Excellence MOOC Metabolic syndrome - When the metabolism runs wild

Project Abbreviation: Metsy

TEL-Excellence MOOC Team:

Project owner	Melina, Amor PhD. Institute for Materials Physics, Graz University of Technology and Institute of Molecular Biology and Biochemistry, Medical University of Graz
Project manager	Dr. Ariane Pessentheiner, Institute of Biophysics, University of Graz and Institute of Molecular Biology and Biochemistry, Medical University of Graz

Additional team members and roles (please also include future members of the team, e.g. study assistants; use N.N. for the name if the person is not yet known):

Role in the project	**Names and institute(s)**
Lecturer	Barbara Siegmund, Assoc.Prof. Dipl.-Ing. Dr.techn. Institute for Analytical Chemistry and Food Chemistry
Lecturer	Gerhard Sommer, Assoc.Prof. Dipl.-Ing. Dr.techn. Institute for Biomechanics
Dissemination	María Cecilia Rabino, Univ. Prof. Dr. (UNMDP & Universidad FASTA, Argentina)
Study assistant	Margit Taibon-Lindheim

Concept

Description of concept of the Excellence MOOC including the didactical embedding in a university course
(max. 850 characters including whitespaces)

This MOOC aims to address the underlying causes and consequences of the metabolic syndrome (MetS), a condition that affects over a billion people worldwide (WHO). The MetS is a compilation of risk factors that includes visceral obesity, high blood sugar and triglycerides, low HDL-cholesterol and hypertension. This results in a considerably higher incidence of diseases such as Type 2 Diabetes, liver disease and cardiovascular events. Therefore, there is an urgent need to address this substantial biomedical challenge. This course will deal with

diverse aspects related to the MetS resulting from the interdisciplinary background of the involved team members. Therefore, this MOOC course will be integrated into a wide spectrum of university courses: Food Technology, Biochemistry and Biomedicine, Biomechanics and Tissue Engineering.

Characteristics	**Please tick the respective boxes!**
Subtitles added to videos	mandatory
Transcripts added to videos	mandatory
MOOC trailer for dissemination	☒
Interactive elements for videos (H5P)	☒
Interactive elements other than H5P videos	☒
Additional content other than videos	☒
Additional analogue content (e.g. workbook)	☐
Content offered in languages other than English	☒
Active use of platform forum	☒
Gender- and diversity-conscious content in spoken and written form	☒
Content as accessible as possible	☒
Badges	☒
Certificate other than ECTS	☐
CC-licence of the MOOC (CC-BY and CC-BY-SA recommended)	CC-BY-SA

Description of Didactic and Educational Setting
(max. 850 characters including whitespaces)

Structure: 6 units of 1-2 hour each

Unit 1: Metabolic syndrome: Facts & Features

Unit 2: (Epi-)genetics vs. Environment

Unit 3: Food technology: Fat, Sugar & Salt

Unit 4: Overnutrition: Role of adipose tissue

Unit 5: MetS and liver disease

Unit 6: Heart disease - an accumulation of all?

The course will be accompanied by three avatars that represent lipids, sugars and salt that help explain the fate of nutrients and their contribution to the development of MetS.

The incorporation of digital media in each unit will follow the 3-2-1 Model of Didactic Elements described by Kerres in 2001 (Table 1).

Table 1. 3-2-1 Model of Didactic Elements

	Didactic element	Function in learning process
3	Learning information, material and task	Orientation Suggestion Activation
2	Communication Cooperation	Support
1	Test	Motivation Orientation

Methodologically, different types of e-tivities will be included by taking advantage of Moodle features such as: explainer and interactive videos or images with H5P, as well as forums and quizzes.

Description of unique selling point (short argument, compared to state of the art)
(max. 500 characters including whitespaces)

This course will strengthen the area of Medicine and Biology, which is notably underrepresented in iMooXs compared to Social or Technical sciences. Even though there are courses available in the context of nutrition, none of them are dealing with the Metabolic Syndrome. There are two aspects that will make this course unique: internationalisation (three languages: English, German and Spanish) and interdisciplinarity (lecturers from 3 different disciplines).

Description of additional content and addons (e.g. games & simulations); please coordinate this with the OU Educational Technology beforehand
(max. 600 characters including whitespaces)

One additional content which would fit our concept and which we would like to include is an interactive, educational game that we design on a platform such as Kahoot. This would also help engage the active participation of the participants. Other interesting tools would be Feedbackr or Mentimeter with which we can include live-polls.

Exemplary demonstration of the didactic and scientific track record (e.g.: 3 didactic milestones such as educational awards & trainings and scientific milestones such as scientific awards, high impact paper/ journal issues/ events & other achievements)
(max. 850 characters including whitespaces)

- Preis für exzellente Lehre (2019-2020), TUGraz (MA, BS)
- eDidactics training program (MA)
- Teaching education program in Biology, UNMDP, Argentina (MA)
- Teaching Academy (various courses) (MA, GS)
- Teaching in English Program (AP, MA)
- Course: “Art of Science Communication” and project leader of a science communication project “Heart Matter(s)” (AP)
- PhD in Social Sciences: Education, UNR, Argentina (MCR)
- oral and poster presentations on scientific conferences (all)

- >200 articles in peer reviewed Journals (all)

Impact

Description of expected effect on teaching and learning as well as addressed lectures, involved disciplines and students as well as intended multiple/regular implementation
(max. 800 characters including whitespaces)

The participants will be able to distinguish the normal metabolic state (concept of homeostasis) from disease (concept of energetic imbalance) and identify causes of MetS. Further, they will be able to make real life connections to common effectors found in food sources. Importantly, metabolism will be explained in a simple, yet state-of-the-art way which will help participants to combine their acquired knowledge with other courses. Importantly, students coming from a technical background such as “Biomechanics and Tissue Engineering”, “Chemistry” or “Biotechnology” will have a low-threshold opportunity to gain basic knowledge in metabolism. On the contrary, biochemists will be introduced into food technology and principles of tissue engineering in the context of MetS.

Based on different teaching and learning scenarios described with MOOCs, we imagine different ways of implementation depending on the courses. For example, a Pre-MOOC as preparation or an in-between MOOC for additional information for the students which could be considered in the final assessment.

Characteristics	**Please fill in**
How many courses	**7-10, among those for example:** “Molecular Diagnostics”, “Biomaterials” (MA), “Lebensmittelchemie”, “Food Technology”, “Sensory evaluation of biotechnologically processed food”, “Post-harvest technology” (by BS), “Tissue Engineering” (GS)
How many learners	200-500
Which study programmes	**Bachelor>** Biomedical Engineering Chemistry Molecular Biology **Master>** Biomedical Engineering Biotechnology Biochemistry and Molecular Biomedicine Chemistry Molecular Biology

Sustainability

Name at least two other intended applications of the MOOC or parts thereof such as usage in courses at other universities & their impact
(max. 850 characters including whitespaces)

Besides the impact of this MOOC at different courses at the TU Graz, we also expect to target a broader audience. In the context of formal education, this course will be promoted and/or embedded at the courses given by: a) the Institute of Biochemistry and Molecular Biology of the Medical University of Graz (affiliation of AP and MA); b) Pädagogische Hochschule Steiermark: Nutritional Education (affiliation of BS); c) UNMDP: Biology and d) Universidad FASTA, Argentina: Nutritional Sciences (affiliations of MCR). Therefore, the content of the course will be also offered in Spanish. Additionally, we expect that the proposed course is attractive for dietitians, sport teachers, fitness coaches, medical doctors (and students) and also science interested lay audience who will be addressed by promotion in different social media channels.

Characteristics	**Please fill in**
Promoted in the course given by Institute of Biochemistry and Molecular Biology	Medical University of Graz
Embedded in the course Food Technology	Pädagogische Hochschule Steiermark, Institute of Secondary Vocational Teacher Education, Department of Nutrition
Promoted/Embedded in different courses for Biology and Nutritional Sciences students	Universidad Nacional de Mar del Plata and Universidad FASTA, Argentina
Promoted in the continuing education course Food Chemistry and Technology that is designed for participants coming from food industry	Life Long Learning, Graz University of Technology (BS is the programme director)

Licensing

Information in terms of CC-license (CC-BY and CC-BY-SA recommended) of all materials that are going to be used, reused and offered, in accordance with the TU Graz OER Policy
(max. 400 characters including whitespace)

In accordance with the TU Graz OER Policy, we will put the content of our iMooXs course under a CC-BY-SA which allows other users to copy and redistribute the material in any medium or format. They can also remix, transform, and build upon the material for any purpose, even commercially. However, the modified contents must be provided in the same way as the iMooXs course and must be available for users similar to the iMooXs platform. In addition, secondary users must give appropriate credit to us as creators. The use of the CC-BY-SA licence will thus contribute to a sustainable use of the material.

Costs

Requested Funding (€ 20k max; no in-kind such as TU Graz staff)

Description	**Price per unit/person**	**Units/Persons**	**Cost**
Material costs			
Consumables for experimental demonstrations			500

Materials for Videos			400
Labor costs			
Study assistant (involved in all planning and organizational aspects)	10 months à 12 hours/week	1 Student	10500
External lecturer & Project manager (Ariane Pessentheiner)	500	10	5000
Graphics designer for creating avatars		3-4 avatars in different positions	3600
Total (max. 20k)			20.000

Supervision und Quality Control (in-kind, such as TU Graz staff)

Position	**Amount in hours**
Amor, Melina, PhD Lic.	100h
Siegmund, Barbara, Assoc.Prof. Dipl.-Ing. Dr.techn.	80h
Sommer, Gerhard, Ass.Prof. Dipl.-Ing. Dr.techn.	20h

Necessary Support

Preliminary meeting

The mandatory preliminary meeting ensures that the project meets all requirements for the MOOC platform iMooX of TU Graz and that a realistic planning of content as well as time for the implementation of the project is guaranteed.

Please, fill in: The preliminary meeting was held on 10.12.2021 with Maria Haas and Walther Nagler from the iMooX Team.

During project time

Describe the expected help/support needed from OU Educational Technology or other OUs/institutions to develop the MOOC
(max. 250 characters including whitespaces)

- Support for Storyboarding
- Use of the video studio and recording, including post-production (cutting and arrangement)
- Graphic design support (consistent corporate design of the course, e.g. color scheme & logo)

- Video equipment for outside recording (maybe also done directly with the OE)

In case of questions, please contact the OU Educational Technology at office@imoox.at

Contenidos de las unidades:

Unidad 1: Síndrome metabólico: Características principales

Definición del Síndrome Metabólico (Síndrome X), los 3 de 5 criterios que se deben cumplir para su diagnóstico, enfermedad asociada y tejidos metabólicos afectados. Vía de señalización de la insulina en diferentes tejidos metabólicos, resistencia a la insulina, Diabetes tipo 1 y 2 e inflamación crónica de bajo grado como mecanismos moleculares subyacentes que impulsan el Síndrome Metabólico.

Unidad 2: (Epi-)genética vs. Ambiente

Papel del medio ambiente frente a la genética en el desarrollo del Sindrome Metabólico. Nutrigenética frente a la nutrigenómica, epigenética y los estudios de asociación del genoma completo (GWAS).

Unidad 3: Tecnología de alimentos: lípidos, azúcar y sal

La química básica del azúcar y los lípidos. Las funciones de los lípidos, el azúcar y la sal en los productos básicos alimentarios y la tecnología alimentaria. Posibles estrategias para reducir el consumo de los tres componentes.

Unidad 4: Sobrenutrición: Rol del tejido adiposo

Localización del tejido adiposo (visceral y subcutáneo) y tipos (tejido adiposo blanco, beige vs marrón), estructura del tejido adiposo y composición celular adipocitos vs otros tipos de células (tamaño de tipos de células vs número de tipos de células). Funciones adicionales del tejido adiposo más alla de la clásica función clásica de “almacenamiento”. Expansión del tejido adiposo: hiperplasia vs. hipertrofia. Consecuencias patológicas del Síndrome Metabólico sobre el tejido adiposo: Inflamación crónica y de bajo grado (metainflamación) y resistencia a la insulina, papel de las adipocinas y adiponectina, leptina. Principales procesos metabólicos que tienen lugar en el tejido adiposo: lipogénesis vs lipólisis. Acumulación de grasa ectópica como consecuencia del desequilibrio energético en el tejido adiposo.

Unidad 5: Sindrome Metabólico y enfermedad del hígado graso

Acumulación de ectópica de lípidos: enfermedad del hígado graso no alcohólico. Inflamación del hígado. Metabolismo de las lipoproteínas. Acumulación ectópica de lípidos en otros tejidos (desbordamiento de grasa del tejido adiposo y el hígado).

Unidad 6: Enfermedades del corazón - ¿una acumulación de todos?

Desarrollo de la aterosclerosis y conexión con la diabetes y la obesidad. Otros factores de riesgo de enfermedades del corazón. Constituyentes microestructurales “saludables” de los tejidos arteriales. Remodelación del tejido arterial y el papel del azúcar que conduce a productos finales de glicación avanzada (AGE) y la reticulación de los constituyentes del tejido (colágeno y elastina). Pruebas biomecánicas de tejidos arteriales.