

Report of the Expert Panel on the REACCREDITATION of the University Postgraduate (Doctoral) Programme Chemistry Faculty of Science, University of Zagreb

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INTRODUCTION

The Expert Panel appointed by the Agency for Science and Higher Education (ASHE) created this Report on the Re-accreditation of the University Postgraduate (Doctoral) Programme in *Chemistry* on the basis of the Self-Evaluation Report of the Programme, other documentation submitted and a visit to the Faculty of Science, University of Zagreb.

The Agency for Science and Higher Education (ASHE), a public body listed in EQAR (European Quality Assurance Register for Higher Education) and a full member of ENQA (European Association for Quality Assurance in Higher Education), re-accredits higher education institutions (hereinafter: HEIs) and their study programmes in line with the Act on Quality Assurance in Science and Higher Education (Official Gazette 45/09) and the Ordinance on the Content of a Licence and Conditions for Issuing a Licence for Performing Higher Education Activity, Carrying out a Study Programme and Re-Accreditation of Higher Education Institutions (OG 24/10). In this procedure parts of activities of higher education institutions and university postgraduate study programmes are re-accredited.

Expert Panel is appointed by the Agency's Accreditation Council, an independent expert body, to carry out independent evaluation of post-graduate university study programmes.

The Report contains the following elements:

- Short description of the study programme
- The recommendation of the Expert Panel to the Agency's Accreditation Council
- Recommendations for institutional improvement and measures to be implemented in the following period (and checked within a follow-up procedure)
- A brief analysis of the institutional advantages and disadvantages
- A list of good practices found at the institution
- Conclusions on compliance with the prescribed conditions of delivery of a study programme
- Conclusions on compliance with the criteria for quality assessment.

Members of the Expert Panel:

- Mark Davies, Professor, Faculty of Health Sciences and Wellbeing, Sunderland University, United Kingdom of Great Britain and Northern Ireland
- R. J. Pieters, Chair of Chemical Biology of Multivalent Systems, Utrecht University, Netherlands
- Mathias Senge, Chair of Organic Chemistry, Trinity College Dublin, Ireland
- Fabian Cerda, Max Planck Institute of Biochemistry, Germany
- Marianne Holmer, Professor, Head of Department of Biology, Syddansk Universitet, Denmark
- Isabel Sá Nogueira, Associate Professor, Head of Laboratory, Faculdade de Ciências e Tecnologia Universidade NOVA de Lisboa, Portugal
- Inger Elisabeth Måren, Associate Professor, Department of Biological Sciences, University of Bergen, Norway
- Peter Bennett, Reader in Biodiversity and Evolutionary Ecology, University of Kent, United Kingdom of Great Britain and Northern Ireland
- Domagoj Vugić, doctoral student, Institut Curie, France

- Maalte Braack, Director of Mathematical Seminar, Christian-Albrechts-Universität, Kiel, Germany
- Barbara Drinovec Drnovšek, Professor, Fakulteta za matematiko in fiziko, Univerza v Ljubljani, Slovenia
- Sebastian Eterovic, doctoral student, Mathematical Institute, University of Oxford, United Kingdom of Great Britain and Northern Ireland
- Donald Bruce Dingwell, Department for Earth and Environmental Sciences Chair of Mineralogy and Petrology, Ludwig-Maximilians-Universität München, Germany
- Giovanni B. Andreozzi, Coordinator of the Ph.D. programme in Earth Sciences, Sapienza Universita di Roma, Italia
- Ponfa Roy Bitrus, doctoral student, Department of Geology and Petroleum Geology, University of Aberdeen, United Kingdom of Great Britain and Northern Ireland
- Anders Omstedt, Professor Emeritus, Department of Marine Sciences, The Faculty of Science, University of Gothenburg, Sweden
- Rafael Laso Perez, doctoral student, Max Planck Institute for Marine Microbiology, Germany
- Kai-Olaf Hinrichsen, Professor, Technische Universitat Munchen, Germany
- Alexandra Pinto, Associate Professor, Director of PhD programme in Chemical and Biological Engineering, Universidade de Porto, Portugal
- Mohamed Hussien, doctoral student, Faculty of Chemistry and Pharmacy, L. M. Universitat Munchen, Germany
- Mikael Rinne, Associate Professor, Aalto University, Finland
- Anders Omstedt, Professor Emeritus, Department of Marine Sciences, The Faculty of Science, University of Gothenburg, Sweden.

The higher education institution was visited by the following Expert Panel members:

- 1. R. J. Pieters, Chair of Chemical Biology of Multivalent Systems, Utrecht University, Netherlands, moderator
- 2. Matthias Senge, Chair of Organic Chemistry, Trinity College Dublin, Ireland
- 3. Fabian Cerda, doctoral candidate, Max Planck Institute of Biochemistry, Germany.

In the analysis of the documentation, site visit and writing of the report the Panel was supported by:

- Emita Blagdan, coordinator, ASHE
- Marko Hrvatin, interpreter at the site visit

During the visit to the Institution the Expert Panel held meetings with the representatives of the following groups:

- Department Management
- Study programme coordinators
- Doctoral candidates
- Teachers and supervisors
- Alumni.

The Expert Panel also had a tour of the Chemistry Department.

SHORT DESCRIPTION OF THE STUDY PROGRAMME

Name of the study programme: Postgraduate University (Doctoral) Programme in Chemistry

Institution providing the programme: Faculty of Science, University of Zagreb **Institution delivering the programme**: Faculty of Science, University of Zagreb

Scientific area and field: Science, Chemistry **Place of delivery**: Horvatovac 102A, Zagreb

Number of doctoral candidates (all): 126

Number of HEI funded doctoral candidates: 95

Number of self-funded and employer-funded candidates: 31

Number of inactive doctoral candidates: 3

Number of teachers at the doctoral study programme: 77 (27 HEI's own teachers which cover 55% of total norm hours, and 50 external teachers)

Number of supervisors at the doctoral study programme:

- officially appointed supervisors: 46

- supervisor-advisor: 27

Number of doctoral candidates to whom a supervisor was officially appointed: 49

Number of doctoral candidates to whom a study adviser was appointed: 77

Ratio student/supervisor: 1:1.

Learning outcomes of the study programme

LO1. KNOWLEDGE AND REASONING:

- LO1.1. To interpret contemporary chemical knowledge on the factual and conceptual level in accordance with the most recent scientific knowledge and in correlation with related scientific disciplines (mathematics, physics, biology)
- LO1.2. To create and value new experimental and theoretical principles related to specific branches of chemistry
- LO1.3. To critically analyse and apply various research procedures and methods within a selected branch of chemistry.

LO2. COMPREHENSION SKILLS:

- LO2.1. To select a theoretical framework and methodology for independent research
- LO2.2. To select relevant scientific and professional publications on a given topic
- LO2.3. To design and perform advanced, complex chemical experiments and research procedures.

LO3. PSYCHOMOTOR SKILLS:

- LO3.1. To conduct complex laboratory procedures with the use of modern instruments and techniques
- LO3.2. To develop and creatively use new models for the interpretation of experimental results
- LO3.3.To have the capacity of critical analysis, evaluation and synthesis of new and complex ideas.

LO4. SOCIAL SKILLS:

- LO4.1.To summarize and explain own research and a research from reference works LO4.2. To write down the results of independent research in given format in form of a scientific article, poster, presentation
- LO4.3. To defend hypotheses, methods, attitudes, results and conclusions of own research.

LO5. INDEPENDENCE:

- LO5.1. To organize and participate in a research team and to adjust to the requirements of work environment with individuals and groups of various affiliations and various cultural and ethnic background
- LO5.2. To use scientific and professional reference works independently and to present scientific topics in oral and in written form
- LO5.3. To independently monitor the development of new knowledge in the field of chemistry and to provide expert opinion about its reach and possible applications.

LO6. RESPONSIBILITY:

- LO6.1. To responsibly approach the implementation and performance of tasks
- LO6.2. To apply ethical principles of research
- LO6.3. To evaluate critically the role of chemistry in the society including the awareness of health, safety and environmental impact of chemistry.

Coursework/research activities ECTS distribution: 70-77/110

Coursework:

1st year: 2 mandatories and 1 elective course, doctoral seminar

2nd year: 1 elective course and doctoral seminar 3rd year: 2 workshops in generic skills (no ECTS)

RECOMMENDATION BY THE EXPERT PANEL TO THE ASHE'S ACCREDITATION COUNCIL

Upon the completion of the re-accreditation procedure and the examination of the materials submitted (Self-Evaluation Report etc.), the visit to the higher education institution and interviews with HEI members in accordance with the visit protocol, the Expert Panel renders its opinion in which it recommends to the Accreditation Council of the Agency the following:

- **issue a letter of expectation for the period up to three (3) years** in which period the higher education institution should make the necessary improvements.

RECOMMENDATIONS FOR THE IMPROVEMENT OF THE STUDY PROGRAMME

- 1. Reassess number and content of taught courses. Rather have fewer courses and deliver them every year. Include more general skills courses.
- 2. Start writing the theses in English.
- 3. Start teaching some courses in English.
- 4. Encourage the students to create a representing body.
- 5. Add a small number of foreign members to the governing body (council) of the PhD school.
- 6. Take more advantage of EU grants.
- 7. Streamline module enrolment and thesis submission procedures. Minor issues, such as the charging of (different depending on subject) fees for reregistration/change of modules should be abolished. The time from submission of thesis to viva defence must be shortened.

ADVANTAGES OF THE STUDY PROGRAMME

- 1. Infrastructure, facilities and instrumentation: The infrastructure at the Faculty of Science, University of Zagreb is excellent, and centred around a relatively new building. Laboratory facilities are good; there is sufficient space for the present and anticipated number of graduate students. Laboratories are reasonably well equipped, some of the instrumentation is dated but this will be alleviated very soon through instrumental analysis acquisitions (NMR, MS, etc.) from a recent EU infrastructure award. Personnel present at the premises were competent and dedicated; teaching facilities clean and well organized. Minor deficiencies relate to safety aspects, and it is recommended that in line with future intake of international researchers the safety and laboratory signs/labels are changed to English.
- 2. Size and national cooperation: The small size of the country and the close, often personal, contacts between different participating research institutes is a strength and allows for flexible management of problems and changes in the program. Not only does this allow for synergistic use of limited facilities (complementary instrumentation and research areas), it may also be further utilized to establish core competencies in larger EU grant applications and to create critical mass in negotiations with industry.
- 3. The students: Very enthusiastic, motivated, open and dedicated students! This is the main strength of the current program and to some extent unrecognized by the supervisors. The students participated openly and critically in discussions with the Expert Panel, and clearly showed commitment and dedication to their research projects

and personal and career development. They are clearly cognizant of the currently limited possibilities, but can be relied upon to pull their weight if supported and recognized appropriately.

- 4. Good legal/organizational framework of the program.
- 5. Great gender balance with respect to staff and students.
- 6. Good reporting system for progress of PhD students and supervisors.

DISADVANTAGES OF THE STUDY PROGRAMME

- Supervisor-student interaction. There is a clear disconnect between students and staff.
 While many reporting procedures are in place, there is no feedback to either side.
 Students clearly feel that they are not heard and are disenfranchised.
- 2. Disparate funding streams for PhD candidates. The different funding streams, ranging from full support through institute contract, to part funding from employers, to full self-financing makes it impossible to streamline PhD progression as a cohort and also results in inefficient teaching and research procedures.
- 3. No representation of PhD students in official bodies like the council.
- 4. No tracking of alumni.
- 5. No career counselling.
- 6. Some industry does not allow students to work during day hours or only to a limited extent.

EXAMPLES OF GOOD PRACTICE

- 1. Very good formal procedures for selection, registration, follow-up and thesis submission.
- 2. Breadth of program as evidenced by range of taught classes, supervisor expertise, and different research projects.
- 3. Encourage participation of the students in Science Faculty PhD candidates' conference.
- 4. PhD students get to go to international conferences.
- 5. Good collaboration with local research institutes and industry.
- 6. The description of the learning outcomes are of high quality.

COMPLIANCE WITH THE PRESCRIBED CONDITIONS FOR THE DELIVERY OF A STUDY PROGRAMME

Minimal legal conditions:	
1. Higher education institution (HEI) is listed in the Register of Scientific	YES
Organisations in the scientific area of the programme, and has a positive	
reaccreditation decision on performing higher education activities and scientific	
activity.	
2. HEI delivers programmes in the two cycles leading to the doctoral programme,	YES
i.e., first two cycles in the same area and field/fields (for interdisciplinary	
programmes), and employs a sufficient number of teachers as defined by Article 6	
of the Ordinance on the Content of a Licence and Conditions for Issuing a Licence	
for Performing Higher Education Activity, Carrying out a Study Programme and	
Re-Accreditation of Higher Education Institutions (OG 24/10).	
3. HEI employs a sufficient number of researchers, as defined by Article 7 of the	YES
Ordinance on Conditions for Issuing Licence for Scientific Activity, Conditions for	
Re-Accreditation of Scientific Organisations and Content of Licence (OG 83/2010).	
4. At least 50% of teaching as expressed in norm-hours is delivered by teachers	YES
employed at the HEI (full-time, elected into scientific-teaching titles).	
5. Student: teacher ratio at the HEI is below 30:1.	YES
6. HEI ensures that doctoral theses are public.	*with
	difficulties
* In total, 53 theses are available in open access, 11 are temporary unavailable, 1 or	ly through
special authorisation.	
7. HEI launches the procedure of revoking the academic title if it is determined	YES
that it has been attained contrary to the conditions stipulated for its attainment,	
by severe violation of the studying rules or based on a doctoral thesis	
(dissertation) that has proved to be a plagiarism or a forgery according to	
provisions of the statute or other enactments.	
Additional/ recommended conditions of the ASHE Accreditation Council for	
passing a positive opinion	
1. HEI (or HEIs in joint programmes) has at least five teachers appointed to	YES
scientific-teaching titles in the field, or fields relevant for the programme involved	
in its delivery.	
2. In the most recent reaccreditation, HEI had the standard Scientific and	YES
Professional Activity marked as at least "partly implemented" (3).	
3. The doctoral programme is aligned with the HEI's research strategy.	YES
4. The candidate : supervisor ratio at the HEI is not above 3:1.	YES
5. All supervisors meet the following conditions:	YES
a) PhD, elected into a scientific title, holds a scientific or a scientific-teaching	(not
position and/or has at least two years of postdoctoral research experience;	everything
b) active researcher in the scientific area of the programme, as evidenced by	could be
publications, participation in scientific conferences and/or projects in the past	validated by
five years (table 2, Supervisors and candidates);	the Panel.
c) confirms feasibility of the draft research plan upon admission of the candidate	l ,
(or submission of the proposal);	Procedures

d) ensures the conditions (and funding) necessary to implement the candidate's	everything
research (in line with the draft research plan) as a research project leader, co-	are in place,
leader, participant, collaborator or in other ways;	but it is not
e) trained for the role before assuming it (through workshops, co-supervisions	clear
etc.);	whether
f) received a positive opinion of the HEI on previous supervisory work.	these are
a) access, on a process of the contract of process of the contract of the cont	actually
	enforced.)
6. All teachers meet the following conditions:	YES
a) holds a scientific or a scientific-teaching position;	
b) active researcher, recognized in the field relevant for the course (table 1,	
Teachers).	
7. The supervisor normally does not participate in the assessment committees.	YES
8. The programme ensures that all candidates spend at least three years doing	NO
independent research (while studying, individually, within or outside courses),	(over 70
which includes writing the thesis, publishing, participating in international	ECTS in
conferences, field work, attending courses relevant for research etc.	coursework
	throughout
	1st and 2nd
	year).
	Notably for
	the self-
	funded
	students
	this is not
	clear and
	unlikely.

QUALITY ASSESSMENT

1. RESOURCES: TEACHERS, SUPERVISORS, RESEARCH CAPACITIES AND INFRASTRUCTURE	
1.1. HEI is distinguished by its scientific/ artistic achievements in the discipline in which the doctoral study programme is delivered.	Improvements are necessary The HEI operates at a national and international competitive level. This is evidenced by a significant number of WoS listed peer-reviewed publications, a respectable number of publications in leading journals and a consistent publication track record at the supervisor and PhD student level. The academic units underpinning the PhD programme are clearly national leaders in Croatia. For example, "Zagreb Chemistry" published 239 WoS papers in the past 8 years with 1600 citations and an H-index of 20. However, the level of international recognition for individual groups is uneven. There are no leaders at the international level with significant H-indices. More focus and funding of younger academics and streamlined promotion/recognition procedures might promote this further.
1.2. The number and workload of teachers involved in the study programme ensure quality doctoral education.	High level of quality The majority of the teaching programs are delivered by own faculty members, clearly in excess of the required 50%. This is augmented by teaching from national external and international experts, which gives further breadth to the program.
1.3. The teachers are highly qualified researchers who actively engage with the topics they teach, providing a quality doctoral programme.	national level, see comments under 1.1. Individual
1.4. The number of supervisors and their qualifications provide for quality in producing the doctoral thesis.	High level of quality The number of supervisors and student-staff ratio is sufficient for a high quality program and in line with regulatory requirements. Many supervisors lead national and international research projects. The quality of the graduates of the program is high (as evidenced by alumni and present students), and a sufficient number of publications arise from the PhD projects.
1.5. The HEI has developed methods of assessing the qualifications and competencies of teachers and	- I

	supervisors.	students in annual reports), there is no system in place where the quality of previous and current teaching is measured and evaluated. While indications were given that evaluations are performed, it remained unclear whether these were simply compiled or actively used for program improvements. The Panel recommends that the results of these evaluations are used for improvements of the study programme.
1.6.	The HEI has access to high-quality resources for research, as required by the programme discipline.	Improvements are necessary The research infrastructure at the Faculty of Science was found to be adequate and in parts excellent. Space is sufficient and of high quality, basic laboratory equipment and resources are adequate. The current instrument base in part is dated, but this will be alleviated through the recent award of EU infrastructure money for new instrumentation (10 Mio). Some safety aspects require urgent attention and it is recommended that goggles are made available in teaching labs and that radioactive materials are properly and securely stored. Enforcement is uneven and, in preparation for more foreign researchers, it is suggested that all safety and laboratory materials are labelled/written in English.
2.	INTERNAL QUALITY ASSURANCE OF THE PROGRAMME	
2.1.	The HEI has established and accepted effective procedures for proposing, approving and delivering doctoral education. The procedures include identification of scientific/ artistic, cultural, social and economic needs.	The need for a Chemistry Department is without question. The PhD programme in Chemistry has a long history and has been of great importance for Croatia, e.g. for its
2.2.	The programme is aligned with the HEI research mission and vision, i.e. research strategy.	Improvements are necessary In formal terms, the Programme is aligned with the respective strategic plan of the Faculty of Science (and its subordinate Department of Chemistry). However, the latter does not contain any specifics except a listing of research areas and pending grant applications. No clear vision has been developed which could feed back into future programme development. While there is full alignment of the programme with the stated strategy, the latter is ill defined and lacks detail.
2.3.	The HEI systematically monitors the success of the programmes through periodic reviews, and implements	Improvements are necessary Periodic (inter)national reviews are important, but also outside the present ASHE review it is useful to have foreign

improvements. participation in the body (council) that governs the PhD programme, e.g. but not limited to the visiting foreign lecturers. Considering there is no other PhD programme in Croatia of this magnitude, best practices and advice needs to be obtained from abroad. A strong point is the annual reports that are prepared about both the student and the supervisor with regard to progress. Unfortunately, it seems that little is done with the content of the report, which could be a valuable tool for improvement of supervisors and students. Several program participants indicated that the course had been updated last in 2008-2009. This is insufficient. No information is collected on the alumni, which would help in defining the role of the school in the world and may guide needed modifications. Feedback can be obtained from the students on the content of the PhD courses, which may lead to higher enrolment and more satisfied students. Module coordinators are not sufficiently visible for all the students, especially those that do their research externally. Improvements are necessary As mentioned in 2.3, the supervisors are evaluated by their students, which is good, but no clear sign was found that the results are used to improve a non-optimal situation. 2.4. HEI continuously monitors supervisors' performance and has mechanisms for evaluating The Department monitors the research quality of the supervisors, and, if necessary, supervisors, based on output, which is e.g. deciding factor changing them and mediating between in promotions to associate and full professor. the supervisors and the candidates. The School has little influence on external supervisors, but they are always linked to an internal supervisor, who should detect problems with the supervision. High level of quality HEI has instated a Code of Ethics, which researchers are 2.5. HEI assures academic integrity and aware of. Supervisors should catch plagiarism, in papers to freedom.

and High level of quality

would be useful.

2.6. The

process

transparent

of

and

developing

objective,

defending the thesis proposal is HEI has a proper system in place with a public seminar, a and committee with an external (not from Science Faculty)

be published, but availability of software to detect this

	includes a public presentation.	member. Details are readily available.
2.7.	Thesis assessment results from a scientifically sound assessment of an independent committee.	High level of quality HEI has a proper system in place with an obligation of one published paper in a recognized journal, a committee with an external (not from science faculty) member. Details are readily available.
		Minor point: There is a significant delay between thesis submission and examination.
2.8.	The HEI publishes all necessary information on the study programme, admissions, delivery and conditions for progression and completion, in accessible outlets and media.	High level of quality HEI publishes the needed information on a website.
2.9.		HEI manages to use the limited budget for quite a number of activities that benefit the students, such as material expenses, reduced tuition, hire lecturers and organize
2.10	. Tuition fees are determined on the basis of transparent criteria (and real costs of studying).	High level of quality The tuition fee is determined by the Faculty of Science Council based on advice of the Department and is transparent. The tuition fee is small in comparison to the overall costs of a student research project (ca. 20%). It is very clear that all the funds will readily be spent on teaching and research activities.
	SUPPORT TO DOCTORAL CANDIDATES AND THEIR PROGRESSION	
	The HEI establishes admission quotas with respect to its teaching and supervision capacities.	High level of quality The number of students per supervisor is low. According to the information supplied in the Self-Evaluation Report (SER), the number of students with a supervisor is 49 and the number of supervisors officially appointed is 46, which means a ratio of student/supervisor close to 1:1. The HEI reported that the number of available supervisors exceeds the number of students and that the teaching workload of supervisors is low. Likewise, the HEI reported that the total number of interested students is lower than

	their capacities. This Panel agree with the HEI that the low demand relative to their large capacities makes the establishing of admission quotas not necessary. However, this Panel recommends to continue monitoring this situation.
3.2. The HEI establishes admission quotas on the basis of scientific/artistic, cultural, social, economic and other needs.	Improvements are necessary For the discussion of the admission quotas regarding the needs of the society and the academia, the HEI did not take into account the average completion rate. Likewise, it has not considered the number of unemployed PhDs, neither the distribution of employed PhDs in the public and private sector nor the number of research projects. This Panel recommends the HEI to use that data in discussing the admission quota with respect to the needs of the society and academia.
3.3. The HEI establishes the admission quotas taking into account the funding available to the candidates, that is, on the basis of the absorption potentials of research projects or other sources of funding.	High level of quality The HEI reported that the doctoral research project costs (chemicals, supplies, etc.) of admitted candidates are fully funded by research projects. However, examples of students supported by specific funding would have strengthened the HEI's position.
3.4. The HEI should pay attention to the number of candidates admitted as to provide each with an advisor (a potential supervisor). From the point of admission to the end of doctoral education, efforts are invested so that each candidate has a sustainable research plan and is able to complete doctoral research successfully.	High level of quality The HEI reported that an advisor is assigned to each doctoral candidate at the beginning of their studies. The advisor monitors and guides the doctoral candidate's work. In conversation with students and supervisors, the Panel has verified that indeed students have each an advisor with whom they can discuss their curricular activities.
3.5. The HEI ensures that interested, talented and highly motivated candidates are recruited internationally.	Improvements are necessary The call for applications is published in Croatia, not internationally. For that reason, the Panel asks that efforts should be made in order to attract international applicants.
3.6. The selection process is public and based on choosing the best applicants.	High level of quality The call for applications is public and open for a period of 3 months. According to the information supplied by the HEI, the criteria for assessment of the applicants include past performance, publications, recommendations by teachers, the interest they expressed in research, a research proposal and an interview. The conversation with the students supported the information given by the HEI.

3.7. The HEI ensures that the procedure is transpared with published criteria, a transparent complain	nt and in line and that there is	High level of quality According to the Self-Evaluation Report, the information is given to all applicants in a meeting with the heads of their study specialties. Then the decision on the admission in the doctoral programme is adopted by the Council of the Chemistry Department of the Faculty of Science based on the recommendation from the Council of the Doctoral Programme in Chemistry. Finally, a list of admitted applicants in the programme is published and placed at the notice board of the Faculty. The HEI reported that no complaints about the procedure have been received until now, but a complaint procedure may not be available or known by applicants The Panel received no complaints from the students regarding the selection procedure.
3.8. There is a possibility to applicants' and candida learning.	_	High level of quality The HEI has an ordinance for recognizing prior learning and achievements relevant for the doctoral programme as well as extracurricular activities. The Panel received comments from the supervisors and students pointing that the process to validate prior learning is time demanding and complex. For that reason, we suggest that efforts should be made to simplify this process.
3.9. Candidates' rights and of defined in relevant HEI a contract on studying to a high level of supervisor institutional support to	regulations and that provides for ory and	High level of quality As is specified in the SER, the HEI counts with an ordinance and a contract where the rights and obligations of the students are defined.
3.10. There are institutional mechanisms for candid progression.	= =	Improvements are necessary The HEI does not have a special document that describes a mechanism for supporting candidates in their research and career development. For that reason, this Panel recommends that the HEI elaborates such a policy document. The future implementation of this document (ordinance or other) should guarantee institutional support for candidate's publications, presentation in international conferences and career oriented activities (e.g. scientific writing and presenting in English).
4. PROGRAMME AND OU	TCOMES	
4.1. The content and quality programme are aligned internationally recognize	with	Improvements are necessary Organizationally speaking, the programme is based on, or similar to established programmes at other established universities. The programme is research oriented, but

nevertheless has a sizable course load of ca. 70 ECTS, including electives and transferable skills courses. The students have the opportunity to travel abroad and present at conferences.

The programme is of high quality and follows international standards in terms of structure, planning, execution, research topics, research, and publications. This is evidenced by the number and quality of publication in international peer-reviewed journals.

Improvements are needed with respect to getting the students to be more involved in research earlier on rather than taking courses.

4.2. Programme learning outcomes, as well as the learning outcomes of modules and subject units, are aligned with the level 8.2 of the CroQF. They clearly describe the competencies the candidates will develop during the doctoral programme, including the ethical requirements of doing research.

Improvements are necessary

Learning outcomes are aligned with the mentioned document, and are described in great details in a sensible way. However, the volume and body of requirements is such that it is very difficult to reach all outcomes. The content should be streamlined to a reachable level. Additionally, specific classes in research ethics are needed.

4.3. Programme learning outcomes are logically and clearly connected with teaching contents, as well as the contents included in supervision and research.

Improvements are necessary

While the learning outcomes are perfectly described, they are not a guideline in the teaching program. According to the candidates, the teaching program needs to offer fewer courses, with more relevance to the research programs and some new general skills courses, such as communication in English.

4.4. The doctoral programme ensures the achievement of learning outcomes and competencies aligned with the level 8.2 of the CroQF.

Improvements are necessary

As mentioned, the alignment of the learning outcomes for the course work is not optimal. Better alignment with realistic learning outcomes for fewer courses, is recommended. Fortunately, the thesis is of a good quality and papers (at least one) need to be published before a degree can be awarded.

4.5. Teaching methods (and ECTS, if applicable) are appropriate for level 8.2 of the CroQF and assure achievement of clearly defined learning outcomes.

Improvements are necessary

The quality of teaching is generally good. In formal terms a range of teaching methods/styles is available. However, the students criticized that many courses consist of simple assignments and self-learning and then evaluation by written assessments without any real taught input from the teachers. The Panel gained the impression that teaching of small classes (<3) was organized in a haphazard fashion.

The Panel commends small group teaching and X-ray

	practicals. There is a good impression from undergraduate teaching laboratories, computer practicals and effective use of company visits.
4.6. The programme enables acquisition of general (transferable) skills.	Improvements are necessary The programme contains a number of valuable general skills courses, e.g., on scientific writing, presenting, research organization, regulatory affairs, etc. These should be augmented by courses in business administration A general criticism is that it would be beneficial if all teaching were in English. Not only would this aid the local Croatian students in language training but also make the program more attractive for international students, raise its international visibility and aid international grant applications, e.g., H2020 or FP9.
4.7. Teaching content is adapted to the needs of current and future research and candidates' training (individual course plans, generic skills etc.).	Improvements are necessary While the mix of courses, topics and the option choices are broad, the students indicated that the teaching content and the list of available courses needs to be updated more often to be in line with the state of the art in science.
4.8. The programme ensures quality through international connections and teacher and candidate mobility.	Improvements are necessary The programme is not very international yet, but some foreign teachers come to Zagreb. Theses and courses in English would be useful and would be applauded by the students. Information on website in English would be useful.

* NOTE: RECOMMENDATIONS OF THE EXPERT PANEL TO THE ASHE'S ACCREDITATION COUNCIL AND QUALITY LABEL

The role of the Expert Panel in the re-accreditation of doctoral study programmes is manifold. The Expert Panel or part of the Expert Panel visiting a higher education institution drafts a report on the basis of a self-evaluation report, the accompanying relevant documentation, and a site visit to HEI. The draft report is adopted by all members of the Cluster Expert Panel, while the president of the Cluster Expert Panel is responsible for coordinating the assessment levels.

The report contains an assessment on whether a doctoral study programme delivered at a higher education institution complies with the prescribed laws and by-laws, as well as any additional/recommended requirements defined by the Agency's Accreditation Council, and whether a higher education institution can obtain a positive, i.e. satisfactory quality assessment according to the criteria set out in this document. Moreover, the Expert Panel must make recommendations for quality improvement.

Based on the assessment of all these elements, the Expert Panel may propose to the Accreditation Council of the Agency to issue either a confirmation on compliance, a letter of expectation for the period up to three (3) years in which period the higher education institution should eliminate the identified deficiencies, or to deny the license.

If the Expert Panel has assessed that a doctoral study programme delivered by a higher education institution does not meet legal and other requirements or that the quality of a study programme is not ensured (i.e. that HEI does not meet additional requirements or recommendations made by the Accreditation Council, or has a very poor quality assessment), they should propose to the Accreditation Council to deny the license.

If the Expert Panel considers that the relevant laws and bylaws have been met by a higher education institution, but that certain elements mentioned above do not meet the quality requirements, while they consider that the identified shortcomings can be corrected within a time frame of three years, they should issue a letter of expectation.

If the Expert Panel considers that all legal and additional/recommended requirements have been met and the quality assessment is satisfactory, i.e. that a study programme fulfils the learning outcomes appropriately defined for that level and scientific area, they may propose the issuance of a certificate and have a HEI commit to quality improvement and reporting to the Agency during the follow-up period.

Finally, if the Expert Panel has, in accordance with the criteria mentioned above, proposed issuing the certificate of compliance and assessed that, in addition to meeting the minimum quality requirements – i.e. the qualification framework level - for a study programme, the programme should be identified as a doctoral programme of a 'high level of quality', the Expert Panel may propose to the Agency's Accreditation Council that such a doctoral study programme be awarded the 'high quality label'. Thus the Agency, with the consent of the Accreditation Council, grants a higher education institution the right to use the label for their academic and promotional purposes.

The 'high quality label' cannot be proposed or awarded to a programme or a higher education institution that does not comply with the requirements laid down by the laws and bylaws mentioned in this document, and any additional requirements recommended by the Accreditation Council. Moreover, the quality assessment awarded to a study programme should reflect a high level of quality inasmuch that at least half of the sub-criteria in each of the quality assessment criteria are assessed as being of high quality. The Accreditation Council of the Agency issues a final opinion on the label awarded. The content and form of the quality labels shall be prescribed by the Agency in a relevant general act.

The Accreditation Council of the Agency discusses the final report with all recommendations and suggestions, and issues their opinion on the report. Based on a prior opinion of the Accreditation Council, the Agency issues an Accreditation Recommendation to the minister responsible for science and higher education, and upon receipt of the minister's final decision on the outcome of the procedure, awards the 'high quality label" to a higher education institution.