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Rector \_\_\_\_\_

“ ” \_\_\_\_\_ 2019

**Specialization:** Biology

**Degree of education:** Doctor

# Doctoral program self-evaluation

**National University of Mongolia (NUM)**

**School of Arts and Sciences**

**Division of Natural Sciences**

**Department of Biology**

Ikh surguuliin gudamj 1, Ulaanbaatar 14201, Mongolia



**ULAANBAATAR**

**2019**

## Report of Self-assessment for Doctoral program of Biology

### **Leader of the self-assessment report team:**

Head of Biology Department DNS, SAS professor OYUNTSETSEG Batlai (Ph.D.)

### **Secretary:**

Associate Professor NYAMBAYAR Dashzeveg (Ph.D.)

### **Members:**

Professor	SONINKHISHIG Nergui (Assoc.Prof, Ph.D.)
Associate Professor	SHAR Setev (Assoc.Prof, Ph.D.)
Associate Professor	BATTSETSEG Choidash (Assoc.Prof, Ph.D.)
Associate Professor	BAYARMAA Gun-Aajav (Assoc.Prof, Ph.D.)
Associate Professor	OYUNGEREL Shagjjav (Assoc.Prof, Ph.D.)
Associate Professor	OYUNCHIMEG Purevjal (Assoc.Prof, Ph.D.)
Senior lecturer	ENERELT Urnukhsaikhan (Ph.D.)
Assistant to the head of department	TSEVEEN Altangerel
Lab technician	ALI Khamet
Lab technician	ALTANGEREL Gombo
Lab technician	ARIUNZAYA Tsolmonbaatar
Lab technician	NYAMDAVAA Byambasuren
Lab technician	TUNGARAG Ganjuur

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## **COMMON ACRONYM**

ADB: Asian Development Bank

BS-Business school

DB: Department of Biology

DNS-Division of Natural Sciences

HERP-Higher Education Reform Project

MECSS-Ministry of Education, Culture, Science and Sports

MES-Ministry of Education and Science

MNCEA: Mongolian National Council for Education Accreditation

NUM: National University of Mongolia

OGSP-Office of Graduate School Policies

PQAO-Program Quality Assurance Office

SAS : School of Arts and Sciences

SEAS-School of Engineering and Applied Sciences

SIRPA-School of International Relations and Public Administration

SL-School of Law

## VISION AND MISSION OF THE UNIVERSITY

With the approval of the “Strategic Planning of NUM 2016-2024” by the order number 13 of the NUM governing board dated 2015 December 28, the vision, mission and leading strategic directions were renewed.

### UNIVERSITY VISIONS

The vision of NUM is to become “world class university”. With this vision, NUM aspires to become leading research institute based on the tradition of liberal knowledge or “liberal arts” in the region and further to enter the rank of 100 leading universities in Asia.

### UNIVERSITY MISSION

Under the vision of NUM, mission of the university is to become academic and educational organization with academic programs covering the main domains of sciences that are based on liberal knowledge or “liberal arts”; maintaining regular activities of teaching and research on basic problems of natural sciences economics and social development; and mission to spread knowledge.

Leading strategic directions

To achieve the vision and mission of our university, we define the following strategic directions with leading importance. These are:

1. Widening the research scope, bringing the research to world level
2. Bringing the teaching and learning process to top level in the world
3. Leading the society in knowledge and being the pioneer in social development
4. Providing the independent status of the organization and following the international best management practices

### University Value

The member of NUM community shall esteem and abide by the below mentioned university values. These are:

Academic freedom	Doing free intellectual search and fully supporting the liberal expression of research results and developing critical thinking
Standard of development	Setting the standards for teaching, learning widening the horizon of knowledge, cultivating creative motivation and attitude
Ethics	Honoring the ethics of teacher, researcher, student and individuals, being truthful and respecting others
Leadership	Being the leadership with confidence of serving for the betterment of society and the nation

## **Doctoral program of biology**

Since 1990, NUM proceeded into the system of preparing professionals with university education at hierarchical levels of bachelor's , master's and doctor's training, pioneering in the higher education reform with objectives of providing the organizational independence to the university and becoming research institute that reach the level of top-class world universities.

To improve the quality and structure of graduate studies, with the advisory of TASIC project in 1999, Office of Graduate Academic Affairs was established; procedure for doctoral program was approved by the decree 637 of the president of NUM dated 2007 November 15; and amendments were made by the decree 421 and 306 of the president of NUM dated 2009 July 3 and 2010 April 30, respectively. By the decree A/370 of the Minister of Education and Science dated 2014 September 12, the program index is renewed.

## Overall information about the biology program

### 1. Program definition

Program name	Biology, F05110101
Medium of teaching	Mongolian
Program affiliation	Department of Biology, Division of Natural Sciences, School of Arts and Sciences
Contact person	Head of Department, Professor Oyuntsetseg Batlai
Person in charge of the program	Head of department, Professor Oyuntsetseg Batlai Professor Soninkhishig Nergui
- e-mail address	<a href="mailto:oyunaa@num.edu.mn">oyunaa@num.edu.mn</a> <a href="mailto:soninkhishig@num.edu.mn">soninkhishig@num.edu.mn</a>
- Telephone	77307730-2490
- Fax	
Program coordinator	<a href="#">Head of the program quality accreditation office under general academic affairs, Purevtsogt N.....</a>
- e-mail address	<a href="mailto:purevtsogt@num.edu.mn">purevtsogt@num.edu.mn</a>
- Telephone	77307730 – 1310
- Fax	
- Web address	<a href="http://dep.num.edu.mn/biology/">http://dep.num.edu.mn/biology/</a>

2. Date of commencement of the program: 1990

3. Level of the program: Doctor

4. Degree awarded by the program: Doctor of Biological Sciences (Ph.D.)

5. Total credit of the program, standard duration of completion

60 credits, 3-4 years (6-8 semester)

6. Student capacity of the program: 50

7. Type of enrollment: full time

8. Admission to the program

Students holding master's degree shall be admitted to the doctoral program. Registration for admission to the fall semester is from July 15<sup>th</sup> to September 10<sup>th</sup> and admission to spring semester is from November 10<sup>th</sup> to January 10<sup>th</sup> through the website <https://burtgel.num.edu.mn/>.

9. Commencement of an academic year for the program

Academic year starts on September 1<sup>st</sup> every year and consists of two semesters. Fall semester is between September and December (16 weeks) and spring semester is between February and June. The program follows the general calendarized planning released by NUM.

10. Tuition fee

The student chooses the subject of interest through the SISI system every semester and makes payment for the total credits for the chosen subjects.

As per the academic year 2018-2019, a student is liable to pay 154,600 tugriks for a credit of any chosen subject for doctoral course or research work and 192,000 tugriks for a credit of thesis.

*Table 1. Tuition fee for Biology program*

		<b>Subjects taught in doctoral course, research work /tugriks/</b>	<b>Doctoral thesis /tugriks/</b>
1	2014-2015	112000	192400
2	2015-2016	128000	192400
3	2016-2017	128000	192400
4	2017-2018	143000	192400
5	2018-2019	154600	192400



## Criterion 1. GOAL OF THE DOCTORAL PROGRAM AND CONTENT

The goal of the doctoral program is to align with the universities research policies and objectives, and to reflect needs and expectations of stakeholders.

### 1.1 Program documents

The doctoral program in biology has been implemented since 1995. The index of the program was updated by the Order A / 370 by the Minister of Education, Culture and Science in September 12, 2014, and after this, goals of the program as well as competence, knowledge and skills of graduates were also updated. However, there is no specific criteria for internationally benchmarking to assess the quality of the Ph.D program.

Ph.D program's rules and regulations, Table 1.1

Rules	Date and number
	March 16, 2010, No A/176
	November 4, 2010, No492
Higher education law	September, 12, 2014, NoA/370
	May 6, 2015, NoA/126
Academic policies and procedures of the NUM	June 30, 2015, No A/203
	May 4, 2016, NoA/112
	September, 09, 2016, NoA/235
	December 28, 2017, NoA/410
	December 28, 2017, NoA/409

### 1.2 Program goal

The PhD program aims to prepare researchers who are capable of conducting independent research and seeking opportunities to solve scientific issues.

#### **Objectives and definitions of the program:**

The program aims to produce researcher specialists who can carry out independent research work to seek scientifically reasonable solutions for relevant social issues.

#### **Grounds of the program**

1.1 Integration of features like vast land, extreme climate, biodiversity adapted to these conditions, nomadic animal husbandry, and traditional lifestyle makes life the special object of study at the level of molecule cell, and ecosystem to discover new principle of life. In the era of sustainable and green development goals under the pressure of increasing pace of development, land exploitation and climate change, studying of the relatively pristine biodiversity of Mongolia at all research levels, conserving them in artificial and natural habitat, restoration and rehabilitation , using the resource in sustainable manner are all pressing issues and as a result the importance of biological sciences and the role of biologist in society is ever increasing.

1.2 The program produces biologists and researchers in a specific branch of biology (microbiology, botany, zoology, genetics and molecular biology) for the government, non-government and business establishments involved in nature conservation, plant breeding, restoration and rehabilitation, agriculture, health, traditional medicine; and scientific researcher for universities, research institutes and industries.

**Table 1.2.** The program goal, knowledge and skills of graduates (Competences)

Academic Competences	Research Competences	General Competences
<p>To gain a broad and deep knowledge of the biological sciences;            Be able to contribute to the development of research theories, ideas, tools, techniques and skills;</p>	<p>To develop research concepts and designs, to develop new knowledge and to introduce applications;            To obtain the basic and applied studies at the highest level and gain ability to publish in peer reviewed professional journals;            Being ethical in science;            Be able to conduct research according to provided procedures;</p>	<p>Be able to use current scientific knowledge in certain circumstances;            Be able to understand, discuss and communicate with scientists about complex, unspecified meaning and issues;            Be able to understand, recognize and accept diverse aspects of knowledge, other disciplines of science and their methodology, values, contributions;            Be able to develop recommendations finding right solutions for problem facing societies using knowledge and information gained during the courses of the program;            Be able to initiate indepently new ideas solving complex issues and to have high competence and ability to perform complex tasks;</p>

### 1.3 Program content

The program of study of the curriculum has the following content that conforms to scientific objectives and learning outcomes (Table 1.3.). Out-of program requirement (courses should be taken from other programs) is about 10 percent of the program.

Table 1.3. The program of study of the doctoral program in Biology

<b>Classification</b>	<b>Credit hours</b>	<b>Competence to gain from the course</b>
Required courses	8-9	To gain broad and deep knowledge of Biology; To read professional journals and get the necessary knowledge and information;
Elective courses	14-15	Six credits out of 15 should be taken from other programs To specialize in certain discipline of Biology (botany, zoology, microbiology, genetics and molecular biology); To read professional journals and get the necessary knowledge and information;
Research work	12	To organize research workshops, to participate in conferences and to present own research, to report the findings orally or in writing; To acquire knowledge, information and experience from scientists and researchers; To be able to convert to other disciplines of Biology;
Dissertation	24	
TOTAL	60	

The details of the program of study, courses, credit hours, teaching methodologies, evaluation and knowledge to be learned are shown in Table 1.4.

### 1.4 Course curriculums

### 1.5 Special requirements for the doctoral program in Biology

## STANDARD 2. DOCTORAL PROGRAM IMPLEMENTATION

The institution has a structure, organization and legal environment to effectively implement the doctoral program, aligned with the program objectives and supports students' achievement of the intended learning outcomes and research activities.

### 2.1. ADMISSION

*Admission policy and criteria is enabling the students to achieve the intended learning outcomes. They are fairly and consistently applied. Therefore, the dissertation thesis and a supervisor selection, regulations for financial form and amounts shall be clear and open.*

According to Higher education law, order A/370 "General regulations for master and doctorate study" approved by the Ministry of Education, Culture and Science in 2014 and Article 4.2, 4.2.6.1, 4.2.6.3, 4.2.6.4, 4.2.6.6, 4.2.6.7 of "Regulations for study of National University of Mongolia" National University of Mongolia recruit students for doctoral degree program every year. Recruitment of foreign students for doctoral degree program regulated by other regulations.

Students can be transferred from one major to another from foreign and domestic universities to NUM and between departments/branches of NUM. It is regulated by "Regulations for student transfer of NUM".

According to "Achieving world leading study and learning process" 2016-2024 master plan of NUM within the admission policy NUM implemented step-by-step action to recruit best students for doctoral degree program. Director approved renewed regulations for recruiting students for master's and doctoral degree program in December 28, 2017 and changed admission policy.

- One of the key goals of NUM master plan is to support and increase higher education study.
- NUM started independently organizing admission procedure through its system throughout the country.
- During every admission for doctoral program, admission registration, admission quota and other related information are posted and promoted through media and web pages [www.burtgel.num.edu.mn](http://www.burtgel.num.edu.mn), [www.graduate.num.edu.mn](http://www.graduate.num.edu.mn).
- According to policy to increase students for higher education study NUM spread advertisement through e-mail marketing, "Eagle news HD" television, Family radio 104.5, daily press such as "Today", "Daily press", "Century news", moreover advertisement banners were posted on NUM web page, Facebook.
- Admission registration are made in electronic form, control numbers are entered into general registration, admission organized 1-2 times a year. Based on department's proposal control numbers of some high demand programs are approved by Director's order.
- Autumn admission organized from July 15 to September 10, Spring admission from November 10 to January 10.
- Student can request admission for several programs, however student can only study in one program with passed entrance exam.
- Entrance exam results will be notified by NUM registration system.
- Registration numbers of qualified students will be officially announced.

Requirements for admission:

- For doctoral degree program student must hold master's degree, for Law school student must hold master's degree in law.
- Student will be examined according to their doctoral degree program. Admission commission will be responsible for entrance exam.
- **Conditional /training/ program:** The program is for students who hold different master's degree than their enrolled doctoral degree study. In conditional program students will study up to 15 credits of master's degree and specialized course of their enrolled doctoral degree study.

- Students who successfully completed training program will continue their doctoral degree study after passing entrance exam.
- Students who meets conditions of the Article 4.2.6.6 of “Regulations for study of National University of Mongolia” can be transferred to external study according to the Academic council decision.
- Foreign citizens enrolled in doctoral degree study according to intergovernmental agreement and cooperation and/or independently must request for study through [www.registration.num.edu.mn](http://www.registration.num.edu.mn). Study will be regulated by Article 7 of this regulation.
- Doctoral degree study has day and evening class.
- Recruiting students for doctoral degree study must be approved by Director’s order.
- Students can obtain information about Master’s and doctoral degree guidance course from “Master’s and doctoral degree study manual”.

Study and student deputy director, head of Department of study, admission and registration department, head of information technology department, school directors supervise the compliance and enforcement of admission procedures.

27 students enrolled in doctoral degree program in biology from 2013 to 2019 (Figure II.1).

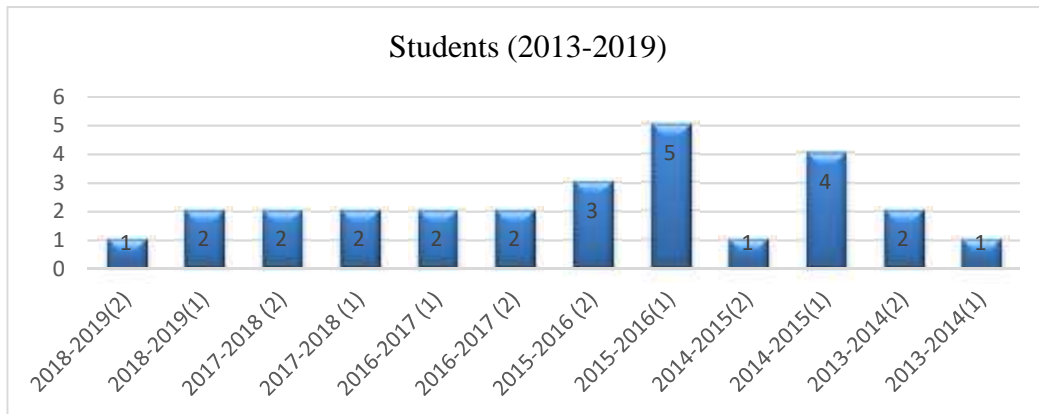
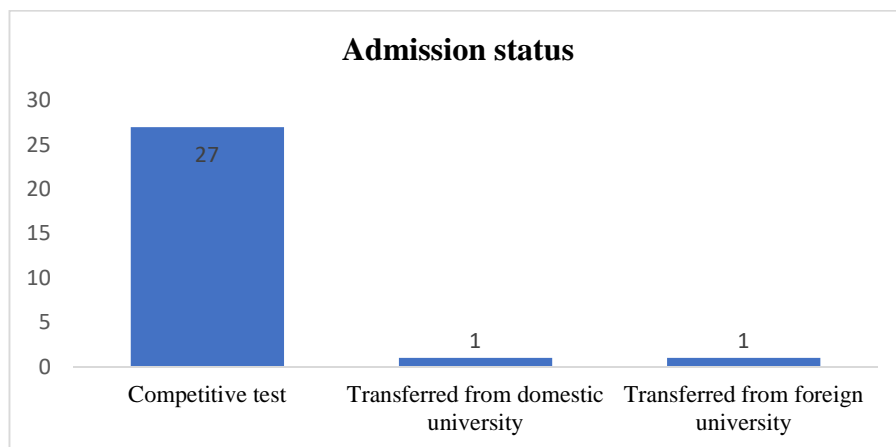


Figure II.1. Number of students enrolled in doctoral degree study in biology of NUM, SAS, 2013-2019.



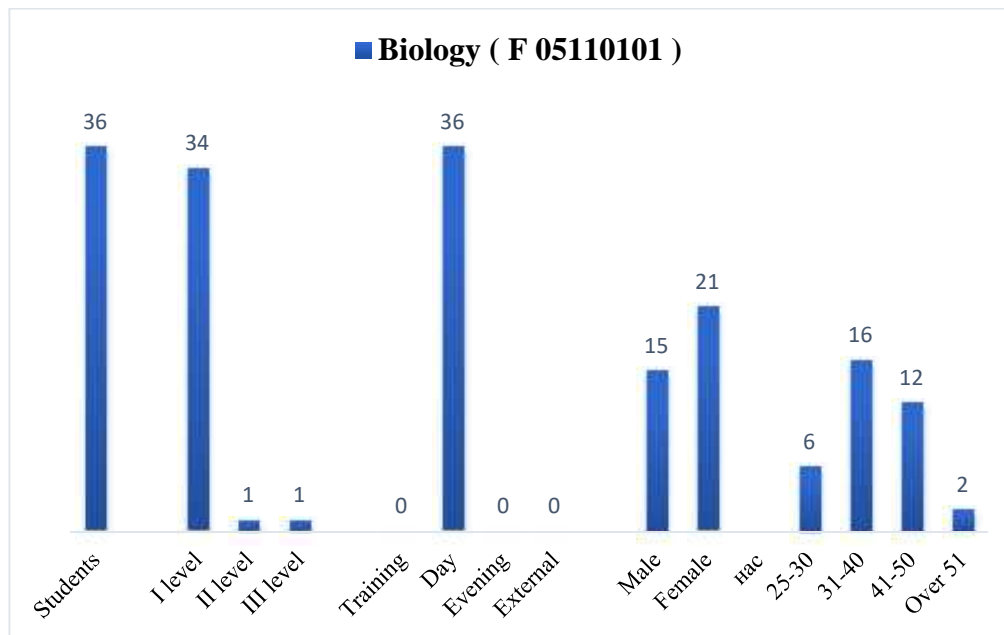


Figure II.2. Number of students enrolled in doctoral degree study in biology, 2013-2019.

Table II.1. Number of students obtained doctoral degree.

	Year of entry	Type of study	Program	Graduated year	Graduates
1	2006	Evening	Biology	2018	Ya. Adiya
2	2010	Day	Biology	2015	S. Tsatsral
3	2010	Day	Biology	2018	D. Delgerbat
4	2011	Day	Biology	2018	D. Badral

Based on department, program principal and doctoral student suggestion research topic and supervisor must be appointed and approved by the school director's order during first year of enrollment (Article 4.4.2 of "Regulations for study of National University of Mongolia").

If doctoral student requested to change the supervisor it must be approved by the school director's order based on department, program principal and supervising professor suggestion.

### Tuition fee and scholarship

Tuition fee is clearly defined in Article 4.13 of "Regulations for study of National University of Mongolia". According to Article 4.1.4 of NUM rules NUM board is obliged to approve tuition fee and student accommodation.

"General regulations for scholarship for students of National University of Mongolia" and "NUM scholarship" regulate the scholarship.

The main criteria for any scholarship program is student's grade point average. Depending character and purpose of the scholarship program its requirements and required documents are different. Many domestic and foreign organizations, individuals grant scholarships to support students with high GPA and successfully participated in research, volunteer work. Scholarships are provided by domestic and foreign sources. Examples of scholarships awarded to research students:

- NUM Academic council scholarship.
- Ts. Damdinsuren, Sh. Luvsanvandan, B. Rinchen scholarship.

- “NUM scholarship for doctoral students” awarded twice a year.
- Regulation for scholarship for NUM teachers studying in doctoral program.
- Employing master’s and doctoral students as an assistant.

Department of Biology has the policy to grant scholarships and awards for doctoral degree research. Number of students received scholarships increasing steadily. Following are types of granted scholarships:

- Grant scholarship from on going projects and programs in Department of Biology.
- Student exchange program /domestic, foreign/.
- Professor's expense.
- Associate professor’s expense etc.

Information about tuition fees and scholarships can be found on NUM web page (www.news.num.edu.mn, Student news-1, Student news-6, Student news-9).

## 2.2. STUDENT WORKLOAD AND CREDIT HOURS

*Workload for teaching contact hours, independent research projects, and thesis writing is balanced, preventing from overload or shortcomings.*

On December 23, 2016 NUM director approved the development of program subcommittee, clarify functions of general committee, develop, approve and changing orders for program of Regulations for program committee of NUM by the Order A/347.

NUM implements programs approved by the Programs general committee.

The goal of the doctoral degree program is to independently conduct research, contribute to scientific methodology and application, convert knowledge into product, to develop knowledge, skill and ethic for themselves and others.

Students with master’s degree, successfully passed the entrance exam and fulfilled other admission requirements can study in NUM doctoral degree program.

On average it's appropriate for the student to obtain 10 credits (evening 6 credits) per year, maximum number of credits per year is 15 (for Law school 13).

Doctoral degree program lasts 3-4 years. Based on Academic council decision students who have met certain conditions can be transferred to external study. It must be approved by school director’s order.

Doctoral degree program consists of main (department, faculty and program requirement), compulsory (department, faculty and program requirement), optional lectures (choose lectures from other department, faculty, university and research institute), conduct research under his/her supervisor, doctoral thesis.

Table II.2. Allocation of doctoral degree program credits.

<b>Program content</b>	<b>Doctoral degree program</b>
Main lectures	8-9 credits
Compulsory lectures	6 credits of 14-15 credits must be chosen from other university, department and research institute.
Research	12 credits. Under his/her supervisor doctoral student must lecture undergraduates, must work as an assistant researcher and obtain at least 3 credits.
Thesis	24 credits
Total credits	60 credits

- Credit system allows students to choose lectures. This requires students to plan their study plan during the entire study.
- To implement well balanced study and research doctoral student must plan his/her personal study plan every year. Study plan must be supervised and approved by the program subcommittee principal of the department. Department of study supervise abovementioned activity.
- Study plan allows students to pay their tuition fees according to their selected credits.
- After completing compulsory lectures and before starting their research doctoral students must pass general exam.
- Based on supervisor's statement and supporting research papers committee will calculate research credits.
- Academic council of schools must decide list of peer-reviewed and non-peer reviewed papers for considering research credits.
- Summary must be made regarding completion of the doctoral study plan, discussion of his/her doctoral thesis in scientific seminars held in department, university branch and sent to the committee.

### 2.3. RESEARCH AND LEARNING METHODOLOGY

*The program methodology should provide program content with a student-centered approach and opportunity to achieve learning outcomes.*

- To improve research methodology for doctoral students NUM invites associate professors and professors with great experience in research for seminars and lectures in research methodology.
- To develop research project, program, publish research article in compliance with international standards NUM provides seminars on research theory and methodology, promote cooperation, exchange research experience between researchers and lecturers every Wednesday. "Research seminar for master and doctoral students" guests discuss their research contents, methodology and give advice to participants.
- "NUM Speaker series" program is implemented for NUM lecturers and doctoral students. Program promotes research, results, exchange experience on quality and features of doctoral study between best young scientists of NUM who have completed their doctoral studies in Mongolia and abroad. Also promotes interdisciplinary research, provides information on latest research methodology for master and doctoral students.

Table II.3. Seminar on research methodology.

	<b>Lecturer</b>	<b>School</b>	<b>Topic</b>
1	D. Narantuya	SAS Sociology division	Social research: application of quantity and quality methods
2	B. Munkhbat	SAS Natural science division	Engineering research methods and its features
3	Ts. Darjaa	SAS Natural science division	Methods on writing a research article
4	Kh. Selenge	Law school	Organization and methods of research
5	A.Orkhonselenge	SAS Natural science division	Methods and techniques obtaining modern research methodology: on examples of geomorphology science
6	B. Altangul	SAS Humanities division	Concepts on research methodology of social science and humanities of France

- Department of Biology organizes "Department seminar" to discuss doctoral study research, invites doctors who obtained their degrees abroad, developed policy to increase doctoral students participation.
- Head of the department approves program and professor's seminars topics and organize seminars regularly and openly. Apart from research theory and methodology on this seminars doctoral study, research status, topic and results are discussed with guest researchers.
- In 2018-2019 8 topics, 2017-2018 9 topics were discussed in program and professor's seminars.



Table II.4. Research seminars held in Department of Biology.

	<b>Topic</b>	<b>Seminar administrator</b>
1	Genome	Associate prof. G. Bayarmaa
2	Biologically active compounds of plant and animal origin	Prof. B. Batjargal Senior lecturer D. Lhagvasuren
3	Biophysics research seminar	Consulting prof. M. Tsogbadrah Senior lecturer U. Enerelt
4	Ecology and evolution biology	Prof. B. Boldgiv
5	Enzymology	Associate prof. J. Bayarmaa
6	Zoology and natural resource program seminar	Prof. S. Gombobaatar
7	Microbiological program seminar	Associate prof. D. Tumenjargal
8	Genetics, molecular biology and physiology of microorganisms	Associate prof. J. Khulan
9	Botany program seminar	Prof. N. Soninkhishig Associate prof. B. Oyuntsetseg Associate prof. D. Nyambayar

- Doctoral student under supervision of professor develops knowledge and practical application of certain field of science and implements independent active learning methods. Conducting research and present results on department and professor's seminars, writing a research article shows that learning methods are student-oriented.
- NUM Higher education policy organizes "Research methodology" seminar. Main objective of this seminar is to determine master and doctoral thesis methodology, selecting research topic, writing and publishing research article, assist in obtaining new methods for conducting a research, exchange research experience. This is one of the student-oriented learning methods.
- Doctoral student must publish his/her research article in peer-reviewed Thomson Reuters and Scopus registered international journals.
- From admission to graduation the doctoral degree study implemented under integrated structure and management. Changes in relevant procedures, updating units' role and coordination, monitoring organizational activity have been implemented.

## 2.4. SUPERVISION

*The doctorate includes individual and regular follow-up of doctoral students, with clearly defined, coherent, and transparent procedures for doctoral students and thesis supervisors.*

General regulations for master and doctorate study, Regulations for study of NUM, Regulations for employing master and doctoral students as an assistant, Temporary regulations for validating master and doctoral students' research and practice credits and Regulations for employing professor at NUM regulates doctoral student and supervisor activity, monitoring performance of doctoral research activity according to individual program.

Higher education policy implements the decisions on activities of master and doctoral study and research. Within this framework it implements programs to improve the quality of master and doctoral research, study and research assistantship (hire in research project).

Supervisor and lecturers for master and doctoral study must hold doctoral degree.

Supervisor for doctoral degree study must guide and implement research, conduct experiment, analyze results, writing research article, presentation. Supervisor must consult and take responsibility on writing doctoral thesis and verify content, quality, scientific accuracy, legal framework of thesis.

To validate research credit doctoral student must publish research results in Thomson Reuters and Scopus registered international journals under his/her supervisor's supervision.

### **Doctoral student study plan**

At the start of the enrolled semester doctoral students must plan his/her study plan with selected lecture credits, thesis topic and supervisor.

Selecting thesis topic and supervisor is the most important choice. Therefore, based on consultation with the department, professor's team and professors doctoral student must select them at the start of the enrolled semester.

Department of study instructor will assist on planning his/her study plan. Doctoral student must fill appropriate form and approve it with signature and send to study specialist at the Department of study. According to this study plan Department of study will propose order to appoint thesis topic and supervisor, which will be approved by NUM director's order. Department of study will resolve based on department, professors' decision doctoral student request to change supervisor and thesis topic.

Monitoring study activity: Study activity regulated by SISI information system. This system is used for NUM study activity.

The main objective of this system is to facilitate, improve, operative, reliable, transparent monitoring NUM study and activities related to management and organization.

This system is used by NUM lecturers, staff, students and administration. The system cooperates with systems within NUM systems and other external systems.

SISI system is web based, can be used in Mongolian and English. In connection with printing diploma and its attachment in English, Cyrillic and Mongolian script the system supports Mongolian script.

From admission to graduation the doctoral degree study activity will be through the system.

## **2.5. RESEARCH LINK, COOPERATION**

*Provisions are made at the level of the program to increase the collaboration with national and international public and private organizations and higher education institutions. The doctoral program has established links and partnerships with internal or external research departments and/or organizations. Teachers and doctoral students are involved in research teams.*

Under the frame of supporting research, teaching and learning and teachers' development, NUM is working with objectives of making agreements of collaboration with international organizations and universities; promoting NUM internationally; and introduce international projects to NUM lecturers, staff and students. By the academic year 2017-2018, NUM has signed 344 memorandums of agreement with 287 universities and educational organizations from 36 countries. Valid memorandums of agreement can be breakdown as follows: 3 of 5 agreements with 5 Australian universities, 8 of 15 agreements with 15 universities of 3 countries from America, 154 of 241 agreements with 188 universities of 16 countries from Asia, 51 of 82 agreements with 79 universities of 15 countries from Europe. In the academic year 2017-2018, NUM signed 26 new memorandums of agreement at university level and extended 2 memorandums of agreement. When signing new memorandum of agreement, NUM observes the "Procedure of signing memorandum of agreement for collaboration" to increase the effectiveness of international relation and collaboration based on the bona fide collaborations between professors and departments. The "Procedure of signing memorandum of agreement for collaboration" was amended by the decree A/108 dated 2018 April 11 to the "Procedure of signing memorandum of agreement of international collaboration, implementation and conclusion of the collaboration". NUM Is working to officiate agreement of collaborations with discussion of participating parties and formulate proposal for a new memorandum of

agreement or extending the existing ones with more real conditions that can be brought to realization. Also, reporting of the information of the decision from the administrative council about the signing of memorandum of agreement for collaboration on the NUM website, the information is delivered to lectures, staff and students of NUM in timely manner. The work of creating a general space on the SISI system for information with memorandum of agreement for domestic and international collaboration and other relevant activities is in progress and some 210 materials related to memorandum of agreement for collaboration are collected (NUM annual report 2017-2018).

In the last 5 years in biology program is working in collaboration with 17 international universities, 3 government organizations and 4 private and non-governmental organizations under signed memorandums of agreement for collaboration (Table 2.5.1). Under these memorandums of agreement, 35 doctoral students in repeated number participated in research works.

<b>Agreement of collaboration made with international organizations</b>						
	<b>Contract name</b>	<b>Involved parties</b>		<b>Contract date</b>	<b>Project supervisor</b>	<b>Participated doctoral students</b>
1	Agreement on research and organizing training in Amar river and Altai ecozone	World wildlife foundation (WWF)	NUM, SAS	2019	B. Bayartogtokh	2
2	Census of ungulates and tracing of snow leopards at Jargalant, Bumbat and Baatar mountains	World wildlife foundation (WWF)	NUM, SAS, Department of Biology	01/11/2017	S. Shar	1
3	Research and supporting policy in relation to intensive land use and water shortage in Mongolia-China transboundary Altai-Dzungarian region	Rural development centre at University of Kassel	NUM, The school of biology and biotechnology (at that time)	2011-2015	N. Soninkhishig N. Batkhoo	5
4	Student exchange	Hosei university	NUM, SAS		B. Bayartogtokh	2
5	Student exchange	Korea university	NUM, SAS		B. Bayartogtokh	1
6	Agreement of cooperation	State museum of Natural History, Germany	NUM	2006-now	R. Samiya D. Lkhagvasuren	2
7	Contract on transfer of assets for specific purposes	People in Need NGO, Czech republic	NUM, SAS	2019		2
8	Golden Eagle Phylogeny and Taxonomy	University of Vienna	NUM, SAS	2018-2019	S. Gombobaatar	1
9	IUCN Red List Re-assessment for Mongolian Birds	London zoological society	NUM, SAS	2018-2019	S. Gombobaatar	3
10	Letter of Intent for the Biodiversity Conservation Network of East Asia	Botanical Garden-Institute, Far Eastern Branch, RAS, Russia; Forestry and Forest	NUM	2013-now	N. Batkhoo B. Oyuntsetseg	1

		Products Research Institute, Japan; Institute of Applied Ecology, Chinese Academy of Sciences; Korea National Arboretum of Korea Forest Service; Taiwan Forestry Research Institute				
11	Memorandum of Understanding	The National Arboretum of Korea Forest Service, Republic of Korea	The School of Biology and Biotechnology, NUM	2013-2018	N. Batkhoo B. Bayartogtokh	1
12	Memorandum of Understanding	National Institute of Biological Resources, Republic of Korea	NUM	2017-2022	N. Batkhoo B. Oyuntsetseg	3
13	Memorandum of Understanding for Research Cooperation	National Institute of Forest Science, Republic of Korea	NUM	2018-2020	N. Batkhoo B. Oyuntsetseg	1
14	Protection and information centre for the Gobi bear	Landesbund für Vogelschutz in Bayern e.V. - Verband für Arten- und Biotopschutz-(LBV)		12/09/2014	R. Samiya	2
15	Phylogeny and Taxonomy of Calandrella, Alauda and Eremophila larks in Mongolia	Uppsala university		2016	S. Gombobaatar	1
16	Sand Martin Taxonomy and Phylogeny In Mongolia	Swiss Natural History Museum	NUM, SAS	2017-2019	S. Gombobaatar	1
17	Taxonomy and Phylogeny of Palearctic species of birds	Harvard university	NUM, The school of biology and biotechnology (at that time)	2012-2018	S. Gombobaatar	1

<b>Agreement of collaboration made with governmental organizations</b>						
1	Conduct research at state protected area around Khar us lake	Administratio n of state protected area around Khar us lake	NUM, SAS, Department of Biology	15/02/2014	S. Shar	1
2	Biodiversity taxonomy and database in Mongolia	Science and technology foundation, Ministry of Nature, environment and tourism	NUM	2017-2018	S. Gombobaatar	2
3	IUCN Red List assessment of Plants of Mongolia	Ministry of Nature, environment and tourism		2017-2018	S. Gombobaatar	1
<b>Agreement of collaboration with private and non-governmental organizations</b>						
1	Agreement on publishing articles about “Environment, society, biological diversity around Uvs lake, Tes and Ulz river basin”	Mongolian Ornithological Society, NGO	NUM, SAS		S. Gombobaatar	1
2	Agreement on conducting research on wildlife of Khan khentii state protected area	Globus Co., Ltd.	NUM, SAS, Department of Biology	06/08/2014	S. Shar	1
3	Field test and simple evaluation methods of compliance and expression of criteria for evaluating ecosystem status involving herders	Clean development center NGO	NUM, SAS, Department of Biology	07/07/2017	S. Shar	1
4	Biodiversity and Society of Ulz, Uvs and Tes River Basin	UNDP and Adaptation fund	NUM, SAS	2015-2016		1

## **2.6. THESIS DEFENSE**

*Certain criteria for granting degree defense (create new knowledge, use outcomes, teaching evaluation, movement etc.) should be clear to the doctoral students and supervisors. The procedure for final defenses (defense commission composition, responsible for the members, meeting procedure and make introduction, etc.) should be defined clearly, concretely and fairly.*

With the objective of becoming one of the best 100 Asian universities, NUM opened the Office of Graduate School Policies (OGSP) in 2017 in line with the process of upgrading graduate level teaching, learning and research and establishing the graduate school with international university standards. OGSP monitors the execution of the decision on the academic and research processes of master’s and doctoral programs issued from central administration organization in charge of education and university administration to improve the quality and result of master’s and doctoral students research work; and implements the program of academic and research assistantship (giving financial support and scholarship by involving doctoral students in the research projects).

The doctoral thesis defense is regulated by the following general procedures and regulations for master’s and doctoral students of NUM. These are:

- Academic procedure of NUM  
Decree A/203 of the president of NUM dated 2015 June 30
- Procedure of NUM for recognition of credit hours of master's and doctoral research work, field work  
Decree A/112 of the president of NUM dated 2016 May 4
- Procedure of NUM for hiring master's and doctoral students and teaching assistant, research assistant  
Decree A/235 of the president of NUM dated 2016 September 9
- Regulations for doctoral thesis defense committee  
Decree 492 of the Minister of Education and Science dated 2010 November 4
- Procedure of NUM followed for preparing the doctoral thesis and submitting  
Decree A/176 of the president of NUM dated 2010 March 16

Committee of deeming credit hours for research work established based on “Academic procedure of NUM”, “Procedure of NUM for recognition of credit hours of master's and doctoral research work, field work” and the proposal made by the Department of Biology recognizes the 12 credit hours for doctoral course under the Biology program.

	<b>Activities</b>	<b>Credit hour</b>
1	Presenting the results of conducted experimental and research at a scientific meeting at the university level	1
2	Presenting at a domestic scientific conference	1.5
3	Presenting at an international scientific conference	2
4	Publishing in a peer reviewed domestic journals accepted by scientific committee	3
5	Publishing in an international peer reviewed journals with international team of editors	4
6	Publishing a monograph internationally	10
7	Publishing a monograph domestically	8
8	Publishing in a peer reviewed journals without Thomson-Reuters index	8
9	Publishing in journal with Thomson-Reuters index	10
10	Working as research assistant	2

The list of Journals approved by the scientific committee of Division of Natural Sciences, School of Arts and Sciences.

#### Pre-defense of doctoral thesis

- Doctoral student presents the doctoral thesis in a large seminar of the department of the component school
- The large seminar gives professional evaluation and decides to forward the doctoral student's thesis to actual thesis defense.

In the case of full completion of doctoral program credit hours and successful passing of the pre-defense , the doctoral student submits a request for graduation along with the following documents to the OGSP.

#### Documents to be submitted for doctoral thesis defense

(Procedure of thesis defense committee)

1. Copies of undergraduate and master's certificate (notarized copies)

2. List of publications (approved with signature of the thesis supervisor)
3. Decree of the president of NUM notifying the entrance and transfer to the doctoral program
4. Individual plan of study
5. Decree of the component school director notifying the approval of thesis theme and appointment of thesis supervisor
6. Decree for approval of the examination committee (applies to students admitted before 2011)
7. Grade sheets, examination papers, booklet of doctoral research activities (applies to students before 2011)
8. Overall grade sheet (printed from the SISI system and approved)
9. Proof of payment for expense of the thesis defense, proof of credit transfer decision by an appointed committee (must be approved)
10. Proof of full payment of tuition fee and proof of payment for expense of the thesis defense (must be approved)
11. Decree of the component school director notifying the appointment of committee for deeming research work credit hour and the decision of the committee for deeming research work (must be approved)
12. Minutes of the department seminars where the research progresses presented (at least of two seminars)
13. Minutes of the thesis pre-defense
14. Minutes of the correction made to the thesis based on the review from the pre-defense (must be approved)
15. Summary of thesis (3 pages of summary written in English)
16. Supervisor's letter of reference
17. Letter of reference for thesis defense from the component school
18. Request for permission to enter doctoral thesis defense
19. Original copy of the doctoral thesis (copy)

Doctoral thesis defense is conducted by the "Committee of doctoral thesis defense" approved by the Minister of Education, Culture, Science and Sports in 2014.

## **2.7. GRADUATION DOCUMENTS**

*Students are provided with a qualification certificate as well as a program-specific Diploma Supplement in English. These documents provide information on the student's qualifications profile and individual performance as well as the program learning outcomes, context, level and status of the degree program regarding its applicable education system.*

By the amendment to the Academic Procedure of NUM made 2015 June 30, a doctoral student successfully completed the requirements of doctoral program is awarded the degree in the specialized field and given a graduation certificate of proof of the degree along with a badge based on the decision of the thesis defense committee of Doctor of Biology.

1. The decision is issued by the thesis defense committee notifying the completion of the requirement of doctoral program.
2. Office of Academic Affairs provides the list of student names graduation in the semester with approval of the decree of component school director.
3. Doctoral diploma is verified by the signatures of the chairman of the NUM governing body, the president of NUM, the chairman of the thesis defense committee, director of the graduate school and seal of NUM and contains registration number.
4. The diploma has enclosed transcript sheet that has the details of major and/or minor specialization, intensive course directions, subjects of successful completion and their credit hours and grade point average along with other written information from the authorized organizations. The enclosed transcript is verified by the signatures and seals of the chairman of the general office of academic affairs of NUM and the chief of the academic affairs.

5. The template of the enclosed transcript is produced by the central administration organization in charge of education affairs.
6. If the student has completed the credit hours required by the doctoral program in the designated duration but yet to complete the research credit hour for completion of thesis, Decree of the president of NUM for completion of required credit hours is issued and certificate of credit hour completion is given. This certificate is valid for 5 years from the date of issue and the student has the right to complete the research credit hours and write and defend thesis in this duration.
7. The graduation documents should be available online.
8. The graduates of doctoral program are awarded the diploma and badge ceremoniously. During the degree award ceremony, the decree of the president of NUM is read out.
9. The ceremony is attended by the graduates, their friends and family and performed as celebration of erudition.



### CRITERIA 3. DOCTORAL STUDENT’S ASSESSMENT, ACHIEVEMENT

*The program demonstrates the achievement of the intended outcomes. Assessment is fairly and consistently implemented in line with the relevant institutional policies.*

#### 3.1 Assessment of doctoral students

*Student learning outcomes (knowledge, skills, competency) are systematically assessed with various approaches and methods. Assessment procedure and criteria is directed towards assessing in a fair and transparent manner. Assessment recourses including test banks in every course is developed and updated to assess students’ knowledge, skills and competency.*

Assessment of skills and knowledge acquired by a subject is an overall indicator that shows how much the student mastered the content of the subject curriculum progressively and finally. To assess doctoral students’ knowledge, skill and personality development, NUM procedure for teaching and learning is followed. Final evaluation consists of O1 for participation, O2 for progress, O3 for semester examination and detailed method for assessing the knowledge, skill and personality development is provided for every subject.

Analysis of the assessment for 9 subjects chosen by doctoral students in the last 5 academic years was conducted (Table 3.1)

Table 3.1 Breakdown of the evaluation of doctoral subject

Evaluation types	1	2		3
		Assignment	Progress test	
Attendance	5-25 points			
Participation	10-15 points			
Writing essay and assignment		10-38 points		
Processing data		10-25 points		
Writing project		25 points		
Reading scientific articles		10-50 points		
Oral			10 points	
Written			20 points	
Semester examination				25-50 points

For doctoral course, assignments of several types are given more importance. Especially, it’s common for the teachers teaching specialization subjects to give assignments on matters in line with the student’s topic of research. To evaluate the students’ progress, teachers give extra marks for semester examination based on analysis of progress results, though no student have been exempted for semester examination. Final semester examination can be conducted in the form of combinations of oral, in written test examination. Out of the 9 subjects covered by the analysis, 50% is oral or viva-voice and evaluated by 25-50 points and the rest are by written exams giving 40-50 points. There are no subjects in the doctoral course with final semester examination in the form of test.

Evaluation grading is in the form of percentage points, letter grades, or numbered marks. Full completion of assignment, compulsory consignment of knowledge and skill are considered 100%, and the relative to the 100% is percentage point. Letter grades are evaluation mark letters A, A-, B, B-, C, C-, D, D-, F that render the student’s level of knowledge and skill and numbered grades 4.0, 3.6, 3.1, 2.7, 2.3, 1.9, 1.4, 1.0, 0 can be allocated to each. The teacher is responsible to enter the grade marks into the information system within 5 working days after the completion of the examination.

Doctoral students must take a general examination after completion of major subjects' credits and before starting the thesis research. Director of the component school approves the team of examiners and examination date based on the proposal of relevant department and program.

Evaluation marks of research work and doctoral thesis defense will be allocated into the academic information system by the head of the department and office of general academic affairs will enter the evaluation.

### 3.2 Doctoral student progress and recognition of achievement

*The learning outcomes of students outside the program, in other schools and other programs are accepted and deemed as a credit hour. It also supports the student mobility /credit hour is accepted in accordance with the procedure and regulations.*

Credit hour shall be deemed for teaching assistantship under thesis supervisor teaching lectures and seminars for undergraduate courses, research assistantship and publishing the results of the research conducted in collaboration with the thesis supervisor in internationally recognized peer reviewed journals. The team of reviewers to account the credit hour for research work of a doctoral student is approved by the director of the component school based on the proposal of the department.

10 doctoral students' research work was deemed for credit hour in the last 5 years.

Delivering presentation at a research meeting at the university level	2 doctoral students 3 presentations
Delivering presentations at domestic science conferences	4 doctoral students 6 presentations
Delivering presentations at international scientific conferences	5 doctoral students 28 presentations
Publishing research results in peer reviewed domestic scientific journals accepted by scientific committee	5 doctoral students 16 articles
Publishing in international peer reviewed journals with international team of editors	2 doctoral students 5 articles
Publishing in international peer reviewed journals without JCR index	3 doctoral students 3 articles
Publishing in international journals with JCR index	4 doctoral students 8 articles

Based on the data represented in the above table, doctoral students of biology program are mainly obtaining credit hours by publishing in domestic scientific journals or presenting at international scientific conferences.

A student can make transfer from domestic or international universities, or from any major programs within the university. The transfer is regulated by the "Procedure of student transfer". Also, if any major's subject is not available in NUM related to the student's topic of research, with thesis supervisor's permission, 6 credit hours can be obtained from accredited universities that have agreement with NUM and national research institutes. Evaluation grades of subjects studied in this manner can be deemed based on the officially delivered evaluation grade and credit hours. The thesis supervisor must allocate the information on the subject into the academic information system and enter the relevant evaluation grade. Recognition of external credit hours of students from the program in the last 5 years:

Name of the doctoral student	University attended	Recognized subjects
Delgerbat Boldbaatar	Sweden, University of Uppsala	English Research methodology of Bioorganic chemistry

		Methods of reading spectral analysis results Research seminar Research methodology of the thesis Literature review of the thesis
Tserennyam Lundaa	School of Natural Recourses and Applied Sciences, University of Vienna	Biochemical engineering Research methodology of Biochemistry Molecular biological diagnosis Industrial microbiology

Since there are no students whose external credit hours were recognized other than the two students transferred from international universities, there is no necessity to choose subjects from other universities or research institutes or because some major's subjects are taught by part-time teachers from outside. Also, it can be explained by the fact that exchange programs for doctoral students are oriented only towards research work.

To make the doctoral research work of good quality, the doctoral thesis is presented to members of the department and expert scientist in a seminar and specialists' evaluation is delivered. This evaluation becomes one of the bases for the evaluation of the thesis defense committee of NUM.

### 3.3 Doctoral student support and advice

*The doctorate invites doctoral students to take part in supplementary scientific and/or professional events or activities, such as scientific events, conferences or panel discussion, etc. For each type of activities, the methods of access, validation and evaluation, particularly by doctoral students are defined and communicated.*

To motivate doctoral students' research activities, to improve the research methodology of doctoral students, NUM encourages its doctoral students to take part in domestic and international scientific conferences, training workshops, panel discussions, sessions and forums of professional and scientific nature from any field of study.

In the last 5 years, Department of Biology organized 4 domestic and international conferences and 5 doctoral students delivered 9 presentations (Table 3.4).

Table 3.4 Presentations given by doctoral students in the domestic and international conferences organized by the Department of Biology

Conference	Year	Doctoral student presented	Theme of the presentation
National conference of Biophysics and Bioinformatics	2015	T. Badamkhatan	Biophysical study of GA-K4 peptide
		Ch. Galbadrakh	
Second national conference of Biophysics and Bioinformatics	2017	T. Badamkhatan	Sonochemoluminescence one globule of water solution of rutin complex with two valency
		Ch. Galbadrakh	Biophysical study of the interaction between cell and antimicrobial peptide

First national conference on the problems of high mountain studies in Mongolia	2017	N. Battogtokh	Tsagaan Bogd Mountain, the homeland of central Asian endangered animal Research results of beneficial plants of high mountains
		J. Battsetseg	Epidemics of marmot plague in high mountain regions
“Biodiversity Research of Mongolia” international conference	2017	D. Narantuya	Arsenite-oxidizing bacteria isolated from mining soil in Mongolia
		D. Narantuya	Bacterial communities of Khubsugul Lake water determined by Phylochip analysis

Graduate student research conference is held annually in the Department of Biology. The number of students participating the research conference organized by the Department of Biology in the last 5 years is 3 and the credit hours were deemed in line with the “Procedure of NUM for deeming master’s and doctoral student’s research work and field work” (Table 3.5).

Table 3.5. List of Graduate students participated in student research conference of Department of Biology

	Name of doctoral student	Academic year the student research conference held
1	Ya. Adiya	2013-2014
2	Ts. Erdenechimeg	2014-2015
3	B. Bolor-Oyut	2017-2018

In line with the transparency of evaluation of participation in each activity, progress, result and attitudes, template of evaluation for doctoral student’s presentation in the graduate student research conference is enclosed (Appendix 3.1)

To monitor the research progress and result of doctoral students, departmental seminars are organized regularly and gives advices to the students. The date of the seminars and the list of presentation themes are approved at the beginning of each academic year and the name of presenter and brief summary of the presentation is delivered to interested parties through the internal network 7 days before the day of the seminar. Besides presenting their doctoral research work, doctoral students have the chance to learn from other researchers’ works (Table 3.6).

Table 3.6. List of doctoral students presented in the seminar of Department of Biology

Name of doctoral student	Date	Theme of presentation
D. Narantuya	2015.12	Study of bacterial community in Kharaa river
N. Kherlenchimeg	2017.5	Classification of capped mushrooms of Mongolia
G. Ulzijiargal	2018.03	Identifying tapeworms from some species of Mongolian wild animals by mitochondrial DNA sequence
Ts. Tserendulam	2018.03	“The vascular plant flora of Hustai National Park, Mongolia: Composition, life forms, ecological groups

		and geographical elements -The vegetation condition of Hustai National Park
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The thesis supervisor organizes professor's seminar to supervise doctoral students' experiments, analysis, organization of results, submission of scientific articles. Schedule for professor's seminars (date, presenter, theme of presentation) is approved by the head of department at the beginning of an academic year. In the academic years between 2017 and 2019, 9 doctoral students presented at professor's seminars (Table 3.7).

Table 3.7. List of doctoral students presented in professor's seminars

Name of research seminar	Name of doctoral student	Date	Theme of presentation
Research seminar of Biophysics	T. Badamkhatan	2017.10.12	Production of silver nanoparticles by biosynthesis
		2018.01.04	Dependence of nanoparticle properties on size and shape
	Ch. Galbadrakh	2017.12.07	Z-potential of cells
		2018.03.29	Discussion on experiments and research on measuring cell Z-potential
Genetics and molecular biology, microbial physiology	B. Tenuun	2017.10.09	Application of molecular biology methods in forensic medicine
	Ts. Nyamlkhagva	2017.11.06	Biological activities of bacterial isolates from hot spring
Seminar of Zoology and Study of Natural Recourses programs	D. Usukhjargal	2018.11.08	Population of Mammals in Khustai National Reserve
	N. Battogtokh	2018.12.20	Monitoring of endangered mammals around Tsagaan Bogd mountain
Seminar or microbiology program	L. Tserennyam	2019.02.11	Study of petrol degrading bacteria
Issues of Botany	Ts. Tserendulam	2018.10.24	Progress of doctoral research work and preliminary results
	O. Munkhzul	2018.11.07	Progress of doctoral research work and preliminary results

To encourage NUM lecturers enrolled into doctoral program, teaching hours are reduced and paid retreat periods are given for research work; and financial supports are available. Also, money incentives given to NUM lecturers who successfully completed doctoral program motivates research and is a genuine financial support.

To get acquainted with modern research methods and technologies, to learn from domestic and international researchers' experiences, and improve students' research capabilities, NUM organizes methodology workshop for doctoral students with other research institutes. For instance, OGSP of NUM organizes "Research methodology seminar" each year regularly, to help doctoral students to define their methods of graduation project and thesis work, choose research theme, write and publish scientific article, acquired research methods and exchange experience. This seminar is organized 7-8 times annually and experienced professors and researchers give lectures on research methodology. Also, OGSP of NUM organizes "NUM speaker series" program regularly and invites young researcher of NUM who have obtained their doctoral degrees in recent 5-6 years from universities in developed countries to create opportunities for doctoral students to learn from and share experiences with the researcher by exchanging information about their thesis research, experimental results, and quality of international education.

To implement doctoral program, doctoral students are trained in research work while working as research assistant. Professors of Department of Biology provides opportunities for their doctoral students to work as research assistant in the projects and researches conducted by them. When a doctoral student is hired as a research assistant, 2 credit hours are deemed in line with the “Provisional procedure of deeming credit hours for doctoral research work and field work” approved by the decree A/112 of the president of NUM dated 2016 May 4.

Research environment for doctoral students are provided in the form of following centers and classrooms. These are:

- Reading room for graduate student in the central library of NUM
- Graduate students’ room in the Department of Biology

### 3.4 Research funding

*The doctoral program is based on transparent research funding policy, which is consistent with its objectives and the scientific policy of the institution.*

Lecturers and professors of biology gives scholarships to students working as research assistant. In the 73 research projects lead by professors from the Department of Biology, 53 doctoral students from domestic and international universities are involved and given financial supports and stipends. Among these, stipends and research funds given to doctoral students are listed in table 3.8.

Table 3.8. List and doctoral students and stipend amounts involved in research projects

Name of project leader	Name of doctoral student	Source of funding	stipend	period
J. Khulan	Ch. Maitsetseg	“One Health Innovation Fellowship for Zoonotic Disease Research in Mongolia”	3 000 \$	2016
	B. Bolor- Oyut		300 000₮	2018
J. Batkhuu	N. Oyunbileg	Application of biologically active compounds from Mongolian indigenous plants and microorganism and study of their favorable genes	?	?
M. Tsogbadrakh	T. Badamkhatan	Isolation of biologically active peptides from animals and plants, and their Biophysical studies	500 000 ₮	2012-2014
	Ch. Galbadrakh		500 000 ₮	
	T. Badamkhatan	Studies of antimicrobial peptide	550 000 ₮	2016-2018
	Ch. Galbadrakh		550 000 ₮	
	T. Badamkhatan	Synthesis of antibacterial nanoparticles by biological method	500 000 ₮	2019-2021
Ch. Battsetseg	D. Narantuya	Increasing the possibilities to use microorganism in restoration of mining sites in Gobi region	1000000₮	2015
		Toxicity study and genetic diversity of cyanobacteria species in Asian large and ancient lakes Khuvsgul and Baikal	600000₮	2016-2017

		Study of possibilities to use microorganism in regions explored by mining	1000000₮	2016-2018
	D. Oyuntsetseg	“People in need”, international organization centered in Czech Republic	Research equipment costing 9874994₮	2018

Professor in the Department of Biology gives stipends to students working as teaching assistant. In the past, associate professor B. Oyuntsetseg hired doctoral student O. Munkhzul as teaching assistant during undergraduate field work in summer of 2017 and gave stipend.

### 3.5 Scholarship

*There are clear procedures for financing doctoral training and funding sources for scholarship.*

To encourage doctoral student to learn, conduct research and develop personally, to reward successful students, to support outstanding entrants, scholarships are awarded. The scholarship is in the form of stipend and others (partial exemption from tuition fee, exemption of credit hour payment).

The granting scholarship to doctoral students are regulated by the “procedure of scholarship granting to NUM students and waiving tuition fee; and proposing a candidate and carrying out preliminary selection for scholarships by other funding organizations are done at the component schools. Following scholarships are available for doctoral students. These are:

- National scholarships to students by the “Law of higher education funding and social security of students”
- NUM scholarship
- NUM scientific committee scholarship
- Scholarship for NUM lecturers enrolled as doctoral students.
- Scholarships by domestic and international organizations
- Scholarships by Alumni and individuals
- Other scholarships

Information related to scholarships can be found on the university website through the link <https://news.num.edu.mn/?cat=30>. For instance, at the moment “NUM scholarship-2019” for the graduate level students has been announced just recently and accepting materials from the applicants.

4 doctoral students received scholarships 6 times from NUM, other organizations and projects led by the supervising professors and their tuition fee were waived partially. One doctoral student received scholarship to participate in the graduate exchange program of an institute that has agreement of collaboration with NUM (Tables 3.9 and 3.10).

Table 3.9. List of doctoral students obtained scholarships from NUM and other organizations

	Name of doctoral student	Source of scholarship	Amount of scholarship	Year
1	.	Scholarship of Mitsubishi corporation	520 000 ₮	2015
2	D. Oyuntsetseg	Expense to support activities of lectures	504 000₮	2016

		from Department of Biology		
3	D. Oyuntsetseg	Expense to support activities of lectures from Department of Biology	500 000₮	2018
4	O. Munkhzul	International project led by the supervising professor	463800	2018
5	Ts. Tserendulam	Mongolia and Germany joint project	800 €	2018
6	O. Munkhzul	International project led by the supervising professor	973837	2019

Table 3.10. list of students participating in students exchange program at an institute with agreement of collaboration with NUM

Name of university and exchange program	Name of doctoral student	Name of supervising professor(s)	Period of exchange
University of Uppsala, Sweden (Maheva programme financed by Erasmus Mundus Action 2)	B. Delgerbat	Ch. Battsesteg J. Batkhuu	2011 August-2014 August



## Criterion 4. Faculty Composition

### 4.1 Faculty resource

The information of faculties who has taught courses of doctoral curriculum in Biology in the academic years between 2013-2019 years was obtained from the Order 1 by the president of the National University of Mongolia (NUM). In total, 25 faculties (1 ScD and 24 PhDs) teach in the PhD program in Biology. In accordance with the faculty positions at the NUM, two of them are full professors, 10 associate professors, 3 advising professors (professors who are retired but teach courses), 6 professors, 2 advising associate professors, 12 associate professors, 1 senior lecturer and 1 lecturer (Table 4.1., Appendix table 4.1, Appendix table 4.2, Orders released in 2013-2019s, the program of study of doctoral curriculum in Biology).

Table 4.1. Degree and positions of faculties belonging to the doctoral curriculum in Biology

	Position	Number	Doctor	
			D.Sc	Ph.D
1	Advising professor	3		3
2	Professor	6	1	5
3	Advising associate professor	2		2
4	Associate professor	12		12
5	Senior lecturer	1		1
6	Lecturer	1		1
	<b>Total</b>	<b>25</b>	<b>1</b>	<b>24</b>

All the professors, except 2 lecturers, have worked for the NUM for 11 at minimum and 40 years at maximum. The academic degrees, positions and experiences of the faculties has shown that the faculties of the curriculum have the full potential and capacity of research and teaching.

Currently, the faculty and student ratio of the curriculum is 1 which could be considered as 1 teacher has a doctorate or ratio of 1 to 1. It shows that students of the curriculum have sufficient resource of assistance in research and teaching from the faculties (Table 4.2, Appendix Table 4.3).

Table 4.2. Number of new PhD students entered to the specialization programs

	Specialization	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	Total
1	Zoology		2	1	1	1		5
2	Biophysics		1				1	2
3	Genetics	1		2	1	3	1	8
4	Microbiology		1	1			1	3
5		1	1	2	1	2		7
	<b>Total</b>	<b>2</b>	<b>5</b>	<b>6</b>	<b>3</b>	<b>6</b>	<b>3</b>	<b>25</b>

## 4.2 Faculty development

### **The role and activity of the Faculty Development Center at the NUM**

The "Faculty Development" national programme and its enforcement plan was released by the order A/136 by the in 22nd of February, 2012. This national programme aims to improve good work conditions of teachers working in all levels of education, to provide teachers with possibilities to develop continuously their teaching and research skills in the working condition. The ultimate purpose of the programme is to prepare teachers who are able to train patriot and life skilled citizens.

The NUM established the Center for Faculty Development and Online Instructional Design on September 12, 2016 consisting of the director, training consultant and center specialist. The center serves to support the teaching and learning methodology of faculties as well as professional and personal development. The following are the main activities taken by the center:

The seminar on **"Developing complete curriculum on higher education"** was held on April 1, 2017. Also **"Training for Multiple Choice Test"** was organized twice on February 21st and March 7, 2019 as the department head requested. Most faculties involved in the trainings (*Appendix, Order to organize the trainings by the vice dean of the Natural Sciences Branch, School of Arts and Sciences and and list of the involved faculties*).

The seminar on **"Using the Rubric Method for Training Evaluation"** was held successfully on May 25, 2017. The content of the training included understanding of the evaluation of the rubric method, types of rubric method, methods of developing rubric, and exercises constructing rubric for verbal and written assignments.

The module training **"Effective teaching in higher education programs"** is taking place from March 5 to May 21, 2019. This course aims to improve whole curriculum of higher education as well as curricula units, to ensure quality assurance of curriculums and to prepare curriculums for national and international accreditation. The module training aims to provide teachers with methodological support to improve teaching and learning within the concept and principles result-based education. Faculties who completed the module training and improved contents of their own courses using the new methodology will be certified.

The **"Faculty writing retreats"** program is being held from March 1 to May 10, 2019. This program aims to create a favourable environment for teachers to write, continue and complete their research work, and to support their actual research and research results. Teachers who have been involved in the program will publish their research results on the planned date and present them in the research meeting and discussion.

**"Training on the concept of online learning, environment and content development"** was held on May 01, 2019. The purpose of this training was to introduce modern open education ideas and trends in the development of technology, shifting from "old" teacher and class based trainings to technology based trainings and basics of how to develop online learning content through the development of online curriculum content and guiding practices.

Our faculties participated voluntarily in the seminars and trainings in order to improve their teaching skills and contents, and to learn new methodology evaluating students and to synthesize and analyse their research results.

## Improving teaching and research skills

The higher education sector is shifting to research-based training system and this system requires high highly qualification in teaching, teaching methodology and research from faculties. Preparing graduates with knowledge, skills, and attitudes those are required by employers needs faculties' qualification in teaching skills, ability to use new techniques and technology, to utilize them in classes, to develop each student, to take account into personal features, interests and talents of students, to work in a way that is appropriate for each student. Also faculties need to develop their personal leadership and communication skills. Therefore, it is necessary to improve the legal environment for faculty development, to support financial needs, to provide with services, to improve the professionalism and teaching skills, to provide counseling and support, and to encourage faculties to be active.

The university provides faculties with training, research and projects supporting their development in cooperation with local and foreign professional organizations. Moreover, faculties also collaborate with internal and foreign scholars and scientists to conduct research and to share experiences on professional and scientific studies. The faculties' participation in short and long term training to develop their teaching and research skills were estimated based on the survey consisting of 25 faculties and the Orders by the president and deans of the NUM between 2013-2019 (*Figure 1, Figure 2, Appendix table 4.4, Appendix table 4.5*).

Faculties belonging to the doctoral program in Biology do research in their field of expertise as well as conduct their research and attend in seminars, conferences in order to discuss their research results. In addition, they participate in various short and long term training courses in order to improve their professional skills (*Appendix table 4.4*).

Moreover faculties visit to foreign universities within exchange programs and conduct joint researches with international students (*Annex table 4.5*).

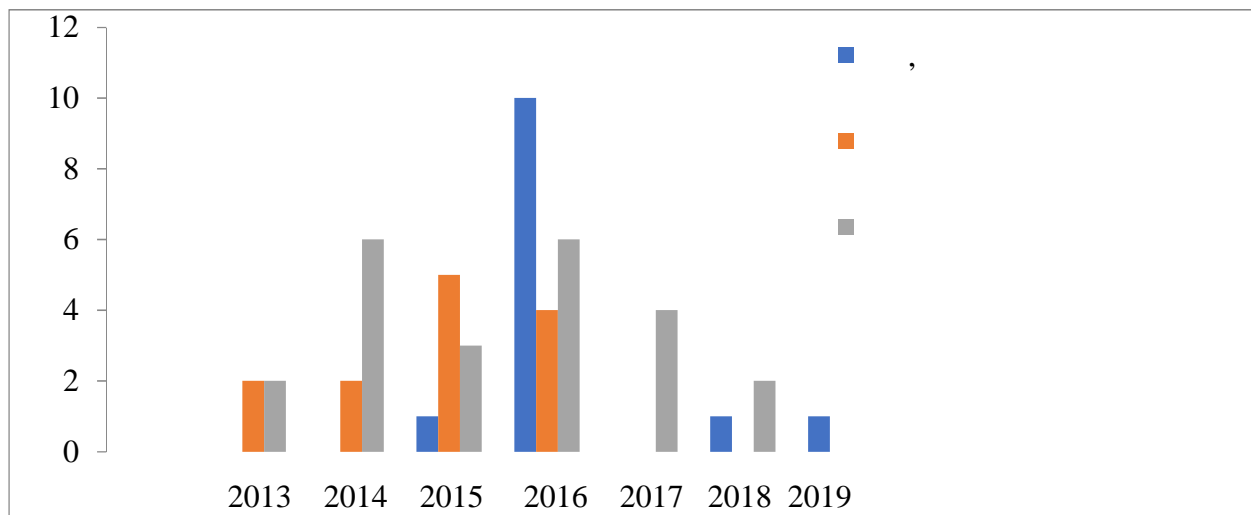
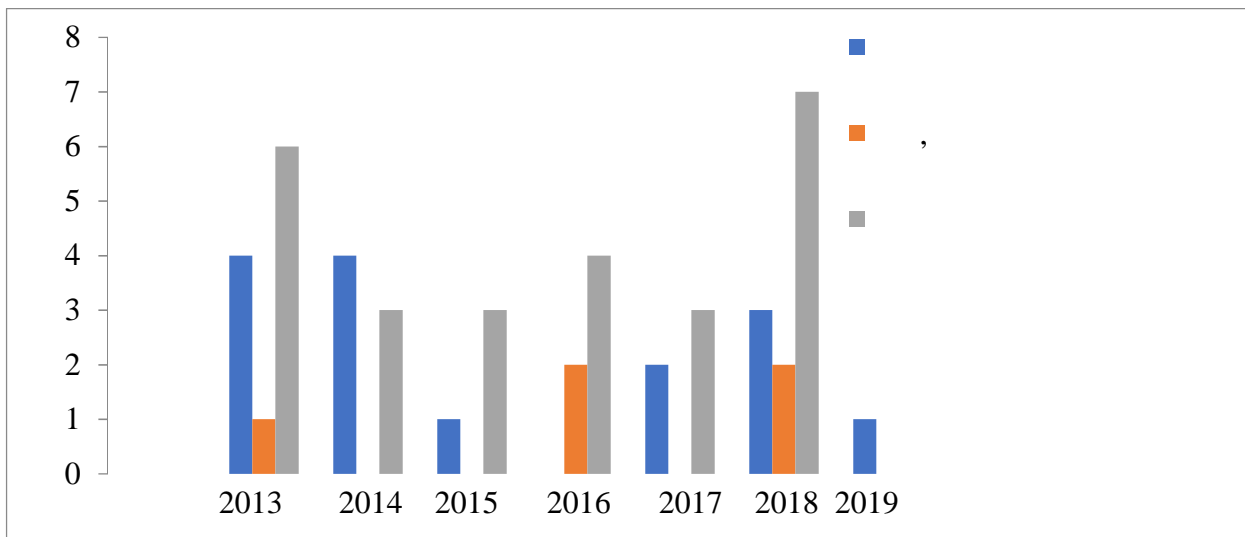


Figure 1. Faculties participated in local trainings, seminars, conferences, and countryside travels for research



**Figure 2.** Number of faculties participated in trainings, seminars, conferences organized in foreign countries

Based on the above Figures, it can be said that there are possibilities to develop their skills in the workplace and to conduct research in their field of expertise as participating abroad, presenting and publishing manuscripts on their research results.

### 4.3 Research and program development

. Publication.

Based on the list of scientific outcomes by the faculties of the doctoral program in Biology published between 2013-2019, number of published research papers in domestic and international professional journals, textbooks and handbooks were estimated (Table 4.3). In total, 236 papers mostly in international journals were published by the faculties; 130 papers out of the total papers were published in international peer reviewed journals with IF of Web of Science and Scopus. In domestic journals, 184 papers were published in total, 44 of them were written in English. Moreover, 11 textbooks, 83 training manuals and 22 translation works are now used in classes (Table 4.3, Appendix table 4.6).

Table 4.3. The number of papers, textbooks, manuals and translations published in 2013-2019

Scientific papers				Textbooks	Manual	Translations
International		Domestic				
With IF	Without IF	In English	In Mongolian			
130	106	44	140	11	83	22

Our faculties continuously conduct research, and the results are published internationally and internally. Faculties upgrade contents of advanced research and training and strengthen ability to prepare a good specialists.

B. Implemented projects and Ph.D. participation

Faculties are required to conduct research with international and local fundings and to provide graduates students with participation in their research projects. In 2013-2019, faculties have been implemented 73 research projects and 56 PhD students have participated in these projects. (Figure 3, Appendix table 4. 6).

PhD students working on research projects have increased their research methodology and have integrate research findings, statistical analysis, presentations, articles, and seminars under supervising by principal investigators and supervisors

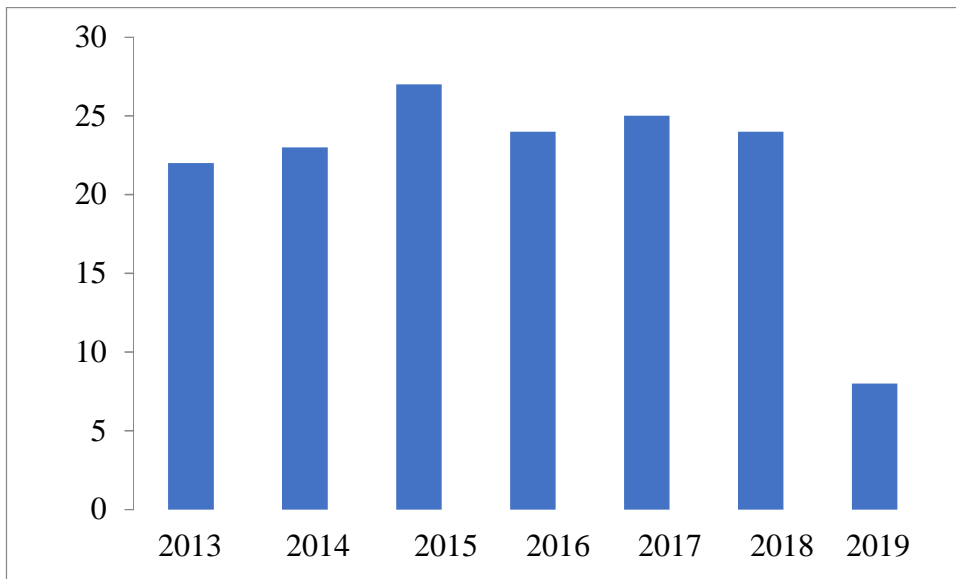


Figure 3. Number of research projects

Faculties belonging to the doctoral program in Biology have been conducting research and research projects with their PhD students.

## **CRITERION 5. INFORMATION SYSTEM OF RESOURCES AND MANAGEMENT**

*An integrated information management system is required to achieve the targets of learning achievement and the required resources for research, resource allocation and monitoring of performance and decision-making programs.*

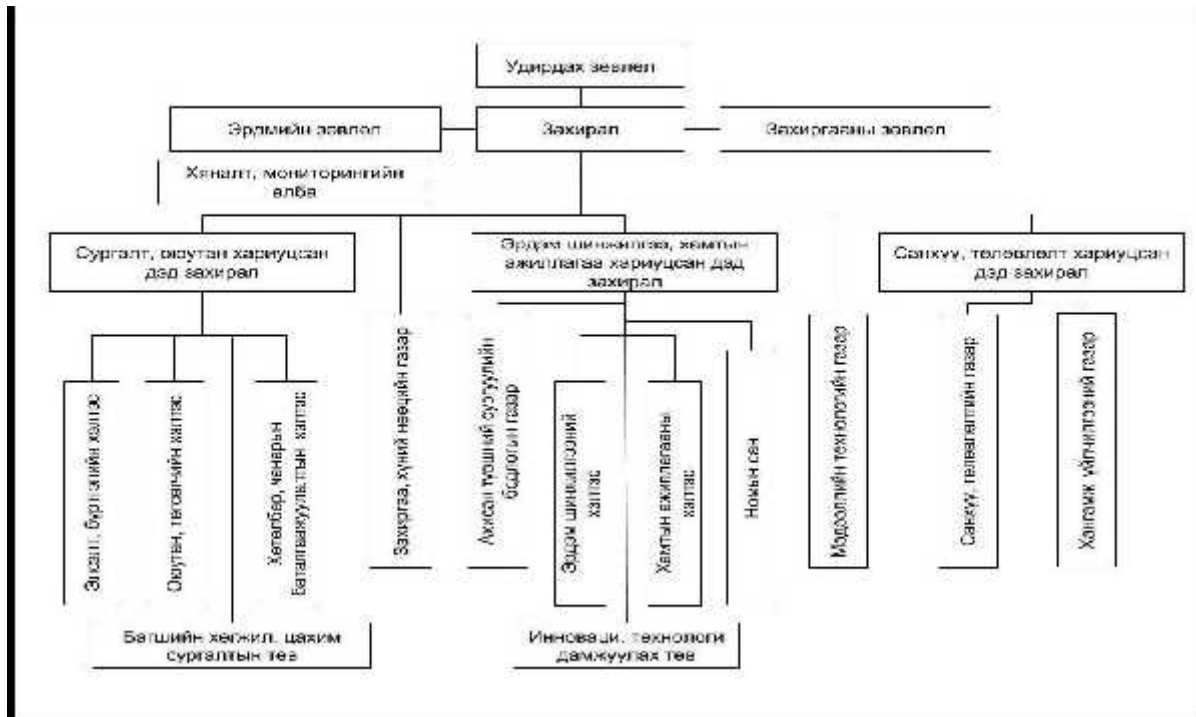
Over the past five years, we have been working on improving to implement effectively the goals and objectives of the doctoral program in Biology and to provide students with good quality of service and the necessary resources for completion the program successfully. For example, in the 2013-2014, 2014-2015, 2015-2016, 2017-2018, 2018-2019 academic year courses, apartments for PhD students were refurbished up, furnished them with furniture and equipment, internet environments, and research laboratories. Moreover, the university operationalized the new building for library, increased scholarships for students and improved the information systems, SiSi.

Within these frameworks, the Department of Biology created a resource for students to study. For example, current PhD students in Biology programs are provided with an office room equipped with with internet, copiers, computers, projectors, books, journals, desk chairs, storage shelves, and research materials. This room is located on the 4th floor of the Building II, NUM. Also, students can use relevant textbooks, foreign professional journals, powerful microscopes, and essential tool for teeth cutting of animals in the room.

Doctoral students are administered by the Advanced Study School at the NUM. This school has an online electronic system tracking all the research and course taking stages from enrollment to graduation of PhD students. The school was established at NUM in the 2016-2017 academic year within the restructuring occurred in the same year. The school administers and monitors PhD students enrollment, graduation and training through the SiSi system. There are two specialists, charging of all aspects which are relevant to PhD students, in the school

The Advanced Study School belongs to and under supervision of the vice dean charging of research and international cooperation. This administrative structure and managements enable to solve any matter related to the doctoral training and PhD students' research work.

## Status of the Advanced Study School at National University of Mongolia



Currently, the school has three job positions, director, senior officer and officer.

This school functionates within the strategic purposes to optimize the PhD programs in accordance with international development, labor market, and knowledge. The school is in charge of implementation and monitoring of all the policies and actions relevant to advanced studies taking by the university, content of those trainings according to approved standards.

### 5.1. Training and research environment

*The doctoral has to provide PhD students with classrooms, laboratories, and equipment for their active study. The students are able to use them freely.*

The strategic plan of the NUM for 2016-2022 aims to increase the NUM's rank, especially to become one of the best 100 universities in Asia. Within this strategic plan, the NUM has invested a certain amount of budget to improvement of research laboratories and encouragement of research teams collaborated with international scientists. For instance, in the 2013-2014 academic year, seven laboratories (Medicine foods, Natural compounds chemistry, Bio-organic chemistry, Forestry, Electron microscope, Space science, Genetics, Eco-physiology, Plant biotechnology and Plant phylogenetics and embryology) were invested by the budget of the Minister of Education (511.2 million tugrugs). Moreover, six laboratories (Biodiversity, Ecology, Biochemistry, Chemistry, New Materials Chemistry, Genetic Engineering, Science Engineering Calculation) were established with the total of 733.6 million tugrugs funded by the High Education Reform Project of the Asian Development Bank.

Laboratories, classrooms, rooms, and equipment of the doctoral program in Biology ensure the standards of Mongolian higher education organization. For example, relative humidity and lighting of classrooms are in the standard level and their temperatures range between 20-22C°. Noise level of the classroom is in low noise levels, less than 60 dB. The Department of Biology has a total of 10 classrooms, with maximum seating capacity of 78 seats (73.2m<sup>2</sup>). The smallest classroom (32m<sup>2</sup>) has 32 seats. The program is fully

equipped with training and research tools, and the program is fully fulfilled the standards of doctoral program standards.

PhD students are conducted their research in five laboratories, the Functional Genomics Laboratory, the Insect Diversity Laboratory, the Water Research Center, the Entomology and Pedozoology Laboratory, the Microbiology Laboratory. List of the training equipment, tools purchased for the labs over the five years are attached the Appendix.

**Table 1. Survey on research labs used for the doctoral program in Biology**

Laboratory		Year of establishment	Size of area / m <sup>2</sup> /	Per student area / m <sup>2</sup> /
Genetics and molecular biology laboratory	116	2007	57,0	4,75
Molecular cell biophysics laboratory	117	2007	54,0	1,5
Ecological biophysical laboratory	118	2001	18,0	1
Computer lab	120	2017	32,0	2,6
Functional genome laboratory	123	2013	13,8	Standart
Microbiological sterilization and disposal laboratories	213	2018	18,5	6,6
Algal study and micro-technical laboratory	312	2018	33,0	2,75
Laboratories of the entomology and pedozoology laboratory	317	2001	18.0	Standart
Insect diversity laboratory	321	2014	16.8	3.3
Plant taxonomy laboratory	420	2015	33,0	2,75
PhD students office rooms	425	2015	33,5	1,9

#### 5.1.1. Supply and supply of equipment

The doctoral program in Biology has regularly updated its laboratory equipment and equipment. For example:

Microbiology laboratory	30	187,117,375 tugrugs
Biophysics laboratory	30	268,833,214 tugrugs
Genetics laboratory		10,951,381 tugrugs
Botany	20	55,167,679 tugrugs
Zoology	10	52.284.790 tugrugs

The list of all equipment is attached in Appendix.

## 5.2. Textbooks and training materials

For each lesson, there is an environment for basic textbooks, training and research tools, and the information and outputs required for the research work are printed and electronic.





#### 5.2.1. Basic textbook research and electronic resources



In the PhD program, there are 269 foreign professional magazines, 25 magazines, 25 foreign languages, 126 textbooks and 30 basic textbooks. In the last five years, the training has been enhanced with a total of 167 types of textbooks and training materials worth 939,000 MNT for master's doctoral training. See the appendix chart. In general, the availability of professional textbooks and academic journals for use in PhD research is sufficient. In the past, professional magazines have been down-to-date, and the use of printed magazines has been reduced.

The training guidebook used in the Biology PhD program has been more enhanced and digitized during last 5 years. In addition to the traditional printed guidebook used in the course of our training, it is favorable condition for students to learn that modern electronic resources have created increasingly. For example, there are 59 book in electronic fund that includes biological textbooks and 967 journal and scientific paper classified by 23 kind of biology. A study of these electronic textbook is available to see in the Appendix.

**A virtual, digital video, audio and other electronic resources for doctors**

Name of e-library	Explanation
	<p><b>EBSCO HOST</b>            The EBSCO HOST database is widely used by the National University of Mongolia for the dissemination of the scientific literature database.</p> <ul style="list-style-type: none"> <li>• eBook Academic Collection</li> <li>• Academic Search Premier</li> <li>• Business Source Premier</li> </ul> <p>three packages are available and can be used until November 2017.</p>
	<p><b>ROYAL SOCIETY</b>            In the publishing sector, the 350-year history of the Great Britain Public Library publishes high-impact magazines and the first publications of scientific journals are open to the public.</p>
	<p><b>ANNUAL REVIEWS</b>            Since 1932, a great deal of information has been published by leading researchers on new developments, knowledge and challenges in science, and publishes 46 publications in Biochemistry, Biology, Physics and Social Sciences.</p>
	<p><b>THE PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA</b>            It's one of the few weekly high-impacted magazines. Free access from any computer in Mongolia.</p>

	<p><b>JSTOR</b> Established in 1995. More than 30,000 books, journals, and research works are available.</p>
	<p><b>SPIE DIGITAL LIBRARY</b> 432,000 journals and academic conferences from 1962 can be read free from university networks.</p>
	<p><b>THE GEOLOGICAL SOCIETY OF LONDON</b> Possible to read the London Geological Society journals.</p>
	<p><b>ECOLOGICAL SOCIETY OF AMERICA</b> On the occasion of the 100th anniversary of the American Ecological Society, it is free to read the most influential articles of the Society's magazines.</p>
	<p><b>SPRINGER</b> The 2700 magazine is free to read from our readers since 1997 and this is the right of our five universities and the Academy of Science.</p>

### 5.2.2. Foundation of the Research Journal

Doctorates are using a research journal fund that is located in the study room of the PhD students. For example, there are currently 987 journals classified by 24 kind in this library. At the same time, they uses from the Electronic Journal Fund. For example, there is a large number of journals in the scientific journal fund of Biological Profession, which has been conducted by T.Enkhbayar who works in Animal Collection fund.

### 5.3. Information system of Management

*There is a management information system for collecting and managing information that will facilitate efficient operation of the program. Collected informations and analysis are used to improve the program.*

The Senior Liaison Board of the National University of Mongolia (MAIN) works in charge of managing the postgraduate and postgraduate training at the National University of Mongolia. Currently, there are 1 head and 2 specialists in charge of managing day-to-day training and research. The ACA maintains its official website at [www.graduate.num.edu.mn](http://www.graduate.num.edu.mn) through its website to provide its information and information regarding the training and graduation activities of the Master Degree and the Master's degree program. Additionally, information is available at the National University of Mongolia (NUM) to increase

access to any public information. To respond quickly to the required issues and to receive feedback and receive graduate@num.edu.mn email addresses, we also need the necessary information.

The National University of Mongolia initiated a restructuring program in 2014 and transformed 14 faculties and 93 departments into 6 faculties and 33 faculties. It has been able to provide overlaps of training, research and investment policies. Procedures for enrollment of Masters in Doctoral programs (Master Order A / 410 of 2017.12.28), Procedures for Calculating Masters and Doctorate Degree of Master and Doctoral Degrees of National University of Mongolia (order . A / 112 of 2016.5.4) , Procedure for a Master's Doctorate Assistant (A / 235th order of the 2016.9), the training course of the National University of Mongolia (Order . A / 203 of 2015.6.30), Procedures for the preparation and dissemination of Doctorate dissertation (2010.3. Order . 176, Order 166), Master Doctorate's Charter (Rule 492 of November 11, 2010), M regulatory and regulatory profession, index and regulation (Order . A / 370 of 2014.9.12).

As a result of the introduction of the information system of the National University of Mongolia, PhDs have been upgraded and monitored.

#### **5.4. Information transparency**

*Information about the program, learning outcomes, recruitment requirements, training plan structure, curriculum, learning load, package time and student evaluation methodology are open to lecturers and students and will be updated regularly.*

In order to improve the SiSi information system at the National University of Mongolia, the entire system of training and research into the unified system is integrated into the financial system until the completion of the SiSi information system. Thus, the payment of the loan payment is fully solved and the budget revenue is structured and the information transparency has been improved. The introduction of doctoral programs, the structure of the training plan, the curriculum, the learning load, the time of the study, the student assessment methodology, and the information is open to teachers and doctors. In other words, information that is technically related to the doctoral course is never ready to come to the system, as information transparency is improving, information difficulties for students are eliminated. Doctorate candidates have access to the SIE system and have all the information available to them, as well as to provide them with all information, selection of classes, and schedule for self-assessment.

#### **5.5. Budget and finance**

*The program will be financed from multiple sources and budgeted for implementation, monitoring, evaluation and updating of the program. A portion of the program's funding is spent on teaching and learning.*

With the restructuring of the National University of Mongolia, it has been financially cost-effective, budgetary and financial policy has resulted in savings, large investments, research programs, best scholarships, and increased staff wages. In addition, the school built a new library of buildings using its internal resources.

With the internal financial resources, 1-2 million 9:16 tugrug annually is provided annually to support teachers and professors working in the professors and associate profiles. It now costs 1 billion MNT annually.

The school administration has adopted a procedure to support the research and has spent the annual budget on promoting 800 million MNT high-level research, graduate scholars, guest researchers and domestic professional journals.

In order to support academic research and doctoral studies, researchers have published 73 articles in the Web of Science index in 2018, and 1025 references to our school are the highest in Mongolia. Among them, the 10 faculty members of the Biology Department published an article in a magazine with the Web of Science index.

## **CRITERION 5. "SWOT ANALYZING" RESOURCES AND MANAGEMENT SYSTEM "SEARCH**

Advantages and features:

- The School and the Department has been working to improve the Doctorate training and research environment. Every school has been fully equipped with projector, projector screen, and computer as well as WIFI network. Now our lecturers and seminary classes at our department and lecturers and doctors prepare only the flash disk and prepare for the lessons.
- Determined the safety regulations of the doctors' laboratory and the procedures for storing toxic substances in health, and provided labor and safety.
- The opportunity to learn from the doctors' facilities in libraries, computer laboratory supplies, access to e-learning environment and internet environment has improved dramatically over the past 5 years. The availability of new libraries has improved dramatically to improve access to doctoral students. For example, during the last 5 years, the SIS system was introduced into the National University of Mongolia. This system has access to all research work.
- Doctors provide training and research in environments provided by modern computer equipment, printers and scanners. The availability of basic textbooks, foreign textbooks and foreign and domestic academic journals in foreign and Mongolian languages. Also, downloadable and readable articles can be downloaded through pdf files in the internet environment.
- Improved e-learning environments in the field of education, changes in policies, decisions, training programs, reforms, goals and targets for schools and departments to improve the policy and training conditions of schools and departments.
- The Department of Biology has a history of 77 years and is a great source of well-developed educational and training environment, with excellent internal and external communication and a strong line of teaching staff and a number of academic degrees from other departments, as well as many other aspects of the biological doctoral program.

Weakness:

- Lack of financial resources to improve the doctoral research laboratory is lagging behind the research lab of foreign universities.
- The lack of access to basic textbooks in Mongolian language for the doctoral student training and study standards is limited.
- Students with day-to-day training have the same strengths and lack of training and research because they are studying at the same time. The granting of grants to support doctors is insufficient.

- Focus on the proper use of teacher training and academic load in Doctorate classes, increase their knowledge of theoretical and practical knowledge, improve the teaching value of the teachers, and pay wages to the standards of foreign universities.
- Number of students studying in biological profession has decreased in recent years. In this connection, there is a lack of financial and financial resources required for the implementation of the program

**Current objective:**

- Increase the number of students enrolled in the Biological PhD program and increase their level of study to international standards.
- Develop and approve grounds for improvement of the conditions of training, laboratory and reactive supplies of doctoral training laboratories, load of teacher training, research work, and norms of work evaluation.
- Develop and approve the administration of the National University of Mongolia to improve the speed and capacity of the Internet
- Study and apply the experience of other biologically-specialized PhDs, as well as other countries that support policy-based natural sciences programs.
- Provide adequate scholarships for the PhD students during the study period and ensure that fieldwork and laboratory research is sustainable

**CONCLUSION**

1. It is important to improve the research tools of the Doctorate of Biology and bring the level of research closer to international standards.
2. It is imperative that the government financially support the need to consider the natural sciences sector as research laboratories, tools, and substances reactive.
3. These issues need to be solved because the transfer of students to the international standard that provides a reasonable amount of scholarship to their students in the course of their studies can positively affect the quality of their work.

## CRITERIA 6. QUALITY ASSURANCE

*The doctoral program is subject to regular internal and external quality assurance mechanisms directed at continuous development with the involvement of external stakeholders.*

### 6.1 Internal quality assurance and program enhancement

Until year 2014, admission procedures had been organized by accepting into individual programs under the responsibility of academic council of individual schools and office of academic affairs. All the materials and documents at every level related to the admissions procedure have been archived. There had been no unit at NUM for internal quality assurance, assessments for internal quality assurance have been conducted by administrations of individual schools directed towards teaching staff and students in the following ways:

- Conducting attestation for the members of teaching staff from individual schools in every 3 years, auditing the **teaching** activities and making necessary provisions
- Focusing on the teaching methodology of young teaching staffs, attending their classes and advising
- Settling the issues related to students such as admission, graduation, grading and **other issues** at the office of academic affairs under the direct administration of the director of individual schools

By the ordinance of the rector of NUM, web based SISI system for academic information was introduced in order to ease the administration and management and make them prompt and transparent. The initial version of the SISI system was brought in 2006, SISI 3.0 version was introduced to all component schools and SISI 4.0 version has been in use since 2013 with continuous improvements (last version as stated in the report of office of information and technology).

In 2014, NUM underwent a structural overhaul of the organization and the office of academic affairs at the component schools were dismissed and a general office of academic affairs was established (please refer to the ordinance of the rector).

In 2014, under the framework of higher education reform by the MECSS funded by the ADB, NUM implemented the grant project “Supporting the Development of Higher Education Institute”. Within the framework of this grant project and based on the NUM strategic planning until 2024, NUM determined it’s need for an office of internal quality assurance and formulated the structure, functions and rights of the office. As a result of this grant project, NUM rector issued ordinance /500 and established the office of quality assurance with staff member of 9 people. The office is in function since 2018 under the name Program and Quality Assurance office (PQAO).

PQAO in charge of creating, validating, implementing and changing academic programs; and producing statistics related to the academic programs, providing information and regular auditing. Also, the office oversees giving instructions for improving academic programs and assisting in international accreditation of academic programs.

PQAO has the following functions. These are:

- Formulating validating the procedures for quality assurance
- Formulating and putting in action the quality assessment system for academic programs to ensure quality assurance

- Performing quality assessments of academic programs; providing the teaching staff and the departments with information; and transfer information to human resources department to assist in the implementation to improve academic activities
- In order to carry out quality assessment of an academic program, the office obtains the annual reports from the respective department and prepare assessment reports for the academic program.

PQAO plans to produce amended procedure for academic program; prepare criterias for external quality assessment and general methodology for implementation of the external assessment; and prepare legal document that includes the solutions. Work plan of PQAO for the year 2019 is shown in table\*.

Table 6.1. General plan of PQAO  
(academic year 2018-2019)

	Planned activities	Implementation period /month/											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Prepare amended procedure for academic program and quality assessment												
2	Issue guidelines for formulating academic program												
3	Improving the methodology for defining the target number of students choosing an academic program, improving the methodology of ranking students choosing an academic program												
4	Validating the procedure for "Honors" program												
5	Issuing the guideline for approving translating and upgrading main textbooks for academic programs (General Introductory course, professional introductory course)												
6	Preparing and implementing general plan for accreditation process												
7	Forming the internal quality assurance system of the university												
8	Preparing procedure for credit transfer (lycée, Cambridge program high school, student exchange, student transfer, credit transfer between component schools)												
9	Organizing promotional events for academic programs												
10	Organizing introductory events for choosing academic program												
11	Organising survey for academic program												
12	Organizing the process for academic program selection and preparing reports and ordinance for the same												

13	Making analysis on academic program selection																			
14	Editing the information on subject, curriculum and planning																			
15	Organize and record the meeting of general curriculum committee and curriculum subcommittee																			
16	Advising the academic plan																			
17	Transferring students who chose their desired academic program to the MECSS																			
18	Preparing and compiling the information related to accreditation criteria																			

The system of quality administration

PQAO overseas formulating, implementing, assessing and upgrading academic programs and bringing external quality assessment to academic programs.

The process of quality assessment of teaching and learning processes follows the relevant regulations and procedures that is to say auditing and evaluating the implementation of the procedures for activities related to teaching and learning such as organizing the teaching and learning processes, formulating and implementing curriculum are as stated in section 4.15 of Academic Policies and Procedures of NUM and chapter 6 of Procedures of Curriculum Committee.

- Evaluating the performances of professors and teaching staff, main factor directly impacting the quality of teaching and learning, is regulated by section 4.5.11 in chapter 14 of the procedure of employing professors and teaching staff in NUM approved by the decree A/414 of the president of NUM dated 2014 December 22
- Questionnaires on content of a subject, quality, teaching methodology, ethics and communication of the teacher, and learning environment are conducted every semester according to the Academic Policies and Procedures of NUM. The Head of Department evaluates, summarizes the teaching processes of the teachers and formulates further plans as stated in the sections 4.1 and 4.2 of the Procedure for General Evaluation (Attestation) of Teacher’s Performance approved by the decree 655 of the president of NUM dated 2012 December 7.

External quality assessment and accreditation

Ensuring and supervising the standard order of teaching and learning programs are overseen by the office of academic affairs (write the offices of academic affairs office of graduate school policies), department heads, and director of component schools. In addition to aiming to create the necessary environment, find and establish resources for organizing the teaching and learning processes for producing a professional, quality assessment of academic program is directed towards bringing the professional accreditation.

Academic program quality assessment is carried out in two major directions, internal (curriculum committee and curriculum subcommittee of the university and component schools) and external (See section 2 of Criteria 6).

Internal assessment:



- General and introductory major's subjects
- Major's subjects
- Internships, field work and teaching intership
- GPA of graduates
- Other

#### External assessment

- Employers' assessment
- Alumni's assessment
- Questionnaire by student, self-assessment
- Assessment by state accreditation organization
- Assessment by international accreditation organization
- Other

The objectives and methodology of quality assessment should be transparent to all partakers in the teaching and learning process, students, teachers, public and the society. Final and progress assessment stages should be implemented (Figure 3. Table 1. Matrix of academic program quality assessment).

#### Internal assessment (Office of Graduate School Policies)

According to the decree A/174 of the minister of Education Culture Science and Sport dated 2014 April 28, curriculum committee should evaluate the Implementation of academic program in every six months and report to the school and NUM is conducting the following surveys with the objective of analysis. These are

- Questionnaires for sanitation is carried out among students and alumni. The survey for students is conducted through the academic information system twice an academic year. The survey for alumni is conducted regularly by the office of students and graduates.
- Progress assessment is the periodic assessment for students' progress
- Performance assessment consists of evaluations by employer and external professional assessment
- Assessment form professional sector is accounted as impact assessment
- Financial auditing and assessment of academic program
- Procedure of quality assessment of academic program

*Office of Academic Affairs:* ensuring the completion of planned activities of department, academic program in the academic year, scheduling the timetable, regulating the teaching and learning process, ensuring the standard of teaching and learning process and resolving any uprising issues promptly.

*Department head:* Every teacher formulates the plan of activities at the beginning of the academic year and gets it approved by the head of department. At the end of a semester, head of department evaluates and summarizes the completion and execution of the teacher's planned activities.

*Director of component school:* Based on the strategic planning of NUM, formulates the plan of activities in the academic year for the department in cooperation with the department and carry out assessment and summary to the completion of the plan.

*External assessment:* Survey from employer, alumni, and student, self-assessment, assessment by the state and international accreditation organizations.

External assessment of the academic program is conducted on the bases of assessment by the state and international accreditation organizations (See section 2, criteria 6). Also, it is based on the data collected by the survey from employer, alumni and students. Students' satisfaction survey is conducted through SISI information system twice a year. Results of the survey from last 5 years are shown in figure\*. Though satisfaction assessment by employer and alumni have not been conducted, all the entrants to the doctorate program of biology program are employed

## 6.2. Academic program accreditation

Within the framework of the policy in the Strategic Planning of NUM to improve the quality of teaching and learning, a working committee is in action formulating the objectives and criteria at several levels in order to bring the learning process up to international level. Since 2014 when a working committee was established by the decree A/382 of the president of NUM consisting of representatives of specialists, teachers and students with the aim to improve the 95 academic programs in total that are approved by the general curriculum committee of NUM MNCEA accredited 22 academic programs of NUM. Out of these, 11 are accredited with funding by HERP (in the 2017-2018 academic year). Also, Information Technology and Programming program from SEAS and Chemistry program from DNS of SAS are accredited with funding by AC. The working committee carried out assessments on general introductory courses of 13 from natural sciences, 11 from social sciences, 13 from humanities as well as 6 of civil education courses, 4 spoken and written ability courses, 33 language courses, 4 health courses and 9 physical training and research methodology course that are totaling to 93 courses; and the office of graduate school policies is involved in activities to improve graduate programs.

Table 6.2 Academic programs accredited by MNCEA

	School	Academic program	Program Index	Frequency of accreditation	Date of accreditation	Expiry of validity of accreditation
1	Business School	Accounting	D341400	II	2013	2018
2	SIRPA		D311900	I	2013	2018
3	Business school	Business administration/ International trade/	D041301	I	2014	2019
4	Zavkhan School	Accounting	D041101	I	2014	2019
5	SL	Legislation	D042101	I	2014	2019
6	SL	Legislation/International Legislation/	D042101	I	2014	2019
7	SL	Legislation /Business legislation/	D042101	I	2014	2019
8	SAS	Chemical technology/School of Chemistry and Chemical Technology-Food chemistry/	D071102	I	2014	2019

9	SAS	Psychology	D031301	I	2015	2020
10	Business school	Insurance	D041202	I	2015	2020
11	Business school	Finance	D041201	I	2015	2020
12	SEAS	Information technology	D061204	I	2018	2023
13	SEAS	Electronics	D071401	I	2018	2023
14	SEAS	Computer networking	D061201	I	2018	2023
15	SAS	Geography	D053202	I	2018	2023
16	SAS	Cadaster	D053211	I	2018	2023
17	SAS	Geology	D053203	I	2018	2023
18	SAS	Physics	D053301	I	2018	2023
19	SAS	Ecology	D052101	I	2018	2023
20	SAS	Mathematics	D054101	I	2018	2023
21	SAS	Biology	D051101	I	2018	2023
22	SAS	Biotechnology	D051202	I	2018	2023

Table 1.4. The details of the program of study of the doctoral curriculum in Biology

	<b>Index</b>	<b>Course name</b>	<b>Credit hours</b>	<b>Academic Competences</b>	<b>Research Competences</b>	<b>General Competences</b>	<b>Evaluation method</b>
1	METH600	Natural Science Methodology	3				
2	BIOL600	Experimental design and statistical analysis	3	Theoretical knowledge of statistical analysis	To explain and report the results; Critical writing of research		Participation and attendance; Independent study; Quarterly exams
3	BIOL601	Biological resource management and protection	3	Basic knowledge of biological resources	Application of national legislation, sustainable use of biological resources	Ecological, economic and social importance of biological resources	Participation and attendance; Independent study; Quarterly exams
4	BIOL602	Advanced molecular biology	3	New theoretical knowledge and methodology in molecular biology	Skill and experience to work in a molecular biology laboratory	Advanced level of basic knowledge	Participation and attendance; Independent study; Quarterly exams
5	BIOL701	Recombinant molecular technology	3	To create, extract and elicit recombinant DNA	To run gene express analyses	To induce and deduce problems	Participation and attendance; Independent study; Quarterly exams
6	BIOL702	Diagnosis of molecular biology	3	Basic knowledge	To learn new methodology to be used in biological research	To gain experiences	Participation and attendance; Independent study; Quarterly exams
7	BIOL703	Molecular genetics of plants	3	Molecular genetic mechanisms of plant development	Interrelations between plants and pathogens and	To read relevant journals and do analyses	Participation and attendance; Independent study; Quarterly exams

					genetic mechanisms		
8	BIOL704	Genetic engineering of plants	3	Basics to create organisms with new characters	To transplant genes and run gene express analyses	To create recombinant DNA and do analyses	Participation and attendance; Independent study; Quarterly exams
9	BIOL705	Cell molecular biology	3	General knowledge of molecular biology	Theoretical base of research methodology	Molecular mechanisms of cell structure and functions	Participation and attendance; Independent study; Quarterly exams
10	BIOL706	Genetics of metabolism	3	Basic theory of metabolism	Molecular mechanisms of activities occurring in cells	Modern achievements and theoretical bases of methods	Participation and attendance; Independent study; Quarterly exams
11	BIOL707	Cell culture	3	Basic theoretical knowledge	To plan research properly	To analyze results properly	Participation and attendance; Independent study; Quarterly exams
12	BIOL708	Genetic analyses	3	Basics of genetic results, to estimate frequency, Hardy-Weinberg law	Population structure, computer software, to create phylogenetic tree	To solve problems of disciplines of Biology	Participation and attendance; Independent study; Quarterly exams
13	BIOL709	Functional genomics of micro-organisms	3	Theoretical and methodological basics of genetics of micro-organisms	Knowledge on methodology	To use a gene engineering on nature conservation and biotechnology	Participation and attendance; Independent study; Quarterly exams
14	BIOL710	Genomics	3	Basic theoretical knowledge	Advanced knowledge on methodology	To conduct research of genetics and molecular biology	Participation and attendance; Independent study; Quarterly exams

15	BIOL711	Methodology of molecular biology	3	Methods to study physiology and biochemical activity	Methodology and skills to work in laboratory	Modern methods to identify micro-organisms	Participation and attendance; Independent study; Quarterly exams
16	BIOL712	Physiology of bacteria	3	Theoretical knowledge on physiology of bacteria	Practicum on bacterial physiology and biochemistry	To solve theoretical and practical problems	Participation and attendance; Independent study; Quarterly exams
17	BIOL713	Aquatic microbiology	3	Methodology of aquatic ecosystems	To gain methodological experience conducting aquatic ecosystem research	Wide knowledge on micro-organisms	Participation and attendance; Independent study; Quarterly exams
18	BIOL714	Soil microbiology	3	Soil micro-flora	To sample from soil and do microbiological research	To isolate soil micro-organisms	Participation and attendance; Independent study; Quarterly exams
19	BIOL715	Molecular microbiology	3	Roles, relations, structure of biomolecules in cell of micro-organisms	Theoretical knowledge and skill to work on the discipline of microbiology	Theoretical knowledge and skill to work on the discipline of microbiology	Participation and attendance; Independent study; Quarterly exams
20	BIOL716	Microbiology of traditional products	3	Theory of micro-organisms on traditional products	Research on yeasts of traditional milk products	It is possible to create milk products using modern technology.	Participation and attendance; Independent study; Quarterly exams
21	BIOL717	Biological active compounds originated in micro-organisms	3	Characters of biological active compounds	To isolate biological active compounds	To conduct an independent research and to use theoretical knowledge on practical work	Participation and attendance; Independent study; Quarterly exams

22	BIOL718	Systematics of micro-organisms	3	Characters to use for identification of genera and species	To learn complete methodology	To learn types and forms of modern systematics	Participation and attendance; Independent study; Quarterly exams
23	BIOL719	Plant evolution and phylogenetics	3	Theoretical knowledge on plant evolution and phylogenetics	Methods on anatomy – morphology and molecule genetics	To learn phylogenetic analyses of a certain taxon	Participation and attendance; Independent study; Quarterly exams
24	BIOL720	Methodology of vegetation	3	Wide knowledge on vegetation and plant community	To conduct vegetation research; To analyses research data	To learn skills analyzing results and concluding	Participation and attendance; Independent study; Quarterly exams
25	BIOL721	Taxonomy of flowering plants	3	To create identification keys monotomy, dichotomy and polytomy	To develop methods	To identify plants	Participation and attendance; Independent study; Quarterly exams
26	BIOL722	Plant eco-physiology	3	Theoretical knowledge	Inducing problems	Deducing problems	Participation and attendance; Independent study; Quarterly exams
27	BIOL723	Biological reclamation	3	To re-vegetate eroded lands	To cultivate plants in greenhouses, indoors and plantations	To select plants for reclamations	Participation and attendance; Independent study; Quarterly exams
28	BIOL724	Ecology of rangeland health	3				Participation and attendance; Independent study; Quarterly exams
29	BIOL725	Limnology	3	Theoretical knowledge	To express orally and written forms	To evaluate and conclude	Participation and attendance; Independent study; Quarterly exams
30	BIOL726	Zoology of specific groups (I)	3	Theoretical knowledge of methodology	To develop scientific bases for conservation	To estimate animal diversity	Participation and attendance; Independent study; Quarterly exams

31	BIOL727	Zoology of specific groups (II)	3	Theoretical knowledge of methodology	To learn modern methods	To estimate diversity of wildlife animals and conservation	Participation and attendance; Independent study; Quarterly exams
32	BIOL728	Biology of behavior and wildlife management	3	Theoretical knowledge	To conduct research on biological diversity	To develop recommendations for management and conservation plan and to do monitoring	Participation and attendance; Independent study; Quarterly exams
33	BIOL729	Game animals and animal farm	3	Legislation on hunting	To learn sustainable use of game animals in local areas	To learn scientific bases of sustainable use of game animals	Participation and attendance; Independent study; Quarterly exams
34	BIOL730	Methods in Zoology	3	Methods to study invertebrate and vertebrate animals	Methods widely used for ecological research	Skills to use modern equipment and tools	Participation and attendance; Independent study; Quarterly exams
35	BIOL731	Systematics and phylogenetics of animals (I)	3	Theoretical knowledge on methods	To learn systematics of animals and to reveal a phylogenetic relation	Understanding of modern methods	Participation and attendance; Independent study; Quarterly exams
36	BIOL732	Systematics and phylogenetics of animals (II)	3	Concepts and principles of animal systematics and phylogenetics	Cladogenetic analyses, historical biogeography, co-evolution	To create phylogenetic trees	Participation and attendance; Independent study; Quarterly exams
37	BIOL733	Animal conservation and management	3		To estimate animal resource and to use sustainably	To study international and Mongolian legislation, to use them properly	Participation and attendance; Independent study; Quarterly exams



38	BIOL734	Animal distribution and spatial analyses	3	Basic knowledge on estimation and sustainable use of animal resource	To learn about animal conservation	To study international and Mongolian legislation, to use them properly	Participation and attendance; Independent study; Quarterly exams
39	BIOL735	Estimating biological diversity and monitoring	3				Participation and attendance; Independent study; Quarterly exams
40	BIOL736	Ecosystem services and sustainable development	3				Participation and attendance; Independent study; Quarterly exams

Table 4.1. Information of teachers teaching biology doctoral programs

	Specialization	Faculty	Academic degree	Position	Degree	Years of experience at NUM
1	Zoology	Bayartogtokh.B	Doctor /S .D/	Professor	Professor	30
		Gombobaatar.S	Doctor /Ph.D/	Professor	Associate professor	21
		Samiya.R	Doctor /Ph.D/	Professor	Professor	40
		Shar.S	Doctor /Ph.D/	Associate professor	Associate professor	26
2	Biophysics	Tsogbadrakh.M	Doctor /Ph.D/	Professor	Associate professor	39
		Enerelt.U	Doctor /Ph.D/	Senior lecture		1
3	Genetic, molecule biology	Bayarlkhagva.D	Doctor /Ph.D/	Professor	Associate professor	
		Bayarmaa.G	Doctor /Ph.D/	Associate professor		14
		Khulan.J	Doctor /Ph.D/	Associate professor	Associate professor	11
4	Microbiology	Oyunchimeg.P	Doctor /Ph.D/	Associate professor		33
		Battsetseg.CH	Doctor /Ph.D/	Associate professor		29

		Tumenjargal.D	Doctor /Ph.D/	Associate professor	Associate professor	34
5		Nyambayar.D	Doctor /Ph.D/	Associate professor		13
		Oyungerel.Sh	Doctor /Ph.D/	Associate professor	Associate professor	20
		Oyuntsetseg.B	Doctor /Ph.D/	Associate professor	Associate professor	32
		Soninkhishig.N	Doctor /Ph.D/	Professor	Associate professor	27
		Suran.D	Doctor /Ph.D/	Associate professor	Associate professor	21
6	Required courses	Ariuntsetseg.L	Doctor /Ph.D/	Professor		11
		Boldgiv.B	Doctor /Ph.D/	Professor	Associate professor	22
		Bayarsaikhan.B	Doctor /Ph.D/	Associate professor		16
		Narangarvuu.D	Doctor /Ph.D/	Associate professor		17
		Lkhagvasuren.D	Doctor /Ph.D/	Associate professor		12
7	Elective courses	Batjargal.B	Doctor /Ph.D/	Professor	Associate professor	23
		Bayarmaa.J	Doctor /Ph.D/	Associate professor		28
		Suvdmaa.T	Doctor /Ph.D/	Lecture		3

Appendix table 4.2. The name of the course for each biological doctoral course and the name of the teaching teacher

	Specialization	Course information			Instructor
		Index	Name	credit	
1	Required courses	BIOL800	Scientific writing and philosophy of Biology	3	Bayartogtokh.B, Soninkhishig.N, Ariuntsetseg.L
		BIOL801	Evolutionary issues	3	Boldgiv.B
		BIOL802	Biodiversity analysis	3	Bayarsaikhan.B, Narangarvuu.D, Lkhagvasuren.D
1	Zoology	ZOOL701	Zoology 1	2	Bayartogtokh.B
		ZOOL702	Zoology 2	2	Shar.S, Gombobaatar.S
		ZOOL703	Behavioral biology wildlife animal management	3	Shar.S
		ZOOL704	Hunting study and animal husbandry	3	
		ZOOL705	Methodology of zoology	3	Bayartogtokh.B
		ZOOL706	Animal systematic, phylogenetics 1	3	
		ZOOL707	Animal systematic, phylogenetics 2	3	Gombobaatar.S
		ZOOL708	Animal conservation and management	3	Samiya.R
		ZOOL709	Animal distribution,	3	
		ZOOL710	Biodiversity assessment and monitoring	3	Gombobaatar.S
		ZOOL711	Sustainable development and ecosystem services	3	
2	Biophysics	BIOP801	Molecular and cell biophysics	3	Tsogbadrakh.M, Enerelt.U
		BIOP802	System biophysics	3	Tsogbadrakh.M, Enerelt.U
		BIOP700	Biomacromolecular physics	3	Tsogbadrakh.M, Enerelt.U
		BIOP701	Membrane biophysics	3	Tsogbadrakh.M, Enerelt.U
		BIOP703	Mathematical biology	3	Tsogbadrakh.M
		BIOP704	bioelectricity	3	Tsogbadrakh.M, Enerelt.U
		BIOP705	Phytobiology	3	Tsogbadrakh.M, Enerelt.U
		BIOP706	Ecological biophysics	3	Tsogbadrakh.M

		BIOP707	Radioactive biophysics	3	Tsogbadrakh.M
		BIOP708	Greenhouse gas concentration and flux physics	3	Tsogbadrakh.M
3	Genetics	GENE701	Recombinant molecular technology	3	Bayarmaa.G
		GENE702	Molecular biology diagnosis	2	Bayarmaa.G
		GENE703	Plant molecular genetics	2	Bayarmaa.G
		GENE704	Plant genetic engineering	3	Bayarmaa.G
		GENE705	Cell molecular biology	3	Khulan.J
		GENE706	Metabolism genetics	3	Khulan.J
		GENE707	Cell culture	3	Khulan.J
		GENE708	Genetic analyses	3	Khulan.J
		GENE709	Functional genomics of microorganisms	2	Khulan.J
		GENE710	Molecular biology method	3	Khulan.J
4	Microbiology	ICR801	Yeast physiology	3	Oyunchimeg.P
		ICR802	Geological microbiology	3	Tumenjargal.D
		ICR803	Mycology	3	Oyunchimeg.P
		ICR804	Microbiology of medicine	3	Battsetseg.Ch
		ICR805	Genotoxicology	3	Battsetseg.Ch
5		BOTA701	Plant evolution and phylogeny	2	Oyuntsetseg.B
		BOTA702	Study Method of Plant	3	Nyambayar.D
		BOTA703	Plant taxonomy	3	Oyuntsetseg.B
		BOTA704	Plant ecophysiology	3	Oyungerel.Sh
		BOTA705	Biological rehabilitation	3	Gombobaatar.S, Suran.D
		BOTA706	Pasture health, ecology	2	Suran.D
		BOTA707	Biology and ecology of algae	3	Sonnkhishig.N

Doctor's curriculum for the last 5 years of study and study instruments / 2012-2016 /

	Name of textbook	Author	Published year	Language	Quantity
1	Conspectus of the vascular plants of Mongolia		2014	English	10
2	A Guide to the Amphibians and Reptiles of Mongolia	Terbish K t al.	2013	English	5
3	Precision agriculture for grain production systems	Brett Whelan	2013	English	1
4	Proceedings of International Conference Plant Biodiversity and Ecosystem Services in Continental Asia		2013	English	3
5	Woodland Studies	Gombosuren N.	2012	Mongolia	5
6	Milk biochemistry	Urtnasan D.	2012	Mongolia	15
7	Beaver	Samiya.R	2012	Mongolia	8
8	Plant diseases	Galt.L	2012	Mongolia	15
9	Evolution	Futuyma	2012	Mongolia	51
10	Very rare ore in the world / Moschusmoschiferus	Delegnyam.D	2012	Mongolia	5
11	Mongolian Red List of Plant and Conservation Plans/ Part1	Cooperative	2012	Mongolia	9
12	References of dominant plant species in Mongolia	Badamkhand J.	2012	Mongolia	21
13	Biochemical metabolism	Enebish D.	2015	Mongolia	10
14	Pathogen biochemistry	Enebish D.	2012	Mongolia	15
15	Water-saltbeconstructuresbiochemistry and pathogenesis	Enebish D.	2012	Mongolia	15
16	Pharmacology	Chultemsuren	2012	Mongolia	20
17	General enzymological basis	Enebish D	2012	Mongolia	20
18	The biochemical basis of vitamins	Enebish D	2012	Mongolia	15
19	Enzymology	Purev D	2012	Mongolia	42
20	Micro-medical breathing	Ganbaatar	2012	Mongolia	25
21	Ecological conservation and restoration technology	Oyunbileg Yu	2012	Mongolia	20
22	Plant culture		2013	Mongolia	5
23	Zoology	Ganbold M.	2013	Mongolia	14
27	Science Biology 2040: Stem Cell Study	Dashnyam B	2016	Mongolia	10
28	Microbiology of veterinary	Galt L	2016	Mongolia	10
29	Color Atlas of Micro Life		2014	Mongolia	5
30	Ecological biochemistry	Bayarmaa J.	2014	Mongolia	10
31	Genetics, molecular biology and gene engineering	Khulan J., Temuujin J.	2015	Mongolia	20
32	Industrial microbiology	Galt L	2014	Mongolia	10

33	Food microbiology	Galt I	2014	Mongolia	10
34	Food microbiology	Davaadorj B.	2015	Mongolia	11
35	Biochemistry	Dumaa Yu	2013	Mongolia	20
36	Ecological Safeguards Technology		2012	Mongolia	2
37	Soyombo Encyclopedia: Biology		2012	Mongolia	21
38	Plant culture	Oyunbileg Yu	2013	Mongolia	5
39	Biochemical metabolism	Enebish D.	2012	Mongolia	20
40	The biochemical base of Hormone	Enebish D.	2012	Mongolia	20
41	Simplified ecology	Munkhbayar Kh.	2012	Mongolia	6
42	Base of Molecular biology	Altantsetseg Kh.	2012	Mongolia	10
43	Modern biotechnology	Davaadorj B	2012	Mongolia	68
44	Physicsecology	Tugjsuren N.	2012	Mongolia	30
45	Biological rehabilitation of disturbed land	Bordanova	2012	Mongolia	17
48	Biological contamination of soil in urban areas	Damdinjav G	2012	Mongolia	1
49	Biophysics		2015	Mongolia	11
50	Population genetic	Janchiv Ts	2013	Mongolia	10
51	Agricultural entomology	Chulujav Ch., Undarmaa D.	2015	Mongolia	5
52	Dictionary - internal and external structure of Plant	Tserenkhandand G., Ganbold E.	2015	Mongolia	10
53	Histology textbooks: Cytology, general histology-1	Tsolmon D	2014	Mongolia	10
54	Histology textbook: Human embryo -2	Tsolmon D	2012	Mongolia	10
55	Histology: Special histology-3	Tsolmon D., Tungalag Ts.	2015	Mongolia	10
56	Physiological basis	Otgon G.	2014	Mongolia	10
58	Guide to the mammal in Mongolia		2014	Mongolia	5
59	Food hygiene	Enhtuya B	2013	Mongolia	5
60	Gardening and green gardens	Batchuluun Ts.	2016	Mongolia	10
62	Microbiology of medicine	Galt L	2016	Mongolia	10
63	Human Body: Guide to the structure, function, and body of a person	Parker S	2013	Mongolia	15
64	The ecosystem of Mongolia is its priority	Mijiddorj J	2014	Mongolia	10
65	Red book of Mongolia		2015	Mongolia	10
66	Mongolian Environmental Encyclopedia		2013	Mongolia	10
67	A brief reference to the mineral spring in Mongolia		2015	Mongolia	5

68	The color of the seed of the rare, rare and beneficial plants of Mongolia	Tsedenbaljid G.	2014	Mongolia	4
69	Bioenergy III	Davaakhuu S	2012	Mongolia	3
70	Comparison Genetics of the Plant: Learning	Buyanchimeg B	2013	Mongolia	10
71	Bioenvironment I	Davaakhuu S	2012	Mongolia	3
72	Biochemistry	Dumaa E	2013	Mongolia	15
73	Plant Chemistry and Biochemistry: Practice Handbook	Sukhdolgor J.	2013	Mongolia	15
74	human evolution of From Darwin's writings to energy theory	Lkhagwaa G	2014	Mongolia	6
75	Mongolian bird photography dictionary / 175 species /	Boldbaatar Sh	2013	Mongolia	3
76	Agrology	Batchuluun Ts	2015	Mongolia	20
77	<i>Falco cherrug</i> of Mongolia	Gombobaatar S	2013	Mongolia	10

PhD study on newly acquired textbook research / 2015-2019 /

	Name of Author	Name of textbook	Published date	Page
1	Romoser, W.S. Stoffolano, J.G	The Science of Entomology	2016	605
2	Gullan, P.J Grantson, P.S	The insects	2017	565
3	Freeman, S. Herron, J.C	Evolutionary Analysis	2015	704
4	Hickman, C,P Roberts	Integrated Principles of Zoology	2016	939
5	L.S Hicman, F.M Peter Frances (ed) Audubon	Birds	2007	512
6	Del Hoyo (eds).	Handbook of the birds of the World volume 1-17 <i>HBW</i> series. Online use with ID and password. ( - )	1994-2019	1000 (each volume)
7	Nicole Silk and Kristine Ciruna (eds)	Freshwater Biodiversity Conservation	2004	393
8	Holger Rogal	Oekologische Oekonomie	2008	
9	Karsten Grunewald, Olaf Bastian	Oekosystemleistungen	2013	
10	Meyer B.Jackson	Molecular and Cellular Biophysics	2010	502
11	Yoshida lhakada	Tissue Engineering: Fundamentals	2006	468
12	Sambrook and Russel	Molecular Cloning, Volume 1 Molecular Cloning, Volume 2	2001	1300
13	T.A.Brown	Gene Cloning an introduction 3 edition	1998	333
14	Singer Berg	Genes Genomes	2010	587
15	Darnel Lodish Baltimore	Molecular Cell Biology	2011	563

16	Watson J.D. Gilman M. Witkowski j., and Zoller M	Recombinat DNA Scientific American books		626
17	Jeremy W Dale and Malcolm von Schantz	Genes to Genomes and Applications of DNA Technology	2002	360
18	Brown T.A	Gene Cloning and DNA Analysis An Introduction	2010	320
19	Wiliam B.Jakoby	Cell culture	2000	478
20	T.A.Egorova, S.M.Klunova, E.A.Zhivukhina	Fundamentals of Biotechnology	2003	76
21	B.B Popow	Genome	2012	243
22	Byung Hong Kim Geoffrey Michael Gadd	Bacterial Physiology and metabolism	2018	529
23	John G;Holt	Bergey s Manual of Determinative Bacteriology, 9th	1994	787
24	Cletus Kurtzman, J,W.Fell, Teun Boekhout	The Yeasts, Taxonomic Study 5th,edition	2011	2353
25	Daryl S. Paulson	Biostatistics and Microbiology	2008	222
26	Eldor A. Paul	Soil Microbiology, Ecology, and Biochemistry, 4 edition	2014	598
27	Edited by: Jose M. Requena	Stress Response in microbiology	2012	354
28	Jeffry Pommerville	Base of Microbiology	2018	792
29	Tsendeekhuu Ts	Plant physiology	2018	512
30	Lincoln Taiz, Eduardo Leiger	Plant physiology	1998	792
31	Dr. Micheal G.Simpson	Plant systematic	2010	
32	Dr. Micheal G.Simpson	Plant systematic	2013	
33	Sarah Simblet	Laboratory Manual Botany for the Artist	2010	
34	S.REryre	Vegetations and Soils	2017	
35	Susan K Pell	A Botanist Vocabulary	2016	
36	K.J.Wills J.C.Mc.Elwai	The Evolution of plants	2002	
37	Zhengyi Wu, Peter Raven	Flora of china volume 25	2009	
38	Zhengyi Wu, Peter Raven	Flora of china volume 20-21	2011	939
39	Henk Beentje	The kew Plant Glossary	2016	1100
40	Adrain D Bell	The kew Plant Glossary Plant from	2008	350
41	Swales, J.M. Feak, C.B.	Academic writing for graduate students	2004	330



42	Day A.R.	How to write a scientific paper	1999	300
43	Bjorn Gustavii	How to write and illustrate a scientific paper	2003	220
44	Pechenik. J.A.	A short guide to writing about biology	2004	280

Research on new research journalists in the last 5 years / 2012-2016 /

	Name of Journal	Published year	Language	Quantity
1	Erforschungbiologischer Ressourcen der Mongolei: Band 12. Exploration into the Biological Resources of Mongolia. Vol-12	2012	English	5
2	Wild horse: Research Conference articles-10	2012	Mongolia	2
3	Academy of Drs.Davaahamtsinite "Summary of the" Mongolia vegetation-2014 "study summary	2014	Mongolia	5
4	Plant Biotechnology-2014: Summary of Academic Conference	2014	Mongolia	5
5	Geocology of Mongolia. 11 (13)	2015	Mongolia	2
6	Geographical issues: Water, weather and ecological issues. 375	2012	Mongolia	4
7	Plant Biotechnology-2014: Summary of Research Conference	2014	Mongolia	2
8	Przewalski: scientific articles-10	2012	Mongolia	2
9	Research Institute of Botany 24	2012	Mongolia	1
10	Summary of the research conference "Plant Biotechnology - 2014"	2014	Mongolia	3
11	Research Institute of Botany 24	2012	Mongolia	1
12	Research Paper: 374. Biology	2012	Mongolia	5
13	Mongolian soil study: 2016 (01)	2016	Mongolia	10
14	Green Technology and Innovation 2016	2016	Mongolia	3
15	Birds of Mongolia: Bird Studies and Conservation Magazine. Number 3/432 /	2014	Mongolia	4
16	Birds of Mongolia: Bird Studies and Conservation Magazine. Issue 2	2013	Mongolia	4
17	Birds of Mongolia: A Journal of Ornithology 1. 2012	2012	Mongolia	4
18	Mongolian journal of biological science	2006-2017	English	20

Study on e-books and manuals used in the PhD program

	Author	Name of Publication	Published year	E-book
1	Matthias Otto	Chemometrics: Statistics and Computer Application in Analytical Chemistry, Third Edition		pdf
2	Andrew G.Mercader., all	Chemometrics Applications and Research: QSAR in Medicinal Chemistry	2016	pdf
3	M.J.Adams	Chemometrics in Analytical Spectroscopy	2004	pdf
4	James Miller	Statistics and Chemometrics for Analytical Chemistry (5th Edition)	2005	pdf
5	Wiley	Chemometrics in Excel	2014	pdf
6	Don Rittner and Timothy L. McCabe, Ph.D.	ENCYCLOPEDIA OF Biology	2004	pdf
7	Ian Kay	Introduction to ANIMAL PHYSIOLOGY	1998	pdf
8	S.C. Rastogi	Essentials of Animal Physiology,4t	2007	pdf
9	Kevin H. Deal	Wildlifeand Natural Resource Management THIRD EDITION	2011	pdf
10	Jane B. Reece	Campbell Biology (10th edition)	2014	pdf
11	Richard W. Hill	ANIMAL PHYSIOLOGY	2012	pdf
12	Lauralee Sherwood	Animal Physiology (2nd Edition)	2013	pdf
	HARVEY LODISH	Molecular Cell Biology	2016	pdf
13	Mary Jones	Biology Coursebook	2014	pdf
14	Wiley Blackwell	<b>Reproductive Biology of Animal Models</b>	2017	pdf
15		Systems Biology: Constraint-based Reconstruction and Analysis, 2 edition	2015	pdf
16		Biology of Damsel fishes	2016	pdf
17		Biology and Ecology of Crayfish	2016	pdf
18		Biology: How Life Works	2015	pdf
19		Biology and Ecology of Venomous Marine Snails	2016	pdf
20		Dan Shen (Salvia miltiorrhiza) in Medicine Biology and Chemistry	2014	pdf
21		Arenaviruses I: The Epidemiology, Molecular and Cell Biology of Arenaviruses (Current Topics in Microbiology and Immunology) (V	2002	pdf
22		Philosophy of Systems Biology: Perspectives from Scientists and Philosophers	2017	pdf

23		Luminescence in Electrochemistry: Applications in Analytical Chemistry, Physics and Biology	2017	pdf
24		Paleopoetics: The Evolution of the Preliterate Imagination	2013	pdf
25		Calcium Signaling (Advances in Experimental Medicine and Biology)	2012	pdf
26		Metaheuristics for String Problems in Bio-informatics	2016	pdf
27		Mathematical Biology: I. An Introduction, 3rd edition	2007	pdf
28		Psychology of Technology	2017	pdf
29		RNA Abundance Analysis: Methods and Protocols	2012	pdf
30		Manual of Industrial Microbiology and Biotechnology	2010	pdf
31		Peptide Synthesis and Applications	2013	pdf
32		Tau Protein: Methods and Protocols (Methods in Molecular Biology)	2017	pdf
33		Bioinformatics: Volume II: Structure, Function, and Applications: 2 (Methods in Molecular Biology)	2016	pdf
34		Photosystem	2006	pdf
35	Geoff Baldwin and Travis Bayer	Synthetic Biology: A Primer, Revised Edition	2016	pdf
36		The Molecular Biology of Down Syndrome	1999	pdf
37		Synapse Development: Methods and Protocols (Methods in Molecular Biology)	2017	pdf
38		Introductory Statistics for Biology Students, Second Edition	1997	pdf
39	Doris R. Helms, Carl W. Helms, Robert J. Kosinski, John C.	Biology in the Laboratory	1997	pdf
40		Contemporary Oral Oncology: Biology, Epidemiology, Etiology, and Prevention	2017	pdf
41	EDWARD M. DZIALOWSKI	Life: The Science of Biology	2008	pdf
42		Reactive Oxygen Species in Biology and Human Health	2016	pdf
43		Molecular Cell Biology of the Growth and Differentiation of Plant Cells	2016	pdf
44		Charge Migration in DNA: Perspectives from Physics, Chemistry, and Biology	2007	pdf

45		Integrated Molecular Evolution, Second Edition	2016	pdf
46		Molecular Microbiology: Diagnostic Principles and Practice	2016	pdf
47		Computational Biology and Bioinformatics: Gene Regulation	2016	pdf
48		Charles Darwin's Natural Selection	1987	pdf
49		Biology of Termites: a Modern Synthesis		pdf
50		Hydrocarbon and Lipid Microbiology Protocols: Field Studies	2016	pdf
51		Cancer Cytogenetics: Methods and Protocols (Methods in Molecular Biology)	2016	pdf
52		Metagenomics: Methods and Protocols (Methods in Molecular Biology)	2016	pdf
53		Cardiac Gene Therapy: Methods and Protocols (Methods in Molecular Biology)	2017	pdf
54		Evolutionary Biology	1978	pdf
55		Current Ornithology, Volume 1	1983	pdf
56		Fiber Plants: Biology, Biotechnology and Applications	2016	pdf
57		Evolutionary Biology: Convergent Evolution, Evolution of Complex Traits, Concepts and Methods	2016	pdf
58		Evolution of Gibbons and Siamang: Phylogeny, Morphology, and Cognition	2016	pdf
59		Advanced Techniques in Soil Microbiology	2007	pdf

A research journal used in the PhD program

	Author	Journal of Research paper			type
1	Marcia McNutt	/Journal/ SCIENCE	24	2014	pdf
2	Marcia McNutt	/Journal/ Cell	12	2015	pdf
3	Marcia McNutt	/Journal/ SCIENCE	12	2016	pdf
4	Graham Southorn	BBC Focus - Science & Technology	12	2015	pdf
5	Sophie Stafford, Editor	/Journal/ BBC Wild life	36	2015	pdf
6	Charles J. Hagner	/Journal/ Bird Watch	84	2016	pdf
7	Melting Arctic & Rubber Boom	National Geographic USA	12	2016	pdf
8	Anil Ahlawat	/Journal/ Biology Today	26	2014-2016	pdf

9	Parul Jain	/Journal/ Spectrum Biology	21	2015-2016	pdf
10		LAB+LIFE SCIENTIST	12	2016	pdf
11	Rolf Dennison	/Journal/ Fishkeeper	61	2009-2016	pdf
12	David Alderton	Practical Reptile Keeping	36	2014-2016	pdf
13	Glen S. Axelirod	Tropical Fish Hobbyist	48	2013-2015	pdf
14	Rolf Dennison	Ultimate Exotics	7	2012-2016	pdf
15	Romi Boom	Wild	4	2016	pdf
16	Craig Orr	Wild life photographic	8	2013-2014	pdf
17	S. Foster, S. Healy	/Journal/ Animal Behaviour	11	1998-2002	paper
18	Y. Nawa, K.F. Hoffmann, D.J. Bzik	/Journal/ Parasitology International	16	1997-2007	paper
19	Nobuaki Akao	Japanese Journal of Parasitology	24	1990-1996	paper
20	Eric Hellgren	Wildlife Monographs	139	1961-2005	paper
21		Journal of Animal Science	243	1963-1986	paper
22	J.G. Eales	Canadian Journal of Zoology	25	1988-1990	paper
23	L.G.Goodwin	Journal of zoology	94	1970-1979	paper
24	Norton B.Gilula	The Journal of cell biology	20	1994-2001	paper
	<b>Result</b>		<b>987</b>		

Study on Biological Specialist Doctorate (2015-2019)

	Program	Doctor's name and surname	2014	2015	2016	2017	2018	2019
1	Zoology	Purev-Ochir Ganhuyag		1				
		Saruul Amarsaikhan	1					
		Buyan Chimeddorj			1			
		Nasanbat Battentogtokh		1				
		Khishigdelger Otgonbayar				1		
		Ulziiburen Tserenchunt				1		
		Tseren-Ochir Tserendulam	1					
		Lkhagvasuren Jantsansambu	1					

2	Botany	Oyunbileg Munkhzul		1				
		Samiya Javkhlan		1				
		Khaltar Oyunbileg			1			
3	Microbiology	Buyantogtokh Uuganbayar	1					
		Natsagdorj Oyunbileg		1				
		Lundaa Tserennyam						1
4	Genetics	Badarch Khaliun	1					
		Chuluunbaatar Mairsetseg		1				
		Ganbold Uyanga		1				
		Erdenetsogt Solongo			1			
		Batbayar Bolor-Oyut						1
		Chuluun Mungunsar				1		
		<b>20</b>	<b>5</b>	<b>7</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>1</b>

#### Research on library fund of National University of Mongolia

Research Fund	It has a total of 126,764 books. There are 36524 books in Mongolian, 90240 books in Russian, and 6103 books are scholarly works.
science library of Nature and social	In total, 113,177 books are available in 33408 languages in Russian, 7989 in Russian language, 14964 in foreign languages, 202 in foreign languages, 651 in Japanese, 651 in english, 292 in Russian, 64 in English The books are available in 16547 in Mongolian language, 474 books in the reading room and 2 books in the electronic library.
Library sectors' fund	It has a total of 151,778 books, including 4886 books of Biology, 8238 geologists, 4046 chemistry specialists and 3373 books of physics. The School of Social Sciences has 9749 books in Mongolian language 7906, in 5452 in foreign languages, 4398 in mathematics, 3703 in HSUM, 65389 in HS, 26726 in Psychology and 7912 books in IHSL.

The library equipment spent MNT 48.8 million and 39.3 million MNT in textbooks in the 2014-2015 academic year. In November 2017, the new library of the National University of Mongolia was commissioned to provide the students with the opportunity to study and to provide them with textbooks. Accessibility of new library building

	Room number	Area size, m <sup>2</sup>	Room name
1 floor	007	30.49	The library of natural sciences
	010	126.37	Mongolian books library
	011	250.50	The foreign books library
	012	46.94	The library of social sciences
	013	92.77	Regular publishing fund
	017	45.5	The library of natural sciences
1-floor	101	46.65	Bookshop - Library of the National University of Mongolia
	107	251.8	One-Stop Service
	108	52.84	Regular reading room
	109	101.4	Home Library Fund No. 1
	110	67.7	Home Library Fund No. 2
	111	49.46	Book back room
	112	46.83	Library room
2-floor	202	177.26	<i>Lecture ll</i>
	203	177.21	<i>Lecture ll</i>
	204	59.1	<i>Seminar room</i>
	205	55.3	<i>Seminar room</i>
	207	59.17	<i>Seminar room</i>
	211	604.93	The reading room of the society and humanity
		27.77	Team working room
	212	59.99	<i>Book repair and sterilization laboratory</i>
3-floor	302	187.41	<i>Lecture ll</i>
	303	184.53	<i>Lecture ll</i>
	304	58.69	<i>Seminar room</i>
	305	59.04	<i>Seminar room</i>
	306	516.5	The reading room of the natural science
		27.05	Team working room
	307	124.88	Electronic reading room
4-floor	407	71.26	Library of Information Technology
	408	71.2	Part of Book account
	409	46.06	Service, Reference-Information Section
	410	71.21	Director of Library
	411	213.89	Scientific reading room
	402	116.85	Teacher reading room

		32.06	Team working room
5-floor	513	31.8	Geochemistry and geomorphology laboratories
	514	52.32	Department Information of Technology
	515	65.17	Department Information of Technology