

**Doctor of Philosophy Program in Bioinorganic Chemistry
(International Program)**

Department of Chemistry

Program Title Doctor of Philosophy Program in Bioinorganic Chemistry
(International Program)

Degree Title Doctor of Philosophy (Bioinorganic Chemistry)
Ph.D. (Bioinorganic Chemistry)

Objectives

1. To produce researchers in the field of Bioinorganic Chemistry at the international level capable of making decision and initiation throughout a research process as well as being able to solve bioinorganic chemistry problems.

2. To produce researchers in the field of Bioinorganic Chemistry capable of generating new knowledge suitable for working in university, college or other institutes both in the government and private sectors.

3. To accommodate the government's effort in the development of personnel in advanced science and technology, with special emphasis on the ability to apply such knowledge to various operations.

Qualifications of the Applicant

1. Plan 1 (Thesis)

1.1 Plan 1.1 Thesis equivalent to 48 credits

Graduates of a Master degree in science or an equivalent, with GPA of 3.50 or higher or with excellent research work in Inorganic Chemistry, Biochemistry, Analytical Chemistry, Organic Chemistry, Physical Chemistry or related fields.

1.2 Plan 1.2 Thesis equivalent to 72 credits

Graduates of a Bachelor degree with honors in science or an equivalent or with excellent research work in Chemistry or related fields.

2. Plan 2 (Thesis and additional courses)

2.1 Plan 2.1 Dissertation equivalent to 36 credits and additional courses 12 credits

Graduates of a Master degree in science or an equivalent in Inorganic Chemistry, Biochemistry, Analytical Chemistry, Organic Chemistry, Physical Chemistry or related fields.

2.2 Plan 2.2 Dissertation equivalent to 48 credits and additional courses 24 credits

Graduates of a Bachelor degree or an equivalent with GPA of 3.20 or higher in Chemistry or related fields or with the approval of the program committee.

3. Eligible candidates under Clause 1 and 2 must have all the qualifications specified in Clause 7 of Silpakorn University's Regulations on Graduate Study B.E. 2550 (2007) (and/or its revised version).

4. They pass an English test or an equivalent with a minimum TOEFL score of 500 (paper based) or 173 (computer based) or 61(internet based), or a minimum IELTS scores of 5.5. The test must be taken not more than 2 years prior to the program's commencement date. Eligible candidates may be allowed to use CU-TEP or TU-GET scores, with the minimum score of 60 or 450 respectively, taken not more than 2 years of the program's commencement date, for their proof of English proficiency. Eligible

candidates who are unable to provide results of the specified English test may be accepted to the program with the approval of the Program Committee.

5. Candidates who do not have all the qualifications in 1-3 must have their cases considered by the Program Committee and the Dean of Graduate School.

Structure of the Curriculum

Doctor of Philosophy Program in Bioinorganic Chemistry offers 2 categories of curriculum.

Plan 1 (Thesis)

Plan 1.1 Master-degree students

Seminars (non-credit)	2 credits
Thesis (equivalent to)	48 credits
Total credits	48 credits

Plan 1.2 Bachelor-degree with honors students

Seminars (non-credit)	4 credits
Thesis (equivalent to)	72 credits
Total credits	72 credits

Plan 2 (Thesis and additional courses)

Plan 2.1 Master-degree students

Seminars	2 credits
Required courses	6 credits
Elective courses	4 credits
Thesis (equivalent to)	36 credits
Total credits	48 credits

Plan 2.2 Bachelor-degree with honors students

Seminars	4 credits
Required courses	12 credits
Elective courses	8 credits
Thesis (equivalent to)	48 credits
Total credits	72 credits

Note Students in every program must participate and present their works at an international conference. It is also a requirement to be included as an appendix of a research thesis that a student gets to know at least two scientists. This brief appendix should give details on topics discussed as well as the main works of the two scientists.

Course Requirements

Plan 1.1

Seminars (non-credit) 2 credits

513 601	Seminar I	1(0-2-1)
513 602	Seminar II	1(0-2-1)

Thesis

513 895	Thesis (equivalent to)	48 credits
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Plan 1.2

	Seminars (non-credit) 4 credits	
513 601	Seminar I	1(0-2-1)
513 602	Seminar II	1(0-2-1)
513 603	Seminar III	1(0-2-1)
513 604	Seminar IV	1(0-2-1)
	Thesis	
513 896	Thesis (equivalent to)	72 credits

Plan 2.1

	Seminars 2 credits	
513 605	Seminar V	1(0-2-1)
513 606	Seminar VI	1(0-2-1)
	Required Courses 6 credits	
513 771	Bioinorganic Chemistry	3(3-0-6)
513 772	Characterization Methods in Bioinorganic Chemistry	3(3-0-6)
	Elective Courses not less than 4 credits	
	Student can choose from the following elective graduate courses:	
513 871	Advanced Bioinorganic Chemistry	3(3-0-6)
513 872	Organometallic Chemistry	2(2-0-4)
513 873	Inorganic Material Chemistry	3(3-0-6)
513 874	Nanotechnology	2(2-0-4)
513 875	Biosensor	3(3-0-6)
513 876	Toxicology	2(2-0-4)
513 877	Selected Topics in Bioinorganic Chemistry	2(2-0-4)
513 878	Selected Topics in Environmental Science	2(2-0-4)
513 879	Selected Topics in Ecotoxicology	2(2-0-4)
	Thesis	
513 897	Thesis (equivalent to)	36 credits

Plan 2.2

	Seminar 4 credits	
513 605	Seminar V	1(0-2-1)
513 606	Seminar VI	1(0-2-1)
513 607	Seminar VII	1(0-2-1)
513 608	Seminar VIII	1(0-2-1)
	Required Courses 12 credits	
513 771	Bioinorganic Chemistry	3(3-0-6)
513 772	Characterization Methods in Bioinorganic Chemistry	3(3-0-6)
513 773	Bioinorganic Molecules and Environment	3(3-0-6)
513 774	Bioinorganic Molecules and Nutrition	3(3-0-6)
	Elective Courses not less than 8 credits	
	Student can choose from the following elective graduate courses:	
513 871	Advanced Bioinorganic Chemistry	3(3-0-6)
513 872	Organometallic Chemistry	2(2-0-4)

513 873	Inorganic Material Chemistry	3(3-0-6)
513 874	Nanotechnology	2(2-0-4)
513 875	Biosensor	3(3-0-6)
513 876	Toxicology	2(2-0-4)
513 877	Selected Topics in Bioinorganic Chemistry	2(2-0-4)
513 878	Selected Topics in Environmental Science	2(2-0-4)
513 879	Selected Topics in Ecotoxicology	2(2-0-4)

Thesis

513 898	Thesis (equivalent to)	48 credits
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Course Descriptions

513 601	Seminar I Seminar on topics of interest in bioinorganic chemistry	1(0-2-1)
513 602	Seminar II Seminar on topics of interest in bioinorganic chemistry	1(0-2-1)
513 603	Seminar III Seminar on topics of interest in bioinorganic chemistry	1(0-2-1)
513 604	Seminar IV Seminar on topics of interest in bioinorganic chemistry	1(0-2-1)
513 605	Seminar V Seminar on topics of interest in bioinorganic chemistry	1(0-2-1)
513 606	Seminar VI Seminar on topics of interest in bioinorganic chemistry	1(0-2-1)
513 607	Seminar VII Seminar on topics of interest in bioinorganic chemistry	1(0-2-1)
513 608	Seminar VIII Seminar on topics of interest in bioinorganic chemistry	1(0-2-1)
513 771	Bioinorganic Chemistry Biological ligands for metal ions. Structure-function relationships in bioinorganic molecules and their model compounds: cobalamins including vitamin and coenzyme B ₁₂ , chlorophyll and manganese complex at the center of photosynthesis, hemoglobin, hemerythrin and hemocyanin for uptake and transport of oxygen in animals, myoglobin for storage of oxygen in animals and other hemoproteins as catalysts for electron transfer, oxygen activation and metabolism of inorganic intermediates.	3(3-0-6)
513 772	Characterization Methods in Bioinorganic Chemistry Principles and applications of techniques for characterization of bioinorganic compounds, electronic spectroscopy, vibrational spectroscopy, nuclear magnetic resonance spectroscopy, electron paramagnetic resonance spectroscopy, Mössbauer spectroscopy, magnetic circular dichroism, magnetic susceptibility	3(3-0-6)

measurements and X-ray crystallography. *In vitro* and *in vivo* techniques for the study in bioinorganic chemistry.

513 773 Bioinorganic Molecules and Environment 3(3-0-6)
Inorganic pollutants in soil, water and air. Interactions of bioinorganic molecules with the organic and inorganic pollutants. Synthetic methods and structural studies of the bioinorganic molecules.

513 774 Bioinorganic Molecules and Nutrition 3(3-0-6)
Roles of bioinorganic molecules in supporting biochemical reactions for the promotion of optimal health benefits to living organisms. Natural sources of bioinorganic molecules in relation to nutrition, with respect to both the required quantity and toxic levels.

513 871 Advanced Bioinorganic Chemistry 3(3-0-6)
Structure-function relationships in metalloproteins and their model compounds, alkaline and alkaline earth metal cations. Biosynthetic processes for bioinorganic chemicals, and chemical syntheses of metal-based medicine.

513 872 Organometallic Chemistry 2(2-0-4)
Properties of organometallic compounds, metal σ -bonded ligand complex, carbonyls and phosphine complexes, complexes of π -bound ligands, metallocenes, metal to metal bonding and metal clusters. Reactions of organometallic compounds.

513 873 Inorganic Material Chemistry 3(3-0-6)
Principles and synthetic methods for inorganic materials. Metal oxides, nitrides and fluorides. Chalcogenides and intercalation chemistry. Framework structures, inorganic pigments, semiconductor chemistry, inorganic molecular materials and fullerides.

513 874 Nanotechnology 2(2-0-4)
Introduction to the principles and applications of nanotechnology. Principles and theories about the nanoscale dimension, basics of nanofabrication and nanocharacterization techniques. Discuss current and future nanotechnology applications in materials, chemistry, biology, energy and medicine.

513 875 Biosensor 3(3-0-6)
General principles and classifications of biosensors. Biomolecules and bioinorganic compounds used in biosensors : enzymes, microorganisms, antibody, DNA and synthetic mimic substances. Techniques relevant to different types of transducers : electrochemistry, conductivity, optical, mass and heat. Nanomaterials in biosensors and nanosensors. Applications in medicine, food, environment, military and biological weapons.

513 876 Toxicology 2(2-0-4)
Historical background of toxicology. Principles of absorption, distribution and metabolism of toxic substances. The effects of toxic agents, food additives, and pollutants affecting human and animal health.

513 877	Selected Topics in Bioinorganic Chemistry Selected topics in bioinorganic chemistry relevant and complementary to current research and topics of current interest.	2(2-0-4)
513 878	Selected Topics in Environmental Science Selected topics in environmental science relevant and complementary to current research and topics of current interest.	2(2-0-4)
513 879	Selected Topics in Ecotoxicology Selected topics in ecotoxicology relevant and complementary to current research and topics of current interest.	2(2-0-4)
513 895	Thesis (equivalent to) Original research dissertation undertaken under guidance of advisor(s).	48 credits
513 896	Thesis (equivalent to) Original research dissertation undertaken under guidance of advisor(s).	72 credits
513 897	Thesis (equivalent to) Original research dissertation undertaken under guidance of advisor(s).	36 credits
513 898	Thesis (equivalent to) Original research dissertation undertaken under guidance of advisor(s).	48 credits

Note:

Students' dissertation must be accepted for at least one publication in international journals or at least two publications in peer-review national journals to ensure an acceptable standard of research work. Students in all plans must also participate and give an oral presentation in an international conference.