



THE UNIVERSITY OF IOWA

GENERAL
CATALOG

1990-1992



Admission to the program is based on assessment of applicants' undergraduate academic record, performance on the Graduate Record Examination (GRE) Aptitude Test (verbal and quantitative), and letters of recommendation. Admission requirements are not rigid. Almost all students currently working toward the Ph.D. in genetics at The University of Iowa have undergraduate grade-point averages higher than 3.20, and their average GRE Aptitude Test scores (verbal plus quantitative) exceed 1300. Students with lower grade-point averages or GRE scores may be admitted, depending on other indications of academic potential.

The program accepts applications for admission at any time, but students generally begin graduate work during the fall semester.

Financial Aid

All genetics graduate students currently receive a financial stipend that is in the range of \$11,000 plus tuition per year. By April 1, nearly all financial aid is committed for students entering in the fall.

Financial support comes from research assistantships, teaching assistantships, scholarships, individual research grants, or other departmental or college funds. All students are encouraged to do some teaching as part of their development as scientists and teachers.

Medical Scientist Training Program

Students may combine study toward an M.D. and a Ph.D. in genetics. Information about this program is available from the director of the Medical Scientist Training Program in the College of Medicine.

Departmental Ph.D. Programs

The Departments of Biochemistry, Biology, Botany, and Microbiology offer degree programs in which students may specialize in a particular aspect of genetics. See the appropriate departmental sections in the *Catalog* for information about these programs.

Courses

The following genetics courses are open to graduate students. Not all courses are offered every year.

99:130 Biochemistry and Molecular Biology II	4 s.h.
99:223 Gene Expression	1-2 s.h.
2:104 Cytogenetics	2 s.h.
2:160 Genetics and Biogenesis of Cell Organelles	3 s.h.
2:161 Plant Molecular Biology	3 s.h.
61:179 Bacterial Diversity	3 s.h.
61:268 Molecular Biology of Animal Viruses and the Eukaryotic Cell	3 s.h.
61:270 Topics in Molecular Biology	arr.

37:131 Evolution	4 s.h.
37:162 Population Genetics and Molecular Evolution	3 s.h.
37:171 Molecular Genetics	4 s.h.
37:172 Topics in Molecular Genetics	2 s.h.
37:173 Molecular Biology of Phage Lambda	3 s.h.
37:175 Topics in Evolutionary Genetics	1-2 s.h.
37:195 Pattern Formation in Development	2 s.h.
37:215 Genetics Seminar (same as 2:215, 61:215, 99:215)	0-2 s.h.
37:260 Developmental Genetics	2 s.h.
127:301 Graduate Research in Genetics	arr.
70:161 Human Genetics	2 s.h.
142:215 Molecular Biology II	3 s.h.

Career opportunities for majors in geography exist in many branches of government and in business. In demand are persons capable of dealing with resource management, regional development, market area analysis, and other problems related to the distribution and spatial interaction of physical, economic, social, and political phenomena.

Courses in geography are commonly required of students preparing to teach at the elementary and secondary school levels, those who want to work in urban and regional planning, and as a background for many related professions, including law, health care, environmental or transportation engineering, and business administration.

GEOGRAPHY

Chair: Michael L. McNulty
Professors: John W. Fuller, Joel L. Horowitz, James B. Lindberg, Michael L. McNulty, R. Rajagopal, David R. Reynolds, Gerard Rushton
Associate professors: Rex D. Honey, George P. Malanson, Frank H. Weirich
Assistant professors: Marc P. Armstrong, Claire Pavlik, Rebecca S. Roberts, Abdi Samatar
Adjunct faculty: Susan Cowart, Mickey Lauria, Thomas G. Newton, Carol A. Parsons
Undergraduate degrees offered: B.A., B.S. in Geography
Graduate degrees offered: M.A., Ph.D. in Geography

Geography seeks to explain spatial organization and areal differentiation through detailed studies of significant patterns and processes. The discipline is concerned with "place" or "environment" and ongoing forces that promote change within and between human and physical systems. Geography is a composite science, requiring a broad base of knowledge from many related disciplines. It also is an analytical science that seeks explanations of specific research questions from a distinctly geographic perspective.

Students who elect courses in geography find that they develop insights and methods of inquiry that are particularly applicable to understanding many of the complex problems confronting societies. For instance, the distribution and consumption of natural resources, air and water pollution, the growth and development of urban areas, increasing populations, transportation problems, spatial inequalities, location of services, and conflicts between nations are some of the issues dealt with during geographical training.

Studies in geography also provide students with concepts and methods for organizing such spatial units as urban areas, marketing regions, school districts, health service areas, drainage basins, and other areas of environmental concern. Thus, geographers can make substantial contributions toward understanding the behavior of individuals and of societies and their relations with the environment.

Undergraduate Programs

The geography faculty has developed an undergraduate instructional program that serves students interested in acquiring a major or minor in geography, as well as those concentrating in other disciplines who are interested in elective geography courses as part of a liberal education. The department also participates in interdepartmental programs involving global, urban, and environmental components.

Bachelor's Degrees

Each student majoring in geography selects one of the following three concentration areas: urban and regional studies, international development studies, or environmental studies.

Majors may work toward either a Bachelor of Science or Bachelor of Arts degree. Students who plan advanced training or careers in geography should elect the B.S. degree. Those pursuing a liberal arts objective may elect either the B.A. or B.S. degree.

General Requirements

All geography majors must complete one of the following computer programming courses:

22C:7 Introduction to Computing with FORTRAN	3 s.h.
or	
22C:16 Introduction to Programming with Pascal	4 s.h.

Bachelor of Science students must satisfy a mathematics requirement consisting of one of the following two pairs of courses:

22M:15 Mathematics for the Biological Sciences	4 s.h.
and	
22M:16 Calculus for the Biological Sciences	3 s.h.
or	
22M:25 Calculus I and	4 s.h.
22M:26 Calculus II	4 s.h.

or

22M:35 Engineering Calculus I 4 s.h.
and
22M:36 Engineering Calculus II 4 s.h.

Students may fulfill the computer programming and mathematics requirements by taking equivalent courses with objectives similar to these, with the consent of the geography faculty.

In addition, all geography majors must complete one of the three course sequences described below. Students are advised to pay close attention to the prerequisites of the intermediate and advanced courses in each sequence and to develop study programs that ensure timely satisfaction of the prerequisites of required courses. Prerequisites are stated in course descriptions. See "Courses" at the end of this section of the *Catalog*.

Urban and Regional Studies

The undergraduate program in urban and regional studies is designed for students who are preparing for positions in government and private business, graduate programs in geography, or professional programs such as urban and regional planning, business administration, applied policy analysis, or regional science.

The courses cover location theories and their application to applied problems, such as assessing sites for development potential, finding the best locations for public and private facilities, developing plans for regional and community development, evaluating alternate plans for improving transport services in a region, and forecasting the populations of small areas.

Methods for solving these applied problems are based on a thorough understanding of the processes of urban and regional development, the roles of individuals and institutions in effecting change, and the processes through which policy decisions are reached. Requisite skills are developed in quantitative analysis, cartography, development and management of geographical information systems, and computer methods. Opportunities for experience in working with real problems are included.

Students concentrating on urban and regional studies are required to complete the following sequence of courses. Prerequisites are listed in course descriptions. See "Courses" at the end of this section of the *Catalog*.

Introductory Courses

44:1 Introduction to Human Geography 4 s.h.
44:3 Introduction to Physical Geography 4 s.h.

At least one of these:

44:11 Introduction to Social Geography 3 s.h.
44:15 Introduction to Political Geography 3 s.h.

44:30 Introduction to Economic Geography 3 s.h.

Intermediate Courses

At least two of these:

44:130 Location Strategy of Firms 3 s.h.
44:132 Industrial Location 3 s.h.
44:133 Introduction to Transportation 3 s.h.
44:135 Urban Geography 3 s.h.

Methods Courses

All of these:

44:108 Statistical Methods of Geographical Analysis 3 s.h.
44:109 Computer Methods in Geographical Analysis 3 s.h.
44:150 Undergraduate Seminar for Geography Majors 3 s.h.

Advanced Courses

Students are required to take at least one course each from group A and B.

Group A

44:134 Methods of Transportation Analysis 3 s.h.
44:137 Economic Theory of Location 3 s.h.
44:139 Economic Analysis of Urban Spatial Structure 3 s.h.

Group B

44:166 Contemporary Europe: Interaction and Change 3 s.h.
44:171 Geography of the U.S. and Canada 3 s.h.
44:175 Locational Conflict 3 s.h.

International Development Studies

The concentration in international development studies is designed for students interested in the processes of economic, social, and political development, particularly as they affect the countries of the Third World. This concentration gives students a better understanding of regional and national development in international and cross-cultural perspective. Students who are interested in the problems of developing countries and who wish to examine competing theories of development intended to explain international and regional inequalities will find this concentration helpful.

Students concentrating on international development studies are required to complete the following sequence of courses. Prerequisites are listed in course descriptions. See "Courses" at the end of this section of the *Catalog*.

Introductory Courses

44:1 Introduction to Human Geography 4 s.h.
44:3 Introduction to Physical Geography 4 s.h.

Intermediate Course

44:94 International Development 3 s.h.

Methods Courses

44:108 Statistical Methods of Geographical Analysis 3 s.h.
44:109 Computer Methods in Geographical Analysis 3 s.h.
44:150 Undergraduate Seminar for Geography Majors 3 s.h.

Advanced Courses

44:194 Geographic Perspectives on Development 3 s.h.

At least two of these:

44:162 Planning and Geography of Underdevelopment 3 s.h.
44:163 Geography of the Newly Industrializing Countries 3 s.h.
44:172 Development Planning and Policy 3 s.h.

One of these:

44:161 African Development 3 s.h.
44:164 Geography of the Middle East 3 s.h.

Environmental Studies

The undergraduate program in environmental studies is designed for students who have career expectations or personal interest in resource management or environmental protection, or who are interested in physical geography. The program provides a knowledge of physical processes in landform development, atmospheric conditions, hydrology, soil development, and biotic communities. It stresses the interrelationships among those processes and helps students acquire knowledge necessary to assess the impact of human activities on physical systems.

Training in field observation, quantitative analysis, computer methods, and cartographic representation are included in this concentration. The program also provides a sound foundation for graduate- or professional-level studies. This undergraduate program has been designed as an introduction to the graduate-level physical geography and water resources subprogram of the Department of Geography.

Students concentrating in environmental studies must complete the following sequence of courses. Prerequisites to these courses are listed in course descriptions. See "Courses" at the end of this section of the *Catalog*. Students are required to take 15 semester hours of intermediate and advanced courses.

Introductory Courses

44:1 Introduction to Human Geography 4 s.h.
44:3 Introduction to Physical Geography 4 s.h.
44:19 Contemporary Environmental Issues 3 s.h.
29:5 Chemistry and Physics of the Environment 3 s.h.
(or a more advanced course in chemistry or physics)

Intermediate Courses

44:101 Climatology	3 s.h.
44:102 Earth Surface Processes	3 s.h.
44:103 Biogeography	3 s.h.
44:121 Natural Resources Policy	3 s.h.
44:122 Environmental Conservation in the United States	3 s.h.

Methods Courses

44:108 Statistical Methods of Geographical Analysis	3 s.h.
44:109 Computer Methods in Geographical Analysis	3 s.h.
44:150 Undergraduate Seminar for Geography Majors	3 s.h.

At least one of these:

44:107 Maps and Mapping	2 s.h.
44:113 Geographic Information Systems	3 s.h.

Advanced Courses

44:123 Landscape Ecology	3 s.h.
44:125 Environmental Impact Analysis	4 s.h.
44:126 Water in the Biosphere	3 s.h.
44:127 Water Quality Control Systems	3 s.h.
44:128 Drainage Basin: Form and Process	3 s.h.
44:129 Water Resources Management	3 s.h.
44:180 Field Studies	arr.

Courses in Other Departments

Under the direction of an adviser, students should select at least 12 semester hours of courses from one of the following clusters.

Biophysical Systems

2:100 Land Plants: An Evolutionary Survey	4 s.h.
2:111 Plant Ecology	4 s.h.
2:116 Field Ecology	4 s.h.
2:119 Plant-Animal Interactions	3-4 s.h.
37:133 Topics in Ecology	3 s.h.
12:108 Introduction to Oceanography	2 s.h.
12:110 Introduction to Remote Sensing	3 s.h.
12:128 Quaternary Palynology	5 s.h.
12:166 Hydrogeology and Groundwater Quality	3 s.h.
12:172 Glacial and Pleistocene Geology	3 s.h.
12:173 Quaternary Environments	3 s.h.
12:179 Engineering Geology	3 s.h.

Environmental Engineering

53:71 Principles of Hydraulics	2 s.h.
53:78 Principles of Hydrology	2 s.h.
53:152 Environmental Chemistry	3 s.h.
53:153 Environmental Chemistry Laboratory	3 s.h.
53:154 Environmental Microbiology	3 s.h.
53:155 Limnology	2-3 s.h.
53:178 Hydrometeorology	3 s.h.

Environmental Management

6E:1 Principles of Microeconomics	3-4 s.h.
6E:2 Principles of Macroeconomics	3-4 s.h.
6E:103 Microeconomics	3 s.h.
6E:105 Macroeconomics	3 s.h.

6E:119 Economics of the Government Sector	3 s.h.
6E:127 Natural Resources in the World Economy: Control and Conflict	2-3 s.h.
6E:133 Environmental Economics	3 s.h.
6J:100 Administrative Management	3 s.h.
6J:161 Individual Behavior in Organizations	3 s.h.
6J:163 Organizational Design and Operations	3 s.h.
102:101 Introduction to Planning and Policy Development	3 s.h.
53:204 Theories of Environmental Policy and Assessment	3 s.h.

Minor

To minor in geography, a student must complete at least 15 semester hours in geography courses with a minimum grade-point average of 2.00. Twelve of the 15 must be taken at The University of Iowa in 100-level courses. Minors are encouraged to select one of the department's three areas of concentration—urban and regional studies, international development studies, or environmental studies—and to take courses from those listed in that concentration. Minors who wish further assistance in selecting courses may contact the Departmental Secretary to request assignment of a minor adviser.

Honors

The honors major is for students of superior ability who want to pursue studies beyond the typical undergraduate level. To graduate with honors in geography, a student must be admitted to the College of Liberal Arts Honors Program as well as the honors program in geography by the first semester of the senior year, and must:

Maintain a grade-point average of 3.20 in all University work and a 3.40 in geography; and

Prepare and successfully defend an honors thesis.

The thesis consists of original research under the direction of a faculty member and is assessed by a three-member faculty committee.

Students complete the thesis through a year-long tutorial in 44:198 Honors Tutorial and 44:199 Honors Thesis. The senior course 44:150 Undergraduate Seminar for Geography Majors may be substituted for 44:199 Honors Thesis, provided the student continues work on the thesis under the direction of a faculty member.

Cooperative Education Program

The Department of Geography is a participant in the University's Cooperative Education Program, which provides opportunities for both undergraduate and graduate students to secure cooperative training assignments related to their academic programs.

Courses for the Nonmajor

Students in the College of Liberal Arts as well as other areas of the University may find geography courses meaningful to their own program of study. The beginning-level courses 44:1 Introduction to Human Geography, 44:11 Introduction to Social Geography, 44:19 Contemporary Environmental Issues, and 44:30 Introduction to Economic Geography are approved for the General Education Requirement in social sciences, 44:157 Third World Development Support is approved for the General Education Requirement in foreign civilization and culture, 44:161 African Development is approved for the General Education Requirements in social sciences and foreign civilization and culture, and 44:3 Introduction to Physical Geography is approved for the General Education Requirement in natural sciences. These courses serve as part of a liberal education.

Other courses also may be attractive as individual electives. These include 44:15 Introduction to Political Geography, 44:35 World Cities, 44:126 Water in the Biosphere, 44:128 Drainage Basin: Form and Process, 44:165 Geography of the Modern World, and 44:191 Energy in Contemporary Society.

Graduate Programs

The goals of the department's graduate programs are to prepare students to carry on creative and productive research in selected areas of geography involving the use and further elaboration of theory, and to prepare students for positions in research, teaching, or some area of applied geography. Success in achieving these goals has been demonstrated by the strong demand for University of Iowa graduates to fill positions on college and university faculties, in private research organizations, and in business and government.

The department offers specialized instruction in the teaching of geography at the college level for those pursuing academic careers. Opportunities are provided for all graduate students to gain practical teaching experience through service as departmental teaching assistants or graduate instructors.

Master of Arts

The department offers six M.A. subprograms: locational analysis, physical geography, political geography, regional development, transportation systems analysis, and water resources. These specialties are designed for students seeking positions in community planning, health planning, development planning in the Third World, water resources management, and transportation as well as for those who intend to pursue the Ph.D.

Each subprogram cuts across some of the more traditional breakdowns of the discipline and builds on the research specialties of the faculty. For example, topics of interest in urban geography are

included in three subprograms—locational analysis, political geography, and regional development—while the traditional concerns of economic geography are included in locational analysis and regional development. The more quantitative perspectives of regional science are included in locational analysis and transportation systems analysis. The subprogram in physical geography emphasizes interacting processes and integrates field studies with computer and simulation modeling. The water resources subprogram builds on foundations in environmental science and political economy.

Although M.A. students pursue a program of study within one of the subprograms, they also must gain a basic proficiency in another. The M.A. emphasizes the acquisition of analytical skills and their application in research. Courses that provide necessary training in oral and written communication, computer programming and graphics, statistics, mathematics, and research methods are integral to the M.A. program. Students in the transportation subprogram may take an additional elective course that enables them to receive a transportation certificate in addition to their M.A. degree.

General Requirements

The M.A. degree requires a minimum of 30 semester hours of graduate work, of which 15 semester hours must be in courses numbered 200 or above. In addition to fulfilling the course requirements in one of the department's six subprograms (see below), students must:

Complete at least one course not in their own subprogram from the following introductory graduate courses: 44:121, 44:123, 44:125, 44:126, 44:128, 44:134, 44:137, 44:175, 44:194 or 44:210;

Enroll in the department's general colloquium series (44:350 Research Seminar: Staff) during each semester in residence;

Satisfy the department's B.S. degree requirements or their equivalents in mathematics, statistics, and computer programming; and

Complete, with a grade of B or better, at least one 3-semester-hour quantitative methods course from a list of courses approved by the faculty.

The M.A. degree may be earned with or without thesis, except in the physical geography and water resources subprograms, which require a thesis. A maximum of 6 semester hours of credit may be earned for thesis work.

Students who elect the M.A. without thesis must pass a written examination and, in most subprograms, an oral examination. For students electing the M.A. with thesis, the written examination can be waived and the thesis defense serves as the oral M.A. examination.

Subprogram Requirements

Locational Analysis

44:134 Methods of Transportation Analysis	3 s.h.
44:137 Economic Theory of Location	3 s.h.
6E:202 Price Theory or	3 s.h.
6E:203 Microeconomics I	3 s.h.
Three of these:	
44:216 Behavioral Analysis in Geography	3 s.h.
44:236 Travel Demand Modeling	3 s.h.
44:237 Urban Economics and Urban Spatial Structure	2 s.h.
44:285 Methods of Regional Analysis: Regional Science	3 s.h.
44:293 Advanced Location Theory	3 s.h.
44:330 Research Seminar: Location Theory	arr.

Physical Geography

44:123 Landscape Ecology	3 s.h.
44:128 Drainage Basin: Form and Process	3 s.h.
44:113 Geographic Information Systems	3 s.h.
44:328 Research Seminar: Physical Geography	arr.
*44:450 Thesis	arr.

Two of these:

44:226 Advanced Biogeography/Landscape Ecology	3 s.h.
44:228 Advanced Earth Surface Processes	3 s.h.
44:225 Water Resources Systems Analysis	2-3 s.h.

Two from one of the following groups:

12:128 Quaternary Palynology and Paleobotany	5 s.h.
12:173 Quaternary Environments	3 s.h.
2:119 Plant-Animal Interactions	3-4 s.h.

or

12:132 Sedimentology	3 s.h.
12:172 Glacial and Pleistocene Geology	3 s.h.
53:170 Flow in Open Channels	3 s.h.
53:173 Mechanics of Sediment Transport	2-3 s.h.

or

53:152 Environmental Chemistry	3 s.h.
53:154 Environmental Microbiology	3 s.h.
53:155 Limnology	2-3 s.h.
53:251 Environmental Systems Modeling	3 s.h.

or

Equivalent group of courses

*M.A. thesis is required of all students in this subprogram.

Political Geography

44:175 Locational Conflict	3 s.h.
44:273 Social Theory and Human Geography	3 s.h.
6E:202 Price Theory	3 s.h.

44:210 Philosophy and Epistemology in Geography	2 s.h.
44:262 Political Economy of Regional Development	3 s.h.
44:270 Jurisdictional Organization/Public Service Provision	3 s.h.
44:315 Research Seminar: Political Geography	arr.

Regional Development

44:194 Geographic Perspectives on Development	3 s.h.
44:210 Philosophy and Epistemology in Geography	2 s.h.
44:262 Political Economy of Regional Development	3 s.h.
44:264 Agrarian Change and Rural Development in the Third World	3 s.h.
44:394 Research Seminar: Regional Development	3 s.h.

Transportation Systems Analysis

*22S:120 Probability and Statistics	4 s.h.
*6E:184 Introduction to Econometrics	3 s.h.
6E:202 Price Theory or	3 s.h.
6E:203 Microeconomics I	3 s.h.
44:134 Methods of Transportation Analysis	3 s.h.
44:236 Travel Demand Modeling	3 s.h.
102:260 Transportation Policy and Planning	3 s.h.
102:261 Problems in Transportation and Land Use	3 s.h.
53:262 Urban Transportation Planning	3 s.h.

*Satisfies the M.A. and Ph.D. quantitative methods requirements.

Water Resources

44:329 Research Seminar: Water Resources	arr.
44:450 Thesis (required of all students in the subprogram)	arr.

The following courses, with at least 9 semester hours earned at the 200-level:

One of these:

44:126 Water in the Biosphere	3 s.h.
44:128 Drainage Basin Form and Process	3 s.h.

Three of these:

44:121 or 44:221 Natural Resources Policy	3 s.h.
44:125 or 44:225 Environmental Impact Analysis/Water Resources Systems Analysis	2-4 s.h.
44:127 or 44:227 Water Quality Control Systems	3 s.h.
44:129 or 44:229 Water Resources Management	2-3 s.h.

An additional sequence of three courses in social theory and regional development, systems analysis, or biophysical processes, chosen under the direction of a faculty adviser; this sequence may include courses in other departments and may fill the out-of-subprogram requirement.

Students are expected to have an undergraduate background relevant to pursuing graduate work in one of the department's subprograms. The B.A. or B.S. degree in geography is not a prerequisite for entry into the program. A strong analytical background in any of the social or environmental sciences and an interest in exploring the regional and spatial perspectives characterizing modern geography are more important than the particular disciplinary orientation of the student's baccalaureate degree. Depending on the strength and suitability of their prior training, however, students may be required to take courses that are prerequisites for courses in their elected subprograms. Credit received for such courses cannot be applied toward the 30 semester hours required for the M.A. Each of the M.A. subprograms is designed to be completed in four semesters. This means that the student typically will accumulate 40 to 48 semester hours of graduate credit in completing the M.A. Students are advised to use these additional hours to elect graduate courses in other subprograms in geography and/or in other University departments and programs, thereby tailoring their programs of study to their individual interests.

Doctor of Philosophy

The Doctor of Philosophy program is designed to prepare students for positions in college and university teaching and in advanced research. It provides programs of study leading to broad knowledge of a field of geography and its literature and special expertise in a specific subfield. The former usually represents the general area in which the Ph.D. holder seeks employment, whereas the latter represents his or her area of most active research involvement. The Ph.D. is fundamentally a research degree and as such is constrained by the expertise of the faculty. At the Ph.D. level, the department is best known for its rigorous analytical orientation, particularly in the areas of locational analysis, spatial behavior, transportation, Third World regional development, urban political geography, physical geography, and water resources management.

The Ph.D. is a four- to five-year, postbaccalaureate program, the first two years of which are identical to the department's M.A. program. Students can enter the program with advanced standing corresponding to their previous graduate training equivalent to that in the department's M.A. program. Students entering the program directly from the B.S. or B.A. must fulfill all departmental requirements for the M.A. except for the M.A. examination. In addition, students whose ultimate objective is the Ph.D. are required to:

Complete at least 3 additional semester hours in graduate-level geography courses from those required or recommended for one of the department's subprograms that is not the student's general area of interest;

Complete at least one additional quantitative methods course (3 semester hours) that is at a level above that required for the B.S. degree and is chosen from a list of courses approved by the faculty (students in the Ph.D. program are advised to fulfill both the M.A. and Ph.D. quantitative methods requirements—a total of 6 semester hours—during their first year in residence);

Complete one additional research seminar under the direction of a faculty member who is not directing the research seminar satisfying the student's M.A. requirement; and

Register for the department's colloquium series, 44:350 Research Seminar: Staff, each semester that the student is in residence.

Before students can be admitted formally to candidacy for the Ph.D., they must submit an original research paper to the faculty for its approval. Students completing the M.A. with thesis can submit the M.A. thesis to fulfill this requirement. Students entering the program with an M.A. from another institution can submit theses or research papers completed elsewhere to fulfill the requirement. Students who initially enter the M.A. program with a terminal M.A. as their degree objective and who complete that program can enter the Ph.D. program by fulfilling the research paper requirement.

By the end of the M.A. portion of the program (typically the fourth semester for the student entering the program directly from the B.S. or B.A.), the student should submit a written report that includes an assessment of progress to date, an outline of the area of geography in which he or she intends to specialize, and a proposed plan of study for the remainder of his or her Ph.D. program. This report is prepared in consultation with the student's Ph.D. adviser and other members of the faculty in the student's general area. The plan of study is amended, as necessary, throughout the remainder of the student's program.

The remainder of the Ph.D. program includes the completion of the student's individual program of study designed to prepare him or her for a research career in a specific area of concentration. It consists of appropriate graduate courses, seminars, readings, and independent research in geography; courses in related disciplines; and courses that satisfy the tool requirements of the student's program of study.

Prior to taking the comprehensive examination consisting of both written and oral components, the student must submit an "area review paper" to his or her Ph.D. committee. This paper, which must be approved by the student's Ph.D. adviser, consists of a critical review of research in the student's area of concentration. As such, it is a culminating step in a student's program of study as well as a statement of future research directions. The comprehensive examination covers both the student's area of concentration and his

or her more general field in the discipline. After obtaining the approval of a dissertation supervisor, the student must submit a dissertation proposal to his or her dissertation committee for its critical comments and approval. The student must then complete and defend the dissertation.

Before receiving the Ph.D. degree, students are expected to serve as both classroom instructors (or teaching assistants) and research assistants.

Admission

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 applicant's undergraduate grade-point average, especially of his or her junior and senior years; scores on the Graduate Record Examination (GRE) General Test; three letters of recommendation; and an essay in which the applicant sets forth the reasons for wanting to study geography at The University of Iowa.

Ordinarily, applicants must have earned an undergraduate grade-point average of 3.00 or better to be admitted to either the M.A. or Ph.D. program in geography.

Students from foreign countries or from undergraduate institutions that evaluate students on a basis other than grade-point average will be considered according to academic standing in their respective institutions.

Financial Aid

A number of graduate appointments as teaching or research assistants are available. Awards are based on merit. Students usually must have a combined score of 1100 on the GRE General Test verbal and quantitative sections and a 3.00 undergraduate or graduate grade-point average to be appointed to an assistantship. Applications for graduate appointments should be received by February 15.

Facilities

The department houses a laboratory for computer cartography and spatial analysis equipped with PC-compatible and Macintosh work stations, digitizers, and plotters. These workstations support a variety of GIS software packages including ERDAS, IDRISI, MAP, MAPINFO, and Transcad. The department also participates in an advanced GIS facility in the Center for Global and Regional Environmental Research. The PCs and other terminals in the department are linked to the University's SYTEK broadband communication network, which provides high-speed access to graphics, data management, and analysis software on University IBM, PRIME, and VAX computer systems.

Students also have access to a University computing cluster that contains IBM PCs, terminals, several printers, and a plotter. It

is located on the same floor as the department offices.

For studies in water resources and physical geography, the department has laboratories for analysis of vegetation, sediment, soil, and water quality; a field station in California; and a variety of field equipment ranging from electronic data loggers to boats.

The map collection in the Main Library contains more than 115,500 maps, a total of 3,600 atlases and reference works, and about 100,000 aerial photographs, primarily of Iowa. The library is a depository for maps of the U.S. Army Topographic Command, formerly the Army Map Service.

The Geology Library contains approximately 70,000 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 laboratory exercises.

Courses

Primarily for Undergraduates

- 44:000 Cooperative Education Training Assignment** 0 s.h.
Assignment
- 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. GER: social sciences.
- 44:3 Introduction to Physical Geography** 4 s.h.
Elementary principles of physical geography: physics of weather and climate, hydrological systems, geomorphological and geological forces, pedological processes and spatial factors in vegetation distribution; geographic explanation of physical environment, with principles applied to the human use system; environmental pollution and natural hazards. GER: natural sciences.
- 44:11 Introduction to Social Geography** 3 s.h.
Spatial considerations of population growth and distribution; minorities within a population; poverty; housing; social organization and disorganization; social systems including education, religion, recreation, medical and social services; diffusion of ideas and traits over space. GER: social sciences.
- 44:15 Introduction to Political Geography** 3 s.h.
Geographic principles applied to political and economic problems at international, national, and local levels; topics include regional disparities in social well-being, service outputs of governments, political dimensions of environmental quality, spatial organization of political systems.
- 44:19 Contemporary Environmental Issues** 3 s.h.
Problems associated with population growth, technology, and resource consumption; protection of natural, historic, and cultural resources; air pollution; water pollution; energy and environment; alternative approaches to the resolution of environmental problems; real world case studies. GER: social sciences.
- 44:30 Introduction to Economic Geography** 3 s.h.
Location and spatial organization of the world's major types of economies; agriculture, energy and minerals, manufacturing, transportation; trade and service centers. GER: social sciences.
- 44:35 World Cities** 3 s.h.
Introductory course on urban geography examining urbanization as a process through lectures, films, readings, and discussions; specific concepts and theories of urbanization through global patterns, regional urban systems, and individual metropolitan areas. Offered spring semesters.
- 44:94 International Development** 3 s.h.
Theories of international development, political economy, development policy and planning; empirical analysis of conditions, policies and experiences of selected Third World countries. Prerequisite: 44:1.
- 44:100 Readings for Undergraduates** arr.
Supervised readings in geography. Consent of instructor required.
- ## For Undergraduates and Graduates
- 44:101 Climatology** 3 s.h.
Boundary layer processes that drive atmospheric dynamics; exchanges of energy and water at simple and complex surfaces; global climate change records, theories, models; impacts of climate on society. Prerequisite: 44:3 or consent of instructor.
- 44:102 Earth Surface Processes** 3 s.h.
Overview of the basic geomorphic and environmental processes that shape the surface of the earth; emphasis on processes of weathering: mass movement such as creep, landslides, and earth flow; erosion, transport, and deposition by fluid agents such as wind, water, and ice; methods used to study these physical processes. Prerequisite: 44:3 or a course in geology. Same as 12:102.
- 44:103 Biogeography** 3 s.h.
Distribution and abundance of plants and animals, spatial patterns and processes, and temporal dynamics of succession, response to climate change, and evolution; methods applied to the study of vegetation and plant community patterns. Prerequisite: 44:3 or 2:1 or consent of instructor. Same as 2:103.
- 44:107 Maps and Mapping** 2 s.h.
Qualities of a good map or diagram; types of maps or diagrams for particular uses; major types of cartographic presentations; available tools for constructing maps and diagrams; procedures for the compilation of maps and diagrams; laboratory experiences in compiling maps and diagrams.
- 44:108 Statistical Methods of Geographical Analysis** 3 s.h.
Geographical data sources, data collection, spatial sampling, survey methods, descriptive spatial statistics, probability, inference, contingency analysis, variance analysis, linear regression, residual mapping, polynomial trend surface analysis, graphing, and presentation.
- 44:109 Computer Methods in Geographical Analysis** 3 s.h.
Use of computer mapping as a tool in geographic analysis; various mapping programs including SYMAP, CALFORM, and others. Prerequisite: 22C:7 or 22C:16 or consent of instructor.
- 44:110 Spatial Organization** 3 s.h.
Approaches to spatial analysis of human activities and natural processes. Offered fall semesters.
- 44:113 Geographic Information Systems** 3 s.h.
Survey of issues important to the establishment of geographic information systems: spatial data encoding, raster-vector options, spatial and attribute resolution, cartographic data models, linkages to spatial analysis procedures, display techniques for decision support, institutional setting. Prerequisite: 44:109.
- 44:121 Natural Resources Policy** 3 s.h.
Geographic, cultural, political, economic, and ethical dimensions of natural resources policy; substantive and theoretical insights from the natural sciences, social sciences, and humanities in building a conceptual framework for the analysis of current resource problems from a geographic perspective; U.S. natural resource problems and policy questions. Prerequisite: 44:19 or consent of instructor.
- 44:122 Environmental Conservation in the United States** 3 s.h.
Varied natural environments of the United States and problems arising from conflicting land uses; consideration of public land use policy, environmental impacts of different land uses, and problems of habitat preservation and endangered species. Prerequisite: 44:3 or 44:19 or consent of instructor.
- 44:123 Landscape Ecology** 3 s.h.
Effects of spatial pattern on spatial processes in ecology; characteristics of matrix, patch, and corridor; fragmentation, deforestation, habitat loss; spatial flows of energy, matter, and genetic information; relationship to human impact and global climate change. Prerequisites: 44:103 or a 100-level course in ecology, and 44:108.
- 44:125 Environmental Impact Analysis** 4 s.h.
Environmental impact assessment methodologies; emphasis on cost-benefit-risk analysis, overlay and graphic techniques, optimal resource use, and system simulation; field trips to local environmental control facilities. Prerequisites: 44:19, and 29:5 or equivalent.
- 44:126 Water in the Biosphere** 3 s.h.
Biotic aspects of water resources production and the geographical basis of physical processes in drainage basins; spatial aspects of lotic dynamics and regional characterization of wetland structure and process. Prerequisite: 44:101 or 44:102 or 44:103 or 2:111.
- 44:127 Water Quality Control Systems** 3 s.h.
Geographical perspectives in the study and interpretation of chemicals in water; primary and secondary drinking water standards; local, regional, national, and international case studies in drinking water and health; socioeconomic and institutional considerations in designing water quality protection strategies. Prerequisites: 44:108 and senior standing, or consent of instructor.
- 44:128 Drainage Basin: Form and Process** 3 s.h.
Hydrological principles, stream channel processes, and fluvial geomorphology within the drainage basin system: spatial and temporal variations in water distribution, analyses of hydrological data, flow mechanisms, sediment transport, forecasting procedures, hydrograph construction and modeling. Prerequisites: 44:108, and 44:102 or a 100-level geology or hydraulics course.
- 44:129 Water Resources Management** 3 s.h.
Application of hydrological information in water resources management; aspects of water quantity and quality, groundwater availability, water use and treatment, resource development, political and administrative issues, and basin management problems—forestry, agriculture, urbanization, floods, and droughts. Prerequisite: 44:108, and 44:121 or a 100-level political economy course.
- 44:130 Location Strategy of Firms** 3 s.h.
Theory and methods used by public and private sector firms to geographically organize their activities; market selection, site analysis, small-area demand forecasting and sales forecasting, network development, delivery of urban and rural services; use of geographical models of spatial interaction and spatial choice; spatial allocation; location-allocation models; districting and dispatching models; route-distance functions; multi-attribute preference elicitation and spatial competition. Prerequisite: 44:108 or 6K:70.
- 44:131 Medical Geography: Health Services** 1-3 s.h.
Provision of health care in selected countries, with particular reference to the Third World; focus on problems of geographical, economic, and cultural accessibility to health services; other topics include disease ecology, prospective payment systems, privatization, and medical pluralism; includes regional case study.
- 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.
- 44:133 Introduction to Transportation** 3 s.h.
Overview of transportation markets—intercity, rural, and urban—and transportation modes—railroads, highways, air carriage, and waterways; discussion of regulation, finance, and physical distribution issues. Same as 102:133, 6E:145.
- 44:134 Methods of Transportation Analysis** 3 s.h.
Conceptual basis for predicting effects of transportation policy measures on traffic flows and system performance; transportation measurements; introduction to travel demand modeling; introduction to system performance modeling, network analysis, and equilibration. Prerequisites: graduate standing, or 44:108 and a previous transportation course. Same as 102:134.
- 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. Prerequisite: 44:1.
- 44:137 Economic Theory of Location** 3 s.h.
Behaviorally based location theories for social and economic activities traced from their classical origins to the contemporary literature where both descriptive (e.g., central place theory) and prescriptive (e.g., location-allocation) models of multiple location decisions exist; the relationship between location-allocation models and competitive location theory. Prerequisites: 6E:1 or

graduate standing, and 44:30 or 44:132; or consent of instructor.

44:138 Health and Development 3 s.h.

The intricate relationship between health status, health services, and socioeconomic development in the Third World; health implications of socioeconomic policies and planning analyzed through economic and health development theories. Open only to seniors and graduate students.

44:139 Economic Analysis of Urban Spatial Structure 3 s.h.

Use of the methods of economics to understand urban spatial structure, central place theory, why cities exist and trade with one another; theoretical models to explain spatial patterns of population, land use, and rents within cities; empirical tests of models; applications of theory to practice policy issues such as urban sprawl, racial segregation, transportation planning. Prerequisites: 44:108 and 44:135.

44:150 Undergraduate Seminar for Geography Majors 3 s.h.

Participation in a term project and preparation of a documented report. Offered spring semesters. Open only to seniors. Prerequisites: 44:108, 44:109, and satisfaction of computer programming requirement.

44:157 Third World Development Support 3 s.h.

Critical analysis of theories, policies, programs, and practices of Third World development; nature of the social scientific support needed to understand and to accelerate the process; analysis of historical trends in the administration of organized development aid since its inception in 1945. GER: foreign civilization and culture. Same as 19:157.

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. GER: foreign civilization and culture, social sciences. Prerequisite: 44:94. Same as 30:146, 141:146.

44:162 Planning and Geography of Underdevelopment 3 s.h.

Spatial implications of the economic, social, and political institutions affecting contemporary Third World countries; political economy of development and underdevelopment studied through reading major theoretical works and analyzing case studies. Prerequisite: 44:94 or graduate standing. Same as 102:162.

44:163 Geography of the Newly Industrializing Countries 3 s.h.

The newly industrializing countries (NICs) in geographic and historical perspectives; U.S. manufacturing base as a backdrop in the NICs' industrialization; topics include off-shore industrial production, women in development, import-substitution industrialization (ISI), export-led industrialization, theories of industrial location, high-technology industries, and the international division of labor; regional profiles taken from the Pacific Rim, Chile, Brazil, and the northern Mexican maquila industry. Prerequisites: 44:94 and 44:108.

44:164 Geography of the Middle East 3 s.h.

Examination of the social, political, and economic geography of the Middle East within countries, among countries of the region, and between the region and the rest of the world. Prerequisite: 44:94.

44:165 Geography of the Modern World 3 s.h.

Conceptualization of the world as an increasingly interconnected system; similarities and differences in the ways diverse regions participate in the changing world.

44:166 Contemporary Europe: Interaction and Change 3 s.h.

Examination of contemporary Europe, stressing societies' problems and attempts to resolve them; interactions within and among European countries, and between Europe and the rest of the world. Prerequisites: 44:15 or 44:30, and 44:135.

44:167 Patterns of Urbanization and Development in Latin America 3 s.h.

Change in Latin America examined through the processes of urbanization; perspectives from modernization and human ecological, dependency, and neo-Marxist theories of development; topical aspects include informal economies, women in development, housing, residential segregation, squatter settlements, and urban-ecological views of the Latin American city.

44:168 Icelandic Studies 2 s.h.

44:169 Latin American Studies Seminar 3 s.h.
Redemocratization in the Southern Cone (Brazil, Uruguay, Argentina, and Chile): effects of authoritarianism on society and state.

44:170 Political Organization of Space 3 s.h.
Geographical aspects of jurisdictional organization, provision of public services, location of public facilities, geography of elections, and public policy.

44:171 Geography of the U.S. and Canada 3 s.h.
Historical, contemporary perspectives on the economic, social, political, and physical environments of the United States and Canada and their principal regions. Prerequisites: 44:15 or 44:30, and 44:135.

44:172 Development Planning and Policy 3 s.h.
Explicit and implicit strategies for economic and social development: origins, goals, formulation, execution, results; policy analysis methods. Prerequisites: 44:94 and 44:108.

44:175 Locational Conflict 3 s.h.
Behavioral and institutional bases of locational conflict, with emphasis on public choice, social justice, and radical perspectives; politicizing processes; strategies of resolution in selected contexts—environmental management, urban infrastructure, public education, service provision. Prerequisites: 44:15 and 44:135.

44:180 Field Studies arr.

Problem definition and research design in a field setting; sampling procedures, collection of primary data, data analyses and interpretation; topics encompass the spectrum of geographic discipline. Prerequisite: 12 semester hours of courses in geography or consent of instructor.

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. Prerequisite: junior, senior, professional, or graduate status.

44:194 Geographic Perspectives on Development 3 s.h.

Theoretical and empirical studies of the regional development process, with special emphasis on developing countries; alternative regional development theories and changes in development theories as evidenced in the literature of geography and related disciplines. Prerequisite: prior or concurrent satisfaction of all other international development track requirements.

44:195 Latin American Economic Development 3 s.h.

Structural conditions of post-World War II regional development in Latin America; import-substitution industrialization strategies, regional integration schemes, and debt repayment. Part of the Summer Social Science Program in Chile.

44:196 State and Society in the Southern Cone 3 s.h.

The rise of authoritarianism and the transition to democracy in the region, particularly in Chile: relationship between regimes and elements of civil society, such as political parties, the church, and the labor movement, in understanding the Southern Cone. Part of the Summer Social Science Program in Chile.

44:197 Summer Social Science Program in Chile—Independent Study 3 s.h.

Health care financing, residential segregation, public policy analysis, and other topics of faculty expertise; research paper based on archival or field investigation in Santiago.

44:198 Honors Tutorial arr.

Individual study for honors majors. May be repeated.

44:199 Honors Thesis arr.

Supervised original research project leading to written thesis and oral defense. Open only to honors students.

For Graduates

44:200 Readings arr.

Supervised readings by graduate students in topics of their choice. Consent of instructor required.

44:210 Philosophy and Epistemology in Geography 2 s.h.

Analysis of philosophies and methodologies of modern geography, with emphasis on epistemological and ontological issues; discussion of positivism (empiricism), its variants, and alternatives, in light of past and current research.

44:211 Advanced Quantitative Methods 3 s.h.

Nonregression statistical methods used in current geographical research: discriminant analysis, factor analysis, multivariate hypothesis testing, models with simultaneous equations; assumes knowledge of ordinary regression techniques. Prerequisite: 22S:157 or 22S:152 or 6E:184.

44:216 Behavioral Analysis in Geography 3 s.h.

Relationship between human behavior and the social and physical environment; environmental perception, mental maps, spatial cognition, and spatial choice models; preference structures, utility theory, and decision making by individuals or groups in relation to the geographical organization of activities.

44:221 Natural Resources Policy 3 s.h.

Advanced analysis of natural resources policy processes from geographic perspective; theoretical insights from social sciences incorporated to build framework for analyzing U.S. natural resources problems, with emphasis on cultural, political economy, and ethical dimensions of policy; analysis of current natural resources policy issues to illustrate the application of concepts developed.

44:225 Water Resources Systems Analysis 2-3 s.h.

Linear optimization and continuous system simulation models; recent applications in water resources management, pollution control, economics, and public policy; potential future applications in designing water quality monitoring networks. Consent of instructor required.

44:226 Advanced Biogeography/Landscape Ecology 3 s.h.

Current questions on spatial distribution of organisms and effect of spatial structure on ecological processes over landscape.

44:227 Water Quality Control Systems 3 s.h.

Geographical perspectives in the study and interpretation of chemicals in water; primary and secondary drinking water standards; local, regional, national, and international case studies in drinking water and health; socioeconomic and institutional considerations in designing water quality protection strategies.

44:228 Advanced Earth Surface Processes 3 s.h.

Theoretical concepts and empirical studies of hydrologic, climatic, and geomorphic processes as related to the earth's surface: measurement, analysis, and modeling; drainage basin analysis and modeling; responses to climatic and environmental change. Prerequisite: strong background in physical geography or consent of instructor. Same as 12:228.

44:229 Water Resources Management 2-3 s.h.

Theoretical concepts and empirical studies of water management problems: application of hydrological data to water problems, including water quantity and water quality issues, groundwater availability, water treatment development policies, political and administrative considerations, and drainage basin management programs. Prerequisite: 44:228 or consent of instructor.

44:236 Travel Demand Modeling 3 s.h.

Mathematical and statistical background for travel demand modeling; choice theories; random utility models; econometric methods for the multinomial logit and related models; applications of random utility models to travel demand forecasting; demand/performance equilibration. Prerequisite: 6E:184 or 6E:221. Same as 6E:226.

44:237 Urban Economics and Urban Spatial Structure 2 s.h.

Economic models of urban land use and rents, racial segregation in housing; measuring the benefits of pollution control, crime control, and public school quality, choice of residential location, decline and revitalization of city centers.

44:262 Political Economy of Regional Development 3 s.h.

The "unequal" relationship between Third World countries and the industrial world, and contemporary development problems of Third World societies; form and function of the Third World-industrial world relationship, in both external and internal dimensions. Consent of instructor required.

44:263 Industrial Location and Regional Development in Latin America 3 s.h.

Conceptual approaches drawn from structuralist, dependency, neo-Marxist, and neoclassical perspectives on regional development; case strategies; topics include methods of industrial location, female labor force participation, automotive industry, spatial perspectives on industrialization, informal economies, research and development, import substitution, and foreign debt.

44:264 Agrarian Change and Rural Development in the Third World 3 s.h.

Introduction to classical and contemporary theories that inform rural development projects and programs; historical roots of contemporary rural development thinking; in-depth research paper on the nature of rural development in a Third World nation.

44:265 Transportation Regulation and Finance 3 s.h.

Public policy options for improving passenger and commodity movements within and between cities, as these policies relate to air, water, and land-based transportation modes. Same as 102:265.

44:270 Jurisdictional Organization/Public Service Provision 3 s.h.

In-depth examination of literatures dealing with geographical aspects of jurisdictional organization, provision of public services, location of public facilities, geography of elections, and public policy.

44:272 Social Theory: Social Movements and the Local State 3 s.h.

Literatures on social theory, territoriality, and relations between national states and their subnational divisions; Marxist and non-Marxist social theories; alternative conceptualizations of territoriality; examination of jurisdictional organization of space in both Western and non-Western contexts.

44:273 Social Theory and Human Geography 3 s.h.

Assumption that space is a socially produced and reproduced commodity that gains value as it enters the production process; how space enters production vis-a-vis forces that circumscribe larger societal relationships; production and reproduction of social space in a capitalist economy.

44:275 Development Policy and Planning in the Third World 3 s.h.

Interdisciplinary seminar; focus on comparing development policies and planning in Third World countries; important development problems and alternative perspectives on problems and proposed solutions. Same as 113:275, 6E:234, 42:275, 34:275, 102:275, 7F:275.

44:280 Advanced Field Studies arr.

Problem definition and research design in a field setting at the graduate level; sampling procedures, collection of primary data, data analyses, and interpretation; may encompass the spectrum of geography; can be tailored to individual requirements. Consent of instructor required.

44:285 Methods of Regional Analysis: Regional Science 3 s.h.

Methods of regional science, including input-output, interregional input-output, econometric and regional economic growth models; emphasis on theoretical foundations and applications to forecasting and policy impact analysis.

44:286 Methods of Regional Analysis: Population Geography/Demography 3 s.h.

Methods of population geography and demography, including migration and multiregional demographic models; models of population growth and spatial interaction; interregional economic-demographic models; emphasis on theoretical foundations and applications to forecasting.

44:290 Regional Development: Theory and Policy 3 s.h.

Methods of regional science, including input, output, and econometric models; migration and multiregional demographic models; spatial interaction modeling; interregional economic-demographic models; emphasis on theoretical foundations and applications to forecasting and impact analysis. Same as 6E:290, 102:290.

44:293 Advanced Location Theory 3 s.h.

Economics of location; location of the firm; transportation cost and location; location-allocation models; spatial price theory. Consent of instructor required. Prerequisite: 6E:202 or 6E:203. Same as 6E:293.

44:308 Research Seminar: Quantitative Methods, Computer Methods, and Modeling 2-3 s.h.**44:315 Research Seminar: Political Geography** arr.**44:328 Research Seminar: Physical Geography** arr.**44:329 Research Seminar: Water Resources** arr.**44:330 Research Seminar: Location Theory** arr.

Critique of the contemporary location theory literature; discussion of solutions to the problems identified. Prerequisite: 44:137.

44:337 Seminar: Urbanization arr.

Problems and consequences of urbanization processes: political, economic, and social study of metropolitan areas. May be repeated. Same as 34:279, 7D:301, 30:324.

44:350 Research Seminar: Staff arr.**44:394 Research Seminar: Regional Development** 3 s.h.**44:406 Research: The Teaching of Geography** arr.**44:440 Research: Environmental Systems Analysis** arr.**44:441 Research: Locational Analysis** arr.**44:450 Thesis** arr.

GEOLOGY

Chair: Holmes A. Semken

Professors: Richard C. Baker, Robert S. Carmichael, Lon D. Drake, Brian F. Glenister, Philip H. Heckel, Richard A. Hoppin, Gilbert Klapper, George R. McCormick, Holmes A. Semken, Keene Swett

Professors emeriti: William M. Furnish, Sherwood D. Tuttle

Associate professors: Robert L. Brenner, Ann F. Budd, C. Thomas Foster, Jr.

Assistant professors: Luis A. Gonzalez, Mark K. Reagan

Adjunct professors: G. Brian Bailey, George R. Hallberg, Donald L. Koch

Adjunct assistant professors: Gregory A. Ludvigson, R. Sanders Rhodes II, Brian J. Witzke

Research associate: Julie Golden

Undergraduate degrees offered: B.A., B.S. in Geology

Graduate degrees offered: M.S., Ph.D. in Geology

Geology is the basic study and practical application of scientific disciplines related to understanding the earth. Geological concerns include the earth's origin, its present appearance and character internally and at the surface, its alteration with time, location of economic and energy resources, and how man is changing the earth for future generations. The Department of Geology has the customary subfields—mineralogy, petrology, stratigraphy, structural geology, paleontology, sedimentology, economic geology, geomorphology, glacial geology, environmental geology—as well as applied geophysics, geochemistry, paleobiology, and remote sensing.

Career opportunities are available to professional geologists in industry (especially related to environmental concerns), education, urban planning, state and federal geological surveys, and government, resource, 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 The University of Iowa's geology graduates find employment with the petroleum industry in exploration geology and geophysics. Others continue in

graduate school or take jobs with government or conservation agencies. Some intend to enter law, business, or other fields such as urban planning, environmental studies, engineering, archaeology, science education, or oceanography as advanced areas. Geology is suited to all of these.

The program puts greater stress on the basic aspects of geology than on the engineering or agricultural phases of the discipline. The department specializes in relating scientific thought to the study of the earth. Its resources include a major paleontology facility (invertebrate, vertebrate, palynology), a terminal link to the Weeg Computing Center, the Geological Survey Bureau (located in the same building as the department), and research equipment for fields such as mineralogy, petrology (igneous, sedimentary, and economic), remote sensing, and exploration geophysics.

Geology majors receive at least an academic year's work in three allied scientific areas—physics, chemistry, and mathematics—and a semester of biology in addition to a course in each major area of geology.

Each year more than 700 students enroll in 12:23 Earth History and Resources and 12:24 Introduction to Environmental Geology, team-taught, laboratory-lecture courses designed to fulfill the College of Liberal Arts General Education Requirement in natural science.

For nonmajors, the department offers a lecture sequence featuring a general survey of geology and several advanced courses with few prerequisites—paleontology, geology of Iowa, remote sensing, geomorphology, and oceanography.

Undergraduate Programs

Students majoring in geology must meet the general requirements of the College of Liberal Arts. It is recommended that they satisfy the foreign language requirement with French, German, or Russian, and the social science requirement with approved courses in economics, geography, and/or anthropology.

Bachelor of Science

The Bachelor of Science professional program in geology is designed primarily as preparation for graduate study and for employment in industry. The following courses are required.

*12:5 Introduction to Geology	4 s.h.
*12:6 Evolution of the Earth	4 s.h.
12:41 Mineralogy	4 s.h.
12:52 Elementary Petrology	4 s.h.
12:92 Structural Geology	5 s.h.
12:93 Geologic Field Methods	2 s.h.
12:113 Summer Field Course	6 s.h.
12:121 Principles of Paleontology	3 s.h.
At least two elective geology courses	6 s.h.