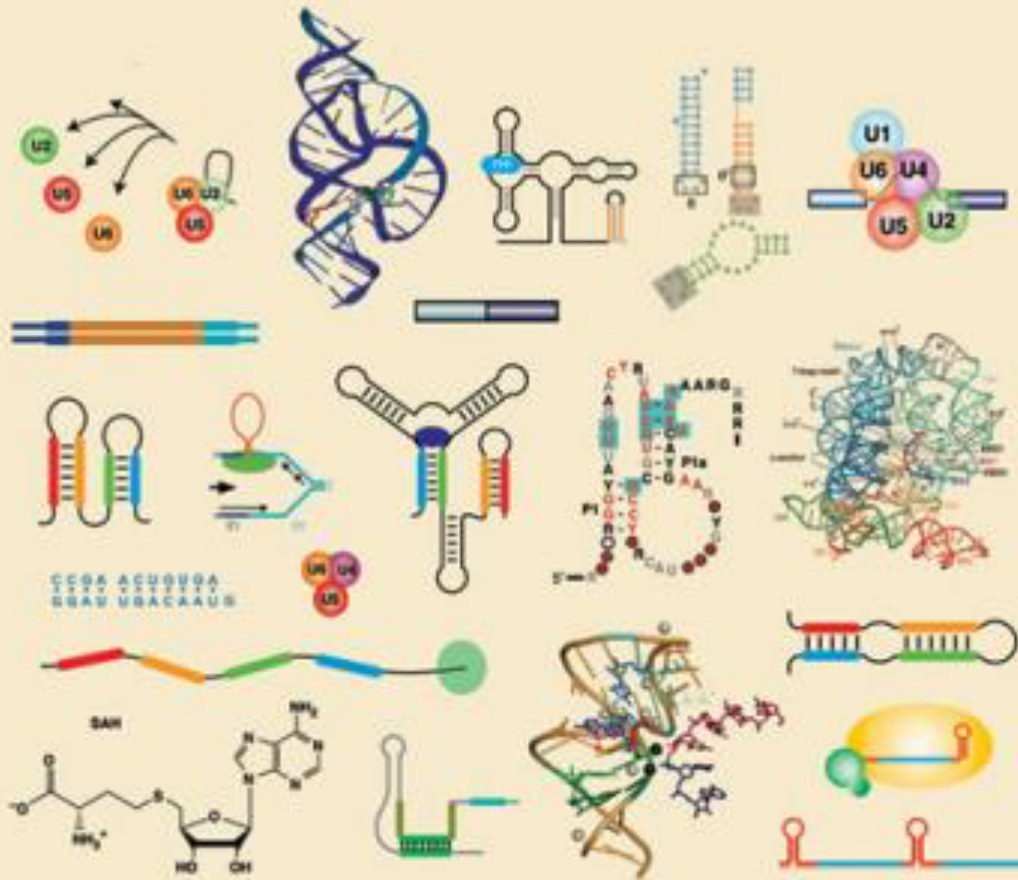


RNA

A LABORATORY MANUAL



RIO • ARES • HANNON • NILSEN

TRASCRIPTOMICA

**Genomica
Funzionale**

-

**Biotechnologie
mediche
AA 2019/2020**

Prof. Schoeftner
(Docente di riferimento)

TRASCRIPTOMICA

Schedule lectures– AA 2019/2020



Entire course in english language

TRASCRIITTOMICA

Schedule lectures– AA 2020/2021

October (18 hours)

- L1: 05.10.2020: 14-16 (2h)
- L2: 08.10.2020: 10:45-12:45 (2h)
- L3: 09.10.2020: 10:45-12:45 (2h)
- L4: 12.10.2020: 14-16 (2h)
- L5: 15.10.2020: 10:45-12:45 (2h)
- L6: 16.10.2020: 10:45-12:45 (2h)
- L7: 19.10.2020: 14-16 (2h)
- L8: 22.10.2020: 10:45-12:45 (2h)
- L9: 23.10.2020: 10:45-12:45 (2h)

November (16 hours)

- L10: 05.11.2020: 10:45-12:45 (2h)
- L11: 06.11.2020: 10:45-12:45 (2h)
- L12: 12.11.2020: 10:45-12:45 (2h)
- L13: 13.11.2020: 10:45-12:45 (2h)
- L14: 19.11.2020: 10:45-12:45 (2h)
- L15: 20.11.2020: 10:45-12:45 (2h)
- L16: 26.11.2020: 10:45-12:45 (2h)
- L17: 27.11.2020: 10:45-12:45 (2h)

December (12 hours)

- L18: 03.12.2019: 11-13 (2h)*
- L19: 04.12.2019: 14-16 (2h)*
- L20: 10.12.2019: 16-18 (2h)
- L21: 11.12.2018: 11-13 (2h)
- L22: 17.12.2019: 16-18 (2h)
- L23: 18.12.2019: 16-18 (2h)

January

- L24: 14.01.2021: 10:45-12:45 (2h) – LAST QUESTIONS EXAM
- XX: 15.01.2021: 10:45-12:45 (2h)
- XX: 21.01.2021: 10:45-12:45 (2h)

48 ore = 6CFU

Edificio C1, Aula L

PPT SLIDES:

MOODLE FEDERALE

PASSWORD: Trascrittomica

Prof. Stefan Schoeftner

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I only reply to official students' emails: @units.it
(no @gmail; @libero....)

Students' representatives: XXXXX@studenti.units.it

TRASCRIPTOMICA

Structure of the course:

1. **Professor's lectures: General Introduction, examples of ncRNAs (ca. 9 lectures, each 2 hours)**
2. **Student's lectures on defined topics of ncRNA research (ca. 14 lectures, each 2 hours)**
3. **1 Lecture for questions before exam**

Goal of the course and training for students:

1. **General overview on ncRNA function in development and disease**
2. **Learning to extract general information on a larger field of ncRNA research**
3. **Learning to analyze-understand scientific data from a publication ("Journal club"); identify scientific question, understand experiments and interpret the data, make conclusions**
4. **Presenting most important information to an audience in a comprehensive manner**
5. **Getting prepared for Master thesis reality**
6. **Get used to apply scientific – english - language**

My Lectures:

1. Introduction – Non coding RNA revolution
2. lncRNA in Physiology:
 - Introduction lncRNAs
 - Pseudogene derived lncRNAs
 - Pseudogene lncRNA function: *mOct4P4* lncRNA and ancestral gene regulation
3. lncRNAs and control of epigenetics in disease
 - FSHD and D-BET
4. Controlling the action of miRNAs (ceRNAs)
 - miRNA review
 - ceRNAs in cancer
 - Circular RNAs (circRNAs)
 - endosiRNAs in stem cell biology
5. Control of regulatory elements by ncRNAs
 - eRNAs and enhancer control
6. DNA Damage and ncRNA
 - DNA damage response RNAs

TRASCRIPTOMICA - EXAMS

1. LECTURE BY STUDENT:

- Evaluation of student performance is based on the quality of the presented student lecture (**score: 0-16 points**).
- The evaluation of the lecture presented by an individual student will remain valid for 2 academic years.

2. ORAL EXAM

- In addition, an oral exam will be performed that contains 3 questions related to the topics presented during all lectures of the course (**score: 0-5 points per question; total 15**).
- In the oral exam the obtained knowledge but also the ability to interpret scientific data and to put scientific findings/data into a larger context will be evaluated.

IMPORTANT:

Students that do not have presented a lecture during the course are not allowed to perform the oral exam.

...how are student's lectures and oral exam organized???

Student's Lectures:

- Student groups comprising 2-3 colleagues will be formed autonomously
- Student groups choose between the proposed papers (Moodle)
- Students groups select 2 reviews on the topic
- Students prepare presentation and present to other students as lecture

Oral exam:

- An inscription into an "Appello" on Esse3 is necessary to perform the oral exam
- Exam: depending on Covid19 situation preferentially via MS Teams
 - 1 question about seminar presented
 - 1 question on seminar of colleagues
 - 1 question of Prof. Lectures
 - Students need to show general knowledge on individual topics and discuss experimental approaches on how to address a particular problem related to the topics (scientific question – experimental approach chosen – result – interpretation
 - Duration: 20-30 min per exam
 - Books, electronic devices or scripts are not allowed during the exam.

Final grade (voto finale):

- Points Student's lecture + Points oral exam

STUDENTS' PPT PRESENTATION

Student's seminar structure – in English:

1. **First part of seminar** (ca. 20 min): general introduction into the topic using the reviews (**10- 15 powerpoint slides**).
2. **Second part of the seminar** (max. 40 min): Students present the results of a key scientific publication on the topic (**10- 15 powerpoint slides**)
Publications to be selected are available on Moodle
3. **Third part of the seminar** (ca. 15 min): **Discussion: question by colleagues -**

IMPORTANT: each student of groups need to cover presentation time

SCHEDULE FOR STUDENT SEMINAR PREPARATION

HOW TO CHOOSE A TOPIC – AND HOW TO START

Topics: recent research papers are available on Moodle.

- **Step 1:** Students together with the students representatives provide a list with all students that will follow the lecture AA 2020 – 2021: Thursday **08.10.2020**; **during the lecture on 08.10.2020 the total number of student groups will be determined**
- **Step 2:** Students form groups and choose research papers until Monday **12.10.2020**; Please present a table naming groups, students + e-mail of individual groups members. Student groups can already start selecting reviews on the topic
- **Step 3:** Student representatives propose allocation of students talks in the lecture schedule: Thursday **15.10.2020**; **All student lectures need to finish latest on 18.12.2020**
- **Step 4:** Students send the papers reviews per mail to Professor latest on Thursday **15.10.2020**
- Students start to prepare presentations
- DRAFT OF PRESENTATION WILL BE DISCUSSED CA: 2 WEEKS BEFORE PRESENTATION: 30 MINUTES OF LECTURE – A SCHEDULE WILL BE PROVIDED

SCHEDULE FOR STUDENT SEMINAR PREPARATION

STUDENT'S SEMINAR PROGRAM

	Group 1	Group 2			Group 3
Topic Number	5	2			11
Title	Genomic Imprinting regulated by lncRNAs	Dosage Compensation in mammals (focus on ncRNAs)	No lecture	No lecture	lncRNAs and cancer chemoresistance
Student 1	Alessio Conci	Annamaria Regina			Daniele Ammeti
Student 2	Eleonora Lucantonio	Claudio Antonio Coppola			Gabriele Di Giustino
Student 3	Ermelinda Sabarese	Giulia Maria Clemenza			Lorenzo Graziani
Presentation of draft to Prof.	31.10.2019	07.11.2019			15.11.2019
Date of presentation	14.11.2019	15.11.2019	21.11.2019	22.11.2019	28.11.2019

	Group 4	Group 5	Group 6	Group 7	Group 8
Topic Number	6	10	9	12	1
Title	Ultraconserved elements (UCEs) and lncRNAs	RNA Editing (ADAR, immunesystem)	R-loops - Gene expression and Chromatin Structure	lncRNAs and cancer immunology/therapy resistance	Dosage Compensation in D.melanogaster (roX RNAs)
Student 1	Lucia D'Amico	Ciro Danubio	Violina Potlog	Debora Maffeo	S�verine Nozownik
Student 2	Maria Pia Viscomi	Carmen Tucci	Margot Ladisl�s	Carmela Tangredi	Roberta Palmitessa
Student 3	Agata Valentino	Michele Tonetti	Isabella Concina	Ilaria Ziccardi	Simone Bellini
Presentation of draft to Prof.	15.11.2019	22.11.2019 per e-mail	28.11.2019	29.12.2019	02.12.2019
Date of presentation	29.11.2019	02.12.2019 (new)	05.12.2019	06.12.2019	11.12.2019 (new)

TOPICS

TOPIC 1: miRNAs: targeting efficiency and extracellular communication

1. Genomic Clustering Facilitates Nuclear Processing of Suboptimal Pri-miRNA Loci

Renfu Shang , S Chan Baek , Kijun Kim , Boseon Kim , V Narry Kim , Eric C Lai
Mol Cell. 2020 Apr 16;78(2):303-316.e4.

2. Circulating miRNAs in disease

Cheng, M.; Yang, J.; Zhao, X.; Zhang, E.; Zeng, Q.; Yu, Y.; Yang, L.; Wu, B.; Yi, G.; Mao, X.; et al. Circulating myocardial microRNAs from infarcted hearts are carried in exosomes and mobilise bone marrow progenitor cells. Nat. Commun. 2019, 10, 959.

3. ncRNA and communication in plants

Cai, Q.; Qiao, L.; Wang, M.; He, B.; Lin, F.M.; Palmquist, J.; Huang, S.D.; Jin, H. Plants send small RNAs in extracellular vesicles to fungal pathogen to silence virulence genes. Science 2018, 360, 1126–1129.

TOPIC 2 Short ORF in ncRNAs

4. lncRNA with ORFs in physiology

Matsumoto, A.; Pasut, A.; Matsumoto, M.; Yamashita, R.; Fung, J.; Monteleone, E.; Saghatelian, A.; Nakayama, K.I.; Clohessy, J.G.; Pandolfi, P.P.
mTORC1 and muscle regeneration are regulated by the LINC00961-encoded SPAR polypeptide.
Nature 2017, 541, 228–232.

5. lncRNAs multiple function and ORF in development

The Tug1 lncRNA locus is essential for male fertility
Jordan P Lewandowski, Gabrijela Dumbović , Audrey R Watson, Taeyoung Hwang, Emily Jacobs-Palmer, Nydia Chang, Christian Much, Kyle M Turner, Christopher Kirby, Nimrod D Rubinstein, Abigail F Groff, Steve C Liapis , Chiara Gerhardinger, Assaf Bester, Pier Paolo Pandolfi, John G Clohessy, Hopi E Hoekstra, Martin Sauvageau, John L Rinn
Genome Biol. 2020 Sep 7;21(1):237.

TOPICS

TOPIC 3: Small RNAs that control chromatin formation

6. piRNAs in Drosophila

A Heterochromatin-Specific RNA Export Pathway Facilitates piRNA Production
Mostafa F ElMaghraby 1, Peter Refsing Andersen 2, Florian Pühlinger 1, Ulrich Hohmann 3, Katharina Meixner 1, Thomas Lendl 3, Laszlo Tirian 1, Julius Brennecke 4
Cell. 2019 Aug 8;178(4):964-979.e20.

7. ncRNA and organization of chromosome topology

Topological organization of multichromosomal regions by the long intergenic noncoding RNA Firre
Ezgi Haciosuleyman, Loyal A Goff, Cole Trapnell, Adam Williams, Jorge Henao-Mejia, Lei Sun, Patrick McClanahan, David G Hendrickson, Martin Sauvageau, David R Kelley, Michael Morse, Jesse Engreitz, Eric S Lander, Mitch Guttman, Harvey F Lodish, Richard Flavell, Arjun Raj, John L Rinn
Nat Struct Mol Biol 2014 Feb;21(2):198-206.

8. Silencing of gene expression by ncRNA

RNA-dependent epigenetic silencing directs transcriptional downregulation caused by intronic repeat expansions
Eimer, H.; Sureshkumar, S.; Singh Yadav, A.; Kraupner-Taylor, C.; Bandaranayake, C.; Seleznev, A.; Thomason, T.; Fletcher, S.J.; Gordon, S.F.; Carroll, B.J.; et al.
Cell 2018, 174, 1095–1105.

TOPIC 4: lncRNA and disease

9. lncRNA as oncogenes

lncRNA epigenetic landscape analysis identifies EPIC1 as an oncogenic lncRNA that interacts with MYC and promotes cell-cycle progression in cancer
Wang, Z.; Yang, B.; Zhang, M.; Guo, W.; Wu, Z.; Wang, Y.; Jia, L.; Li, S.; Cancer Genome Atlas Research Network; Xie, W.; et al.
Cancer Cell 2018, 33, 706–720.

TOPICS

10. lncRNA and cancer progression

A ROR1–HER3–lncRNA signalling axis modulates the Hippo–YAP pathway to regulate bone metastasis.
Li, C.; Wang, S.; Xing, Z.; Lin, A.; Liang, K.; Song, J.; Hu, Q.; Yao, J.; Chen, Z.; Park, P.K.; et al.
Nat. Cell Biol. 2017, 19, 106–119. [

11. ncRNAs, subcompartments and genomic stability

p53 induces formation of NEAT1 lncRNA-containing paraspeckles that modulate replication stress response and chemosensitivity
Carmen Adriaens, Laura Standaert, Jasmine Barra , Mathilde Latil, Annelien Verfaillie, Peter Kalev, Bram Boeckx, Paul W G Wijnhoven, Enrico Radaelli , William Vermi, Eleonora Leucci, Gaëlle Lapouge, Benjamin Beck, Joost van den Oord, Shinichi Nakagawa, Tetsuro Hirose, Anna A Sablina, Diether Lambrechts, Stein Aerts, Cédric Blanpain, Jean-Christophe Marine
Nat Med. 2016 Aug;22(8):861-8.

TOPIC 5: ncRNAs and cell physiology

12. Introns and response to starvation

Introns are mediators of cell response to starvation.
Parenteau, J.; Maignon, L.; Berthoumieux, M.; Catala, M.; Gagnon, V.; Abou Elela, S.
Nature 2019, 565, 612–617.

13. RNA and liquid-liquid phase separation

Stress Induces Dynamic, Cytotoxicity-Antagonizing TDP-43 Nuclear Bodies via Paraspeckle lncRNA NEAT1-Mediated Liquid-Liquid Phase Separation
Chen Wang, Yongjia Duan, Gang Duan, Qiangqiang Wang, Kai Zhang, Xue Deng, Beituo Qian, Jing Gu, Zhiwei Ma, Shuang Zhang, Lin Guo, Cong Liu, Yanshan Fang
Mol Cell. 2020 Aug 6;79(3):443-458.e7.

TOPICS

TOPIC 6: Functional ncRNA screenings

14. CRISPR RNAi Screening

CRISPRi-based genome-scale identification of functional long noncoding RNA loci in human cells

S John Liu, Max A Horlbeck, Seung Woo Cho, Harjus S Birk, Martina Malatesta, Daniel He, Frank J Attenello, Jacqueline E Villalta, Min Y Cho, Yuwen Chen, Mohammad A Mandegar, Michael P Olvera, Luke A Gilbert, Bruce R Conklin, Howard Y Chang, Jonathan S Weissman, Daniel A Lim
Science. 2017 Jan 6;355(6320)

15. lncRNA and cancer drug resistance

Bester, A.C.; Lee, J.D.; Chavez, A.; Lee, Y.R.; Nachmani, D.; Vora, S.; Victor, J.; Sauvageau, M.; Monteleone, E.; Rinn, J.L.; et al. An integrated genome-wide CRISPRa approach to functionalize lncRNAs in drug resistance.
Cell 2018, 173, 649–664.