

Faculty of Sciences

Master of Science in Biochemistry and Biotechnology

Language of instruction: English

Programme version 9

## 1 General Courses 30 credits

Nr	Course	CRDT	Ref	MT1	Session	Study
1	C003525 Structure and Function of Biological Macromolecules <i>Savvas Savvides -- Department of Biochemistry, Physiology and Microbiology</i>	4		1	A:1	120
2	C003526 Structural Bioinformatics <i>Savvas Savvides -- Department of Biochemistry, Physiology and Microbiology</i>	3		1	A:1	80
3	C000500 Bioinformatics 2 <i>Vanessa Vermeirssen -- Department of Molecular Biology</i>	3		1	A:2	80
4	C003527 Biostatistics <i>Caroline De Tender -- Department of Biochemistry, Physiology and Microbiology</i>	4		1	A:1	120
5	C003671 Biotechnology and Society <i>Jonathan Maelfait -- Department of Molecular Biology</i>	3		2	A:J	80
6	C003616 Systems Biology <i>Bert De Rybel -- Department of Plant Biotechnology and Bioinformatics</i>	4		1	A:2	120
7	C002381 Biotechnology: Biosafety, GMP and Intellectual Property <i>Koen Vanhalst -- Department of Molecular Biology</i>	3		2	A:1	80
8	C002865 Bioethics <i>Michiel De Proost -- Department of Philosophy and Moral Sciences</i>	3		2	A:1	80
9	C003106 Preparation of Master's Dissertation <i>Peter Vandenabeele -- Department of Molecular Biology</i>	3		2	B:1	80

## 2 Majors 30 credits

Subscribe to 1 major from the following list. Subject to approval by the faculty.  
Students with minor research choose another major than the courses of the focus.

### 2.1 Major Bioinformatics and Systems Biology 30 credits

Nr	Course	CRDT	Ref	MT1	Session	Study
1	C002732 Programming for Bioinformatics <i>Pieter De Bleser -- Department of Molecular Biology</i>	6		1	A:1	160
2	C002700 Comparative Genomics <i>Klaas Vandepoele -- Department of Plant Biotechnology and Bioinformatics</i>	3		1	A:2	80
3	C004456 Linux for Bioinformatics Environment <i>Svitlana Lukicheva -- Department of Plant Biotechnology and Bioinformatics</i>	3		1	A:2	80
4	C003083 Bioinformatics Algorithms <i>Veerle Fack -- Department of Mathematics, Computer Science and Statistics</i>	3		1	A:2	80
5	C003084 Project Bioinformatics and Systems Biology <i>Svitlana Lukicheva -- Department of Plant Biotechnology and Bioinformatics</i>	6		1	A:J	170
6	C004611 Biological Databases <i>Wim Van Criekege -- Department of Data Analysis and Mathematical Modelling</i>	3		2	A:2	90
7	C003617 Modelling of Biological Systems <i>Steven Maere -- Department of Plant Biotechnology and Bioinformatics</i>	3		2	A:1	80
8	C002703 Data Mining <i>Yvan Saey -- Department of Mathematics, Computer Science and Statistics</i>	3		2	A:1	80

### 2.2 Major Biochemistry and Structural Biology 30 credits

Nr	Course	CRDT	Ref	MT1	Session	Study
1	C003086 <b>Proteomics</b> <i>Bart Devreese -- Department of Biochemistry, Physiology and Microbiology</i>	3		1	A:1	80
2	C003670 <b>Biomolecular Production Methods</b> <i>Nico Callewaert -- Department of Biochemistry, Physiology and Microbiology</i>	4		1	A:1	110
3	C003088 <b>Drug Design</b> <i>Savvas Savvides -- Department of Biochemistry, Physiology and Microbiology</i>	3		1	A:2	80
4	C003615 <b>Experimental Structural Biology</b> <i>Savvas Savvides -- Department of Biochemistry, Physiology and Microbiology</i>	5		1	A:2	135
5	C003089 <b>Project Biochemistry and Structural Biology</b> <i>Hannah Eeckhaut -- Department of Biochemistry, Physiology and Microbiology</i>	6		1	A:J	170
6	C002695 <b>Bionanotechnology</b> <i>Kevin Braeckmans -- Department of Pharmaceutics</i>	3		2	A:1	80
7	C002717 <b>Metabolic Engineering</b> <i>Alain Goossens -- Department of Plant Biotechnology and Bioinformatics</i>	3		2	A:1	80
8	C002713 <b>Glycobiology</b> <i>Nico Callewaert -- Department of Biochemistry, Physiology and Microbiology</i>	3		2	A:1	80

## 2.3 Major Biomedical Biotechnology

30 credits

[Subscribe to 30 credit units from the following list, with 6 credit units with reference a.](#)

Nr	Course	CRDT	Ref	MT1	Session	Study
1	C002725 <b>Molecular Pathophysiology and Experimental Therapy</b> <i>Charlotte Scott -- Department of Molecular Biology</i>	6		1	A:1	160
2	C002738 <b>Transgenetics of Animal Model Organisms</b> <i>Kris Vleminckx -- Department of Molecular Biology</i>	6		1	A:2	160
3	C002708 <b>Experimental Molecular Cell Biology</b> <i>Rudi Beyaert -- Department of Molecular Biology</i>	3		1	A:2	80
4	C003090 <b>Project Biomedical Biotechnology</b> <i>Jens Staal -- Department of Molecular Biology</i>	6		1	A:J	170
5	C002716 <b>Human Genetics and Genetic Diseases</b> <i>Bruce Poppe -- Department of Biomolecular Medicine</i>	3		2	A:1	80
6	C002722 <b>Molecular Cancer Biology</b> <i>Geert Berx -- Department of Molecular Biology</i>	3	a	2	A:1	80
7	C002728 <b>Neurobiology</b> <i>Geert van Loo -- Department of Molecular Biology</i>	3	a	2	A:1	80
8	C002699 <b>Cellular Stress, Cell Death and Senescence</b> <i>Mathieu Bertrand -- Department of Molecular Biology</i>	3	a	2	A:1	80
9	C002720 <b>Molecular and Experimental Immunology</b> <i>Martin Guillems -- Department of Molecular Biology</i>	3	a	2	A:1	80

## 2.4 Major Microbial Biotechnology

30 credits

Nr	Course	CRDT	Ref	MT1	Session	Study
1	C002711 <b>Food Microbiology and Safety</b> <i>Kurt Houf -- Department of Veterinary and Biosciences</i>	3		1	A:1	80
2	C004007 <b>Molecular Bacteria-Host Interactions</b> <i>Petra Van Damme -- Department of Biochemistry, Physiology and Microbiology</i>	3		1	A:2	80
3	C002715 <b>Host-Virus Interactions</b> <i>Xavier Saelens -- Department of Biochemistry, Physiology and Microbiology</i>	3		1	A:1	80
4	C002719 <b>Microbial Genomics</b> <i>Caroline De Tender -- Department of Biochemistry, Physiology and Microbiology</i>	3		1	A:2	80
5	C002724 <b>Molecular Microbial Ecology</b> <i>Marie Joossens -- Department of Biochemistry, Physiology and Microbiology</i>	3		1	A:2	80
6	C003092 <b>Project Microbial Biotechnology</b> <i>Bart Devreese -- Department of Biochemistry, Physiology and Microbiology</i>	6		1	A:J	170
7	C004394 <b>Microbes in Biotechnology</b> <i>Marie Joossens -- Department of Biochemistry, Physiology and Microbiology</i>	6		2	A:1	150
8	C002714 <b>Host-Parasite Interactions</b> <i>Dirk de Graaf -- Department of Biochemistry, Physiology and Microbiology</i>	3		2	A:1	80

## 2.5 Major Plant Biotechnology

30 credits

Nr	Course	CRDT	Ref	MT1	Session	Study
1	C003095 Plant Environment Interactions <i>Sébastien Schoenaers -- Department of Biology</i>	3		1	A:1	80
2	C003097 Plant Biotic Interactions <i>Sofie Goormachtig -- Department of Plant Biotechnology and Bioinformatics</i>	3		1	A:2	80
3	C003098 The Plant Cell <i>Daniël Van Damme -- Department of Plant Biotechnology and Bioinformatics</i>	3		1	A:2	80
4	C003099 Plant Growth and Development <i>Moritz Nowack -- Department of Plant Biotechnology and Bioinformatics</i>	3		1	A:2	80
5	C003100 Molecular Plant Breeding <i>Tom Ruttink -- Department of Plant Biotechnology and Bioinformatics</i>	3		2	A:1	80
6	C003101 Project Plant Biotechnology <i>Fien Lanssens -- Department of Plant Biotechnology and Bioinformatics</i>	6		1	A:J	170
7	C003102 The Plant Factory <i>Frank Van Breusegem -- Department of Plant Biotechnology and Bioinformatics</i>	3		2	A:1	80
8	C003825 Functional Plant Genomics <i>Lieven De Veylder -- Department of Plant Biotechnology and Bioinformatics</i>	3		1	A:1	80

### 2.5.1 Elective Course List Plant Biotechnology

3 credits

[Subscribe to 3 credit units from the following list.](#)

Nr	Course	CRDT	Ref	MT1	Session	Study
1	C003618 Advanced Plant Biotic Interactions <i>Bartel Vanholme -- Department of Plant Biotechnology and Bioinformatics</i>	3		2	A:1	80
2	C003163 Plant Yield <i>Hilde Nelissen -- Department of Plant Biotechnology and Bioinformatics</i>	3		2	A:1	80
3	C002717 Metabolic Engineering <i>Alain Goossens -- Department of Plant Biotechnology and Bioinformatics</i>	3		2	A:1	80
4	C004006 Advanced Plant Cell Biology and Signaling <i>Daniël Van Damme -- Department of Plant Biotechnology and Bioinformatics</i>	3		2	A:1	80

## 3 Elective Courses

30 credits

[Subscribe to 1 minor from the following list. Subject to approval by the faculty.](#)

### 3.1 Minor Research

30 credits

[Subscribe to no less than 1 and no more than 2 modules from the following list. Subject to approval by the faculty.](#)

#### 3.1.1 Focus

[Subscribe to no less than 21 and no more than 30 credit units from 1 focus from the following list.](#)

[Focus has to be different from the major.](#)

[Courses for which MT1 mentions '1' are mandatory and must be followed in the first master's year.](#)

##### 3.1.1.1 Focus Bioinformatics and Systems Biology

[Subscribe to no less than 21 and no more than 30 credit units from the following list, distributed over the first standard learning path as follows: 21 credit units in year 1.](#)

Nr	Course	CRDT	Ref	MT1	Session	Study
1	C002732 Programming for Bioinformatics <i>Pieter De Bleser -- Department of Molecular Biology</i>	6		1	A:1	160
2	C002700 Comparative Genomics <i>Klaas Vandepoele -- Department of Plant Biotechnology and Bioinformatics</i>	3		1	A:2	80
3	C004456 Linux for Bioinformatics Environment <i>Svitlana Lukicheva -- Department of Plant Biotechnology and Bioinformatics</i>	3		1	A:2	80
4	C003083 Bioinformatics Algorithms <i>Veerle Fack -- Department of Mathematics, Computer Science and Statistics</i>	3		1	A:2	80
5	C003084 Project Bioinformatics and Systems Biology <i>Svitlana Lukicheva -- Department of Plant Biotechnology and Bioinformatics</i>	6		1	A:J	170
6	C004611 Biological Databases <i>Wim Van Criekege -- Department of Data Analysis and Mathematical Modelling</i>	3		2	A:2	90
7	C003617 Modelling of Biological Systems <i>Steven Maere -- Department of Plant Biotechnology and Bioinformatics</i>	3		2	A:1	80

8	C002703	Data Mining	3	2	A:1	80
<i>Yvan Saeys -- Department of Mathematics, Computer Science and Statistics</i>						

### 3.1.1.2 Focus Biochemistry and Structural Biology

Subscribe to no less than 21 and no more than 30 credit units from the following list, distributed over the first standard learning path as follows: 21 credit units in year 1.

Nr	Course	CRDT	Ref	MT1	Session	Study
1	C003086 Proteomics <i>Bart Devreese -- Department of Biochemistry, Physiology and Microbiology</i>	3		1	A:1	80
2	C003670 Biomolecular Production Methods <i>Nico Callewaert -- Department of Biochemistry, Physiology and Microbiology</i>	4		1	A:1	110
3	C003088 Drug Design <i>Savvas Savvides -- Department of Biochemistry, Physiology and Microbiology</i>	3		1	A:2	80
4	C003615 Experimental Structural Biology <i>Savvas Savvides -- Department of Biochemistry, Physiology and Microbiology</i>	5		1	A:2	135
5	C003089 Project Biochemistry and Structural Biology <i>Hannah Eeckhaut -- Department of Biochemistry, Physiology and Microbiology</i>	6		1	A:J	170
6	C002695 Bionanotechnology <i>Kevin Braeckmans -- Department of Pharmaceutics</i>	3		2	A:1	80
7	C002717 Metabolic Engineering <i>Alain Goossens -- Department of Plant Biotechnology and Bioinformatics</i>	3		2	A:1	80
8	C002713 Glycobiology <i>Nico Callewaert -- Department of Biochemistry, Physiology and Microbiology</i>	3		2	A:1	80

### 3.1.1.3 Focus Biomedical Biotechnology

Subscribe to no less than 21 and no more than 30 credit units from the following list, distributed over the first standard learning path as follows: 21 credit units in year 1.

Nr	Course	CRDT	Ref	MT1	Session	Study
1	C002725 Molecular Pathophysiology and Experimental Therapy <i>Charlotte Scott -- Department of Molecular Biology</i>	6		1	A:1	160
2	C002738 Transgenetics of Animal Model Organisms <i>Kris Vleminckx -- Department of Molecular Biology</i>	6		1	A:2	160
3	C002708 Experimental Molecular Cell Biology <i>Rudi Beyaert -- Department of Molecular Biology</i>	3		1	A:2	80
4	C003090 Project Biomedical Biotechnology <i>Jens Staal -- Department of Molecular Biology</i>	6		1	A:J	170
5	C002716 Human Genetics and Genetic Diseases <i>Bruce Poppe -- Department of Biomolecular Medicine</i>	3		2	A:1	80
6	C002722 Molecular Cancer Biology <i>Geert Berx -- Department of Molecular Biology</i>	3	a	2	A:1	80
7	C002728 Neurobiology <i>Geert van Loo -- Department of Molecular Biology</i>	3	a	2	A:1	80
8	C002699 Cellular Stress, Cell Death and Senescence <i>Mathieu Bertrand -- Department of Molecular Biology</i>	3	a	2	A:1	80
9	C002720 Molecular and Experimental Immunology <i>Martin Guillems -- Department of Molecular Biology</i>	3	a	2	A:1	80

### 3.1.1.4 Focus Microbial Biotechnology

Subscribe to no less than 21 and no more than 30 credit units from the following list, distributed over the first standard learning path as follows: 21 credit units in year 1.

Nr	Course	CRDT	Ref	MT1	Session	Study
1	C002711 Food Microbiology and Safety <i>Kurt Houf -- Department of Veterinary and Biosciences</i>	3		1	A:1	80
2	C004007 Molecular Bacteria-Host Interactions <i>Petra Van Damme -- Department of Biochemistry, Physiology and Microbiology</i>	3		1	A:2	80
3	C002715 Host-Virus Interactions <i>Xavier Saelens -- Department of Biochemistry, Physiology and Microbiology</i>	3		1	A:1	80
4	C002719 Microbial Genomics <i>Caroline De Tender -- Department of Biochemistry, Physiology and Microbiology</i>	3		1	A:2	80
5	C002724 Molecular Microbial Ecology <i>Marie Joossens -- Department of Biochemistry, Physiology and Microbiology</i>	3		1	A:2	80

6	C003092	Project Microbial Biotechnology <i>Bart Devreese -- Department of Biochemistry, Physiology and Microbiology</i>	6	1	A:J	170
7	C004394	Microbes in Biotechnology <i>Marie Joossens -- Department of Biochemistry, Physiology and Microbiology</i>	6	2	A:1	150
8	C002714	Host-Parasite Interactions <i>Dirk de Graaf -- Department of Biochemistry, Physiology and Microbiology</i>	3	2	A:1	80

### 3.1.1.5 Focus Plant Biotechnology

Subscribe to no less than 21 and no more than 30 credit units from the following list, distributed over the first standard learning path as follows: 21 credit units in year 1.

Nr	Course	CRDT	Ref	MT1	Session	Study
1	C003095 Plant Environment Interactions <i>Sébastien Schoenaers -- Department of Biology</i>	3		1	A:1	80
2	C003097 Plant Biotic Interactions <i>Sofie Goormachtig -- Department of Plant Biotechnology and Bioinformatics</i>	3		1	A:2	80
3	C003098 The Plant Cell <i>Daniël Van Damme -- Department of Plant Biotechnology and Bioinformatics</i>	3		1	A:2	80
4	C003099 Plant Growth and Development <i>Moritz Nowack -- Department of Plant Biotechnology and Bioinformatics</i>	3		1	A:2	80
5	C003100 Molecular Plant Breeding <i>Tom Ruttink -- Department of Plant Biotechnology and Bioinformatics</i>	3		2	A:1	80
6	C003101 Project Plant Biotechnology <i>Fien Lanssens -- Department of Plant Biotechnology and Bioinformatics</i>	6		1	A:J	170
7	C003102 The Plant Factory <i>Frank Van Breusegem -- Department of Plant Biotechnology and Bioinformatics</i>	3		2	A:1	80
8	C003825 Functional Plant Genomics <i>Lieven De Veylder -- Department of Plant Biotechnology and Bioinformatics</i>	3		1	A:1	80

### 3.1.2 Elective Courses

Subscribe to at most 9 credit units from no less than 1 and no more than 2 modules from the following list.

#### 3.1.2.1 Elective Course List

Subscribe to no more than 9 credit units from the following list.

Nr	Course	CRDT	Ref	MT1	Session	Study
1	C002681 Advanced Programming in Bioinformatics <i>Pieter De Bleser -- Department of Molecular Biology</i>	3		2		80
2	C002720 Molecular and Experimental Immunology <i>Martin Guillems -- Department of Molecular Biology</i>	3		2	A:1	80
3	C002697 Biotechnological Techniques in Medical Diagnostics <i>Dieter Deforce -- Department of Pharmaceutics</i>	3		2	B:2	80
4	J000454 Cutting Edge Technologies for Drug Delivery - Nanomedicines <i>Stefaan De Smedt -- Department of Pharmaceutics</i>	3		2	A:2	90
5	C002699 Cellular Stress, Cell Death and Senescence <i>Mathieu Bertrand -- Department of Molecular Biology</i>	3		2	A:1	80
6	C003311 Phylogenetics <i>Olivier De Clerck -- Department of Biology</i>	4		2	A:1	120
7	C002717 Metabolic Engineering <i>Alain Goossens -- Department of Plant Biotechnology and Bioinformatics</i>	3		2	A:1	80
8	C002737 The Eukaryotic Cell Cycle <i>Lieven De Veylder -- Department of Plant Biotechnology and Bioinformatics</i>	3		2	A:1	80
9	C002706 Epigenetics <i>Wim Vanden Berghe -- Department of Molecular Biology</i>	3		2	A:1	80
10	C002718 Metabolomics [nl] <i>Kris Morreel -- Department of Plant Biotechnology and Bioinformatics</i>	3		2	A:1	80
11	C002727 Molecular Simulations of Biosystems <i>Toon Verstraeten -- Department of Physics and Astronomy</i>	3		2	A:1	80
12	C004455 Advanced Biomolecular 3D-structure Determination by X-ray Crystallography and Cryo-Electron Microscopy <i>Kenneth Verstraete -- Department of Biochemistry, Physiology and Microbiology</i>	3		2	A:1	80
13	C003695 Applied High-throughput Analysis <i>Tim De Meyer -- Department of Data Analysis and Mathematical Modelling</i>	6		2	A:1	180

14	C004008	Laboratory Animal Science <i>Katleen Hermans -- Department of Pathobiology, Pharmacology and Zoological Medicine</i>	6	2	A:1	180
15	C004009	History and Philosophy of Sciences [nl] <i>Maarten Van Dyck -- Department of Philosophy and Moral Sciences</i>	3	2	B:2	90

### 3.1.2.2 Elective Courses UGent and other Universities

Subscribe to no more than 9 credit units from the study programmes of UGent including courses from the other majors or the [Ghent University elective courses](#), or courses from other universities of the Flemish Community or (online) courses from [Erasmus+ partner universities](#), distributed over the first standard learning path as follows: no more than 9 credit units in year 2.

## 3.2 Minor Interdisciplinary Combination 30 credits

Nr	Course	CRDT	Ref	MT1	Session	Study
1	C003105 Project Interdisciplinary Combination <i>Fien Lanssens -- Department of Plant Biotechnology and Bioinformatics</i>	6		1	A:J	170

### 3.2.1 Elective Courses UGent or other Universities 24 credits

Subscribe to 24 credit units from the study programmes of UGent (no more than 9 credits from the own study programme), courses from other universities of the Flemish Community, or with the permission of the Study Programme Committee, from non-Flemish universities within the ERASMUS+ programme.

The minor allows a focus on another discipline.

The courses must be included in a specific discipline, approved by the Study Programme Committee, and can not be a specialisation within the programme.

## 3.3 Minor Economics and Business Administration 30 credits

Subscribe to 30 credit units from no less than 1 and no more than 2 modules from the following list.

### 3.3.1 General Courses

Subscribe to no less than 24 and no more than 30 credit units from the following list, distributed over the first standard learning path as follows: no more than 24 credit units in year 1.

Dare to Venture can be chosen if you have already subscribed to Introduction to Entrepreneurship.

Nr	Course	CRDT	Ref	MT1	Session	Study
1	F001019 Economics [nl] <i>Bruno Merlevede -- Department of Economics</i>	5			B:1	150
2	F001020 Introduction to Entrepreneurship <i>Petra Andries -- Department of Marketing, Innovation and Organisation</i>	3			A:1	90
3	F001022 Dare to Venture <i>Johan Verrue -- Department of Marketing, Innovation and Organisation</i>	4			A:2	120
4	F000845 Business Administration [nl] <i>Mirjam Knockaert -- Department of Marketing, Innovation and Organisation</i>	4			A:2	120
5	F000551 Business Skills <i>Mieke Audenaert -- Department of Marketing, Innovation and Organisation</i>	4			C:2	120
6	F000768 Marketing Management [nl] <i>Maggie Geuens -- Department of Marketing, Innovation and Organisation</i>	6			A:1	180
7	F000855 Organization Theory <i>Gosia Kozusznik -- Department of Marketing, Innovation and Organisation</i>	4			A:2	120
8	F001009 Business Cycles and Growth [nl] <i>Freddy Heylen -- Department of Economics</i>	5			A:1	150
9	F001008 Markets and Prices [nl] <i>Dirk Van de gaer -- Department of Economics</i>	5			A:1	150
10	F001010 Financial Markets and Institutions [nl] <i>Rudi Vander Vennet -- Department of Economics</i>	5			A:2	150
11	F000752 Environmental Economics and Policy [nl] <i>Brent Bleys -- Department of Economics</i>	4			B:2	120
12	F000859 Corporate Social Responsibility [nl] <i>Saskia Crucke -- Department of Marketing, Innovation and Organisation</i>	3			A:2	90

### 3.3.2 Elective Courses UGent or other Universities

Subscribe to no more than 6 credit units to be chosen from the study programmes of:

- UGent including the [Ghent University elective courses](#),
- Other higher education of the Flemish Community,
- [Erasmus+ partner universities](#) including the [ENLIGHT \(online\) elective courses](#).

## 4 Master's Dissertation 30 credits

Nr	Course	CRDT	Ref	MT1	Session	Study
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### Teaching

When a course is not taught (solely) in the programme's language of instruction, the effectively used languages are indicated in square brackets following the course name, using the following ISO codes:

bg: Bulgarian	de: German	es: Spanish	ja: Japanese	pl: Polish	sh: Croatian/Serbian	zh: Chinese
cs: Czech	el: Greek	fr: French	nl: Dutch	pt: Portuguese	sl: Slovene	
da: Danish	en: English	it: Italian	no: Norwegian	ru: Russian	sv: Swedish	

### Semester

Semesters are indicated by their number (1 or 2); semester 3 represents the summer period and J indicates a course spanning semesters 1 and 2. When a capital letter precedes a semester number, the course has multiple offerings. The letter indicates the offering concerned.

When a semester is shown in brackets, the course is not offered this year in the specific offering.

The offering frequency and first year of offering are indicated by the following codes:

a: bi-annually	c: annually, from 2026-2027	f: annually, from 2027-2028	i: annually, from 2028-2029
b: tri-annually	d: bi-annually, from 2026-2027	g: bi-annually, from 2027-2028	j: bi-annually, from 2028-2029
	e: tri-annually, from 2026-2027	h: tri-annually, from 2027-2028	k: tri-annually, from 2028-2029