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## Editorial 2015 - Especial

A área de ensino de Bioquímica integra a reunião Anual da Sociedade Brasileira de Bioquímica e Biologia Molecular (SBBq) desde 1993. Ao longo dos anos, a área foi se estabelecendo e ganhando força e corpo.

A materialização desse trabalho ocorreu com o lançamento, pela SBBq, da Revista de Ensino de Bioquímica e Biologia Molecular (REBBM), em 2001. Em 2012 a revista passou por um processo de reestruturação, ampliando seu escopo e equipe de trabalho, passando a se chamar Revista de Ensino de Bioquímica - REB (*Journal of Biochemistry Education*).



Professores Wagner (UFRJ) e Vera (UFRGS) recebendo visitantes.

Visando ampliar a divulgação da REB, a SBBq proporcionou, desde 2013, um espaço físico (estande) dentro da área do evento, para inserção de banners, materiais publicitários e espaço para contatar e dialogar com os visitantes.

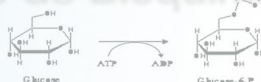
Uma vez que este ano a SBBq sediou a reunião da *International Union of Biochemistry and Molecular Biology* (IUBMB), o espaço da revista ganhou destaque pela presença de membros do corpo editorial do Brasil, Chile e Uruguai.

O evento ocorreu em Foz do Iguaçu, de 24 a 28 de agosto de 2015 (<http://www.sbbq.org.br/iubmb2015>).

Os participantes puderam conversar com parte da equipe da REB, esclarecendo dúvidas, conhecendo novas informações e compartilhando suas experiências, constituindo-se um importante espaço de diálogo sobre Ensino de Bioquímica, Biologia Molecular e áreas correlatas.



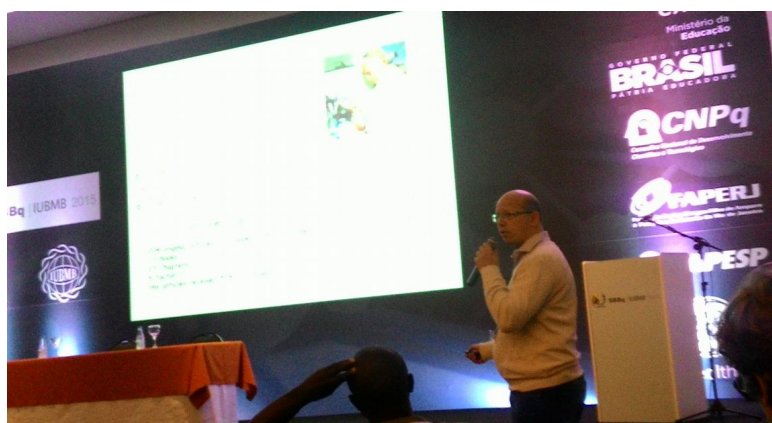
Professores Wagner (UFRJ) e Vera (UFRGS) recebendo visitantes.



Além disso, muitos membros do corpo editorial, por conta da distância física, puderam se conhecer e trocar experiências.

Com relação aos trabalhos apresentados na área de educação, durante o evento, houve dois simpósios, além dos 32 painéis apresentados na área de ensino de Bioquímica (área K).

As primeiras apresentações ocorreram no dia 25 de agosto (9:00-11:00), no Simpósio 3 ( *Science Education* “Leopoldo de Meis”), mediada pelo prof. Dr. Wagner Seixas da Silva (UFRJ, Brasil), com a apresentação três simposiastas, com as seguintes apresentações:

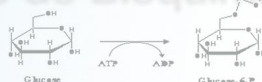


Professor Wagner iniciando as atividades no Simpósio 3 - Science Education “Leopoldo de Meis”.

- The *Critical Importance of Science Education for Society* , por Bruce Albert (University of California - San Francisco, USA);



Apresentação do professor Bruce Albert.



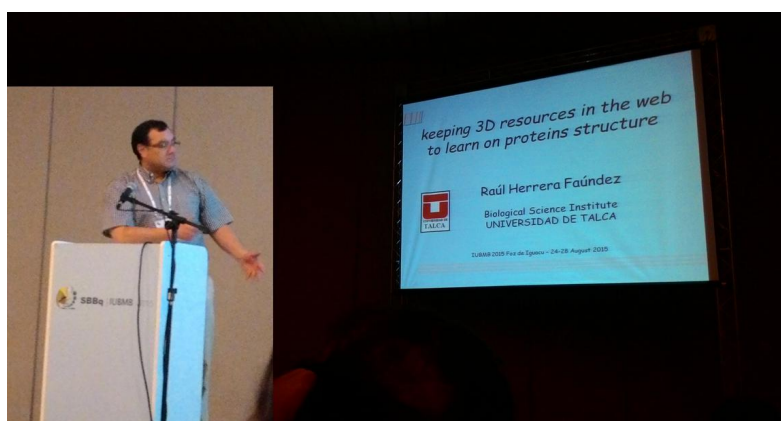
- *The Relevance of Neuroscience in Evaluation of Students in Classroom* , por Diogo Onofre de Souza (UFRGS, Brasil);

- *Replacing Prctical Classes with Experimental Projects* , por Paulo S.L. Beirão (UFMG, Brazil).

O segundo simpósio (*PABMB: Teaching biochemistry in a connected world*) ocorreu no dia 26 de agosto (15:30-17:30), mediada pelo professor Dr. Miguel Castanho (Universidade de Lisboa, Portugal), com a apresentação de quatro simposiastas:

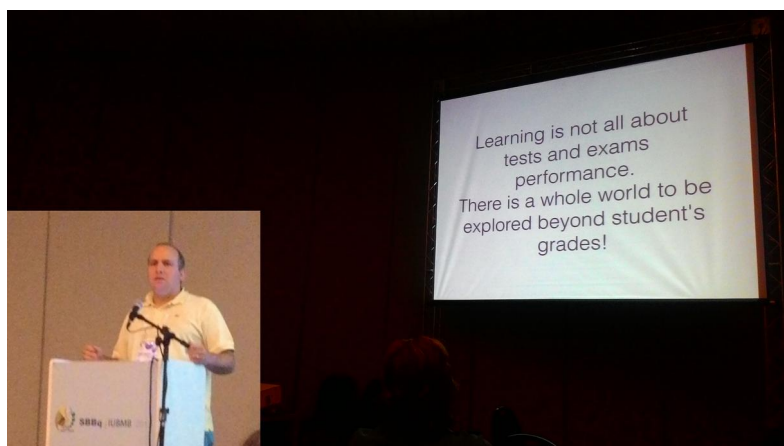
- *Hands-on inquiry-based biochemistry courses for improving scientific literacy of school teachers and students*, por Andrea T. Da Poian (UFRJ, Brasil);

- *Keeping 3D resources in the web to learn on protein structure* , por Raul Herrera (Universidad de Talca, Chile);

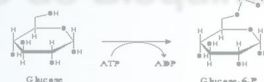


Apresentação do professor Raul Herrera.

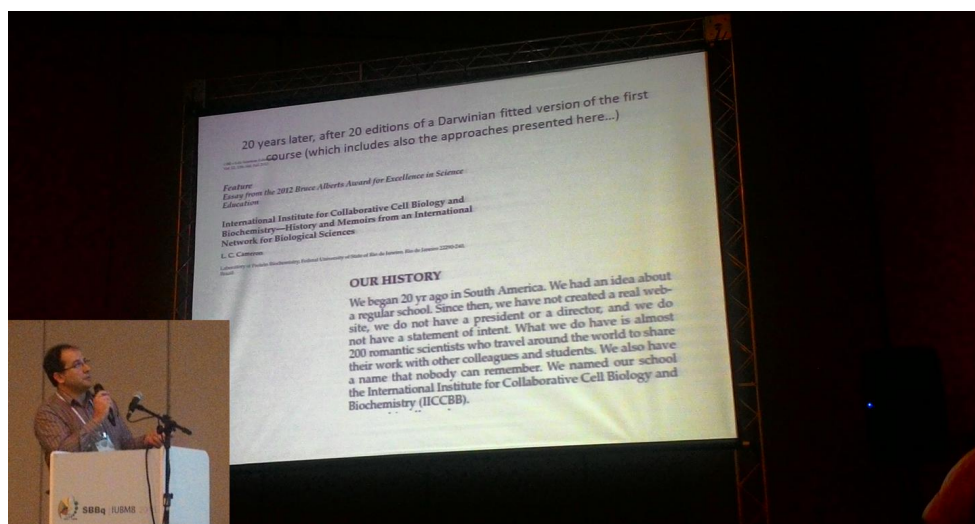
- *How Apps-Embedded Assessment can contribute to learning outcomes mapping*, por Eduardo Galembeck (Unicamp, Brasil);



Apresentação do professor Eduardo Galembeck.



- Using "raw" online data derived from global gene expression experiments for postgraduate teaching activities, por Jose Sotelo (Montevideo, Uruguay).



Apresentação do professor Jose Sotelo.

Agradecemos aos membros do corpo editorial e aos colaboradores que estiveram presentes no estande da revista, auxiliando nesse importante processo de valorização do ensino: Aos professores Gabriel Gerber Hornink (Unifal-MG), Eduardo Galembeck (Unicamp), Vera Treis Trindade (UFRGS), Leila Maria Beltramini (UFSCar), Wagner Seixas da Silva (UFRJ), Raul Herrera Faúndez (Universidade de Talca-CH), André Amaral Gonçalves Bianco (Unifesp), Adriana Cassina (Universidade de la República-UR); María Noel Alvarez (Universidade de la República-UR). Aos estudantes Frederico José Moreira Baêta (Unifal-MG), Thanuci Silva (Unicamp), Mayara Lustosa de Oliveira (Unicamp), Caetano Costa (Unicamp), Caroline Dutra Lacerda (UFRJ).

Atenciosamente

Bayardo B. Torres  
USP

Eduardo Galembeck  
Unicamp

Gabriel G. Hornink  
Unifal-MG

Vera Maria T. Trindade  
UFRGS



Integrative activities content (aic): an auxiliary tool for the teaching of Biochemistry  
in the course of biological sciences at UFRN

SILVA, D. F.<sup>1</sup>; NASCIMENTO, J.K.S<sup>1</sup>; MEDEIROS, M.V.S<sup>1</sup>; MATTA, L.D.M<sup>1</sup>; LIMA,  
R.V.C<sup>1</sup>; FERREIRA, V.D.S<sup>1</sup>; FILGUEIRA, L.G.A<sup>1</sup>; ANDRADE, G.P.V<sup>1</sup>.

<sup>1</sup>Departamento de Bioquímica, UFRN, Natal-RN, Brazil

There are constant changes in the development of science, technology, politics, culture and society; the need for change is also evident in the training of teachers. The ease of access to information makes us realize that traditional teaching needs to be updated. The increasing demotivation of students, followed by high reprobation rates, has become a real challenge to the teaching practice. The objective of this work was to awaken in students enrolled in the discipline of MOLECULAR DIVERSITY (MD), a required curricular component in the Course of Biological Sciences at UFRN, an interest in studying the chemistry and functions of biomolecules, better relating the two to each other, and the content already studied in the course, in order to improve the teaching-learning process. This work was developed in a tutoring project registered at PROGRAD/UFRN. This discipline, MD, addresses chemical and structural features of the main organic molecules. The methodology focused on applying problem integrators called INTEGRATIVE ACTIVITIES OF CONTENT. This refers specifically to the application of problems that integrate the topics taught in the discipline, and also those administered in the disciplines processed in parallel, or even in previous semesters. In this way students realize that molecules relate and interact in all bodies; this gives rise to life through metabolism. The discipline is expected to promote meaningful and inter-related learning. We obtained the following results: greater participation and involvement of students in answering the questions posed; greater interest in the discipline; positive changes regarding the number of students who dropped the class, and in reprobation; and greater integration between teachers, students, and teaching assistants. The methodology used in this work was extremely important to achieve the proposed objectives, helping to facilitate the process of teaching-learning, as also to important relate content.

**Keywords:** biochemistry, education, integrative activities of contents.



**USING SCIENTIFIC PAPERS TO STIMULATE THE STUDY OF BIOCHEMISTRY AND THE UNDERSTANDING OF SCIENTIFIC KNOWLEDGE CONSTRUCTION: THE RESEARCH ON ADRENOLEUKODYSTROPHY** Gaglianone, R.B.<sup>1</sup>, Ribeiro, M. G. L.<sup>1</sup>

<sup>1</sup>Departamento de Biologia Celular e Molecular, Instituto de Biologia, Universidade Federal Fluminense, Niterói, Brazil

### **Introduction**

The X-linked adrenoleukodystrophy (X-ALD) is characterized by mutations in very long chain fatty acids (VLCFA) peroxisome transporter, leading to VLCFA accumulation in myelin sheath. In the 70's and 80's it was hypothesized that X-ALD is caused by enzymatic deficits in FA-coenzyme A connection, VLCFA degradation or FA elongation. The latter enabled Lorenzo's oil (LO) treatment, which became famous by the homonym movie. The apparent initial therapy effectiveness lead to LO administration in many patients, although with biochemical knowledge progress its relevance has been questioned.

### **Objectives**

Our aim was to discuss X-ALD researches in "Lipids Metabolism" classes during 2014 Biochemistry courses to Biology and Biomedicine undergraduate students at Fluminense Federal University to illustrate how scientific knowledge is constructed.

### **Materials and Methods**

In order to contrast the recent scientific advances with the information spread to society through "Lorenzo's Oil", the movie in edited version was presented to students followed by a questionnaire with Likert scale to evaluate the perception of scientific knowledge exposed by the movie. Afterwards, a Guided Study containing a brief history and discursive questions based upon a paper (Wiesingner *et al.*, J. Biol. Chem. 288:19269, 2013) was applied in class.

### **Results and Discussion**

From 58 students who filled in the questionnaire, 72,4% considered the movie shows that X-ALD biochemical knowledge has been achieved. This notion was confirmed since 84,5% agreed LO is an effective alternative treatment if X-ALD is early detected. The same percentage agreed that based on the movie the biochemical deficiency relies on an enzyme involved in VLCFA degradation. Although the movie transmits the idea that the cure has been found, 67,2% believed X-ALD biochemical mechanisms are not fully comprehended.

### **Conclusions**

The Guided Study/movie application was very effective because allowed the understanding of mechanisms completely unknown by the time of LO development and also the comprehension of scientific knowledge construction through a playful and participative activity.

### **Acknowledgements**

We thank Prograd-UFF for scholarship supply.

### **Key words**

Adrenoleukodystrophy; Biochemistry teaching; scientific knowledge



## BIOCHEMISTRYGUIDE: A GUIDE TO STUDY BIOCHEMISTRY IN THE PALM OF YOUR HAND

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<sup>3</sup>Programa de Pós-Graduação em Bioquímica, Universidade Federal do Pampa, Rio Grande do Sul, Brasil

The new generation has grown driven by the digital technologies. Nowadays, the access to information has extended to the mobile technologies, like cell phones and tablets, increasing the technological resources for use in education. Educational institutions are opening more and more space to technologies, which have a new teaching, and learning methodology. The internet is an inexhaustible source of knowledge. With so much available material, the student finds difficulties in choosing the best source to study. Develop a cell phone app that works as a biochemistry study guide, providing materials from safe source and easy access. The app was developed at the website "[Factory of apps](#)", for free, and available for all the operational systems (Android, IOS, windows), enabling the download in any device. Were inserted in it materials like: summaries of the main subjects dealt in the discipline with clear and objective language, scientific articles to complementary reading, video-classes and exercises. Offering fast and practical access to the material, facilitating the process of studying and learning. The student does not have to let his mobile phone in preference of studying and does not find difficulties to filter available information in the internet. After the app's use, was applied a questionnaire to the participating students for this tool's assessment, such as layout, quality of the available material, access facilities. All the participants have approved the listed aspects and have said that the use of the tool can help at the biochemistry study, by the reliable material and by being available in a mobile device providing quick and immediate access, at any time in the palm of the hand. The use of this tool can be applied in the classroom to help the professor in getting materials and to help the students by its practicality.

Acknowledgements: CnpQ, Unipampa.

Keywords: App, BiochemistryGuide, Biochemistry







## ACTIVE TEACHING-LEARNING METHODOLOGY TO APPROACH CARBOHYDRATE AND LIPID METABOLISM: AN INTERDISCIPLINARY STRATEGY THAT INVOLVED THE MOODLE TOOL IN THE DEVELOPMENT OF PROBLEM BASED LEARNING

**Borges, J. M. P.<sup>2</sup>, El Bacha, R.<sup>2</sup>, COSTA, M. F.<sup>1</sup>.; FREIRE, E<sup>1</sup>**

<sup>1</sup>Programa de Pós-graduação em Processos Interativos dos Órgãos e Sistemas, Departamento de Biofunção, Instituto de Ciências da Saúde, UFBA, Salvador, Brazil; <sup>2</sup> Programa de Pós-graduação em Imunologia, Departamento de Biofunção, Instituto de Ciências da Saúde, UFBA, Salvador, Brazil

Highlight the relevance of topics studied for professional practice and associate approaches provided by different areas of knowledge are pointed as essential aspects for significant learning. Contextualize the study of metabolic pathways, linking the clinical use and expanding the vision with the approach of cellular and molecular biology discipline was the motivation for the development of the strategy described and evaluated here. In this work, starting from the concept of active methodology of teaching and learning was developed a methodological strategy to approach the carbohydrate and lipid metabolism. This strategy included: questioning the content through the clinical case study on diabetes mellitus and hypercholesterolemia, individual and collective study in the external space the classroom with the help of Moodle tool, classroom discussion accompanied by the teacher, preparation of seminar, evaluation of the content through individual written test and evaluation of the method. Analysis of student involvement with method indicates an average frequency of 98% in the practical class of Biochemistry discipline, effective participation in the preparation of seminars, an increase of 2 points in average of individual written evaluation. As for the fact that the cases were studied in two curricular components, the answers show that 92% of students feel more compression. Only 6% of students think unnecessary to interdisciplinary approach. As for the different steps of the method, the answers show that 99% of students consider how relevant the initial self-study and discussions in class. However, only 50% of students appreciated the use of Moodle tool. Thus, student responses indicated the perception of the effectiveness of the method for their ability to: stimulate interest in learning, stimulate the search for answers through research and the building of learning.

Keywords: active methodology, teaching biochemistry, metabolism

## THE EVOLUTION OF THE KREBS CYCLE: A PROMISING THEME FOR MEANINGFUL BIOCHEMISTRY LEARNING IN BIOLOGY

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Departamento de Bioquímica e Biologia Tecidual, Instituto de Biologia,  
Universidade Estadual de Campinas, Campinas, Brazil.

**INTRODUCTION:** Evolution has been recognized as a key concept for biologists. In order to motivate biology undergraduates for contents of central energetic metabolism, we addressed the Krebs cycle structure and functions to an evolutionary view. To this end, we created a study guide which contextualizes the emergence of the cyclic pathway, in light of the prokaryotic influence since early Earth anaerobic condition to oxygen rise in atmosphere. **OBJECTIVES:** The main goal is to highlight the educational potential of the material whose subject is scarcely covered in biochemistry textbooks. **MATERIALS AND METHODS:** The study guide is composed by three interrelated sections, the problem (Section 1), designed to arouse curiosity, inform and motivate students; an introductory text (Section 2) about life evolution, including early micro-organisms and Krebs cycle emergence, and questions (Section 3) for debate. The activity consisted on a peer discussion session, with instructors tutoring. The questions were designed to foster exchange of ideas in an ever-increasing level of complexity, and cover subjects from early atmospheric conditions to organization of the metabolism along the subsequent geological ages. **RESULTS AND DISCUSSION:** We noticed that students were engaged and motivated by the task, especially during group discussion. Based on students' feedbacks and class observations, we learned that the material raised curiosity and stimulated discussion among peers. It brought a historical and purposeful way of dealing with difficult biochemical concepts. **CONCLUSIONS:** The whole experience suggests that the study guide was a stimulus for broadening comprehension of the Krebs cycle, reinforcing the evolutionary stance as an important theme for biology and biochemistry understanding. On the other hand, we do not underestimate the fact that approaching Krebs cycle from an evolutionary standpoint is a quite complex discussion for the majority of students. **KEYWORDS:** Evolution. Krebs cycle. Metabolism learning. Biology. **ACKNOWLEDGEMENTS:** We thank Capes for financial support.



## THE BACHELOR OF BIOCHEMISTRY IN BRAZIL

**Cordeiro, H.G.<sup>1</sup>, Dias, G.G.<sup>1</sup>, Pompeu, D.G.<sup>1</sup>, Torres, B.<sup>2</sup>, Granjeiro, P.A.<sup>1</sup>**

**<sup>1</sup>Curso de Bioquímica, CCO-UFSJ, MG, Brazil; <sup>2</sup>Departamento de Bioquímica, Instituto de Química, USP, SP, Brazil**

**INTRODUCTION:** The economic and social development of Brazil in the last decade has contributed to the installation of new graduate and undergraduate programs, as are the case with bachelor degrees in Biochemistry at UFV, UFSJ and UEM. These graduates are prepared to work in industry, research institutes and universities in areas of knowledge involving Biochemistry and Molecular Biology. This is happening in developed countries since the first half of the last century, surprising and late is the implementation of bachelor of Biochemistry in Brazil. **OBJECTIVES:** The aim of this study was to perform a comparative analysis of the Bachelor in Biochemistry in Brazil from the perspective of the main difficulties of implementing and courses maintenance. **MATERIAL AND METHODS:** This is a descriptive research with a qualitative approach. Interviews were conducted with undergraduate students, graduates, professors, staff and managers from bachelor degrees in Biochemistry at UFV, UFSJ and UEM. The sampling procedure was non probabilistic for judgment (choice of the subjects involved and interested in the course of biochemistry) to undergraduate students, graduates, professors and staff and non probabilistic for convenience to managers. The qualitative assessment to depict the representative keywords was performed using words cloud by WordleTM. **RESULTS:** The study included 5 managers, 24 professors, 12 staff, 25 undergraduate students, 5 graduates. For the students the main reason for the course selection should be scientific vocation and affinity with chemistry and biology; most cited positive parameters were faculty and great structure, practical classes and broad playing field; most cited negatives were high mandatory disciplines, little student free time and lack of sophisticated equipment. Despite the conception of the programs have happened in different contexts and regions we noted similarities deficiencies and distresses. **CONCLUSION:** Difficulties must be overcome for all courses are structural adjustments in program and physical installation.

**Keywords: Bachelor, Biochemistry, Brazil.**

**Sponsor: UFSJ**



## KREBER'S ADVENTURES: COMPUTER GAME ABOUT THE ATP FORMATION

Baêta, F.J.<sup>1</sup>, Souza, B.M.<sup>1</sup>, Marinho, G.B.<sup>1</sup>, Andrade, J.G.<sup>1</sup>, Souza, J.C.<sup>1</sup>, Bertoldi, M.L.M.<sup>1</sup>, Hornink, G.G.<sup>2</sup>

<sup>1</sup> Biomedicine undergraduate course, Federal University of Alfenas, Minas Gerais, Brazil; <sup>2</sup> Biochemistry Department, Biomedical Institute, Federal University of Alfenas, Minas Gerais, Brazil

**Introduction:** Biochemistry, as well as other subjects related to molecular area, have several abstract and difficult concepts to be understood, therefore, many educational innovations have been developed, highlighting the digital games. The digital games feature a playful and motivational character that encourages students during the concepts learning, with a different way to learning the concepts studied. **Objectives:** The objective of this study was the development of a computer game focused on the concepts of ATP formation, including the glycolytic pathway, Krebs cycle and Electron Transport Chain, as well as aspects related to the regulation, and evaluate the usability of it, as well as some evidence of its educational potential. **Material and methods:** The development of the game followed the following steps: definition of the subject; understanding of game developer (it was chosen the GameMaker); storyboard creation of the game; prototyping, implementation and usability testing. For the evaluation, inspection usability was performed (without involving end users) and subsequently the cognitive route and the usability questionnaire (the latter two with students of the discipline of Biochemistry). **Results:** The game approached the energy metabolism in three phases: the glycolytic pathway, Krebs cycle and electron transport chain. Each phase has a different purpose, with some questions about the ways. To complete the game, you must correctly answer the questions, avoid the obstacles and achieve the goals of each phase. After usability testing, it found that users could, in a playful manner, actively interact with the content addressed and, through the difficulties presented in the game, had the opportunity to expand and review their knowledge. **Conclusions:** The game was identified as a motivating and innovative proposal for teaching, and it had good usability for undergraduate students. The ludic worked as a pedagogical practice encourages student for learning and may assist in the construction of knowledge.

**Keywords:** ATP, digital game, arcade

**Acknowledgements:** FAPEMIG



## **INTERACTIVE SEMINARS IN BIOCHEMISTRY DISCIPLINE FOR UNDERGRADUATE DEGREE IN BIOMEDICINE: BENEFITS AND PROBLEMS OF CARBOHYDRATES ASSOCIATED WITH MODERN LIFE**

**Pessoa, R.B.G<sup>1</sup>; Silva, R.M.A.M.<sup>1</sup>; Fernandes, A.R.<sup>1</sup>; Aragão, M.A.L.<sup>1</sup>; Lacerda, S.S.<sup>1</sup>; Rodrigues, J.K.F.<sup>1</sup>; Araújo, D.S.<sup>1</sup>; Souza, S.R.<sup>2</sup>; Silva, M.V.<sup>1</sup>; Correia, M.T.S.<sup>1</sup>; Maciel Carvalho, E.V.M.<sup>2</sup>**

- 1- Universidade Federal de Pernambuco, Recife, Pernambuco, Brasil, Departamento de Bioquímica, Centro de Ciências Biológicas.**
- 2- Universidade Federal Rural de Pernambuco, Brasil, Departamento de Educação.**

The present project is part of the course in biochemistry for biomedical undergraduate students of the Federal University of Pernambuco - UFPE, which comprises theoretical and practical classes and interactive seminars prepared by students on studied topics to supplement learning. The aim of this research was to encourage students to innovate their search for knowledge, presenting an interactive strategy to demonstrate the importance of carbohydrates, as well as other energy fuels, for undergraduates students attending classes of biochemistry at the first semester at the university, in order to clarify the importance of maintaining a healthy way of life. The methodology used was a field research, documented in videos in which the opinions of a few people were registered in different places, such as in a fast-food restaurant, on the importance of carbohydrates. Records acquired were associated with a slide presentation on the subject, based on scientific books and articles, which were presented to the students of the discipline. It was also developed a dynamic to illustrate the consumption of carbohydrates in daily life and in different situations. After the project exhibition, a review of the research was conducted to the audience to express innovations or additions to their pre-existing concepts, on consumption of carbohydrates. The results of our work were very promising and the main goal of the project was achieved, since 88.2% of the respondents said there was an improvement in their knowledge, both theoretical and practical, on the subject, while only 11.8% reported no improvement at all. In conclusion, there was a greater involvement of students during the presentation of the subject and a higher participation during the group dynamic on the consumption of carbohydrates.

Key Words: Carbohydrates; Biochemistry; Health.  
Supported: CNPq, CAPES.





## EDUCATIONAL TECHNOLOGIES TO EMPOWER HIGHER EDUCATION

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Introduction and objectives: The New Media Consortium (NMC) Horizon Project defines educational technology in a broad sense as tools and resources that are used to improve teaching, learning, and creative inquiry. Each technology has been carefully researched and framed in the context of its potential impact on higher education. Within the Horizon Project there are currently seven categories of technologies, tools, and strategies for their use that the NMC monitors continuously. All they have the potential to foster real changes in education, particularly in the development of progressive pedagogies and learning strategies; the organization of teachers' work; and the arrangement and delivery of content. Following the recommendations of NMC experts panel, we design an application named Augmented Reality Metabolic Pathways (ARMET) in order to improve motivation and to promote student interactivity to the development of skills needed to learn the metabolic pathways. Materials and methods: The ARMET app was developed using Unity, 3D molecules obtained from Protein Data Bank and ChemSpider-chemical structure database, the usage data are stored into a database (MySQL) and are analyzed using the statistical software R. Results and conclusions: ARMET mixes several technologies out of seven categories recommend in the NMC Horizon Report: Mobile app, Bring Your Own Device, Flipped Classroom, Learning Analytics and Augmented Reality. The principal criterion for the inclusion of those technologies into the app was its potential relevance to teaching and learning biochemistry. ARMET is available for iOS and Android platforms, and includes PDF files with a set of cards, the game board and classroom worksheet's. The students and teachers can register for free. Teachers can create classes and track student performance. ARMET collects data for personalizing learning experiences addressing the challenge to build better pedagogical tools to establish effective formative assessment for metabolism teaching.

Key Words: Augmented Reality, Flipped Classroom, Learning Analytics.

Supported by: Administrative Department of Science, Technology and Innovation - COLCIENCIAS (Colombia).



## LEADING CHANGES IN ASSESSMENT USING AN EVIDENCE BASED APPROACH

Macaulay, J.O.<sup>1</sup>, Speed, C.J.<sup>1</sup>, Dimitropoulos, A.<sup>1</sup>, Simpson, C.M.<sup>1</sup>.

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### Introduction and objectives

It has been widely accepted that assessment of learning is a critical component of education and that assessment drives/guides student learning through shaping study habits and student approaches to learning. However, although most academics would agree that assessment is a critical aspect of their roles as teachers it is often an aspect of teaching that is regarded more as an additional task rather than an integral component of the teaching/learning continuum. An additional impediment to high quality assessment is the non-evidence based-approach to the decision making process. The overall aim of this project was to improve the quality of assessment in Biochemistry and Molecular Biology undergraduate education by promoting high quality assessment.

### Materials and methods

To do this we developed and trialled an audit tool for mapping assessment practices. The audit tool was designed to gather data on current assessment practices and identify areas of good practice in which assessment aligned with the learning objectives and areas in need of improvement. This evidence base will then be used to drive change in assessment.

### Results and conclusions

Using the assessment mapping tool we have mapped the assessment regime in a Biochemistry and Molecular Biology major at Monash University. Criteria used included: assessment type, format, timing, assessors, provision of feedback, level of learning (Bloom's), approaches taken to planning assessment. We have mapped assessment of content and the systematic development of higher order learning and skills progression throughout the program of study. The data has enabled us to examine the assessment at unit (course) level as well as the vertical development across the major. This information is now being used to inform a review of the units and the major.

### Acknowledgements

**This project was supported by a Monash University, Faculty of Medicine, Nursing and Health Science Teaching and Learning grant**



## METABOLIC INTEGRATION: BEYOND THE BUILDING BLOCKS

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The theme "metabolic Integration" discussed during Biochemistry classes is considered by many students a complex issue. It could be due to their difficulty in understanding that the metabolic pathways are not isolated reactions, but a completely interdependent system finely regulated. Given this reality, a didactic game was developed. The main objective was to challenge students to understand the metabolism integration, through a playful, interactive and dynamic way. The class was divided into groups and to each group was given a set of parts that represented an important pathway of energetic metabolism. The aim of each group was to complete the metabolic process assigned to them. However, during the assembly, they realized that was always lacking some part of the puzzle and that the game only succeeds if all the groups exchange parts with each other. After that, the pieces came together in order to assemble all the processes in an integrated way. The game was organized into two situations: metabolic reactions that occur in the fasted state and reactions of the fed state. When the groups realized they needed to join themselves to complete the processes, they also had to get into a consensus that the "body" in which the reactions were happening, was in a fasted state or not, because the pieces didn't match each other if both metabolic states were being assembled at the same time. It is not suitable to the organism performs the reactions of antagonistic states at the same time/or at the same velocity. Along the schema assembly, key points were didactically marked in some pieces with colors and warnings. The proposal was to open a discussion after assembling of the parts. The game was applied to students at the first year of medicine school and had a great acceptance.

Key words: metabolism, integration, game.





## FACEBOOK AS A MEDIATION TOOL IN BIOCHEMISTRY DISCIPLINE

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**Introduction:** The current students generation are daily connected to the Internet, which encourages the use of mobile tools in education. Many of the students of Biochemistry feel apprehensive about the discipline and the use of facebook may contribute, among other factors, motivating them. **Objectives:** It was analyzed the use of facebook as a mediator and motivator in the discipline of Biochemistry, basing on socioconstructivist interventions. **Material and methods:** This work was developed in the action-research perspective, using the quali-quantitative method. An investigative questionnaire was used, using Likert scale and open questions, to investigate the facebook use, as well as the preferences of students, focusing on Biochemistry group in the Biomedicine course. The posts were analyzed identifying: frequency of the interaction's types (post, comment, likes); interaction's categories (question, answer, motivational); and the content itself of the post. **Results:** It was highlighted students' interest to search materials, answering questions, and especially seeking information about the discipline. It was emphasized that the group was motivating for learning Biochemistry, encouragement the group to study, with quick and easy access to the professor by chat. **Conclusions:** The results indicate a preference for students at facebook, with a great motivational potential, is at easy access to colleagues, professor and monitor, or even the ease of obtaining the materials and ask questions in real time, indicating that this tool as a possible way, still little explored, to enhance the teaching of Biochemistry.

**Keywords:** Facebook, Biochemistry teaching-learning, social web

**Acknowledgements:** FAPEMIG



## CONSTRUCTION OF DIDACTIC MODEL OF MEMBRANE AND EXTRACELLULAR MATRIX TO FACILITATE THE TEACHING/LEARNING BY BIOLOGICAL SCIENCES STUDENTS AT UFRN

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### ABSTRACT

This work was developed in the course of MOLECULAR DIVERSITY, required curricular component for the courses of Biological Sciences at UFRN. This course intends to encourage the study of the chemical structure and function of biomolecules using lectures and practical classes. Looking at the evaluations from previous semesters, it became evident that the subjects of the membrane and extracellular matrix were not being learned in a meaningful way. We also noticed lack of motivation from students due to difficulties in understanding molecules, weakening the teaching/learning process. Given this situation, our work aimed to encourage students to construct the constituent molecules of the membrane and extracellular matrix and assemble these structures, in order to understand molecular interactions, improve understanding of the subject and facilitate the learning process. This was accomplished through a monitoring project with the help of monitors. The proposed methodology consisted of separating the class into groups, where each would be responsible for making and exposing the other students to one of the molecules (Membrane Lipids, integrins, fibronectin, collagen, elastin, laminin, hyaluronic acid), and then discussing these molecules' structural characteristics and interactions. The students could use various types of materials like cardboard, colored pens and polystyrene. The molecules were presented to the class, and the groups had set up the membrane and the matrix indicating the location of molecules and their possible interactions. All groups created their molecules according to given specifications. They created didactic and colorful molecules and positively interacted with all other groups during the assembly of the membrane and extracellular matrix; they also discussed molecules functions and interactions. We noticed during presentations and evaluation a strong performance in the subjects in question, as well as the construction of a didactic model easily used to understand these subjects; we therefore postulate that the activity achieved its objectives.

**Keywords: Biochemistry, didactic model, meaningful learning**



## Biochemistry on the game board: improvements in the teaching-learning process in basic education.

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According to the Curriculum Guidelines of Biology of Basic Education "school should encourage the pedagogical practice based on different methodologies, valuing the teaching concepts, the learning (internalization) and the evaluation that allow teachers and students being aware of the need for emancipatory transformation". The teaching of biochemistry and its contents in basic education are not discussed as a structuring content within the Biology subject, but are included in related content such as cellular biology. The objective of this study was to inventory the contents and methodologies related to biochemistry taught by teachers of basic education and produce teaching-learning materials as contribution to these contents from the inventory results. The methodology was developed from the analysis of the questionnaires applied to biology teachers from public schools of Guarapuava-Pr. The results showed that the teaching of biochemistry and biology discipline, although it comes from the same area, are designed as two unattached areas, meaning there is no perception by teachers in relation to the implicit conceptual intercept in teaching Biology and Biochemistry. To this end, the profile of the game Grow was adapted using themes related to Biochemistry. The game consists of 45 cards and a game board with a track. The player who gives more write answers to the questions reaches the end and wins the match. For game evaluation participants answered a questionnaire at the end of the activity. Most of the participants argued that the process has contributed to ensure the assimilation of the contents, since it is a leisure activity with effective participation of students. Thus, the obtained data confirmed the assumption of Pedrosa (2009), which states that the games allow a significant teacher-student interaction, disseminating scientific knowledge from the views and experiences of the student.

## THE PRESENCE OF BIOCHEMISTRY EXPERIMENTS IN TEXTBOOKS

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**INTRODUCTION:** Being present in high school in chemistry and biology disciplines, biochemistry is to explain the chemical and biological reactions in cells. His concepts are seen as abstract and difficult to understand and can be contextualized through experimentation. Experimentation is used in the classroom to allow students to view the applicability of the contents through observation, creating hypotheses, discussion and conclusions. ~~The choice of method of teaching is done through research sources adopted by teachers, and the textbook the main frame.~~ **OBJECTIVES:** The aim of this study was to evaluate the presence of experimentation in biochemistry content in high school books. **MATERIALS AND METHODS:** In this way, it was analyzed the presence of experimental activities in the textbooks approved by the National Textbook Plan 2015 "Biology 1", authored by César da Silva Junior, Sezar Sasson and Nelson Caldini Junior, and in the book " Chemistry - Volume 3 "by Martha Reis. **RESULTS:** At the end of the unit where the biochemical concepts are covered in the book "Biology 1" is presented an interdisciplinary project called "Enzymes - chemical tools of life" that proposes four experiments on catalase, pH and contact surface enzyme-substrate. They are easy activities to be implemented with affordable materials. Already at the Chemistry book, when addressing the biochemistry there is only one proposal for experimental activity called "Glycolic Extract of milk proteins". In this case, we need materials like food processor and enameled pots, which can hinder your performance in virtual classes, however, the experiment is easy to perform. Both books contain questions after the experimental proposals enhancing the questioning of the activities and understanding the contents addressed. **CONCLUSIONS:** The present experimental activities in the textbooks are mostly easy to apply and is not required sophisticated equipment of Sciences laboratories. It also allows the contextualization of theory and practice enhancing the process of teaching and learning with the proposals made.

**KEYWORDS:** experimentation, biochemistry, textbook.



## The qualitative analysis of biochemical content in textbooks of elementary school.

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**Introduction:** Biochemistry is the science that deals with the metabolic functions of living beings. In its concepts, it uses chemistry and biology to study the interactions of organisms with the environment. For basic education students is often complex the association of biochemistry with their daily lives, especially in elementary school where they have their first contact with science in school and the didactic book will serve as an important tool for research. Thus, this work aims to analyze qualitatively content related to biochemistry in science books of the final years of elementary school. **Methods:** We analyzed six science books used in elementary school, and the following criteria were examined: clarity and language presented on the inserted content; resolutions and images shown subtitles, and interdisciplinarity of matters. **Results and discussion** : The books of the sixth and fifth years were those who achieved the expected learning goals. The first of them made a very good presentation of the content and the images, addressing the subject in an interdisciplinary way. However, the second one is well below in the analyzed criteria, bringing the matter in a vague writing, and failing in associate the content with other assumptions themes. The images had a very low quality and their explanations were difficult to associate. **Conclusion:** We can say that the biochemistry content are complex, however its development from the beginning of primary education contributes to overcoming the complexity of their understanding. The analysis of the books brought a result that was expected. Only one book had significantly positive results in all analyzed characteristics, the other books had some very good aspects, but in several details, they were vague and poorly contextualized. Approaching the school sciences to the student every day we can demystify scientific knowledge and its production.

## Dyslipidemias as generating issue in Biochemistry classes

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The traditional didactic model is based on the transmission of the teacher's encyclopedic knowledge. In this model, the teaching of Science aims at the transmission of dominant values, regarded as absolute truths. The teacher is seen as an expert on scientific contents who transmits them to students without motivating them, and without taking into consideration their previous ideas and life experience. This model contributes to the formation of professionals who accept those values uncritically. An effective approach to break up this traditional teaching model in Biochemistry is the use of a generating issue. A Generating Issue is the starting point to the knowledge construction process which, in turn, replaces traditional models. Thus, this study aimed at developing a lesson for a 12th grade class at IF Fluminense on the following content: alcohol, carboxylic acid, ester, and esterification reaction, using dyslipidemias as the Generating Issue. To verify the value of such methodology in Biochemistry classroom, data was collected by applying a questionnaire and images with texts produced by students. In addition, they had a class based on the methodology known as Three Pedagogical Moments, proposed by Delizoicov *et al.* (2007). Several didactic resources designed by the authors were used, such as slide presentation, tridimensional molecular models, and a roulette game named "Bioquimicados", based on the Facebook game "Perguntados" ("Trivia Crack"). After this, students developed more grounded scientific concepts, making use of terms common in scientific language. This suggests that the use of the Generating Issue in a lesson based on problematization, and supported by a ludic activity, provided a meaningful contribution to improve the students' understanding of the scientific content. This type of non-traditional class promotes greater student motivation, resulting in meaningful learning.

Key Words: Biochemistry, Generating Issue, Dyslipidemias.  
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## BIOCHEMISTRY ACADEMIC MONITORING: IT'S INFLUENCE ON TEACHING BACKGROUND AS A TEACHING-LEARNING PRACTICE COMPLEMENT TOOL

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The monitoring process is based on a strategy which propitiates interdisciplinary and gathering theory and practice, apart from teaching assistance, easing and increasing students learning, awakening the academic discipline's interest and importance. The developed task held over the course of two academic consecutive semesters in 2014 on Biology Science Major at Federal University of Uberlândia had as a goal the use of diverse methodological alternatives in Biochemistry such as: basic bibliography's comprehension support, approaching and integration mechanism from the content to learner's reality, meetings to feedback pre-assessment valuation, constructive debates, conceptual issues and questioning in order to clarify any doubts from the content discussed, besides the supervisor's assistance in practical classes. The resources used to this approach were the student's analysis to monitoring, their performances on the subject and the approval, retention and evasion levels at the end of the semesters. The obtained results have shown a high level of approval on both semesters, combined to decreasing level of evasion and retention. It was possible to clarify that on the discipline's development the increasing search for monitoring as much as the complexity's raise from some contents as the interest and curiosity in knowing certain methods used in monitoring. Improving on student's performance and arguing on written evaluation also were noticed. The obtained results also proved that diverse methodological alternatives in Biochemistry are potential strategies in maximizing the approval levels in that discipline and bring the student close to the content in a dynamic way, supporting to a better knowledge development in the subject. Monitoring can also be a mean to stimulate the interest in teaching.

**Acknowledgements:** PROPP-UFU, FAPEMIG, CAPES, CNPq.

**Key Words:** biochemistry, monitoring, teaching.





## A BIOCHEMISTRY LABORATORY COURSE DESIGNED TO ENHANCE STUDENTS AUTONOMY

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**INTRODUCTION:** Laboratory sessions are responsible for promoting instrumentation skills desirable in biochemistry and biochemistry related careers. They are traditionally based on experimental protocols that lead to the expected results, and students usually have not autonomy to plan and execute their experiments.

**GOALS:** This work aimed to enhance a traditional biochemistry lab course, applying pre-lab quizzes on protein biochemistry and lab techniques in order to have students better prepared to plan, execute and interpret experiments. This approach also aims to bring the laboratory sessions into an inquiry-based environment capable to improve students' independent capabilities in 2 autonomy domains: learning and communication. **MATERIAL AND METHODS:** Online quizzes are delivered one week before each laboratory session, containing questions regarding the experimental techniques and theoretical basis related to them. Laboratory activities are presented in an inquiry-based approach where the first class of each activity is dedicated to plan experiments in order to answer the research questions presented by instructors. Activities are also organized in order to enhance students' autonomy. The first activity is the simplest and more instructor-controlled and the last one is the most complex and less driven, transferring gradually to students the responsibility for their decisions in laboratory, supporting students' autonomy. **RESULTS:** Online quizzes allowed instructors to identify students' difficulties and to timely intervene. Scientific reports presented by students at the end of each activity showed that they performed better on less driven activities in which autonomy support were more complex than in the instructor controlled activities. **CONCLUSIONS:** Scientific reports analysis reveals students capabilities related to different scopes of autonomy, such as: discuss different strategies; find multiple solutions to solve problems; make their own experiment hypothesis and look for literature to support data found. Thus, this approach may have positively supported students' autonomy, encouraging them to think by themselves and to take decisions concerning their experiments.

**ACKNOWLEDGEMENTS:** We would like to thank São Paulo Research Foundation (FAPESP) for supporting this work.

**KEYWORDS:** autonomy, flipped classroom, biochemistry laboratory







## HOW DO STUDENTS PERCEIVE AND APPRECIATE “FAILURE” DURING UNDERGRADUATE RESEARCH?

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Since 2011 we have conducted Authentic Large-scale Undergraduate Research Experiences (ALURES) with our Sophomore and Junior biochemistry cohorts - so far over 1000 students have participated.

The students in 2011-2014 wrote reflections about their experiences mid-semester and/or at the end of semester. Their writing indicates a growing awareness of the value of failure and struggle, as well as a healthy respect for the power of peer support and interaction.

We asked the question “what do our students see as a “failure”, and does their understanding of the value of struggle change as a result of the ALURE experience?

In 2015 we are conducting a longitudinal study of our ALURE students as they progress through the semester – the students have completed a series of five semi-structured interviews and the URSSA survey. We are examining their development of research and scientific literacy through the lens of productive failure.

Our results indicate that although we feel we are designing productive failure into our undergraduate research experiences, we do not appear to be providing a high enough sense of risk or responsibility . This means that the students do not experience a sense of struggle or project ownership with the authenticity we desire . This is causing us to redesign our ALURE offerings.



## LEARNING AS A TOOL FOR CANCER PREVENTION THROUGH THE ACQUISITION OF NEW DIETARY HABITS AND BEHAVIORS

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The need to promote knowledge of health entails, in part, by encouraging healthy eating habits. The creation of popular science materials, especially at schools, by promoting guidance for the eating habits is presented as an important tool. Foods that contain bioactive compounds are called nutraceutical foods and about 35% of various cancers occur due to inadequate diets. Conventional therapies are used in the treatment of cancer, even though they are efficient in fighting tumors, to cause many harmful effects to the patient, and therefore the researches for alternative therapies have increased. Especially those act strengthening the immunologic system. The mushrooms are able to modulate carcinogenesis in all stages of the disease through different mechanisms of action of the bioactive compounds, thus having an antitumor effect that is assigned to restore and improve the immune response through stimulation of cellular immunity which are present polysaccharides the composition of the mushrooms, such as beta-glucans that besides the anticancer effect, it still has activity as immunostimulant, antioxidant, anti-inflammatory, which are already used in Japan as drugs for treating cancer patients. The aim of this work was to use learning as a tool for acquiring habits and eating behaviors in the general community and ownership and acquisition of knowledge about the antitumor potential of bioactive compounds in foods which are applied in cancer prevention through the scientific dissemination / education. Because it is a popular science work using written material and the dissemination of the material make for yourself the methodology used for the dissemination of scientific knowledge. Thus, the inclusion of consumption of mushrooms in the diet may represent an important step in the cancer prevention as the best form of prevention, and therefore it shows the need for available information to everyone, as it has proposed this work, disclosure.

**Keywords:** Learning. Cancer prevention. Bioactive compounds.





## Biochemistry in the idea of graduation students

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**INTRODUCTION AND OBJECTIVE:** Biochemistry is an interdisciplinary area that allows us to study chemical phenomena in live organisms. That way, its study is of extreme importance, in all levels, to enlarge the comprehension of natural phenomena. However, it is barely explored in the basic education and often fragmented in the higher education, or in graduation degrees that contemplate this area. Especially in the teacher training, where the fragmentation of knowledge can contribute to form wrong concepts. Based on that, this work aims to identify the concept of Biochemistry according to the future teachers of Natural Science. **MATERIALS AND METHODS:** The work was developed with 3<sup>o</sup>, 5<sup>o</sup> and 9<sup>o</sup> semesters students of the natural science degree on Universidade Federal do Pampa. 50 students, from 18 to 56 years old, were interviewed. The data was obtained through a semi-structured questionnaire. The methodology of categorization and analysis of content with emergent categories of speech was chosen for the analysis. **RESULTS AND CONCLUSION:** Initially, 11 categories were chosen by content similarity. In descending order: chemical reactions in organisms, chemistry area, chemistry of life, cell metabolism, the study of living beings, origin of life, biology area, organic balance, chemical-biological study. The reports made possible to identify that most students do understand with clarity the goal of studying biochemistry. Although, we can see that there are some students that fragment the area, what means, they try to discriminate chemistry from biology. This way, they demonstrate a difficulty to comprehend biochemistry as interdisciplinary, what makes it hard to contextualize the built knowledge. It is important to develop strategies to overcome the fragmentation of knowledge, so that biochemistry can be comprehended in its fullness and help on the teaching processes that will be developed by the future teachers.

Keywords: Conception Biochemistry, Teacher Training, Science Education

Acknowledgements: UNIPAMPA

## THE POTENTIAL OF BIOCHEMISTRY EDUCATION APPS IN THE FORMATIVE ASSESSMENT

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Introduction and objectives: Apps can be designed to provide usage data, and most of them do. These data are usually used to map users interests and to deliver more effective ads that are more likely to result in clicks, and sales. We have applied some of these metrics to understand how can it be used to map students' behavior and to promote a formative assessment using educational software. The purpose of a formative assessment is to monitor student learning to provide ongoing feedback that can be used by instructors and students to improve the teaching and learning process. Thus, this modality aims to help both students and instructors to identify strengths and weaknesses that need to be developed. This study aimed to describe the potential of educational apps in the formative assessment process. Material and Methods: We have implemented assessment tools embedded in three apps (ARMET, The Cell and 3D Class) used to teach: 1) Metabolic Pathways; 2) Scale of the cellular structures, and 3) Concepts from techniques used in a Biochemistry Lab course. The implemented tools allow to verify on what issues there were recurring mistakes, the total number of mistakes presented, which questions they most achieved, how long they took to perform the activity and other relevant information. Results and conclusion: Educational apps can provide transparent and coherent evaluation metrics to enable instructors to systematize more consistent criteria and indicators, reducing the subjectivity of the formative assessment process and the time spent for preparation, tabulation and analysis of assessment data. This approach allows instructors to understand better where students struggle, giving to them a more effective feedback. It also helps instructor to plan interventions to help students to perform better and to achieve the learning objectives.

**Key Words:** Formative Assessment, Educational Apps, Biochemistry.



## HOBBY WITH BIOCHEMISTRY: USE OF ACTIVE LEARNING METHODOLOGY IN BIOCHEMISTRY AT THE MEDICAL SCHOOL

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**Introduction and objectives:** The learning of Biochemistry is generally considered difficult by the graduates, because studies the molecular level the metabolism of living and it demands a great capacity for abstraction by students. Thus, researchers have tried alternative methods to provide an alternative study method.

**Materials and methods:** 178 students of the School of Medicine, PUC-PR, that course the disciplines of Medical Biochemistry I and II, were divided into 50 groups, each with 3-4 students, and were have to draw up a hobby activity with a specific theme of the Biochemistry. The selected topics were, amino acids and proteins, enzymes, cellular respiration, glycogen metabolism, gluconeogenesis, lipid metabolism, metabolic integration, dyslipidemia and atherogenesis, pathophysiology of diabetes mellitus and metabolic syndrome, mechanisms of diabetes mellitus complications. The hobby activities chosen were direct, duplex, self-defined, cryptogram, bugs game. Both issues such as the type of hobby was drawn between groups. The groups had to: elaborate hobby; presents it to class orally, applying the questions prepared; printing and expose the hobby at the wall in the University; answer an evaluation regarding the preparation of work; and all groups should get together and organize one titled magazine "Hobby with Biochemistry" and deliver it printed. **Results and conclusions:** According the groups, the greatest difficulty was the adequacy of the questions posed in the required format, once they had only one issue and restricted space for the responses. Furthermore, the formatting was also identified as a point very difficult in activity elaboration. On the topic of learning through the development of work, and/or a new skill groups assigned grades ranging between 7.0 and 10.0 and about 90% of the groups attributed note 10 on satisfaction of seeing the work done and its ability to produce it. According to the results, the activity proved to be an efficient tool to develop different skills desired profile of student teaching the course project, and a different learning opportunity for the student.

**Acknowledgements:** to Medical School Coordination to support for this work.

**Key Words:** biochemistry learning; active methodology; hobby magazine.



## VISUALIZATION APPROACH TO STRUCTURE-FUNCTION RELATIONSHIP IN BIOLOGICAL MACROMOLECULES

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**Introduction:** Most of recent research in the field of education strongly recommends the use of visualization in the daily teacher's practice, especially when it comes to teaching science.

**Objectives:** We investigated the impact of different kinds of visualization on student's accomplishments, and the relationship between 2D and 3D visualization on the learning outcomes in biochemistry teaching, as well as gender-related differences in 2D vs 3D perception abilities.

**Materials and Methods:** The research study was conducted on a sample of 149 senior secondary school students, divided into three groups: control group (usual teaching approach), and two experimental groups taught using different kinds of visualization: E1 (2D and 3D static visualization tools), and E2 (3D dynamic visualization tools, in addition).

**Discussion and results:** We measured the students' learning outcomes in biochemistry, as well as the level of satisfaction with different teaching methods. The data were interpreted by performing statistical measures and analyses. In order to validate our hypothesis, we used one-tail and two-tail ANOVA analyses (along with the *t*-test).

**Conclusions:** There was no statistical significance regarding 2D vs 3D visualization tools in biochemistry teaching. Although there existed some gender-related differences in students' achievements (in favor of females), it was not established that they were related to the type of visualization (2D or 3D) tools applied. However students from the E2 group (additional computer animations) were more interested and involved in this kind of teaching. Although the results do not show a statistical significance in favor of 3D visualization, we must conclude that in teaching biochemistry it is certainly a more efficient approach than traditional teacher-oriented lessons. By using this kind of visualization tools in everyday teaching practice, chemistry teachers are given the opportunity to enlighten students with somewhat complex and abstract biochemical concepts.

**Key Words:** Biochemistry; Teaching; Visualization.



## A proposal of collaborative education for biochemistry and cell biology teaching

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**INTRODUCTION:** Currently students grow up in a world of digital tools that allow you to connect instantly with the world. At the same time, teachers face several challenges to increase student interest and learning efficiency. One such challenge is the pedagogical commitment of the density of biochemistry and cell biology contents, producing a conflict scenario, between meeting content and maintain the class quality.

**OBJECTIVES:** From this perspective, this study aimed to evaluate the learning biochemistry and cell biology contents in high school classes of IFRN, using collaborative and digital tools in the Moodle. **MATERIAL AND METHODS:** The contents were offered using various tools such as video lectures, forums, questionnaires, portfolios, glossaries and electronic books. Then these tools were evaluated using an electronic form. In addition to the tools, we evaluated the platform interaction, the performance of activities and the content gamification. **RESULTS:** The quantitative results revealed directly proportional relationship of the interaction of Moodle with the performance of activities. The content gamification was also assessed positively, with 61% of students considered good, very good or excellent. The best evaluated tools were video lectures, with 31% preference, and questionnaires, with 24%; followed by electronic book, with 10%, and portfolio, with 5.5%. The other tools totaled 30% of the preference. Qualitative results revealed an educational gain of content, because the student lived the experience of teaching and learning collaboratively. In addition, these tools decreased conflicts between content and schedule. **CONCLUSION:** Thus, the use of information and communication technology (ICT) in a collaborative learning provides relevant results, bringing the reality of the world connected to the classroom. In addition, it assists in defining the content and creative development of a strategy for the construction of the concepts applied to biochemistry and cell biology teaching.

Keywords: biochemistry teaching; collaborative education; information and communication technology.

## A DIGITAL TOOL FOR CASEIN ISOLECTRIC POINT DETERMINATION

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**Introduction:** Casein is a milk protein that has the same number of positive and negative charges in a pH around 4.7. This characteristic is called the isoelectric point (pI). The pI varies from protein to protein and it depends on the charges of the lateral chain of the constituent aminoacids. At this pH value the protein has its minimum solubility since the net charge is zero and the repulsion between molecules is decreased. Furthermore, the electrostatic interaction occurs between the protein molecules. Thus, they form clumps which tend to precipitate. On the other hand, when they are placed in a solution whose pH is above or below of its pI, the protein molecules have respectively a negative or positive net charge, with strong repulsion between themselves and great interaction with the solvent (water).

**Objective:** This learning object presents a simulation of a laboratory practice for the determination of casein isoelectric point. **Materials and Methods:** Cartoons were planned in order to show the methodology procedures and biochemical fundamentals. Animations were developed with the aid of the Adobe® Flash 8 software associated with logic programming.

**Results:** The simulation consists of six steps that reproduce the activities performed in the laboratory. Among them, the user can observe different degrees of turbidity and / or precipitation of casein in solutions with different pH values, he can measure these values with paper indicator strips and then determine the pI of this protein.

**Conclusions:** This learning object was tested by students of Biochemistry I, Pharmacy course since 2012/2. The navigation features, design, interaction, interactivity were considered excellent by 80% of students indicating that this object can be used as an interesting tool to assist the teaching and learning of basic biochemistry. Support: SEAD-UFRGS. Available at:

[www.ufrgs.br/gcoeb/PontoIsoleletricoDaCaseina/PontoIsoleletricoDaCaseina.swf](http://www.ufrgs.br/gcoeb/PontoIsoleletricoDaCaseina/PontoIsoleletricoDaCaseina.swf)





BIOCHEMISTRY APPROACH IN BOOKS APPROVED BY THE NATIONAL  
BOOK TEACHING PROGRAM 2015

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**INTRODUCTION:** Collections of textbooks are distributed every three years to basic education schools and represent a source of knowledge to students and a reference to the pedagogical work of teachers. Biochemistry is an area that studies the chemical processes occurring in living organisms, with their concepts present in both chemistry textbooks as in biology. It is necessary that the present approach in these books are interesting to students, to recognize the importance of understanding these processes. **OBJECTIVES:** To analyze as it has been crafted in biochemistry textbooks high school approved by PNLD 2015. **MATERIALS AND METHODS:** We investigated how the biochemical area-related content are described in the book "Bio - Volume 1", authored by Sonia Lopes and Sergio Rosso, and in the book "Chemistry - Volume 3" by Martha Reis with regard to clarity of concepts, context, illustrations and interdisciplinarity. **RESULTS:** Both books have chapters devoted especially to describe on this area, with plenty of catchy titles, but one in the first year and the other in the final year of high school. In biology textbook chapter called "The chemistry of life" brings in its approach clear and succinct concepts, contextualizes the issues on current information of figures and tables, features lots of illustrations that range from photographs to represent chemical structures and is mainly interdisciplinary in test questions. In chemistry textbook chapter "Introduction to Biochemistry" shows clear and detailed concepts, contextualizes with curiosities and everyday issues of students, has auxiliary illustrations in understanding and is interdisciplinary. **CONCLUSIONS:** We realize that there is a gap between the disciplines to work biochemistry during high school, but the form of presentation used for books is clear and present use of languages in the daily lives of students, making learning interesting and attractive.

**Keywords:** Textbooks. Biochemistry. Analysis.



## **NEW MATERIALS FOR PEDAGOGICAL TEACHING-LEARNING IN BIOCHEMISTRY: MONITORING PARTICIPATION**

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This summary consists of an experience report about actions taken by biochemical monitors with pharmacy students. The reason of our work was the intention to both improve the process of teaching and also learning and invalidate the labels owned by biochemistry of hard and high-level-failure subject. The three actors: teachers, students and monitor could act on an integrated basis for the construction of an articulated pedagogical process between theory/practice and learning signification. Our main objective was to initiate the monitors in teaching practice effected through educational projects aimed at improving the teaching and learning of undergraduate courses and encouraging teacher training, involving teachers and students the guiding condition and monitors, respectively. The methodology was applied in three stages: 1) preparation of teaching materials; 2nd) application in class and 3rd) students rating of the methodology applied by monitors. The teaching materials presented discussed several biochemistry's topics and students had the opportunity to scaffold their own knowledge actively. Almost 90% considered the tool applied as highly related to classes and 82% considered this way of learning more significant than dialogical lectures. The performance of the monitors, focused on students and their learning, was considered great by students who were more motivated, resulting in the excellent evaluation of the work (100% of acceptance). The failure rate of the subject reduced in the four groups wherein the pedagogical materials were applied. It can demonstrate that both the mastery of scientific content and the pedagogical process involved during the teaching and learning moments are important.



## PROTEIN TEACHING: AN APPROACH FOR TEACHER TRAINING APPLIED TO STUDENTS OF THE BIOLOGICAL SCIENCES COURSE AT UFRN

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Teaching biochemistry in higher education is increasingly becoming a challenge. It is notoriously difficult for students to assimilate the topic; in addition there are many complaints about the complexity of subjects and a lack of integration with the day-to-day. A recurrent problem in undergraduate courses is the absence of teaching practice in specific disciplines. This work aimed to stimulate students in the biological sciences course who were enrolled in the discipline of MOLECULAR DIVERSITY (MD), to create hypothetical classes focused on basic education highlighting the proteins topic. The methodology was applied in a class that contained 35 students. Seven groups were formed, and each group chose a protein to be used as a source of study for elementary school classes. A lesson plan was created focusing on the methodology that the group would use to manage a class. The class was to be presented orally. Students were induced to be creative and incorporate a teacher figure, and to propose teaching methodologies for research using the CTS approach (Science, Technology and Society). Each group presented a three-dimensional structure of the protein they had chosen, explained their structural features and functions and how they would develop the theme for a class of basic education, and what kind of methodology they would use for this purpose. At the end of the presentations, a questionnaire was given to students in order to evaluate the effectiveness of the methodology in the teaching-learning process. The activity improved the teacher's training and developed skills and abilities, such as creativity, didactical planning, teaching ability, development of educational models and the use of new technologies. The methodology used in this work was extremely important to the training of future teachers, who were able to better understand the content covered in the discipline and relate it to day-to-day life.

Keywords: Educational models; teacher training; meaningful learning.



## STUDENTS' MISCONCEPTIONS ABOUT THE NATURE OF MATTER AND HOW IT IMPAIRS BIOCHEMISTRY LEARNING

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**Introduction:** It is widely known that misconceptions impairs student's learning. IUBMB proposed a concept inventory which defines biochemistry's teaching scope. Even though it is known that many of them are subject of misconceptions by students, we collected informal data suggesting a deeper and most pervasive misconception related to the students' perceptions about what is and is not a molecule through their classroom statements and tests. We hypothesize that students' impairments on biochemistry learning possibly come from failure to assume that names are related to well defined molecules indicating lack of matter's representative levels of integration.

**Objectives** The present work aims to detect in freshmen students' misconceptions about the chemical nature of main small and macromolecules which potentially impairs biochemistry learning.

**Materials and methods:** A list of assertions about real life situations involving and citing main biomolecules – ATP, DNA, protein, lipid, carbohydrate, enzyme, hormon, vitamin – were mixed with other containing vague common terms – toxin, transgenic, healthy, unwanted elements, chemical compound – not suggesting hazardous situations in order to capture students' impressions. More than 150 students from five courses in three different higher education institutions answered true or false on 35 assertions.

**Results and discussion:** More than 70% of students had more than 80% error in this task designed to be not tricky, misleading or with unpreviously studied concepts. Results suggests students do not understand compounds as molecules but as entities unrelated to real life situations; on the other hand vague terms triggers a negative perception not necessarily related to harm or hazardous situations. We suggest that it is originated by poor scientific literacy from previous scholarship as well as lack of criteria on media vehicles about the topics here cited.

**Conclusion:** We conclude that many misconceptions on biochemistry topics come from students' assumptions which arises at the biochemistry course.

**Key-words:** Misconceptions; Scientific Literacy; Integration of representative levels.

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## EVALUATION OF A SUMMER BIOCHEMISTRY COURSE SETTLED BY GRADUATE STUDENTS (PMBqBM/SBBq) AIMING UNDERGRADUATE STUDENTS

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The good development of research in biochemistry is strongly linked to the knowledge and skill of the professional in using the techniques available to perform the research. To do this, the researcher must have adequate training and the period of initiation to science during graduation is of fundamental importance for the formation of this professional. Graduate students, in its turn, must seek to strengthen their knowledge and development of their teaching skills. In this scenario, the Multicenter Postgraduate Program in Biochemistry and Molecular Biology (PMBqBM) - (Brazilian Society for Biochemistry and Molecular Biology - SBBq - and Federal University of São João del Rei, Campus Midwest - UFSJ/CCO) joined the Postgraduate Program in Biotechnology (UFSJ/CCO) for the creation of I Summer Course in Biochemistry, Molecular Biology and Biotechnology of UFSJ. The objective was to promote the dissemination of the research areas in biochemistry present in UFSJ as well as both Postgraduate programs. This course was organized and taught by students of the two Postgraduate programs and exclusively aimed to undergraduate students from other institutions. In it, undergraduate students could choose from 12 courses of different lines of research linked to the areas of Biochemistry, Molecular Biology and Biotechnology established at UFSJ. The course, lasting 40 hours, had 80 subscribers for a total of 61 vacancies. Registrants were from 8 different Brazilian states and 12 different graduate degree courses, especially Biology. The course had average rating of 9.4, and the practical activities reached the rate of 100% positive evaluations. Through the observation of results obtained, it is concluded that the course met its main objectives to strengthen ties between institutions where develop research in biochemistry, to promote teaching and training techniques, as well as disclose the Postgraduate courses on Biochemistry, especially PMBqBM.

**Keywords:** Biochemistry, education, SBBq