Behavior	arr.
44:331 Research Seminar: Location Theory	arr.
44:335 Research Seminar: Urban	arr.
44:336 Research Seminar: Urban Travel Behavior	arr.
44:337 Research Seminar: City Growth and Development	arr.
44:350 Staff Seminar	arr.
44:380 Field Seminar	arr.
44:406 Research: The Teaching of Geography	arr.
44:408 Research: Quantitative Methods, Computer Methods and Modeling	arr.
44:419 Research: Physical Geography	arr.
44:440 Research: Environment and Behavior	arr.
44:441 Research: Locational Analysis	arr.
44:442 Research: Models of Spatial Behavior	arr.
44:450 Thesis	arr.

Geology

Department Chairman: Richard A. Hoppin
Degrees offered: B.A., B.S., M.S., Ph.D.

Geology is the theoretical and practical application of all scientific disciplines to the study of the earth. How the earth was formed, what it looks like now and how man is changing it for future generations—all are geological concerns.

Career opportunities are available to professional geologists in industry, teaching, urban planning, geological and resource surveys, government and research organizations. The master's degree is regarded by most hiring agencies as the working degree in geology. However, an undergraduate degree is fully satisfactory in certain teaching, federal and industrial situations.

Many of Iowa's geology graduates find employment in the petroleum industry as exploration geologists. Others go on to graduate school or take jobs with government conservation agencies. Some intend to enter law, medicine or business. Some are interested in urban planning, environmental studies, engineering, archeology, science education or oceanography as advanced areas. Geology is suited to all these.

The program at Iowa stresses theoretical geology and paleontology more than the engineering or agricultural phases of the discipline. The Department specializes in relating scientific thought to the study of the earth. Geology majors receive at least an academic year's work in basic scientific areas—physics, biology, chemistry and mathematics—in addition to a course in each major area of geology.

Each year more than 1,000 students enroll in Earth Science 11:23 Earth History and Resources and 11:24 Man and His Physical Environment, a team-taught, laboratory-discussion-lecture course designed to fulfill the College of Liberal Arts requirement for natural science core studies.

Other offerings for nonmajors include a lecture sequence for persons interested in a general survey of geology and several advanced courses without prerequisites—paleontology, geology of Iowa, history of the vertebrates, a planet in crisis, minerals and world affairs, landforms.

Undergraduate Programs

Students majoring in geology must meet the general require-

ments of the College of Liberal Arts. It is recommended that they satisfy the language requirement with French, German or Russian, and the social science requirement with approved courses in economics, geography and/or anthropology.

Bachelor of Science Degree

The Bachelor of Science professional program is designed primarily as preparation for graduate study and for employment in industry. Required courses in this program:

Geology Courses

11:23	Earth History and Resources	4 s.h.
and		
11:24	Man and His Physical Environment	4 s.h.
or	two semesters of freshman geology	6-8 s.h.
12:41	Mineralogy	3 s.h.
12:52	Elementary Petrology and Geochemistry	3 s.h.
12:112	Geological Field Methods	1 s.h.
12:113	Summer Field Course	6 s.h.
12:121	Principles of Paleontology	3 s.h.
12:191	Structural Geology I	4 s.h.
12:198	Junior Seminar	1 s.h.
	Two elective geology courses	6 s.h.

Supporting Sciences

The geology major requires at least 10 semester hours of college-level mathematics, including either one semester of calculus or 22M:35 Engineering Mathematics I (computer science or statistics courses may be counted toward the 10-hour requirement), and eight hours of physics, eight hours of chemistry and five hours of college-level zoology or botany.

Bachelor of Arts Degree

The B.A. program is designed to provide a general background in geology, with a broader choice of electives than in the B.S. program, for students who are not planning to become professional geologists. With appropriate coursework in education, the B.A. program provides a base for high school or community college teaching. A general background in geology and allied fields is also applicable to interests in such areas as conservation and environmental problems. Course requirements:

Geology

12:5	Introduction to Geology	
or		
12:3	Principles of Physical Geology	
and		
12:4	Principles of Historical Geology	
or		
11:23	Earth History and Resources	
and		
11:24	Man and His Physical Environment	7-8 s.h.
12:41	Mineralogy	3 s.h.
12:106	Geologic Map and Air Photo Interpretation	3 s.h.
12:121	Principles of Paleontology	3 s.h.
12:116	Field Trip (two sections)	4 s.h.
12:198	Junior Seminar	1 s.h.
	Geology electives	12 s.h.
		33-34 s.h.