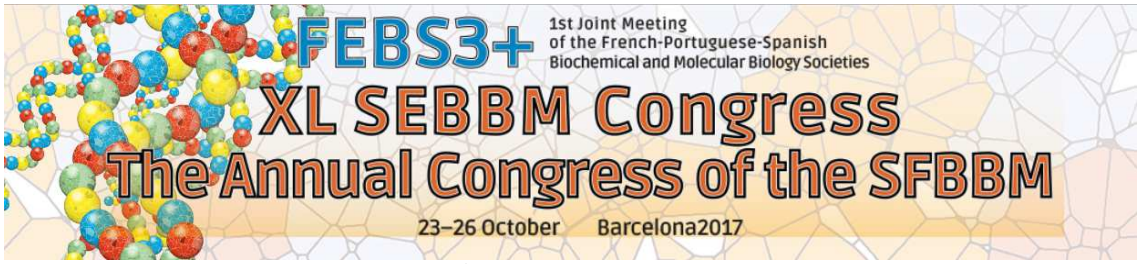


http://febs3.barcelona2017.org/buscador.asp

# P09. Teaching Biochemistry

## *P09-1*
## *Uncover rather than cover: teaching metallomics to master's students*

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Introducing Master's students to Metallomics, a field of increasing interest from environmental chemistry to medicine, should focuses on the role of essentials elements in biology (Cu, Fe, Zn, Mn, V, *et al.*), following a program that would include chemistry, biochemistry, biology, toxicology and biomedical applications of metals. However, the students seem to better acquire knowledge in the different Metallomics subjects and topics if they are involved in a process of active learning and if the teacher follows a teaching process which uncovers rather than covers specific contents of the program. Moreover, the participation of the students in learning instead of simply lecturing them leads to improved attendance, questioning and interest in the study of Metallomics. A problem with active learning, however, is that they are time-consuming, although there are other short, easy, and effective instructional methods [1].
In the present communication, some features of the teaching of Metallomics to master´s students are described. The students were incentivized to report the positive and negative aspects of this approach, with 5 positive points emerging in most reports: the sense of improvement in creating a presentation independently, the potential for self-improvement and learning rising from the creation of a short video on a scientific subject, the sensation of effortless learning and the appealing characteristics of the teaching methodology, the flexibility of teaching (allowing for the student to assemble their own program), and the increased gain from the interactive classes. Also, examples of Metallomics in society as well as others subjects not included in the discipline program were welcomed by the students. Furthermore, we will also discuss the contribution of the final work presentation in form of monography or as a video report to improve the learning and/or teaching of Metallomics topics.

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## *P09-2*
## *Multidisciplinary teaching of Biotechnology and Omics sciences*

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In the last years, there was a great boom in the Omics fields that have developed as multidisciplinary sciences. They use laboratory techniques related to Biology and Chemistry but also Bioinformatics tools. However, the developmental progress of these disciplines has led that much of undergraduate studies related to Biology have curricula that become outdated. From this point of view, it is necessary to focus

the students to the fundamentals and techniques of complementary disciplines that will be essentials for the understanding of the Omics sciences. In the present work, we have developed a new teaching approach for Biochemistry, Biology and Bioinformatics students. They formed interdisciplinary working groups. These groups have prepared and presented communications about different techniques or methods in Molecular Biology, Omics or Bioinformatics participating in a technical meeting. This learning strategy "I do and I learn" has enabled to the students a first contact with the scientific communication including the approach to the scientific literature to acquire technical knowledge. The cooperation between students from different disciplines has enriched their point of view and even has been used in some practical master's works.

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## *P09-3*
## *Promotion of educational innovation in biosciences from European scientific societies*

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A concern about teaching methods and strategies is increasing among the educators in biochemistry and molecular biology. This is boosted by the fast development of the subject, the changing attitudes of the young and the need to train the students for a fast evolving professional market. It has been particularly reinforced since the needed reform in the degrees for the European Higher Education Area.
To many university professors this has brought a great deal of stress and doubts. But we are not alone, and our particular situation is not singular. Many people in many countries are facing similar challenges for readdressing teaching methodologies. Therefore, it is capital that we know experiences from other colleagues, we work together in designing the best approaches for our task as instructors, trainers, facilitators of learning.
FEBS has been supporting communication among biochemistry educators from diverse countries. Aims are to disseminate advice on educational strategies, facilitate sharing, encourage innovative methods, as well as define quality standards. FEBS Education Committee regularly develops education workshops and organises sessions within each FEBS Congress.
Another initiative is the group of "FEBS Education Ambassadors", with a representative from each interested national society, that is working to strengthen collaboration and developments.
An ongoing project is a new web portal, the FEBS Expert Network, that will grow a community, foster collaboration, provide services, and support FEBS activities. The education channel within this portal will provide means for connection, exchange, discussion, and support for courses.
Finally, a new Education Section has been created in FEBS Open Bio, to attract research articles dealing with educational issues.

## *P09-4*
## Medical Biochemistry *seminars: use of formats with metabolic schemes*

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Medical Biochemistry (6 ECTS) is a subject of the second semester of the first year of the Degree in Medicine. The students have studied in the first semester Basic Biochemistry, which provides them with the molecular basis for understanding metabolism and its regulation. The use of seminars with resolution of metabolic schemes is very attractive as a learning tool aimed at the study of metabolic integration. The students (20-25) are distributed in subgroups of 3-4 members to carry out the activity.

In the theoretical classes the characteristics, stages, stoichiometry and energy balance of carbohydrate metabolism routes, lipid degradation and synthesis of ketone bodies have been described. The regulation of these routes has been analyzed in detail, with special emphasis on the main tissues and organs where they are located. One week before the seminar, students are given a series of open-ended questions. On the day of the seminar the teacher distributes a questionnaire that must be solved and delivered at the end of the activity. We have designed metabolic schemes that students must complete by writing the names of the routes and certain metabolites. In the seminar the students face for the first time this aspect of the metabolism. They know the isolated routes and their regulation by hormones, but they do not yet have a global vision of how these routes are connected between the different organs and tissues in our body. It is surprising to see how they manage to solve through the debate the different pieces of the enigma to complete the scheme, a laborious work that gives them the strategies to better understand the metabolic interrelationships.
*We thank the Medical Biochemistry Teaching Group for sharing reflections to improve the teaching and students' learning.*

## *P09-5*
## Medical Biochemistry *seminars: closed-format questionnaires to work in group*

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*Medical Biochemistry* (6 ECTS) is taught in the second semester of the first year of the Degree in Medicine. One of the competences of Medical Biochemistry is "To know the main metabolic pathways and their regulation and integration in the organism". Teaching modalities include seminars. In the seminars 20-25 students develop the activity distributed in groups of 3-4 members. They carry support material to answer a series of questions, and have to deliver the report with the answers at the end of the activity. In the theoretical classes the teacher has explained a topic and proposes a concept and several open-ended questions that the student should address. In the seminar the teacher gives each group a document with questions in closed-format. The students in groups debate the answers, write the agreed answers and manage their time to deliver the questionnaire at the end of the activity. Especially suitable for this activity is the subject of oxidative phosphorylation. In the theoretical classes the respiratory chain, mitochondrial synthesis of ATP, its regulation and how inhibitors work have been explained. Students should address the workings of uncouplers. Closed-answer questions avoid dispersion in responses, which often occurs when a concept is not well understood, and also favor discussion for better understanding. The questionnaire is completed with open-ended questions. It is very interesting to analyze the answers, which sometimes become contradictory.
*We are grateful to the Medical Biochemistry Teaching Group for participating actively in the profitable discussions on training activities and on how to improve student learning.*

## *P09-6*
## *The challenge of improving the understanding of biochemistry: a new methodology integrating basic subjects in clinical scenarios*

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Biochemistry, Genetics, Cellular and Molecular Biology are subjects perceived as difficult by students due to their abstraction level. They become clearer when they are studied in an integrated context. In the Department of Basic Biomedical Sciences at the Universidad Europea de Madrid we are tackling this reality through our newly designed methodology named *Workstation Learning Activities* (WSLA, González-Soltero *et al.*, submitted). Based on the TBL approach, WSLA benefits from using clinical scenarios as a thread to instruct students with an integrated perspective. This method improves the

understanding of the basic biochemical processes behind physiological events whilst relating them to the fundamentals of anatomy. Workstations are designed to cover the specific learning objectives. Set with state of the art environments and using cutting edge technology, students are faced with practical and theoretical settings as they will find them in the real professional world. Hence implementation of WSLA is especially welcomed when implemented in laboratory practices. Students understand the relevance of integration of otherwise separated subjects as a fundamental background to comprehend basic biological processes developing critical thinking. WSLA represents a flexible instrument that can be scalable to different degrees and levels of integration across academic years. Given the internationality of our institution, WSLA proves to be a helpful resource to be used in multicultural sessions. When analyzing student's perceptions, motivation and academic results we have found that WSLA improves both, showing the benefits of implementing this new methodology in the Health Sciences Degrees Curricula.

## *P09-7*
## *Integrated learning of basic sciences and nursing procedures through a clinical case study in a simulated context*

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It is important that nursing students experience how important is to acquire a solid and integrated knowledge on Biochemistry and Physiology to perform the procedures and interventions with accuracy and critical thinking. This activity, designed by a multidisciplinary team from the Biomedical Science and the Nursing Departments at the European University, combines the advantages of an integrated curricula with the simulation methodology through the WSLA approach (Working Station Learning Activities).
A total of112 first year students of the Nursing grade (21 teams), focused on the case of a patient that through the diagnosis of her type I Diabetes declines into a ketoacidosis and is hospitalized. Teams worked different aspects of the disease, such as insulin signaling deficiency, adaptation and coordination of the metabolism and respiratory physiopathology and also reviewed analytic data from the patient. In the simulated hospital, students applied their theoretical knowledge and performed a urinary catheterization to aSVA Simulator and a urinalysis test to demonstrate the presence of glucose and ketone bodies in the artificial urine.
The acquisition of the specific learning objectives for each working station was evaluated as well as the interest and perception of the students for this activity. Our data demonstrate that 81% teams succeeded to acquire the expected learning objectives. Moreover, 77% students participated in a voluntary and anonymous survey and 71% considered that the activity had helped them to integrate concepts from different subjects.
We conclude that activities that promote the integration of basic sciences such as Biochemistry and Physiology with Nursing Procedures in a simulated context has a positive impact on the learning of our students.

## *P09-8*
## *Vertical Integrated Activity in Biochemistry based on WSLA as a tool to integrate good laboratory practices into preclinical dentistry scenarios*

**María José Blanco Fernández de Valderrama**, María Antonia Cid, Mariangela Tabone, Rocío González-Soltero, Apolonia Novillo
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In order to integrate basic and clinic subjects, and to comply with the guidelines of the European Higher Education Area (EHEA), the Department of Basic Biomedical Sciences of the Universidad Europea de Madrid has designed a new teaching methodology named WSLA (Workstation Learning Activities,

González-Soltero et al, submitted). Based on WSLA the team of Biochemistry academics in Dentistry Bachelor's Degree has designed a vertically integrated activity using the Biochemistry laboratory as a touchstone. The activity is suitable for groups of 2-3 students that work autonomously to pursue specific learning objectives regarding knowledge of good practice in practical and clinical scenarios. These learning objectives were organized in 4 sequential workstations covering Introduction to the work in the laboratory, Handling of Physical and Chemical materials, Risks and Plan of Contingency in the Laboratory, and Management of waste in the Laboratory and in the Dental Clinic. Workstations are provided with state of the art technology such as computers with access to databases, workbooks and panels that were used to search, analyze and integrate the information from different sources in order to solve the questions proposed by the instructor. The acquisition of knowledge and skills was assessed individually through a multiple-choice questionnaire.
This activity aims at establishing relationships between theory and practice in the laboratory and dental clinic through vertical integration, making the educational process more effective. In addition, the use of the model of workstations and practical cases is perceived more positively by students compared to the model of classical laboratory practices.

## *P09-9*
## *A student congress as an example of integration of both Biochemistry and Genetics curricula*

Alicia Romero-Lorca, Paloma Aivar, **Emma Muñoz-Sáez**, Maria Gaibar, Ana Fernández-Santander, Rocío González-Soltero, Nicole Gorfinkiel, Javier Vicente-Tejedor, Vinatha Sreeramkumar, Ana María Sánchez, Iván Rodríguez-Martín
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Integrated curriculum has become a popular concept internationally. The goal is unification of different subjects (horizontal integration) and basic and clinical sciences (vertical integration). Universidad Europea de Madrid is improving the apprenticeship of students through the integration of first year curriculum subjects. We have combined two methodologies, case based learning and project base learning focused on the subjects of Biochemistry and Genetics, within a real congress for Biotechnology and Medicine first year students.
This activity was designed to develop key skills (oral communication, information management, critical thinking and team working) as well as specific skills (to understand the biochemical and genetic bases of hereditary metabolic diseases). A total of 450 students were involved in the activity, organized in groups. A clinical case or disease was assigned per group at the beginning of the course, covering 23 metabolic hereditary diseases. The congress was inaugurated with 2 plenary talks presented by experts in metabolic diseases to motivate the students. Each team worked autonomously and presented their work both orally and with a poster. A common assessment was stablished in which students had an active role. A total of 75 posters were exposed during the two-days Congress in the University, and the students had to defend them.
To evaluate student motivation and perception of this activity, the same questionnaire using a Likert scale was used to evaluate before and after the activity. Different student profiles were distinguished regarding their motivation to the integrated activity. Results showed that the students positively valued the activity and their perception about their knowledge improved significatively ($p<0.05$).

## *P09-10*
## *Relevance and impact of the formative profile of new students in science degrees for their progress and permanence (with special attention to their results in Biochemistry subjects)*

**Rodrigo Trujillo González**, Roberto Dorta Guerra, Isabel Marrero Rodríguez, Nestor Torres Darias
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The High School curriculums in Spain have been involved in a big controversy in the last years, and finally this past course the total deployment of the Education General Law (LOMCE) has concluded. One of the main consequences of this new structure has been the variety of backgrounds of the new students of sciences when they access to university.
For many educators, these inhomogeneous profiles of the new students are becoming the main reason for the high rates of drop and fails in the first university years.
In this talk, we present a pilot program of analysis of the profiles of new students at the School of Science of University of La Laguna (Tenerife, Spain), a study of the performance along past course 2016/17 and a discussion on new actions to reduce the fails in the near future.

## *P09-11*
## *Teaching strategies to afford mathematical contents in Molecular Systems Biology: An experimental on-hands oriented experience*

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After a four years experience, teaching Molecular Systems Biology (MSB) as a stem topic of the new Degree in Biochemistry (DB), it seems necessary to timely come back again about how to meet all the mathematical musts needed to afford the teaching of this field with the appropriate depth and accuracy. Being probably the most demanding DB subject in terms of the students “quantitative background”, teaching strategies of mathematical foundations could be formally positioned among two rather opposite outlines: largely skipping of those contents that can be hard to understand by the students, irrespectively of its relevance in a MSB context or getting deeply onto them, so the students can really be prepared to challenge true (basic) quantitative analysis of real Molecular Systems. Of course, in this last more suitable scenario, time, poor conceptual background and unequal student motivation will be, by far, three of major aspects the lecturer will have to boldly challenge against to achieve the goals. We discuss here the experimental, on-hands oriented strategy we have followed, mainly based on a guided set of immersive, formal activities where conceptual backgrounds are introduced as experimental goals that must be achieved through modeling and simulation techniques and where all the mathematical stuff is tunneled through a bundle of minimum, comprehensive threads of self sufficient contents, exclusively oriented to solve the proposed experiments, and presented as interactive master classes or seminars. Current results and implementation problems and limits as well as the emphatic needing of developing innovative evaluation strategies will be also proposed for later open discussion.

## *P09-12*
## *Simulating metabolic pathways in an elementary course of Biochemistry*

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In recent years *Naiad,* a simple metabolic pathway modeling software created by the author as a friendly tool in advanced courses on metabolic control, is being used in a more elementary course. Students learn, in two sessions of two hours each, basic concepts on metabolic fluxes. They can visualize how steady states are established, how they regenerate themselves after certain perturbations, how the

different steps differ in their distance from the thermodynamic equilibrium, and the importance of these differences in the control of the fluxes.
We believe that these practices, which are accompanied by other traditional laboratory practices, are being a success, as they allow students to approach the study of metabolism with clearer general concepts about how the metabolic fluxes are established and controlled.

Simulación de rutas metabólicas en un curso de Bioquímica general. El *software* de modelización de rutas metabólicas sencillas *Náyade,* creado por el autor como una herramienta amigable de apoyo en cursos avanzados sobre control del metabolismo, se está empleando en un curso más elemental ("Bioquímica II", del Grado de Biología de la Universidad de Granada). Los alumnos aprenden, en dos sesiones de dos horas cada una, conceptos básicos sobre los flujos metabólicos. Pueden visualizar cómo se establecen los estados estacionarios, cómo se restablecen tras ciertas perturbaciones, cómo difieren las distintas etapas en su alejamiento del equilibrio termodinámico, y qué importancia tienen estas diferencias en el control del flujo de la ruta.
Estas prácticas, que vienen acompañadas de otras de laboratorio de tipo tradicional, creemos que están siendo un éxito, pues facilitan el que los alumnos se aproximen al estudio del metabolismo con unas ideas más claras sobre cómo se establecen y controlan los flujos metabólicos.

## *P09-13*
## *Improvement of student assistance and learning process by implementing activities with the "Kahoot" virtual tool*

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The use of Information and Communication Technologies in teaching and, in particular, Personal Response Systems (PRS), are a group of interactive systems that can motivate students and improve the learning process. Within this framework, recently, new systems are being developed in order to ease their use. The objective of this study was the implementation of a new teaching methodology based on an on-line PRS, Kahoot, in subject with assistance problems in order to improve this problem and evaluate the learning process of the students. This compulsory subject is taught in the second course of different biosciences degrees of the Universitat Rovira i Virgili (namely, Biochemistry, and Biotechnology). To carry out this objective, 5 activities in which the students were asked 9-10 questions about certain topics on the agenda were designed with Kahoot. At least 7 correct answers allowed to obtain extra points in the subject. At the end of the course, each student was anonymously surveyed, asking for their opinion about the activities. Results showed that, on average, 83% of the students regularly attended to classes, 64% attended motivated by the realization of Kahoot activities and 71% of the students had reviewed at home the subject matters or had shown more attention in class because of these activities. Therefore, the implementation of Kahoot activities can be helpful to motivate the learning in cases of low student attendance or lack of motivation. However, it is necessary to compensate them with the obtaining of extra points in the subject.

## *P09-14*
## *Composing good practices on education*

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The Europe 2020 strategy''s target is to increase the proportion of persons having completed tertiary education to at least 40% of the EU28 population in this age group by 2020. This nice and interesting

challenge is a kind of response to the impact of new technologies on society and jobs also to security concerns. The role of university education is a central question in this approach. In Europe, most states finance universities but apparently it is not proposed an increase in budgets that should be correlated with the massive increase in the number of students hosted. Moreover, the expectations of these students may be significantly different from those currently proposed. In order to face these new challenges, which merely add to those traditionally encountered, it is necessary to confront, discuss and amend what we define as the good practices on university education.

## *P09-15*
## *Is problem-based learning a motivating didactic strategy for undergradate science students to study metabolism?*

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The learning of biochemistry and metabolism uses to be perceived as a demanding and difficult task by undergraduate science students (Bottomley y Denny, 2011). Furthermore, the first approach to this subject for most of the students is a superficial overview and only a few students achieve an integrated and deep learning of the subject twith this first approach (Minasian-Batmanian, Lingard, y Prosser, 2005).
According to some authors, the learning of metabolism, its regulation and its integration is not only one of the most complex study subjects for Biochemistry students (Vullo, 2014), but its teaching based in conventional lectures leads to student demotivation (Megías y Oñaderra, 2013, p.48).
Although problema-based learning (PBL) has been a tool success fully used for years in some foreign universities (Dolmans, Loyens, Marcq y Gijbels, 2016), it is still a relatively innovative strategy in Spanish universities to be applied for the study of fundamental topics in Biochemistry.
Some professors of the Department of Molecular Biology and Biochemistry at the University of Málaga are currently involved in an Educative Innovation Project aimed to improve the teaching practice of Metabolism. With in the framework of this Project, PBL is already having and will have an important role. In the next years we want to analyze in depth whether the design, development and application of new cases of PBL are help ful to improve students' skills and aptitude to integrate their knowledge of metabolism.

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## *P09-16*
## *Enhanced interactivity in and outside the classroom*

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The search for new ways of learning by students within universities must take place within the different teaching rooms (amphitheatres, tutorial rooms). Within these, it seems crucial to foster interactivity between students and teachers. The Paris Descartes University has enabled the development of various learning technologies in its health care sector. In the amphitheatres, quizzes were initially used. Within the tutorial classes, special equipment has been set up, and will be presented through the ACIP device. A reflection was then under taken to go beyond this direct interactivity to promote the regularity of learning. Timed quizzes have been developed and used in the form of continuous control at student homes, to stimulate the learning of a course immediately after its rendering in amphitheatre. It is this story and these different tools that we propose to present during a session that we hope also interactive.

## *P09-17*
## *Innovative methods for teaching molecular biology of the cell to medical students*

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We are heading towards a new understanding of medicine where medical treatments will be personalized and precise. The knowledge and tools developed by biomedical research are essential for the success of this new medicine. To be able to offer in a near future diagnosis and treatment tailored to each patient, medical students need to understand the molecular processes involved in disease. The subject “Molecular Biology of the Cell” is essential to allow future doctors the implementation of this personalized medicine and to understand the mechanisms of action of drugs.
The teaching experience in this particular subject as part ofthe Degree in Medicine at the University of Cantabria has showed us that some students are not motivated enough to understand the importance of Molecular Biology of the Cell for their future practice as medical doctors. We have introduced innovations into the teaching of this subject to increase student motivation. In addition, to improve student learning, we have used information and communication technologies (ICT) and other didactic methodologies to develop meaningful learning activities. We have incorporated educational trends such as BYOD *(bring your own device)* and *Mobile Learning*. Whereas teaching of Molecular Biology of the Cell requires still a teaching model in which the traditional university lecture plays a key role, we have introduced a new trend called *Flipped Classroom* to allow students to learn part of the key contents in the subject before attending the classroom, promoting an interactive environment. We present here the positive results that this new approach has achieved for medical students at the University of Cantabria.

## *P09-18*
## *Implementation and evaluation of a game-based learning activity to promote participation and learning in group-tutorial activities. A pilot experience*

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We have implemented a game-based learning (GBL) activity, based on virtual learning platforms available for free, to promote participation and learning in group-tutorial activities of the Biochemistry-degree subject Integrated Laboratory I and evaluated the degree of satisfaction of the students and, objectively, the impact on the level of knowledge assimilated by the students.
A question bank was developed using the Kahoot platform based on the contents of the subject accompanied by images or videos, very useful given the practical nature of the subject. Just before the evaluation test, two optional group-tutorial sessions were performed with students to develop the GBL activity (20 questions per session). Most students attended at least to one session. The evaluation test consisted of two equivalent parts: one included contents reinforced with the GBL activity and the other not. A satisfaction survey was conducted for the students and the impact on their evaluation test scores was assessed.
The students overall assessment of the activity was very good (4.7/5) who would not hesitate to repeat (all). The activity has motivated students (4.0/5) and helped in their learning process (4.3/5). The results of the evaluation test showed that the students who participate in at least one session increase their scores by 31.2%, especially in the reinforced part. This increase was particularly noticeable in students who scored below 7.5/10. On the other hand, the activity enhances dynamism (4.4/5) and effectiveness in students'' learning (4.1/5) compared to a conventional group tutoring.
These results reflect the good acceptance among the students and encourages us to use GBL activities as tools to promote participation and learning in the classroom of Biochemistry related subjects.

## *P09-19*
## *New format for a Final Bachelor Project: Learning-Serving Project for the teaching of basic concepts of Biochemistry and Molecular Biology in pre-university education stages*

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Fourth year students of the Biochemistry and Biomedical Sciences Bachelor Degree perform a "Final Bachelor Project" (TFG in spanish) which represents for them an opportunity to demonstrate the maturity acquired at scientific level throughout the whole degree. In this context we have devised a new format of project within the section dedicated to didactics and scientific disclosure in which we propose the development by the student of a Learning-Service Project (ApS in spanish, within the effort that our University is making with this methodology ) in which their learning objective is to review basic concepts of different disciplines, such as Biochemistry and Molecular and Cellular Biology, in order to be able to transfer them to pre-university stages working with Secondary and Primary students to provide them materials and resources with which to strengthen their scientific background and promote vocations among the young students.

## *P09-20*
## *Una nueva visión de la Bioquímica para preuniversitarios*

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En Catalunya, todos los alumnos de bachillerato han de presentar un trabajo de investigación que representa el 10% de la nota final. La principal finalidad es consolidar la competencia investigadora del alumnado y supone un primer contacto con la ciencia que más les atrae; para la mayoría es el primer acercamiento con el mundo real de la investigación e incluso la primera experiencia real en un laboratorio.
La Bioquímica ofrece numerosos experimentos que se pueden aplicar a dicho trabajo. Un ejemplo es la determinación colorimétrica de fenoles solubles mediante el reactivo de Folin-Ciocalteu. Los polifenoles son antioxidantes naturales que han mostrado tener efectos antiinflamatorios beneficiosos y de prevención de enfermedades cardiovasculares.
La cuantificación espectrofotométrica de dichos polifenoles se lleva a cabo con el reactivo de Folin Ciocalteau, el cual, contiene una mezcla de fosfomolibdato y fosfowolframiato ambos con un estado de oxidación +6. Inicialmente, este reactivo es amarillo, pero una vez que reacciona con fenoles totales en un medio básico se reduce y se vuelve azul. Y es este cambio de color el que es detectado y medido a 760 nm.
Esta experiencia permite introducir conceptos asociados a las estructuras moleculares (tipos de polifenoles), sus propiedades, reacciones de reducción-oxidación, mediciones volumétricas, bancos de diluciones y rectas de calibración relacionados la ley de Lambert-Beer y el uso del espectrofotómetro. También permite ensayar diferentes metodologías de extracción y dar respuesta a porqué se realiza la infusión de té con agua caliente y no fría.

## *P09-21*
## *Introducing Biochemistry to students of high school*

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High school students should start thinking about their future when they reach these levels of study, and sometimes it is advisable to steer them to a path if they do not have clear ideas. Those of us who are already on this road would like to have many students follow in our footsteps, and one of the best ways to do this is to prepare a fun day about science with them where they are in the laboratory doing some practice and they are who handle the equipment and material that we usually use in research.
The Science Faculty of University of Alicante organizes every year laboratory practices for the students of 4th year of Compulsory Secondary Education and Secondary School, in which highschools can participate after request. The number of students visiting each laboratory depends on the capacity of the spaces. Specifically, the Biochemistry and Molecular Biology area has been participating since the first year in this event and for a week two different practices (Isolation of DNA from haloarchaea and agarose electrophoresis and sugar identification) are carried out every day, where the students signed up for science subjects from different institutes and schools, perform them in the practices laboratory accompanied by biochemistry researchers. The two organized activities are related to concepts that they study in the high school, in this way they have the possibility to relate theoretical concepts with practical experiences that they can not carry out in their centres. Therefore, this experience offers an excellent possibility to bring science closer to future students interested in Biochemistry and Molecular Biology.

## *P09-22*
## *A virtual laboratory to introduce molecular diagnosis techniques in students' training*

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Analytical tests on genetic material are essential in diagnosis of many diseases as well as in pharmacogenetics: the choice of drugs depending on their anticipated efficiency for a particular individual. Limitations in a teaching laboratory regarding the use of samples, techniques and equipment should not prevent the students to receive complete and up-to-date training on these molecular procedures. The use of simulations may fill such a gap, and it is particularly convenient that they are true spaces for experimenting, much better than just animations or videos that always progress in the same way and end with the correct or expected result.
We present here a virtual laboratory that may alleviate this shortage; it allows to perform experiments centred on the examination of polymorphic regions of the genome. The techniques offered are fragmentation of DNA using restriction enzymes (RFLP assay), PCR and electrophoretic separation. The system allows the users to design their own experiment and explore conditions, amounts, combinations... The results obtained are not prefabricated, but will depend on the actual conditions used. Such an open exploration may be very significant for assimilation of the underlying scientific concepts, both methodological and diagnostical, and to gain relevant professional abilities like experimental design, observation and analysis of results.
This tool is freely accessible (http://biomodel.uah.es/en/lab/) and will afford incorporation of virtual practicals in the syllabus, aiming to introduce students in the knowledge of some modern methodologies for genome analysis, which is crucial for their professional future and has applications not only diagnostic but also in fields like forensics, identity testing or food analysis.