

NAME OF THE COURSE		Shellfish toxicity				
Code	PMB535	Year of study	2			
Course teacher	Stjepan Orhanović, Ph.D. Associate Professor	Credits (ECTS)	2			
Associate teachers		Type of instruction (number of hours)	L	S	E	F
			15			
Status of the course	electional	Percentage of application of e-learning	10%			
COURSE DESCRIPTION						
Course objectives	<p>Getting acquainted with the issue of bivalve toxicity in the natural environment and cultivation sites</p> <p>Getting acquainted with the symptoms of poisoning after consumption of toxic bivalve molluscs.</p> <p>Getting to know the extent of the risk of occurrence and accumulation of biotoxins and other pollutants in bivalve mollusc.</p>					
Course enrolment requirements and entry competences required for the course	Courses taken: General Chemistry, Cell Biology, General Zoology					
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	<ul style="list-style-type: none"> - Understand the causes of shellfish toxicity and the transfer of dangerous substances through the food chain, - understand the role of phytoplankton in the marine ecosystem, - explain the importance of shellfishing in the economy, - define the poison, explain the toxicological and pharmacological effects of the poison and the interaction of poisons with the chemical and morphological structures of the organism, - explain the processes of the interaction of poisons with other substances that are brought into the organism - recognize symptoms of sea biotoxin poisoning, - perform a risk assessment calculation for marine toxins, - link information related to the maximum permissible amounts of marine biotoxins in food, - explain the global spatial distribution of toxicity and define areas characterized by certain types of toxicity, - understand the traceability principle (at official controls) from sampling to analysis results. 					
Course content broken down in detail by weekly class schedule (syllabus)	<p>Lecture 1. Causes of bivalve toxicity Causes of shellfish toxicity, transmission of dangerous substances through the food chain, characteristics and role of phytoplankton, phytoplankton categories, spatial and seasonal distribution of phytoplankton, dangerous phytoplankton blooms.</p> <p>Lecture 2. Types of bivalve toxicity Types of bivalve toxicity, PSP toxicity type, NSP toxicity type, DSP toxicity type, ASP toxicity type, Ciguatera type of toxicity (fish), cyanobacterial toxicity type.</p> <p>Lecture 3. Commercial importance of bivalve molluscs Shellfish cultivation in Croatia, monitoring the quality of sea and bivalve molluscs in the Republic of Croatia, ordinance on veterinary and health conditions for the production, cultivation, purification and marketing of bivalve molluscs.</p>					

Lecture 4. Spatial and temporal distribution of toxicity.

Global spatial distribution of toxicity. Areas susceptible to certain types of toxicity.

Seasonality of reporting toxicity.

Lecture 5. Basics of toxicology

Basic toxicological components, elementary toxins and their mixtures, sources of poisoning, reversible and irreversible effects in the body, interactions of poisons.

Lecture 6. DSP toxins

Division of natural toxins in the sea according to the mode of action on man, the influence of toxins on bivalve mollusks, chemical structure, properties and mechanism of action of DSP toxins, derivatives of DSP toxins, toxicology of azaspiracids (AZA) and yessotoxins (YTX). Symptoms of DSP toxin poisoning.

Biological and instrumental methods of toxins determination in phytoplankton samples and soft shellfish tissue. Basic principles of operation of mass spectrometry technique linked to liquid chromatography. Cases of DSP toxins in the world and in Croatia. Calculation of risk assessment for DSP toxins. European and Croatian legislation related to DSP toxins in bivalve mollusks.

Lecture 7. ASP toxins

Chemical structure, properties and mechanisms of action of ASP toxins, derivatives of ASP toxins. Symptoms of ASP toxin poisoning. Instrumental methods of determination in phytoplankton samples and soft shellfish tissue. Risk assessment factors for ASP toxins. Cases of ASP toxins in the world and in Croatia. Calculation of risk assessment for ASP toxins. European and Croatian legislation related to ASP toxins in bivalve mollusks.

Lecture 8. PSP toxins

Chemical structure, properties and mechanisms of action of PSP toxins, categories of PSP toxins according to chemical structure and relative toxicity. Mild, moderately severe and severe symptoms of PSP toxin poisoning. Biological and instrumental methods of determination in phytoplankton samples and soft shellfish tissue. Risk assessment factors for PSP toxins. Cases of PSP toxins in the world and in Croatia. Calculation of risk assessment for PSP toxins. European and Croatian legislation related to PSP toxins in bivalve mollusks.

Lecture 9. NSP toxins and tetrodotoxins

Toxicity, toxicity levels and tetrodotoxin distribution. Recorded cases of tetrodotoxin poisoning in the world. Chemical structure, properties and mechanism of action of NSP toxins. Symptoms of NSP toxin poisoning. Distribution of NSP toxins. Shortcomings and advantages of biological methods of determining toxins.

Lecture 10. Monitoring of farms and areas of shellfish cultivation, European and Croatian legislation

	Sea and shellfish quality monitoring plan, traceability principle (at official controls) from sampling to analysis results.					
Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>on line</i> in entirety <input type="checkbox"/> partial e-learning <input type="checkbox"/> field work			<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)		
Student responsibilities	Attendance to at least 70% of the estimated classes					
Screening student work (<i>name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course</i>)	Class attendance	1	Research		Practical training	
	Experimental work		Report		(Other)	
	Essay		Seminar essay		(Other)	
	Tests		Oral exam		(Other)	
	Written exam	1	Project		(Other)	
Grading and evaluating student work in class and at the final exam	Students are evaluated on the basis of a written exam (or 2 partial written colloquium) Colloquium or exam evaluation criteria (score scale): % of evaluation test solution <60 insufficient (1) 60 -70 sufficient (2) 71-80 good (3) 81-90 very good (4) 91-100 excellent (5)					
Required literature (available in the library and via other media)	Title			Number of copies in the library	Availability via other media	
	Luis M. Botana (2000) Seafood and Freshwater Toxins, Pharmacology, Physiology and Detection, Marcel Dekker, Inc. New York.				chemistry-chemists.com/..../Toxicology/seafood-and-freshwater-toxins-2000.pdf	
	Priručnik-Hrvatska agencija za hranu (2015). Prirodni toksikanti - toksikanti biljnog podrijetla. Hrvatska agencija za hranu, https://www.hah.hr/doc/prirucnik.doc .				https://www.hah.hr/doc/prirucnik.doc .	
	Skoog D.A., West D.M i Holler F.J. (1999) Osnove Analitičke kemije, Školska knjiga, Zagreb, prvo izdanje			3		
	Ujević, I., Ž. Ninčević-Gladan, R. Roje, S. Skejić, J. Arapov, I. Marasović (2010) Domoic acid – a new				http://www.mdpi.com/1420-	

	toxin in the Croatian Adriatic shellfish toxin profile Molecules, 15: 6835-6849		3049/15/10/68 35
	Roje-Busatto, R. & Ujević I. (2014) PSP Toxins Profile in Ascidian <i>Microcosmus vulgaris</i> (Heller, 1877) after Human Poisoning in Croatia (Adriatic Sea). <i>Toxicon</i> . 79: 28-36		http://bib.irb.hr/datoteka/670657.1-s2.0-S0041010114000051-main.pdf
	Narodne novine, broj 117/04. Pravilnik o veterinarsko-zdravstvenim uvjetima za izlov, uzgoj, pročišćavanje i stavljanje u promet živih školjkaša.		www.propisi.hr/print.php?id=3853
Optional literature (at the time of submission of study programme proposal)	<p>-Hallegraef, G.M. (1993) A review of harmful algal blooms and their apparent global increase. <i>Phycologia</i>, 32: 79-99</p> <p>-Falconer, J.R. 1993. <i>Algal Toxins in Seafood and Drinking Water</i>. University press, Cambridge, pp. 224</p>		
Quality assurance methods that ensure the acquisition of exit competences	<ul style="list-style-type: none"> - Active participation in class - Student survey of evaluation of teachers' work and subject. - Feedback from students at the consultation. 		
Other (as the proposer wishes to add)	-Consultations are taking place according to agreement with students by prior notice or on e-mail: stipe@pmfst.hr		