

Master's Dissertation/ Trabajo Fin de Máster

ATTENTION TO DIVERSITY IN CLIL: A SCIENCE DIDACTIC PROPOSAL FOR SECONDARY EDUCATION. "THE CELL"

Student: Álvarez Martínez, María de los Milagros

Supervisor: Dr. Carmen Plata Luque

Department: English Philology

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Resumen

No es un secreto que en los últimos años AICLE ha aumentado su presencia a nivel europeo y por consiguiente, también en España. La propia naturaleza de esta metodología se presta especialmente bien a la atención a la diversidad dentro de aula, ya que es vista como un valor añadido y no como un inconveniente. La intención de este trabajo es por un lado presentar los fundamentos metodológicos de este modelo de enseñanza y su aplicación a la diversidad, tanto para alumnos con necesidades específicas de apoyo como para aquellos que tienen diferentes estilos o ritmos de aprendizaje y por el otro lado aplicarlos en el diseño de una unidad didáctica del área de ciencias adaptada a los elementos del currículo de 4º curso de enseñanza secundaria obligatoria

Palabras clave: AICLE, atención a la diversidad, inclusión, bilingüismo

Summary

It is no secret that in recent years CLIL has increased its presence at the European level and therefore also in Spain. The very nature of this methodology lends itself particularly well to the attention to diversity within the classroom, as it is seen as an added value and not as a disadvantage. The intention of this paper is on the one hand, to present the methodological foundations of this teaching model and its implication for attention to diversity, both for students with specific support needs and those with different learning styles or rhythms, and on the other, to apply them in the design of a didactic unit in the area of science adapted to the elements of the curriculum of 4th year of CSE.

Key words: CLIL, attention to diversity, inclusion, bilingualism

TABLE OF CONTENTS

1. INTRODUCTION	1
2. THEORETICAL FRAMEWORK	2
2.1 WHAT IS CLIL.....	2
2.1.1. <i>History of CLIL</i>	2
2.1.2 <i>CLIL in Andalusia</i>	3
2.1.3 <i>CLIL characterization</i>	4
2.1.4 <i>Benefits, pitfalls and challenges of CLIL</i>	9
2.2 ATTENTION TO DIVERSITY	10
2.2.1 <i>What is attention to diversity?</i>	10
2.2.2 <i>Attention to diversity in Andalusia</i>	12
2.2.3 <i>Attention to diversity in CLIL</i>	14
3. DIDACTIC PROPOSAL: “THE CELL”	16
3.1 INTRODUCTION.....	16
3.2 CONTEXTUALISATION	17
3.2.1 <i>Center</i>	17
3.2.2 <i>Environment</i>	18
3.3.3 <i>Classroom</i>	18
3.3 OBJECTIVES	19
3.3.1 <i>Content objectives</i>	19
3.3.2 <i>Language objectives</i>	20
3.3.3 <i>Key competences</i>	20
3.4 CONTENTS.....	23
3.5 METHODOLOGY.....	23
3.6 MATERIALS.....	27
3.7 ATTENTION TO DIVERSITY	27
3.7.1 <i>Sequence of activities</i>	31
3.8 ASSESSMENT.....	39
3.8.1 <i>Assessment criteria</i>	41
3.8.2 <i>Description of assessment</i>	42

4. CONCLUSIONS.....	45
5. ANNEXES	46
6. REFERENCES	76

1. INTRODUCTION

As stated in the Conclusions on multilingualism of the European Commission, Member States must implement measures to improve the language skills of their citizens.

In recent years, there has been an increase in the number of schools that have opted to teach non-language subjects of the curriculum in a foreign language (FL).

With this new reality, we face new challenges. Classrooms are composed of students with different abilities, different cultural backgrounds, and different educational needs, which becomes even more evident when a new vehicular language comes into play, as the levels of the students may be very different.

That is why I think it is paramount to consider the heterogeneity of the classroom when designing the didactic units also at secondary education levels so that all students can get the most out of them.

In the first part of this paper, I will briefly review the theoretical principles of CLIL and attention to diversity as well as a summary of the current legislation in Spain, particularly that which affects the Andalusian community.

The second part of the paper is the design of a didactic unit in the area of science for secondary education in which CLIL methodology, adapted to the attention to diversity, is used.

2. THEORETICAL FRAMEWORK

2.1 What is CLIL

2.1.1. *History of CLIL*

In every day more globalized world, the command of different languages has become paramount. In fact, teaching subjects through a single language is considered, depending on the authors, as “drip-feed education” (Vez, 2009), “second-rate education” (Lorenzo, 2007) or illiteracy of the 21st century. CLIL methodology was designed to solve this situation. Although the term is relatively new, was coined in 1994 by UNICOM, the educational phenomenon is not that new.

As a natural consequence of economic, geographic, and demographic matters, different bilingual programs were designed, mostly in border regions, to favour communication with the natives of the area (Hanesová, 2015). In the specific case of Spain, a program of Bilingual and Intercultural Border Schools has been initiated in cooperation with Portugal in order to promote the internationalization of education and the diversification of language education. In addition, this project contributes to pedagogical research and innovation, creates and distributes pedagogical resources, and develops teacher training processes in bilingualism and interculturalism.

Roughly in 1965, a group of English-speaking parents of the French territory of Quebec in Canada asked for a programme where on a voluntary basis, the English-speaking children learnt school subjects in French (e.g., Mathematics or Geography) together with the French-speaking children in order to provide them with a better understanding of the French and the English culture and traditions without neglecting the curriculum and favouring the competence in French and English languages. The term immersion was considered during the 70s and 80s as a synonym of bilingual education (Hanesová, 2015).

Concurrently, in London, a group of teachers created the Language Across the Curriculum (LAC) movement, where the role of discussion in English lessons was

evaluated. Around this debate was where the idea of language across the curriculum was born (Hanesová, 2015).

As an alternative to the approach used with learners of immigrant communities in the US, content-based language teaching was born around the 80s (Brinton, Snow & Wesche, 1989; Snow, Met & Genesee, 1989 as cited in Martínez 2011).

The term CLIL emerged in the 90s to encompass different learning methodologies in which the use of a language was having a crucial role in learning any specific content. CLIL was used as an umbrella term for various European agencies and programmes (Martínez 2011).

2.1.2 CLIL in Andalusia

The European Commission's "*Conclusions on multilingualism and the development of linguistic competencies*" published in 2014 recognize linguistic diversity as a component of European culture and intercultural dialogue and point out that language skills contribute to the mobility, employability, and personal development of European citizens, inviting member countries to implement measures aimed at improving the language skills of their citizens.

At a national level, Royal Decree 217/2022, of 29 March, which establishes the organisation and minimum teaching requirements for Compulsory Secondary Education, states in its second additional provision that "*The educational administrations may authorise that part of the subjects of the curriculum to be taught in foreign languages without this entailing any modification of the basic aspects of the curriculum regulated in this Royal Decree*".

At the autonomous level, the Order of 1 August 2016 which modifies the Order of 28 June 2011 regulating bilingual education in schools in the Autonomous Community of Andalusia, establishes that public schools will be considered bilingual if certain non-language areas or subjects of the curriculum are taught at least 50 per cent in a foreign language and will be authorized as such by the head of the ministry responsible for the subject. Furthermore, in its last provision, an added paragraph states that the persons responsible for plurilingualism in each

province belonging to the Educational Planning Service will provide advice and monitor bilingual schools.

The strategic plan for the development of language in Andalusia (PEDLA) includes as its main objective the full acquisition of linguistic competence understood as the use of language not only as an instrument of communication but also for learning and regulation of behaviours and thoughts. Other aims of this plan are consolidating the achievements of the bilingual program, improving and enhancing teacher training, optimising the use of R+D+i, increasing language exposure outside the classroom, encouraging interculturalism and improving student achievement in language learning.

In addition, every academic year instructions are published regarding the organization and operation of bilingual teaching in Andalusian centres, the one corresponding to the 22/23 academic year is the Instruction 21/2022 of July 21st. These instructions regulate aspects such as the subjects that will be taught in FL, the number of hours allocated to them, the methodology, resources and materials, and attention to diversity or evaluation.

2.1.3 CLIL characterization

Despite the many definitions of CLIL the one that better encapsulates the spirit of this approach was provided by Coyle, Hood and Marsh in 2010: “a dual-focused education approach in which an additional language is used for the learning and teaching of both content and language”.

Regardless of the heterogeneous and multifaceted nature of CLIL models there are some core features which differentiates it from other language instruction approaches one of most important is that CLIL is content driven (Coyle, 2010).

One of the fundamental aspects of the quality of CLIL methodology is that it is not only based on the teaching of the subject or the language but also on understanding and operationalizing approaches.

Based on this premise, Coyle (1999) developed the 4Cs Framework from a holistic perspective in order to relate content (subject matter), communication

(language), cognition (learning and thinking) and culture (social awareness of self and 'otherness').

The idea behind this is that effective CLIL only takes place when there is an advance in acquiring knowledge, improvement in the skills, interaction in the communicative context, use of the appropriate language and intercultural awareness.

CLIL represents an evolution towards a methodology which combines using the language to learn and learning to use the language in contrast to the old approach of learning the language itself (Coyle et al, 2007).

Learning to use the language properly in this methodology implies following these principles (Coyle, 2010):

1. The content matter is about the learners creating their knowledge and developing skills, not only acquiring them.
2. The content is related to learning and reflection.
3. The content and thinking process must be analysed for their linguistic requirements to allow the learners to create their interpretation.
4. The language should be transparent and accessible and needs to be learned related to the learning context.
5. Interactions are paramount when using FL.
6. Cultural awareness is fundamental to CLIL.

The relationships between language objectives and content objectives must be clearly defined in CLIL.

The Language Triptych (**Figure 1**) helps to make these connections, analysing the CLIL vehicular language from three interrelated perspectives: the language of learning, language for learning and language through learning (Coyle, 2010).

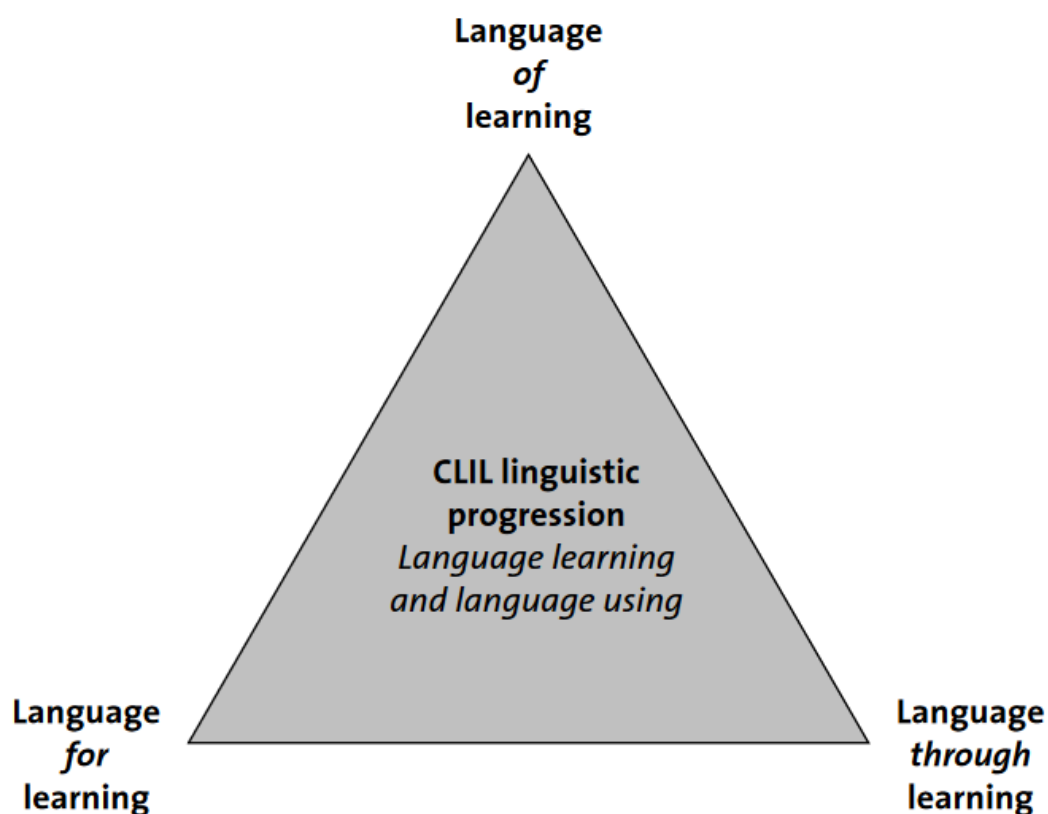


Figure 1. The Language Triptych. Coyle (2010)

Assuming that the cognitive and FL level of the students is likely to be different, finding activities that are challenging but still achievable could be a difficult task for the teachers. The CLIL matrix (**Figure 2**), adapted from Cummins' 1984 model, is the perfect tool to balance cognitive and linguistic demands.

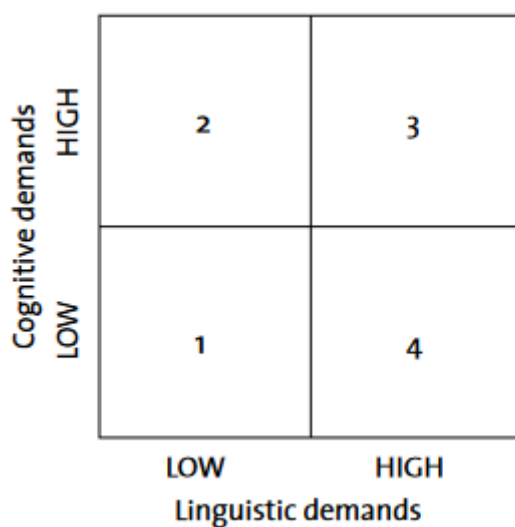


Figure 2. The CLIL Matrix (adapted from Cummins, 1984)

Focus on the second quadrant can ensure that limitation in the FL is not going to impede learning of the contents and the development of the skills.

One of the six quality strategies in CLIL set out by Meyer (2010) is "Make it HOT: Indeed, Thinking Skills (HOT) are the key to success in the Information Age". The revision of Bloom's Taxonomy published by Anderson and Krathwohl in 2001 proposes a continuum of thinking skills and processes involved in learning tasks (Fazio et al, 2015). This revision brought some changes in emphasis, terminology (from nouns to verbs) and structure (it becomes a two-dimensional model). This model recognises the Knowledge Dimension and the Cognitive Process Dimension. In the Knowledge Dimension there are four main types of knowledge (Anderson and Krathwohl, 2001):

- Factual knowledge: bits of information (terminology, details)
- Conceptual Knowledge: knowledge of classifications and categories, principles, theories and models.
- Procedural knowledge): knowledge of how to do something (techniques and methods)
- Metacognitive knowledge: knowledge about cognition (strategic knowledge, contextual knowledge, self-knowledge)

The Cognitive Process Dimension is composed of six levels, which are defined as remember, understand, apply, analyse, evaluate, and create.

- Remember: Retrieving, acknowledging, and recalling relevant knowledge from long-term memory.
- Understand: Constructing meaning from oral, written, and graphic messages through interpretation, exemplification, classification, summarisation, inference, comparison and explanation.
- Apply: Performing or using a procedure by carrying out or implementation.
- Analyse: To decompose the material into constituent parts, establish how the components relate to each other and to an overall structure or purpose by differentiating, organising, and attributing.
- Evaluate: Making assessments based on criteria and standards through testing and critiquing.

- Create: To connect elements together to form a coherent or functional whole; rearranging elements into a new pattern or structure through generation, planning or production.

The use of a Bloom's Taxonomy Matrix (**Figure 3**), where the knowledge dimension interacts with the cognitive processes dimension, is a very effective tool in the classroom when creating purposeful learning activities. This matrix can also be used to build curricula, as an assessment tool or to help in the selection of learning objectives.

Taxonomy table (after Anderson & Krathwohl, 2001)

	1. remember	2. understand	3. apply	4. analyze	5. evaluate	6. create
A. factual knowledge						
B. conceptual knowledge						
C. procedural knowledge						
D. meta-cognitive knowledge						

The diagram shows a vertical arrow on the left side of the table, pointing downwards from row A to row D, labeled 'concrete → abstract'. A horizontal arrow points from the 'remember' column to the 'create' column, labeled 'remember → create'.

Figure 3. Bloom's matrix (Glessmer, 2019)

Since CLIL is an attempt to bring innovation into teaching, it is an open window to new pedagogical methodologies such as Task-based learning, collaborative work, or meaning- and form-focused processing.

2.1.4 Benefits, pitfalls and challenges of CLIL

The multiple advantages of CLIL can be analysed from different points of view. As far as the linguistic dimension is concerned, one of the greatest benefits is the increased exposure to FL, as it is given more weight in the curriculum. The increased number of hours of exposure to the target language can lead to more advanced levels of performance (Coyle et al, 2010).

According to Grabe and Stoller, 1997 and Cummins, 1999, the content acquisition is not impaired, while communication skills are fostered because the language is used in a real communication context. This use of the language for a real purpose also stimulates the learner's motivation (Calviño, 2012).

On the other hand, the presence of language assistants in the classroom promotes cultural gain for students, not only understood as cultural advancement but also as the cultivation of intercultural components (Tobin and Abello-Contesse, 2013; Perez Cañado, 2013; as cited in Lancaster (2018).

It has been proven that CLIL improves cognitive development such as problem-solving, risk-taking, pragmatic, and interpersonal abilities. In an increasingly mobile and heterogeneous society, CLIL fosters intercultural communication skills and promotes intercultural communicative competence (Perez Cañado, 2013).

CLIL not only benefits learners but teachers, offering them opportunities to refresh their skills, work collaboratively with other teachers and diversify and modernise methodologies. In this aspect Lancaster (2016) and Perez Cañado (in press) as cited in Lancaster (2018) highlight the use of digital whiteboards, online and multimedia resources and a general increase in the use of technological equipment with the implementation of the CLIL methodology.

From a social point of view, it offers students, regardless of their socio-economic background, the opportunity to learn FL in an immersive way and prepares them to be competitive in an increasingly globalised world.

In contrast to the advantages of the CLIL methodology, which tend to benefit students, most of the disadvantages of CLIL are borne by teachers.

"One of the main problems of CLIL is that language teachers lack knowledge on the subjects while subject teachers have minimal knowledge of FL"(Calviño, 2012)

The lack of mastery of the methodology itself is another point highlighted by Darn (2006), who states that the lack of CLIL teacher-training programmes can affect teachers' ability to approach the classroom.

The availability and suitability of CLIL materials is another problem that teachers have to face. Many teachers may be overwhelmed by the amount of work involved in preparing their own materials (Smit, 2008).

Darn (2006) also underlines the difficulty of assessment in CLIL and questions whether learners are assessed on the basis of language or content and the teacher's attitude to possible errors or limitations in content caused by lack of language proficiency.

Another possible disadvantage is that the focus on an academic subject may bias the balance between Basic Intercommunication Skills (BICS) and Cognitive Academic Language Proficiency (CALP) in favour of the latter. The design of structured lesson plans in which cooperative work plays a major role can help to compensate for this effect (Calviño, 2012).

2.2 Attention to diversity

2.2.1 What is attention to diversity?

The existence of individual differences is a phenomenon recognized for a long time by humankind and it has always been tried to give a response from the point of view of pedagogy, but it is not until the appearance of the didactic movement of the individualization of teaching emerged in the New School, when differential pedagogy takes off, that there is a growing interest to give an adequate response to these differences (Romero and Alcocer, 2008).

Diversity can be understood as the variety of students in the classroom. All of them have different cultural background, learning styles, beliefs, limitations, physical possibilities, or disabilities.

Attention to diversity consists of attending the students taking into account their differences in order to include all of them in the teaching-learning process (Cabrera, 2011). "It is about moving between two poles that would go from the evaluation of students' needs to their educational response" (Romero and Alcocer, 2008).

As already stated in the Declaration of Human Rights in article 26.1, everyone has the right to receive an education:

Everyone has the right to education. Education shall be free, at least in the elementary and fundamental stages. Elementary education shall be compulsory. Technical and professional education shall be made generally available and higher education shall be equally accessible to all on the basis of merit (ONU, 1948).

This definition makes clear that education must be available for all people without exception. According to Darling-Hammond (2001): *"Educar a todos los niños de manera efectiva es la misión de las escuelas hoy en día"*. The word all indicates that no one can be left behind, and to this end, different models are provided trying to respond to people's educational needs.

The Order of January 15, 2021, which develops the curriculum for the Compulsory Secondary Education stage in the Autonomous Community of Andalusia for 2nd and 4th of CSE, includes in Article 11 of Chapter III the definition of attention to diversity as the set of educational actions and measures that guarantee the best response to the needs and differences of each and every one of the students in an inclusive environment offering real learning opportunities in ordinary educational contexts (BOJA, 18-01-2021).

In the last ten years, an increase in the percentage of non-university education students with special educational needs has been observed, standing at 2.6% during the 2018-19 academic year. Of these students, 82.4% are enrolled in regular schools. So, the implementation of measures to attend to diversity is paramount from the perspective of inclusive education, and it is enshrined as part

of the school's educational project in the plan for attention to diversity in every didactic programme.

Since it is applied through the current educational laws, it must not only be observed from a doctrinal but also from a legal point of view (Hontangas & de la Puente, 2010).

2.2.2 Attention to diversity in Andalusia

The Order of 15 January 2021 develops the curriculum corresponding to the Compulsory Secondary Education stage in the Autonomous Community of Andalusia for 2nd and 4th of CSE.

Furthermore, this order regulates certain aspects of attention to diversity in Compulsory Secondary Education, which, based on the already established principles of inclusive education and universal accessibility, aim to provide the adaptations and measures considered necessary for such attention, and thus guarantee equal opportunities, offering to facilitate measures to those students who may have specific educational support needs.

The article 12 of this Order establishes the general principles for attention to diversity, among which stands out schools to develop organizational and curricular measures to diversity that allow them to pay attention to the students.

Among the general principles of action for attention to diversity, we find consideration and respect for differences, all within the framework of diversity; personalisation of teaching in response to students' educational needs; early detection and identification of the educational needs of pupils to adopt measures more appropriate to meet the needs of pupils in order to develop key competences and the objectives of secondary education compulsory and, an approach to the use of information technologies and to facilitate the individualization of teaching and coordination between all members of the teaching team. Equity and excellence are considered as guarantees of Educational Quality and Equal Opportunities.

The general measures of attention to diversity, understood as the actions defined within the school's educational project, aimed at promoting the learning and academic success of all pupils using resources and materials with a global focus, are defined in the second section of chapter 3 of this Order.

These measures aim to respond to the different curricular competencies, motivation, different learning styles, interests and rhythms through different organisational and methodological strategies aimed at achieving objectives and competencies and should be used at any time during the stage.

Among these measures we can highlight the integration of subjects into areas of knowledge as established in article 14, the support of a second teacher in the classroom in some subjects of an instrumental nature, the splitting of groups, flexible groupings for more personalised attention to students, always temporarily, the use of collaborative work and heterogeneous groups, peer tutoring and project-based learning, and the use of the "learning by projects" approach.

We can differentiate between 3 types of programmes for attention to diversity. On the one hand, learning reinforcement programmes, when the pupil's progress is not adequate, and which can be applied at any time during the course when difficulties are detected; reinforcement programmes for general subjects in the block of core subjects in first and fourth year: and in-depth programmes for those pupils who are highly motivated to learn or for those with high intellectual abilities.

These programmes will be proposed and allocated by the tutor and the teaching team at the initial assessment session with the collaboration of the guidance team if necessary and will be communicated to the parents or guardians of the pupils through the centre guidance counselling.

The didactic programmes of the Compulsory Secondary Education stage will include the measures of attention to diversity according to the provisions of Article 29.2. g) of Decree 327/2010 of 13 July and, the form of attention to diversity adopted by each centre will form part of its educational project according to the provisions of Article 23.3. f) of the abovementioned Decree.

2.2.3 Attention to diversity in CLIL

After a period of positive appraisal and enthusiasm about CLIL programs, over the past decade critic voices like Paran (2013; as cited in Perez Cañado, 2021) have grown accusing it of elitism.

Although Bruton (2013) and Cortazar and Taberner (2020, as cited in Casas and Rascón, 2021) among others, argue that bilingual education is elitist and promotes segregation, the Spanish Association for Bilingual Education contradicts this assertion by stating that access to this type of education is open to everyone regardless of their socioeconomic status (SES).

Researchers such as Barrios Espinosa (2019, as cited in Casas & Rascón, 2021) point out the value of bilingual education as an instrument of social cohesion, eliminating the elitist component that foreign language education had until now.

Since here students not only have to deal with their special needs but also with their language difficulties, Liasidou (2013; as cited in Casas & Rascón, 2021) stress the integrative character of bilingual programs. Lisiadou (2013) emphasises that more attention should be paid to the needs of English language learners (ELLs) with special educational needs or disabilities. It should also be borne in mind that some learners with special needs also experience the cumulative effect of an unfavourable socio-economic background for second language learning, and therefore require special attention (Ortiz, 2001; Klingner and Artiles, 2003; as cited in Lisiadou, 2013).

Despite advances in inclusive education and the fact that the 2008 United Nations Convention of 2008 recognises that disability is the result of individual impairment and both environmental and institutional barriers and points to the need to understand that policy plays a crucial role in the education of students with special needs, there is sufficient evidence that students with special needs tend to drop out of school earlier than those without special needs.

To achieve successful learning, the coordination of the different stakeholders is paramount. In the words of Lisiadou (2013; as cited in Casas & Rascón, 2021): "meeting students' diverse needs entail a systemic and interdisciplinary approach in order to address effectively and efficiency their full continuum of needs". The

importance of cognitive styles, special needs, diversity, and multiple intelligences in students' academic achievement is also pointed out by Madrid and Barrios (2018). Although students and teachers, in a study carried out by Siepmann (2021), agreed that the methodology used in CLIL is student-centred rather than teacher-centred and that it uses project and task-based learning and is inclusive in relation to different abilities, both groups complained about the lack of diversity-sensitive resources. This problem is exacerbated by insufficient ICT resources and a limited selection of appropriate CLIL textbooks.

English language learners with SEN are at a disadvantage because few educators have the adequate training to meet their needs simultaneously due to their impairment and language learning difficulties. This is reflected in the high number of ELLs who are placed in SEN categories. It is also common to find students with disabilities in bilingual education who are not given due attention (Artiles and Ortiz, 2002; in Lisiadou, 2013).

In a study carried out by McClintic (2022) data were collected on a group of secondary school teachers' perceptions of how three different types of achievers (under-, normal-, and over-) are catered for within CLIL programmes. One of the conclusions is that there is a lack of coordination and guidelines between CLIL and attention to diversity. Especially considering the high percentage of foreign students whose mother tongue (L1) is neither Spanish nor English. In particular, several factors have emerged that need to be addressed, such as the lack of classes for newcomers, diversity-related training and collaboration between teachers.

To fill the niche of attention to diversity in CLIL programs in Europe, the ADIBE project (Attention to Diversity in Bilingual Education) has emerged. It is addressed to three target groups: Secondary Education institutions (which have incorporated CLIL), Teacher education institutions and Educational Authorities. It involves six countries (Spain, Austria, Finland, Germany, Italy, and the United Kingdom) with the aim of achieving a more reflective, inclusive and innovative society by offering resources to improve language learning, such as task- and ICT-based activities, design teacher training modules or identify difficulties and best practices to diversity in CLIL.

Different scaffolding techniques will be used for the development of the communicative skills, such as providing students with the vocabulary necessary to perform a task, visual support (graphics, videos) or giving them enough time to formulate their oral responses.

3. DIDACTIC PROPOSAL: “THE CELL”

3.1 Introduction

This didactic unit has been designed according to the elements of the school curriculum (general and linguistic objectives, key competences, contents, methodology and assessment criteria). All these elements will cover the diversity of the classroom.

I have chosen "The cell" as is an essential topic in biology teaching. Cells are the structural and functional units of organisms. The cell is not only the basic unit of organization of living beings, but it is also the genetic unit, given that its DNA contains the genetic instructions that regulate its activities, and it is transmitted to its descendants. Therefore, the knowledge of the structure and functions of the cell constitutes one of the fundamental pillars for the understanding of biology. Consolidating these concepts is especially important for students who will study Biology in the *Bachillerato* since they are the basis for the following courses.

The didactic unit "The cell" can be found in the Biology Program for the 4th year of ESO. To carry out the above-mentioned didactic unit, and consequently, the following sessions, I have taken as a reference the *Order of 15 th January 2021*, which establishes the curriculum for Compulsory Secondary Education for the Community of Andalusia.

This didactic unit belongs to the block 1 Life evolution. From the 33 hours dedicated to this block, 9 hours are used to work in this unit. It will be taught in the first term of the course 2022/2023.

3.2 Contextualisation

3.2.1 Center

This didactic unit has been designed for a group of 4ths ESO of the community of Andalusia. As I am not working as a teacher at the moment, I have selected the compulsory secondary school Los Pedroches located in the town of Pozoblanco. The school has approximately 1000 students and started its bilingual program in 2009. In addition to ESO, the school offers baccalaureate, vocational training and baccalaureate for adults.

Although the building was built in 1966, it has undergone numerous renovations over the years. It has a multipurpose room, gymnasium, ICT room, science laboratory, multiple classrooms, and offices as well as a canteen.

The content areas included in the CLIL program are Biology and Geology, Technology, Geography and history, and Physical education. There is a bilingual coordinator in charge of organizing weekly meetings between the linguistic and non-linguistic subject teachers. There is also a language assistant that works 12 hours per week.

The Center's Educational Project defines some of the objectives aimed at improving student performance, among which the following stand out:

- To promote and achieve civic habits in the students.
- To intensify the use of information and communication technologies.
- To inform students of the evaluation criteria for each subject.
- To encourage the habit of reading in a transversal way.
- To foster strategies to improve oral comprehension (presentations) and written comprehension (elaboration of texts of different typologies).
- To work on inclusive support for students with special needs.
- To improve students' mastery of skills (methodological changes, interdisciplinary activities, projects).

In addition to the Bilingual Program, the centre is adhered to other plans and projects:

- School as a Peace Space Project.

- Plan for equality between men and women.
- ICT school project (since 2003/04).
- Plan for reading and school libraries.
- ALDEA environmental project.

3.2.2 Environment

The region of Los Pedroches, located in the north of the province of Córdoba, has a tradition of mining and metallurgy, now abandoned, and agricultural, but today 70% of the active population is agglutinated in the service sector.

The economic situation is very variable among the different population centres that conform to the region and can be improved if we compare it to the state level.

On the other hand, it has experienced a sharp drop in population in recent years due to the emigration of younger people caused by the lack of work, which has led to the ageing of the population.

The immigrant population of Pozoblanco is 4.76%, with a third of them coming from Romania.

3.3.3 Classroom

Since Biology and Geology is an optional core subject, only 20 of the 28 students chose Biology, the rest opted for the Technology subject. The student's body is 60 per cent female and 40 per cent male and are 16 years old. Most students will continue their science studies in the baccalaureate of science or follow some vocational training within the health area.

I was informed by other teachers that this is a very participatory group really interested in the bilingual project. Three of the students will take part in the Debate Tournament organized in the centre and two others will collaborate in the Bloglingual project.

As for the language level of the students, this is quite variable, as we find students who have spent a summer in England and speak English fluently, while others

have considerable difficulty in expressing themselves orally or in writing. In general, all of them understand texts and instructions well according to their age and school year but have not achieved the B1 level of the CERF stated in the *Instruction 21/2022, Of July 21, Of the General Directorate of Educational Planning And Evaluation, On The Organization And Functioning Of The Bilingual Education In Andalusian Schools For The Course 2022/2023*.

In our classroom, in addition to the cases of diversity among the different types and rhythms of learning, we have a student with a moderate postlingual hearing loss (hearing impairment of 60% (called A from now on)) and a student of whose mother tongue is English that join the school this year (Spanish A2 level CERF (called B from now on)).

The classroom in which the subject is taught has a digital board and a projector. In addition, the tables, 30 in total, are distributed in six rows with five tables each where the students sit individually. For group activities, the tables can be grouped according to the needs of the task. The classroom also has a corkboard on which students can hang their activities or posters.

For the realization of some of the tasks will be used the ICT classroom (sometimes in collaboration with the ICT teacher), which has 20 desktop computers, a digital whiteboard and a projector or the science laboratory where the practices will be carried out, which has large double tables to work in pairs and high swivel stools.

3.3 Objectives

3.3.1 Content objectives

The content objectives to be achieved with the development of the following didactic unit are included in the *Order of January 15th, 2021*.

- Determine the analogies and differences in the structure of prokaryotic and eukaryotic cells and interpret the evolutionary relationships between them.

- Identify the cell nucleus and its organization according to the phases of the cell cycle through direct or indirect observation.
- Compare the structure of chromosomes and chromatin.
- Formulate the main processes that occur in mitosis and meiosis and review their biological significance and importance.

3.3.2 Language objectives

Cognitive Academic Language Proficiency (CALP) and Basic Interpersonal Communication Skills (BICS) will be worked on throughout the development of the unit.

- Use and recognize the technical vocabulary related to the cell (membrane, cell wall, nucleus, mitochondrion...) both in written and oral communication (CALP).
- Develop oral and written communication skills in presentations and discussions (BICS).
- Use English fluently to communicate with peers and the teacher during the development of the tasks (BICS).
- Appropriate use of different grammatical structures to talk about experiments and universal truths (present tense), hypotheses or possible causes (conditional tense) or comparative structures to highlight differences and similarities between two given elements (CALP and BICS).

3.3.3 Key competences

The recommendations of the European Union contained in the Council *Recommendation of May 22nd, 2018*, emphasize the need for citizens to acquire key competencies for personal and professional development. Competencies are defined as a set of attitudes, skills and knowledge within a lifelong learning concept.

In the educational field in Spain, these key competences are included in the *Royal Decree 217/2022 of March 29th*, which establishes the organization and the minimum requirements for compulsory secondary education and must be related to the objectives defined in the curriculum. The subject of Biology and Geology contributes to the acquisition of key competencies. Specifically, in this unit, we will work on the following competencies:

- Linguistic competence (LC): as a result of communicative action within the classroom context by applying the language to real communication situations, both in interactions with other classmates or the teacher and through written production and the use of texts in different media and formats.
- Mathematical competence and basic competencies in science and technology (CMST): this will be worked through the understanding of scientific concepts related to biology and its processes. Students will develop critical judgments about scientific and technological facts both present and past.
- Digital competencies (DC): through information management, content creation, problem-solving and the use of programs and tools for the creation of presentations and posters.
- Learning to learn (L2L): through the use of different learning strategies, students learn to recognize and control their learning processes to create increasingly autonomous learning. The activities presented are also designed to train students' critical thinking.
- Sense of initiative and entrepreneurship (SIE): it will be fostered through the involvement of the students in tasks that imply the development of experimentation and discovery processes, as well as the use of methodologies that encourage the active participation of the students in their own learning.

3.3.4 Transversality and interdisciplinarity

The transversal elements that contribute to the achievement of the key competencies and objectives are described in the 6th article of the *Decree 111/2016 of June 14th*, which establishes the organization and curriculum of

Compulsory Secondary Education in the Autonomous Community of Andalusia, must be present in the programming of all subjects. In this didactic unit, the following elements will be worked transversally:

- The encouragement of the values and actions necessary for the promotion of real equality between men and women and the contribution of both sexes to society.
- The promotion of values and behaviours appropriate to equal opportunities, universal accessibility and non-discrimination, as well as the prevention of violence against people with disabilities.
- The fostering of tolerance and recognition of diversity and intercultural coexistence.
- Development of basic skills for interpersonal communication.
- Critical analysis of information and communication technologies.

The interdisciplinarity, inherent in the integral formation of secondary school students, allows distinct aspects to be worked on in the different areas of the curriculum, which enables students to create interconnections between the different subjects. In the case of this particular unit they are also worked on:

- English as a foreign language: through the communicative situations created in the classroom and during the development of the tasks.
- Physics and Chemistry: some chemical reactions are involved in the preparation of the laboratory samples.
- Spanish language and literature: when students apply the knowledge of their mother tongue to learn FL. Oral and written skills of both reception and comprehension are practised.

3.4 Contents

The contents to be worked on in this didactic unit ("The cell" included in Block 1: The evolution of life) are stated in the *Order of 15 January 2021*, which establishes the curriculum of compulsory secondary education, and contribute to the achievement of the teaching objectives as well as the acquisition of the key competencies are the following:

- The cell
 - Levels of organisation of living organisms
 - Development of cell theory
 - Prokaryotic cell characteristics and structure
 - Eukaryotic cell characteristics and structure
 - Plant cell
 - Animal cell
- Cell cycle
 - Mitosis
 - Meiosis
 - Differences between mitosis and meiosis
 - The biological significance of mitosis and meiosis

3.5 Methodology

In order to work competently in the classroom, the role of the teacher is transformed into that of a knowledge manager, giving a more prominent role to the students.

Although the aim is for students to acquire basic knowledge determined by the curriculum and the necessary strategies to use the scientific method, it is crucial that students also develop critical attitudes of reflection and analysis of current scientific advances as well as understand their advantages and disadvantages and the ethical dilemmas they pose.

To accomplish all this, it is essential to train reflective and individual work through oral and written expression, argumentation, public presentation as well the use

of audio-visual supports. The correct use of scientific language is fundamental to being able to understand and transmit knowledge. To encourage this, activities focused on working with this vocabulary will be carried out, such as the creation of a glossary of terms.

We will also work in collaborative groups to favour the training of basic social skills and the understanding and acceptance of diversity. In addition, this encourages learning not only through the teacher but also through other colleagues. Peer tutoring will be encouraged whenever possible.

Taking into account the different potentials of the students and trying to make everyone feel included and fulfilled, the activities have been designed based on the theory of multiple intelligences.

Learning by discovery will also be promoted, for instance, with a laboratory practice, in which the students will have to search for information by themselves and reflect on the new knowledge acquired, starting from a basic protocol.

The aim is to create meaningful learning based on a constructivist approach in which students relate new knowledge with the previous one they already had from other courses. The utilization of games in the classroom (gamification) combined with the use of new technologies serves us to stimulate the motivation of students while providing us with useful tools for the detection of previous ideas or consolidation of new content. At the beginning of this unit, we will use Kahoot to see the level of the students.

The use of FL is a key point in the CLIL approach. Students will be provided with all the material and support needed to understand the content. Multilevel activities that work with all language levels of the students will be offered.

Content will be prioritized over FL proficiency since one of the objectives of the CLIL methodology is for students to acquire the content and be able to communicate fluently in FL even if they do not do so in a fully accurate way. Nonetheless, it is important that students improve their communicative skills in the target language.

Level: 4 th CSE	Subject: <i>Biology and Geology</i>	Unit: The cell
Teaching objectives		
CONTENT	COGNITION	CULTURE
-Cite the basic cell structure and the main postulates of cell theory (LC, MC, DC, L2L). -Know the levels of organization of living beings, their main characteristics, and to establish relationships between them (LC, MC). -Determine the similarities and differences in the structure of prokaryotic and eukaryotic cells, interpreting the evolutionary relationships between them (LC, MC, DC, L2L, SIE). -Identify the cell nucleus and its organization according to the phases of the cell cycle (direct and indirect observation) (LC, MC, DC, L2L, SIE). -Determine the similarities and differences between mitosis and meiosis, interpreting their biological significance (LC, MC, DC, L2L, SIE).	-Observe and interpret cells using images produced by microscopes. - Debate the similarities and differences between the functions of nutrition, interaction and reproduction of prokaryotic and eukaryotic cells. - Design comparative diagrams of eukaryotic and prokaryotic cells. -Create diagrams to compare mitosis and meiosis. -Design diagrams of animal and plant cells.	-Recognize and accept that all living things have the same chemical, structural and functional units, despite the variety of organisms. - Present the basic concepts of cell theory correctly in both oral and written forms. - Reflect on the existence of single-celled organisms that carry out the same fundamental functions as multicellular organisms. -Reflect on the consequences of the differences between prokaryotic and eukaryotic cells. -Practice rigorous experimental work.

COMUNICACION			
Language of learning (CALPS)		Language for learning	Language through learning (CALPS)
Key Vocabulary	<u>Nouns</u>: Chromosome, cell wall, chlorophyll, chloroplast, cytoplasm, mitochondrion, nucleolus, nucleus, organ, tissue, vacuole, cell membrane, chromosome, mitosis, meiosis. <u>Adjectives</u>: large, small, high, low, partially, fully, ciliated, specialized. <u>Verbs</u>: contain, combine, form, relate, pass, provide, store, absorb. <u>Frequency adverbs</u>: often, sometimes, never, always, usually.	Structures: (CALPS) -The different levels of organization are... -The different kind of cells are... -Express agreement or disagreement -I agree/don't agree -Express hypothesis -Ask and answers questions.	-Reading the text -Internet research -Use of dictionary -Retain language revised by the teacher.
	- Use present, future, and conditional tenses to express solutions, suggestions, cause-effect regarding the topic cell. - Review comparative sentences.	Language functions Giving instructions: (BICS) -Who wants to go to the blackboard? -Open your book at page -Which page, please? -Could you repeat it, please? - I don't understand	

Table 1. 4Cs Framework "The cell"

3.6 Materials

For the realization of the activities proposed in the development of this didactic unit the following spaces, materials and resources will be used:

- The classroom where the material is normally taught. It is equipped with a blackboard, a digital blackboard and a projector. The centre has a Wi-Fi network in all its facilities.
- ICT classroom with 20 computers located on individual tables organized in 4 rows.
- ICT resources:
 - Tools (Padlet, Kahoot, Mentimeter, Google classroom/Teams).
 - Computer programs (Powerpoint, Word)
 - You tube videos
- Biology Laboratory (with microscopes, high tables, and swivel chairs).
- Biology and Geology Secondary 4 textbook (1st ed.). McGraw-Hill Publishing House.
- 2016. ISBN: 9788448608903.
- Photocopies for activities and adapted materials.
- Stationery and office supplies.
- Students' cell phones for some of the gamification activities.
- Plasticine of different colours.
- Toothpicks.
- Cell models.

3.7 Attention to diversity

The need for attention to diversity, initially included in the *Organic Law 2/2006, of May 3, 2006*, on Education, later modified by the *Organic Law 3/2020, of December 29, 2020*, establishes in article 71 that:

“It is the responsibility of the educational administrations to ensure the necessary resources so that students who require educational attention different from the ordinary one, due to special educational needs, due to maturational delay, language and communication development disorders, attention or learning

disorders, severe lack of knowledge of the language of learning, for being in a situation of socio-educational vulnerability, for their high intellectual abilities, for having joined the educational system late or due to personal conditions or school history, can achieve the maximum possible development of their personal abilities and, in any case, the objectives established in general for all students”.

The *Order of January 15th, 2021* also states in article 12 that teachers must develop methodological and curricular measures to attend to diversity that allow them to provide personalized attention to students. This Order also establishes that the centres must present the measures to be taken in their Educational Center Projects.

From all the above, it can be deduced that the didactic programs must be adapted for those students who need special attention, either for their high capacities, for having been late schooled, for presenting maturational delay, auditory or visual deficiencies, ADHD, or lack of motivation among other causes.

The detection of the specific needs of each student will be done by performing some simple initial activities to detect motivation, communication, and previous knowledge to give them the appropriate attention and implement the necessary strategies.

So, designing the activities and explaining the contents, we must establish all possible measures aimed at helping students who need more help to achieve the objectives and those with more capabilities to expand the contents. For this, we will use two types of activities:

Reinforcement activities: they are aimed at those students who need support for having fallen behind in the acquisition of knowledge compared to the group. These tasks can be concept maps, activities to complete schemes and true or false questionnaires. At the end of this unit and for those students who have not satisfactorily achieved the learning standards, a worksheet will be provided with different activities ranging from completing some definitions or labelling an image of a cell.

Extension activities: designed to deepen the subject, and they will be available to students who by the level of knowledge achieved or by their high reasoning

abilities are above the average. They can be information search tasks, interactive crossword puzzles or optional questions at the end of the main activities. These types will be voluntary and will be available to all students. In this particular case, students who wish to delve a little deeper into the subject will have at their disposal an extra activity in which they are invited to answer a set of questions to relate the process of mitosis with cancer after watching a video.

Furthermore, to promote integration and motivation I will use different types of groupings: individual, pair and group work. This allows students to learn from the skills, abilities and strategies of their peers, which contributes to the acquisition of key competencies. To avoid that the groups are always formed by the same students, I will use different methods to group the learners, always trying to ensure that the abilities are balanced so that everyone can benefit as much as possible.

Another means of adapting activities to the diversity of the classroom is to make flexible activities that allow the use of different strategies and levels of depth, where it is also possible to change the grouping in order to obtain better results and respond to the needs of the learners.

The activities and tasks proposed are varied in nature, so that the learner needs to put into practice a wide repertoire of cognitive processes. This avoids process-focused learning situations in which some learning styles may be excluded.

In addition to the measures mentioned above and designed to address the diversity of different types and rhythms of learning, some specific measures will be applied to cater for a pupil with moderate post-linguistic hearing loss. The pupil has lost some of his hearing after learning to speak. He can hear when he is being addressed directly but has difficulty following conversations if it is crowded or if he is not close enough. He presents a poorer vocabulary than the rest of his peers and some problems with pronunciation due to marked nasalisation. He sometimes finds difficult to follow explanations and may appear distracted. He has also difficulty integrating with peers. The general measures taken to improve the learning and integration of this pupil are as follows:

- Tables are placed in a U-shape so that he can see his classmates when they speak.
- His table will be placed in the position closest to the teacher.
- Light signals will be used to mark the times of the activities.
- I will not talk while writing on the board.
- Visual support will be provided during explanations.
- He will be seated with back to the window so that the light shines on the largest number of students in front of him/her.
- Additional written information will be provided.
- Technical aids are available in the classroom to counteract background noise (FM equipment, magnetic loop).

I will provide Spanish scaffolding for student B to help him to communicate with his peers in all group activities. As he is a newcomer, I will rotate him between groups frequently so that he can get to know all his classmates and integrate better. His status as a native speaker will also help his classmates to improve their communication skills.

Specific measures for the development of the activities will be detailed in the sequencing section.

3.7.1 Sequence of activities

Session	Activities/Contents	Grouping	Time
1	Mentimeter (ice breaker)	Individual	5'
	Kahoot (previous knowledge)	Individual	5'
	Presentation of unit contents	Whole group	5'
	Description content: levels of cellular organization	Pair	10'
	Activity: sort by levels of complexity	Individual	10'
	Cell Theory Video	Whole group	10'
	Activity: list the 3 laws of cell theory	Individual	5'
	Webquest: Scientist and cells	Individual	Home
2	Production of posters	Group	30'
	theoretical development of eukaryotic prokaryotic eukaryotes with the help of models	Whole group	20'
	Review activity: interactive activity eukaryote / prokaryote	Individual	Home
3	Reading Activity: A (eukar) B (prokar)	Individual	17'
	Information gap activity	Pair	13'
	Venn diagram	Pair	10'
	Discussion advantages and disadvantages	Individual	10'
4	Review activity	Individual	15'
	Construction of an animal/vegetable cell model in plasticine.	Group	35'
5	Prelab virtual microscope session in the ICT classroom	Individual	50'
	Draw animal/plant cell		
	Review activity microscope parts	Individual	Home
6	Description of the theoretical content of the cell cycle (the nucleus, vital functions of the cell, mitosis).	Whole group	40'
	Review activity: ordering the photographs of the different phases of the cell cycle.	Pair	10'
7	Laboratory practice: mitosis in onion root cell	Group	50'
8	Description of the theoretical content: meiosis	Ind	20'
	Activities: prepare a comparative meiosis/mitosis chart.	Pair	20'
	Biological importance of mitosis/meiosis	Whole group	10'
	Providing the self-assessment target	Individual	Home
9	Test	Ind	50'
10	Grades and reinforcement and extension activities	Individual	50'

Table 2. Timing

Session 1

Before starting the didactic unit, I want to assess the students' previous knowledge about the topic of the cell in order to create meaningful learning.

To do this, I have decided to use two different activities. First and for the students to get in touch with the topic, an icebreaker activity (Remember-LOTS) consisting of a brainstorming session using the Mentimeter tool ([link in Annex 1](#)).

The application is opened on the whiteboard, and students send their answers through their mobile phone or tablet, using a numeric or QR code. They have two minutes to provide all the terms they can remember related to the cell and its functions. At the end of the time, the terms written down will be reviewed, and those that are incorrect will be clarified.

For the second activity, I have used gamification, specifically the Kahoot tool ([link in Annex 2](#)), which is a format that students love. It consists of a short quiz of 7 questions in two different formats: multiple choice and true/false (Remember-Understand-LOTS). For its realization I have used the content of the curriculum of 3rd ESO.

The operation is similar to the previous one. The questions are projected on the digital whiteboard and students answer from their devices using an access code. They receive points for the correct answers they send as well as for the speed of their answers. At the end of the activity a ranking is generated with the best scores. For the development of these two activities, no specific adaptations are needed for student A.

Once these activities have been completed, I will make a brief presentation of the content to be seen during the following nine sessions (Figure 4). This is intended to give the student an overview of the contents to be worked on and how they relate to each other. They will be given a file with the following outline:

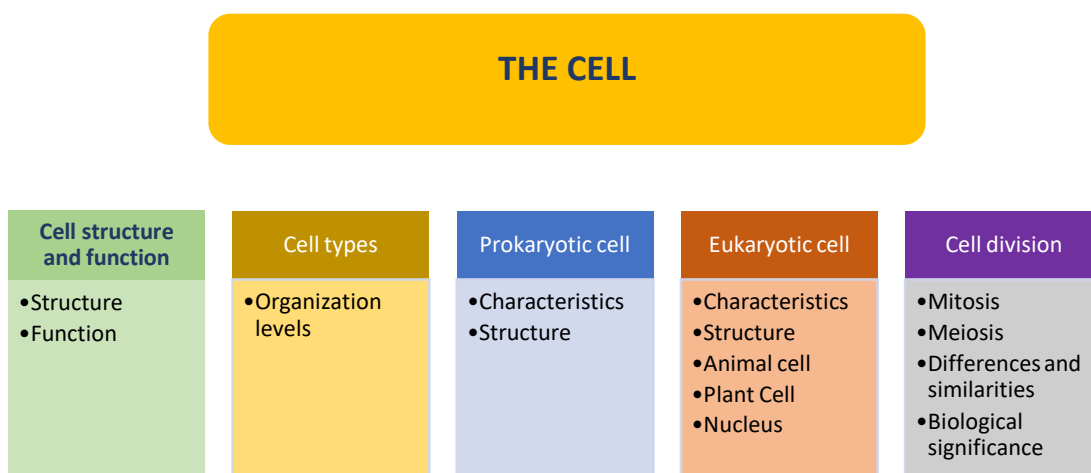


Figure 4. Organisation of the unit

Once the organization of the unit has been established, we will present the levels of organization of living beings with the help of a diagram ([see Annex 3a](#)). In the previous course they had already seen the levels of organization of the human body, so this concept will not be unfamiliar to them. To practice what they have learned, they will do a task ([Annex 3b](#)) in pairs in which they will be given a list of elements that they will have to relate the concepts to the corresponding levels of organization (Understand-LOTS).

The next step will be the visualization of a short video on cell theory on the digital whiteboard ([link in Annex 4](#)). As a measure of attention to diversity, subtitles will be used to favour the comprehension of those students with bigger problems with listening comprehension. As an accessory measure, student A will be provided beforehand with a transcription ([in Annex 4](#)) of the video so that he can follow it more easily, and the audio of the video will be connected to the Modulated Frequency system of the classroom. To consolidate what was exposed in the video, students should write the three postulates of cellular theory in their notebooks (Understand-LOTS).

As a homework activity, a small, directed research task is proposed (Analyse-HOTS). Students are numbered consecutively from one to five and are assigned the scientist to whom that number corresponds. They will be provided with an

activity sheet with the data to be collected and a series of web pages where they can find them ([in Annex 5](#)).

Session 2

We will start the session with a group activity. The aim of this activity is to elaborate a poster with the three principles of cellular theory and a card of each of the scientists who worked on the previous day and to train the linguistic competences, both CALP and BICS (Evaluate-Create-HOTS). The students will be grouped by number (all those who have the same number will form a group) and will have to summarize everything contributed by its members and capture it in a card as complete as possible. Team one will also be responsible for designing the title, while teams two, three and four will be responsible for writing the three postulates of cell theory (one per team). They will be able to summarize the main ideas and then present them to the class (they will be in charge of choosing a representative to present them). Once the poster is finished, it will be hung on the class board so it can be consulted whenever they want. No specific adaptations are planned for this activity.

The second part of the session will be a theoretical overview of eukaryotic and prokaryotic cells using models to better visualize the differences. The idea is for the students to understand the differences between the two types of cells. As an attention measure for student A I will use the FM system to talk and will not speak while writing on the whiteboard.

To go a little deeper into the content and as a preparation for the activity of the next session, the students will be provided with a link ([in Annex 6](#)) to an interactive page about cells, where they will be able to visualize the organelles and an explanation of them by clicking on them with the mouse.

Session 3

The third session begins with a reading exercise to train reading comprehension. Students will be grouped in pairs (in the manner deemed most appropriate to ensure better learning achievement). Each one will receive a different text ([in Annex 7](#)): A (eukaryotic cells) and B (prokaryotic cells).

The first part is done individually, each one reads their text and draws the cell that corresponds to them (Understand-LOTS/Create-HOTS). The second part of the activity consists of explaining it to their partner who will have to write the most important data in the notebook. Some students will be asked aloud to explain the cell that did not correspond to their text (Understand-LOTS). The third part of the activity is also developed in pairs and consists of designing a Venn diagram (template [in Annex 8](#)) in which the similarities and differences of both types of cells are marked (Understand-LOTS). The diagrams will be handed to the teacher who will correct them as part of the summative evaluation.

Session 4

We will start the session with a review activity. A table like this will be projected on the digital whiteboard and with the participation of the students, we will complete the different organelles of the cell with their structures and functions (Figure 5). As an adaptation for student A, I will use the FM system and repeat what the students answer so that he can hear it perfectly. As always, turns of speech will be respected so that communication is clearer (Understand-LOTS).

ORGANELLE	STRUCTURE	FUNCTION
Plasmatic membrane	Lipid bilayer with immersed proteins and glucides in its external part.	• Protect the cell • Regulates the entry and exit of substances

Figure 5. Table organelle: their structure and functions

This activity will support the following task, which consists of building a plasticine model of an animal and a plant cell (Create-HOTS). I will divide the students into four groups of five people in a way that is most beneficial for achieving the learning objectives. Two of them will make the plant cell and two will make the animal cell. I will show them some models to inspire them ([in Annex 9](#)). Once they finish the model, they will mark the organelles with labels made of toothpicks and cardboard.

Session 5

The next session will take place in the ICT classroom and will be a pre-lab session (Apply-LOTS). Each student will sit at a computer and using a virtual microscope tool (link [in Annex 10a](#)) will familiarise themselves with the use of the microscope and then apply their knowledge in the practice that we will carry out in the biology laboratory. The objectives of this practice are:

- Identify the parts of the microscope
- To understand the terminology used in microscopy
- To calculate the magnification settings
- Explore animal and plant cells
- Prepare to work with a real microscope

Once they have opened the tool, they will first click on the Learn tab: where they will click through the different parts of the microscope.

The second part will be to open the Explore tab: there they will have to look at the slides and draw a sketch of what they see (indicating the magnification they used). Compulsory slides:

- Plant cell
- Onion root
- Whitefish interphase
- Whitefish late anaphase
- Blood

Once they have finished, they can go to the Test tab (this activity is optional for those students who finish earlier and want to test their knowledge), alternatively, they can continue looking at microscope slides if they feel like it.

To reinforce what they have learned in the lab, I will give them a worksheet with a photo of a microscope that they will have to label its different parts ([in Annex 10b](#))(Remember-LOTS). To make the activity easier they will be given the names of the parts (scaffolding).

Session 6

During this session I will explain the eukaryotic cell nucleus, highlighting its importance as the container of DNA and describing its components. We will then go on to describe the vital functions of the cell: nutrition, relationship and reproduction, before starting with the cell division cycle. To support the explanation, graphic aids will be used to visualise the stages of the cycle in the form of a graphs ([1](#) y [2](#) in Annex 11a) and a table of contents summary ([in Annex 11b](#)). The intention is that the concepts are very clear because they will have to be used in the laboratory practice session. During the explanation as a measure of attention for student A, I will use the FM system and repeat the questions asked by his classmates if there are any.

To check if the concepts are clear, students will be given a worksheet ([in Annex 12](#)) with drawings of the different phases of mitosis in disarray and they will have to put them in order and give a brief description of the phenomenon that is happening in each one of them (understand-Apply-LOTS). The work will be done in pairs selected based on the criteria that allow for the best learning outcomes and will be handed in to be graded by the teacher.

Session 7

This session will take place in the biology laboratory and will consist of observing the phases of mitosis in an onion root. The objective of this practice is for the student to observe and interpret the figures of different phases of mitosis in plant cells and draw a scheme of each of them in their laboratory notebooks (Analyze-Evaluate-Create-HOTS). It will take place in groups of three people except for one group which will be of two. Although we will work in groups, the laboratory notebook will be handed out individually on the day of the final test. Before starting the practice, students will be reminded of the rules of the laboratory and will be given the protocol ([in Annex 13](#)) to be followed during the practice.

Before the practice, the pupils were asked to put an onion in water to make the roots grow. Orcein A and B were used as dyes to make the preparations for observation during the practical. Part of the aim of the practical is for the students

to prepare their own samples, but as time is limited, I will have an extra sample for each group ready in case a group damage theirs.

As diversity measures for student A, I will use the FM system so that he can follow the explanation, and I will include him in the two-person group to make it easier for him to communicate and give him a little extra time to prepare the task.

Session 8

This session will consist of a first theoretical part where the process of the meiosis will be explained to the students, the two process of division, results, and biological significance. I will use graphic aids projected in the whiteboard to help to better understand the concepts ([in Annex 14](#)). As diversity measures for student A, I will use the FM system so that he can follow the explanation

After the explanation, the students in pairs will have to draw up a table (Understand-LOTS) comparing the characteristics of mitosis and meiosis (example of the final product [in Annex 15](#)). They can use the textbook to complete the task. Students will be paired based on criteria that maximize learning. This task will be handed in to be corrected by the teacher.

At the end of the session, there will be a small debate in which the students will have to contribute ideas about the biological importance of mitosis and meiosis (Evaluate-HOTS). As it is one of the learning standards and it is very important that they understand it perfectly all the statements will be collected by me in a document that will then be provided to students for further study. During this activity, it is important that the students express themselves correctly using the appropriate scientific terms and respecting the turns. As a measure of attention for student A, the students stand up when they are going to make their intervention so that A can know at all times who is speaking, and it will be easier to follow the argumentation and I will repeat what they answer through the FM system for optimal reception.

As a homework activity, I will give each student a card with a self-assessment target ([in Annex 16](#)) on the contents of the unit to bring it covered on the day of the end-of-unit exam (Evaluate-HOTS) (. This target will be used to compare the

results of the test with the students' perception of their learning process and will help me to detect problems in the students' achievement of the objectives and to detect possible difficulties. In the last session, I will give the grades of the exam and will distribute reinforcement or extension activities depending on the needs of each student.

Session 9

This session of this unit is devoted to a written test (in [Annex 17](#)) combining different types of questions (multiple choice, true or false, short answer) and a couple of images to label. Students will have 50 minutes to complete the test. In addition to the content, the accuracy of the language (use of the correct terms, appropriate verb tenses, and grammatical structures) will be assessed.

Session 10

In this session, the grades will be handed out and in view of the results obtained in the test and with the data from the self-assessment target, the students will be given worksheets either for reinforcement (Remember-Understand-LOTS) ([in Annex 18](#)) in case they need to review or clarify concepts or for extension activities (Analyze-Evaluate-Create-HOTS) ([in Annex 19](#)) if it is observed that they have successfully achieved the objectives and can go a little further in their learning.

3.8 Assessment

How to measure the students' ability is one of the most complicated issues in education. This gets even more complicated when speaking of CLIL context since the knowledge of the content has to be evaluated together with the linguistics elements.

Before starting, it is necessary to define what assessment is. One of my favourites definitions is:

'the systematic basis for making inferences about the learning and development of students. It is the process of defining, selecting, designing, collecting, analysing,

interpreting, and using the information to increase students' learning and development (Erwin, 1991, as cited in Didenko 2017)'.

In CLIL programmes, it is paramount to have clear what? why? when? and how to evaluate?

According to the moment of the evaluation, we can differentiate between initial, formative and summative assessment. Every one of these types accomplishes a specific function in the learning process.

In order to offer an appropriate scaffolding, an initial assessment is a valuable tool providing teachers with information about student's prior knowledge. An initial assessment has been proved to be crucial in detecting students' lacunae and locating individual differences. For this purpose, the tools Mentimeter and Kahoot will be used at the beginning of the session 1.

When the information is used to adapt teaching and learning to adjust the learning process to student needs, we speak about formative assessment (Boston, 2002). Usually is associated with continuous evaluation and provides valuable information about students' competence. It can involve self-evaluation, and for maximal effectiveness, it has to be accompanied by detailed feedback. The instruments to be used in this formative assessment will be the following:

- Creation of a poster with information on the postulates of cell theory and the contributions of the main scientists.
- Venn diagram comparing prokaryotic and eukaryotic cells.
- Plasticine models of cells
- Worksheet on the phases of mitosis
- Laboratory notebook
- Comparison table mitosis meiosis
- Participation in debate
- Self-assessment target

Since summative assessment is carried out at the end of the learning process it is also called assessment of learning. It allows the students to show their understanding of the content and to think critically when applying their knowledge to solve problems (National Research Council, 2001 as cited in Dixon & Worrell, 2016). A final test will be carried out at the end of the unit.

3.8.1 Assessment criteria

The *Order of June 15th, 2021* establishes that the assessment will take as a reference the different learning standards included in the curriculum, as well as its development through the learning standards.

In addition, it determines that the assessment is made through continuous observation of the student's learning evolution concerning the general objectives of compulsory secondary education and the key competencies.

As assessment instruments to carry out this assessment, it proposes the use of various methods, such as questionnaires, forms, presentations, oral presentations, editing documents, tests, observation scales, rubrics or portfolios, among others, adjusted to the evaluation criteria and the specific characteristics of the students.

The following table shows the assessment criteria, the learning standards and key competencies that will be evaluated in this unit, as well as the instruments used to carry it out.

Content	Assessment criteria	Learning standard	Assessment instrument	Key Competences
The cell The cell cycle	To determine the analogies and differences in the structure of prokaryotic and eukaryotic cells, interpreting the evolutionary relationships between them.	Compare the prokaryotic and eukaryotic cell, the animal and the plant cell, recognizing the function of cell organelles and the relationship between morphology and function	- Venn diagram comparing prokaryotic and eukaryotic cells. - Plasticine models of cells	CMCT LC L2L DC

	To identify the cell nucleus and its organization according to the phases of the cell cycle through direct or indirect observation.	Distinguish the different components of the nucleus and their function according to the different stages of the cell cycle.	• Pre-Lab activity • Laboratory notebook	CMCT LC L2L DC SIE
	To compare chromosome and chromatin structure.	Recognizes the parts of a chromosome.	• Pre-Lab activity • Laboratory notebook	CMCT LC L2L DC SIE
	To formulate the main processes that take place in mitosis and meiosis and to review their biological significance and importance.	Recognizes the phases of mitosis and meiosis, differentiating both processes and distinguishing their biological significance.	• Laboratory notebook • Comparison table mitosis meiosis • Participation in debate	CMCT LC L2L DC SIE

Table 3. Assessment Unit “The cell”

3.8.2 Description of assessment

Various procedures and instruments will be used to assess the learning processes and the achievement of the objectives by the students. These evaluations will be carried out at different moments of the didactic unit (initial, summative, final) and in addition to the teacher, some will be carried out by the students themselves (self-assessment, correction of homework) or by classmates (peer correction). The following procedures will be used:

- Direct observation of students to check the evolution of their knowledge and skills and also for early detection of learning difficulties (initial and formative assessment). A variety of evaluation instruments such as the teacher's notebook or checklist will be used. Positive or negative points will be scored with a maximum value of one point on the final mark.
- Review of students' production (formative assessment):
 - Correction of notebooks (at least once per didactic unit)

- Assessment of written work (murals, worksheets, research work) and oral presentations. The most commonly used instrument will be rubrics detailing the evaluation criteria for both the content and the presentation itself.
- Exams at the end of each unit (summative assessment) to check the understanding of the contents worked on. A range of formats will be used: true/false test, multiple choice, essay questions, short answer test or label a diagram.
- Self-assessment (summative assessment): at the end of each unit, for the student to reflect on their own learning and be aware of the areas they need to improve or deepen in order to achieve the objectives of the unit. The instrument used will be a self-assessment target in which the different objectives to be achieved are formulated in the format "I can", and the student rates them from 1 to 5 depending on their degree of achievement.

To assess oral presentations and posters, I have opted for a rubric (Table 4) that takes into account the two principal aspects of the CLIL approach (content and language) and other student skills that are highly valued such as creativity, critical thinking and cooperative work, the so-called 21st-century skills.

The score is divided into five different marks from 5(excellent) to 1 (unsatisfactory), The division of the ratings into five categories allows for a detailed evaluation of the student's performance in each of the criteria described in the rubric.

Apart from creativity also the application of knowledge is taking into account when evaluating the students. I consider this especially important because represents a deeper understanding of the content.

	Criteria	5 excellent	4 good	3 satisfactory	2 almost satisfactory	1 unsatisfactory	Score
C O N T E N T	<i>Use of basic subject concepts and knowledge (what)</i>	Has acquired all the basic concepts and principles of the topic. Well structured, correct and comprehensive explanation; excellent personal evaluation.	Has acquired most of the basic concepts and principles of the topic. Generally well structured, correct and adequate explanation; good personal evaluation.	Has acquired some basic concepts and principles of the topic. Sufficient explanation, with a limited number of errors; limited personal evaluation.	Has acquired only a few basic concepts and principles of the topic. The explanation shows major deficiencies in terms of logical structuring and formulation.	Hasn't acquired any of the basic concepts and principles of the topic. The explanation is severely deficient in terms of logical structuring and formulation; no personal evaluation.	
	<i>Application of knowledge to new situations (how it relates)</i>	Has used new knowledge with confidence and creativity, applying it in an original way.	Has used new knowledge and applied it correctly in new situations.	Has used new basic concepts and applied them in simple situations.	Has used a few simple concepts and applied them when guided.	Hasn't achieved any knowledge.	
	<i>Creativity /evaluation</i>	Has shown critical thinking, creativity and initiative.	Has shown a good level of creativity and evaluation capability.	Has shown sufficient evaluation capability and sometimes original ideas.	Has not always shown sufficient evaluation ability and has presented poor creativity.	Has shown inability to evaluate and very poor creativity.	
L A N G U A G E	<i>Use of language -listening -speaking -reading -writing - interaction</i>	Consistent grammatical control and appropriate use of vocabulary. Can express him/herself with a natural flow and interact with ease.	Good grammatical control and generally appropriate use of vocabulary. Can express him/herself and interact with a good degree of fluency.	A few mistakes in grammar and vocabulary use do not lead to misunderstanding. Can express him/herself and interact with a reasonable degree of fluency.	Systematically makes mistakes in grammar and vocabulary use but the message is generally clear. Can manage the discourse and the interaction with effort and must be helped.	Systematic grammar mistakes and the narrow range of vocabulary makes the message meaningless. Communication is totally dependent on repetition, rephrasing and repair.	
	<i>Cooperative work</i>	Original and creative.	Good level of interaction.	Sufficient degree of interaction.	Partial cooperation.	Unable to work in group.	

Tabal 4. Rubric oral presentation /posters (Adapted from Assessment and Evaluation, Quartapelle, 2012.)

4. CONCLUSIONS

The didactic unit developed in this work is an example of how to integrate attention to diversity in a CLIL environment at the compulsory secondary education stage. It is mainly focused on students not only achieving the learning objectives but also developing the key competencies while learning FL in a real context to become more competent citizens.

The design has taken into account current legislation, the CLIL methodology, the different types of skills present in the classroom as well as measures of attention to diversity. The use of ICTs has been used to promote the development of 21st-century skills and make the content and learning more attractive to students. To achieve the objectives, we have used activities and tasks that progress in difficulty from LOTS to HOTS to create more meaningful learning.

To detect the specific needs of the students a variety of assessment methods and moments have been used. The main aim of this is to be able to adapt and create the materials that better suit each student.

5. ANNEXES

SESSION 1

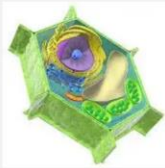
Annex 1: Mentimeter link: <https://www.menti.com/alcog5dv8b2w>

Annex 2: Kahoot link: <https://create.kahoot.it/share/previous-knowledge-the-cell/53c74a61-d0cb-4c25-86ef-45a4fa5bd04c>

Kahoot Quiz (originally designed)

What type of cell is it?

13



0 Answers

▲ Plant cell

◆ Animal cell

1/7 kahoot.it Game PIN: 2253469

What are the most important organic biomolecules?

10



0 Answers

▲ carbohydrates, mineral salts, water, proteins

◆ carbohydrates, lipids, proteins, nucleic acids

● water, carbohydrates, nucleic acids, proteins

■ mineral salts, carbohydrates, lipids, proteins

2/7 kahoot.it Game PIN: 2253469

Is photosynthesis an example of autotrophic nutrition?

14

0 Answers

True False

3/7

kahoot.it Game PIN: 2253469

What organelle is found only in the plant cell?

14

0 Answers

Nucleus Cell wall
Ribosomes Mitochondria

4/7

kahoot.it Game PIN: 2253469

Which organelle synthesizes proteins in the cell?

15

0 Answers

Golgi apparatus Ribosomes
Nucleus Lysosomes

5/7

kahoot.it Game PIN: 2253469

What is the difference between a eukaryotic cell and a prokaryotic cell?

Skip

16



0
Answers

▲ Nuclear membrane

◆ Cytoplasm

● Vacuole

■ Cell membrane

6/7

kahoot.it Game PIN: 2253469

Mitosis: a special type of cell division that only takes place in the gonads or sex organs.

Skip

14



0
Answers

◆ True

▲ False

7/7

kahoot.it Game PIN: 2253469

Annex 3a: Diagram levels of organisation

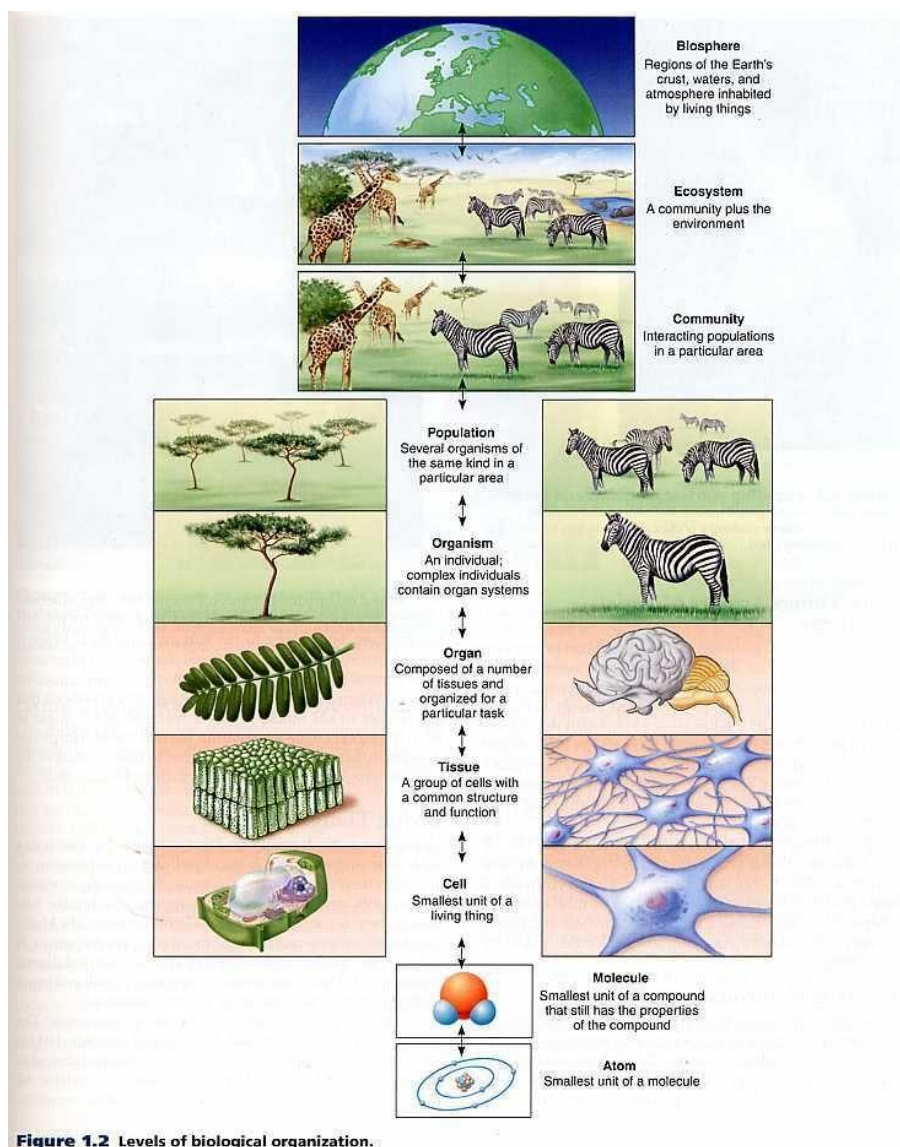


Figure 1.2 Levels of biological organization.

Source: http://desertbruchid.net/4_GB_Lecture_figs_f/4_GB_01_BiolInt_Figures_f/1_02_ed8_BioOrg_full_la.jpg

Annex 3b: Activity 1

Relate the concept to the corresponding level of organization.

1. Basic level of organization. In it we find Carbon, Hydrogen, Oxygen...
2. Associations of atoms.
3. Level of organization where the simplest living structures appear.
4. Equal cells with the same function.
5. Organs are different but all collaborate to perform the same function.
6. Living and inert matter interact at this level.
7. All individuals are equal.
8. Earth is the largest of them all.

- a) Biome
- b) Population level
- c) Ecosystem level
- d) Multicellular level
- e) Multicellular level
- f) Cellular level
- g) Molecular level
- h) Atomic level

Annex 4: Video about Cellular Theory: <https://youtu.be/4OpBylwH9DU>

Transcription: One of the great things about science is that when scientists make a discovery, it's not always in a prescribed manner, as in, only in a laboratory under strict settings, with white lab coats and all sorts of neat science gizmos that go, "Beep!"

In reality, the events and people involved in some of the major scientific discoveries are as weird and varied as they get.

My case in point:

The Weird History of the Cell Theory.

There are three parts to the cell theory.

One: all organisms are composed of one or more cells.

Two: the cell is the basic unit of structure and organization in organisms.

And three: all cells come from pre-existing bacterium.

To be honest, this all sounds incredibly boring until you dig a little deeper into how the world of microscopic organisms and this theory came to be.

It all started in the early 1500s in the Netherlands, where a spectacle maker named Zacharias Janssen is said to have come up with the first compound microscope, along with the first telescope. Both claims are often disputed, as apparently, he wasn't the only bored guy with a ton of glass lenses to play with at the time.

Despite this, the telescope soon became a hot item that every naturalist or scientist at the time wanted to play with, making it much like the iPad of its day.

One such person was a fellow Dutchman by the name of Anton van Leeuwenhoek, who heard about these microscope doohickeys, and instead of going out and buying one, he decided to make his own.

And it was a strange little contraption indeed, as it looked more like a big paddle the size of a sunglass lens. If he had stuck two together, it probably would have made a wicked set of sunglasses that you couldn't see much out of.

Anyhow, once Leeuwenhoek had his microscope ready, he went to town, looking at anything and everything he could with them, including the gunk on his teeth.

Yes, you heard right.

He actually discovered bacteria by looking at dental scrapings, which, when you keep in mind that animals didn't brush their teeth much if at all back then, he must have had a lovely bunch of bacteria to look at.

When he wrote about his discovery, he didn't call them prokaryot, as we know them today. But he called them "animalcules," because they looked like little animals to him.

While Leeuwenhoek was staring at his teeth gunk, he was also sending letters to a scientific colleague in England, by the name of Robert Hooke.

Hooke was a guy who really loved all aspects of science, so he dabbled in a little bit of everything, including physics, chemistry and biology. Thus, it is Hooke who we can thank for the term "the cell," as he was looking at a piece of cork under his microscope, and the little chambers he saw reminded him of cells, or the rooms monks slept in in their monasteries. Think college dorm rooms, but without the TVs, computers and really annoying roommates.

Hooke was something of an underappreciated scientist of his day --something he brought upon himself, as he made the discover of locking horns with one of the

most famous scientists ever, Sir Isaac Newton. Remember when I said Hooke dabbled in many different fields?

Well, after Newton published a ground-breaking book on how planets move due to gravity, Hooke made the claim that Newton had been inspired by Hooke's work in physics. Newton, to say the least, did not like that, which sparked a tense relationship between the two that lasted even after Hooke died, as quite a bit of Hooke's research as well as his only portrait was ... misplaced, due to Newton.

Much of it was rediscovered, thankfully, after Newton's time, but not his portrait, as, sadly, no one knows what Robert Hooke looked like. Fast-forward to the 1600s, where two French scientists discovered something that today we might find rather obvious but helped tie together what we now know as the cell theory.

The first scientist was Matthias Schleiden, a biologist who liked to study plants under a microscope. From his years of studying different plant species, it finally dawned on him that every single plant he had looked at were all made of cells.

At the same time, on the other end of Germany was Theodor Schwann, a scientist who not only studied slides of plants cells under the microscope and got a special type of nerve cell named after him, but also invented rebreathers for firefighters, and had a kicking' pair of sideburns. After studying animal cells for a while, he, too, came to the conclusion that all animals were made of cells.

Immediately, he reached out via snail mail, as Twitter had yet to be invented, to other scientists working in the same field with Schleiden, who got back to him, and the two started working on the beginnings of the cell theory. A bone of contention arose between them.

As for the last part of the cell theory that cells come from preexisting cells Schleiden didn't exactly subscribe to that thought, as he swore cells came from free-cell formation, where they just kind of spontaneously crystallized into existence.

That's when another scientist named Rudolph Virchow, stepped in with research showing that cells did come from other cells, research that was actually hmm.

How to put it? "Borrowed without permission" from a Jewish scientist by the name of Robert Remak, which led to two more feuding scientists.

Thus, from teeth gunk to torquing off Darwin, crystallization to Schwann cells the cell theory came to be an important part of chemistry today.

Some things we know about science today may seem boring, but how we came to know them is incredibly fascinating. So, if something bores you, dig deeper.

It's probably got a really weird story behind it somewhere.

Annex 5: Mini WebQuest: Scientist and their contributions:

1. Robert Hooke
2. Matthias Schleiden
3. Theodor Schwann
4. Rudolph Virchow
5. Anton van Leeuwenhoek

For each one of them:

- Date of Birth and Date of Death
- Contribution to Development of Theory
- Area of Work
- Location of Work
- Interesting Facts

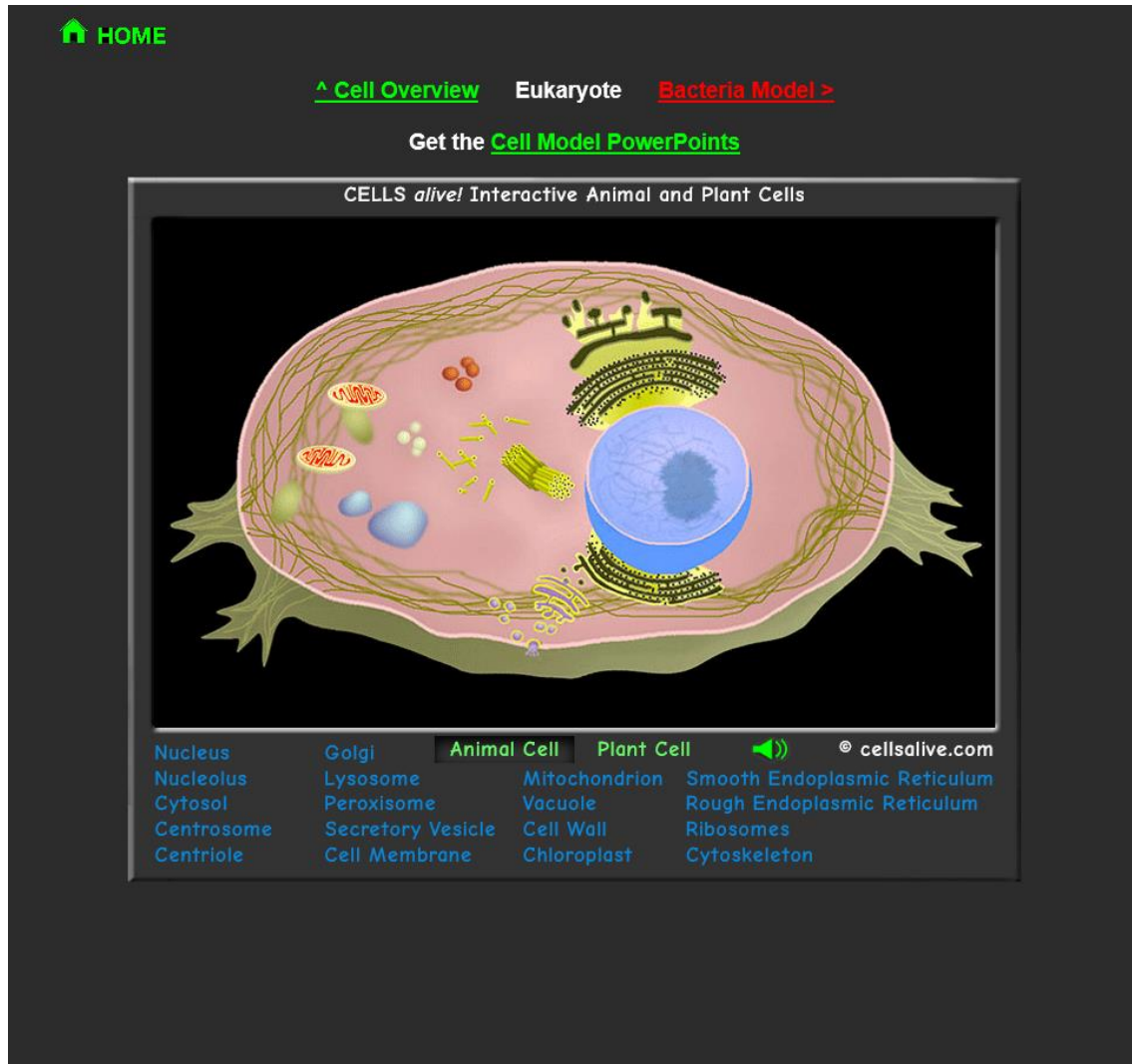
Useful links

- <https://quizlet.com/16981601/scientists-who-contributed-to-the-cell-theory-flash-cards/>
- <https://www.britannica.com/science/cell-theory>
- https://en.wikipedia.org/wiki/Cell_theory

SESSION 2

Annex 6: Review Activity link:

https://www.cellsalive.com/cells/cell_model_js.htm



SESSION 3

Annex 7: Reading Activity

STUDENT A

Eukaryote, any cell, or organism that possesses a clearly defined nucleus. The eukaryotic cell has a nuclear membrane that surrounds the nucleus, in which the well-defined chromosomes (bodies containing the hereditary material) are located. Eukaryotic cells also contain organelles, including mitochondria (cellular energy exchangers), a Golgi apparatus (secretory device), an endoplasmic reticulum (a canal-like system of membranes within the cell), and lysosomes (digestive apparatus within many cell types). There are several exceptions to this, however: for example, the absence of mitochondria and a nucleus in red blood cells and the lack of mitochondria in the oxymonad *Monocercomonoides* species.

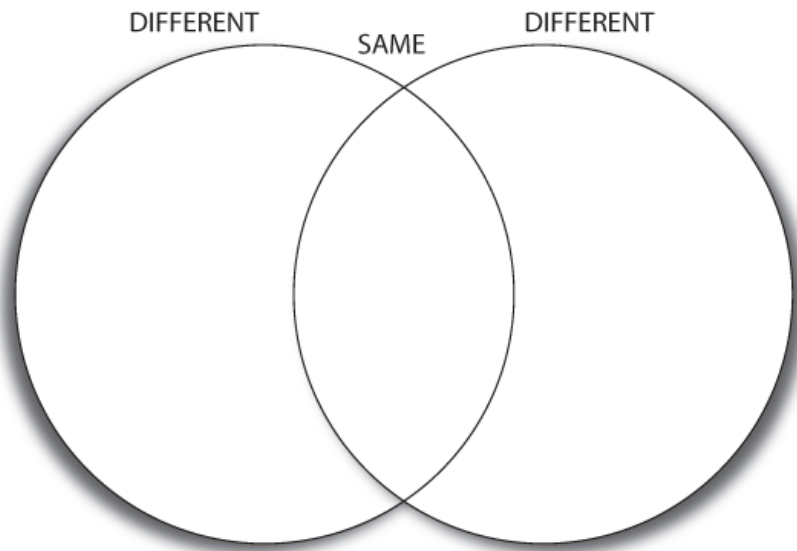
<https://www.britannica.com/science/eukaryote>

STUDENT B

Prokaryote, also spelled **procaryote**, any organism that lacks a distinct nucleus and other organelles due to the absence of internal membranes. Bacteria are among the best-known prokaryotic organisms. The lack of internal membranes in prokaryotes distinguishes them from eukaryotes. The prokaryotic cell membrane is made up of phospholipids and constitutes the cell's primary osmotic barrier. The cytoplasm contains ribosomes, which carry out protein synthesis, and a double-stranded deoxyribonucleic acid (DNA) chromosome, which is usually circular. Many prokaryotes also contain additional circular DNA molecules called plasmids, with additional dispensable cell functions, such as encoding proteins to inactivate antibiotics. Some prokaryotes have flagella. Prokaryotic flagella are distinct in design and movement from the flagella found on some eukaryotes.

<https://www.britannica.com/science/prokaryote>

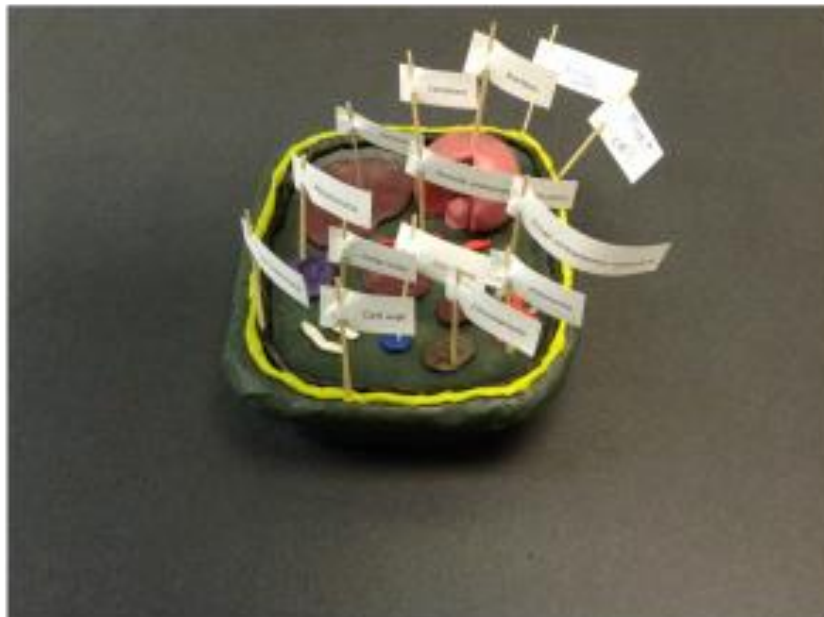
Venn Diagram



Source: <https://www.cehd.umn.edu/dhh-resources/reading/venn.html>

SESSION 4

Annex 9: Plasticine models of cells



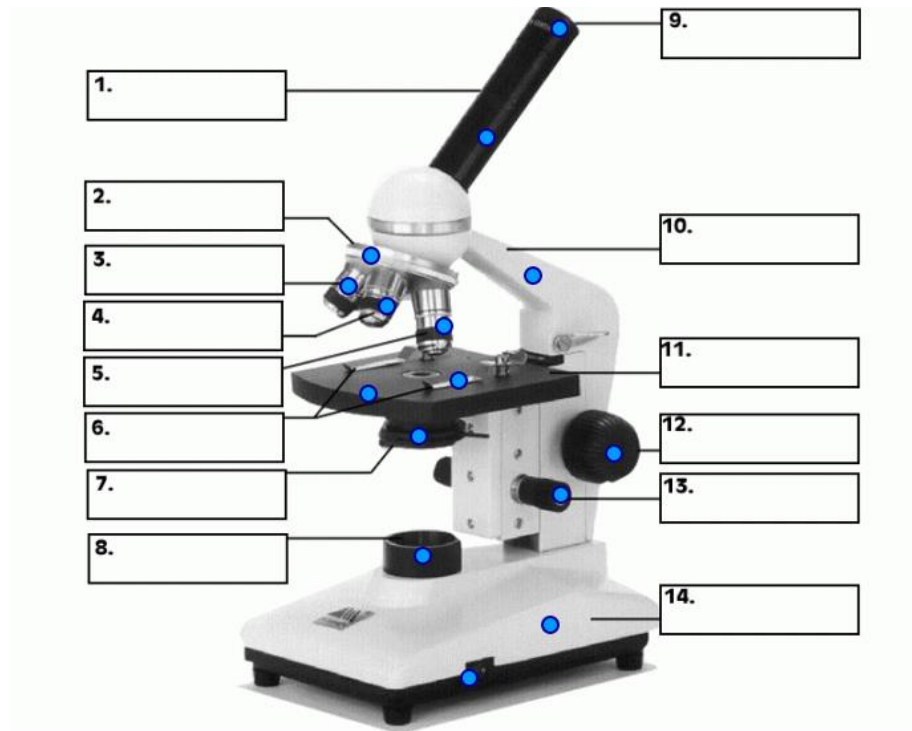
Source: <http://mrsburnham.weebly.com/cell-project.html>

SESSION 5

Annex 10a: Pre-lab practice :

<https://www.ncbionetwork.org/iet/microscope/>

Annex 10b: Label the parts of the microscope:



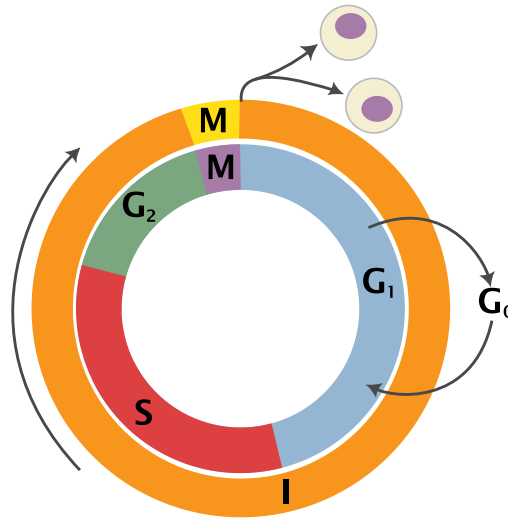
Source: https://www.biologycorner.com/worksheets/microscope_labeling.html

High power Objective/ Power Switch /diaphragm/ Low power objective/ Light Source/ Medium Power Objective/ Stage/ Clips/ Arm/ Base/ Ocular Lens (eye piece)/ Revolving Nosepiece/ Stage/ Course Adjustment Knob/ Body Tube

SESSION 6

Annex 11a

1. Graph Cellular Cycle

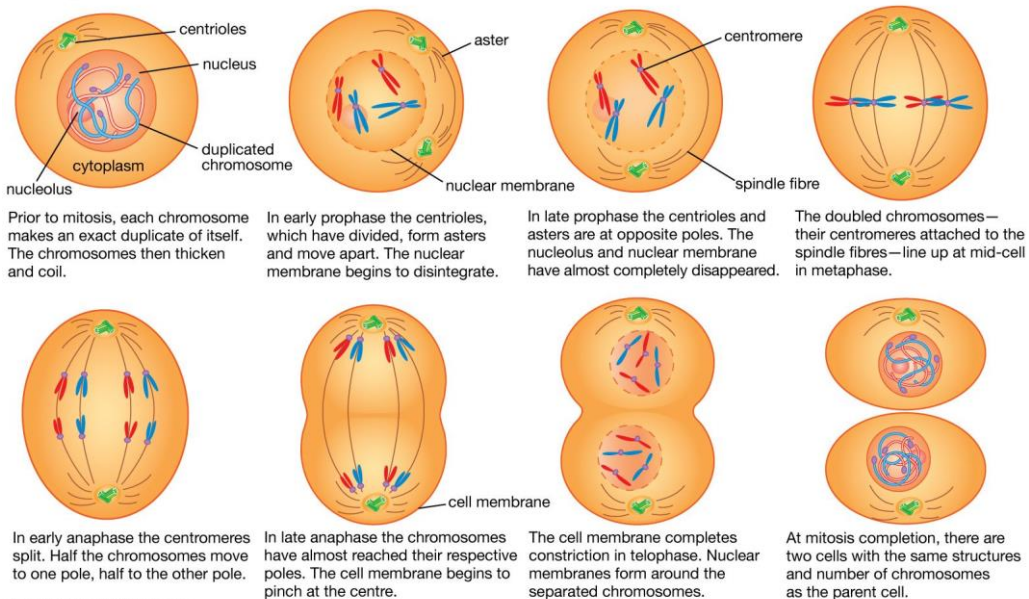


The First Gap (G₁), Synthesis (S), and Second Gap (G₂) phases make up Interphase (I). The mitotic phase (yellow M) includes mitosis (purple M) and cytokinesis. During cytokinesis two cells result. Some cells do not divide, and they enter into G₀ phase.

Source: [https://bio.libretexts.org/Bookshelves/Human_Biology/Book%3A_Human_Biology_\(Wakim_and_Grewal\)/07%3A_Cell_Reproduction/7.2%3A_Cell_Cycle_and_Cell_Division](https://bio.libretexts.org/Bookshelves/Human_Biology/Book%3A_Human_Biology_(Wakim_and_Grewal)/07%3A_Cell_Reproduction/7.2%3A_Cell_Cycle_and_Cell_Division)

2. Mitosis phases

Mitosis, or somatic cell division



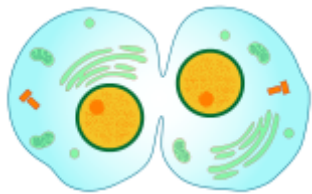
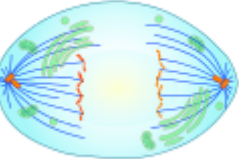
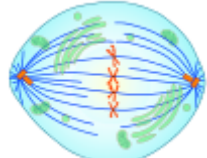
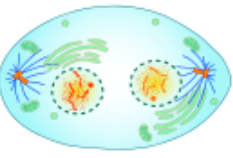
Source: <https://cdn.britannica.com/87/78587-050-A85FBB5D.jpg>

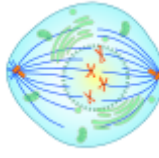
Annex 11b: Table Cellular Cycle

State	Name	Description
Quiescent Senescent	Resting phase (G ₀)	A resting phase where the cell has left the cycle and has stopped dividing.
Interphase	1st growth phase (G ₁)	Cells increase in size in G ₁ . Cells perform their normal activities.
	Synthesis phase (S)	DNA replication occurs during this phase.
	2nd growth phase (G ₂)	The cell will continue to grow and many organelles will divide during their phase.
Cell division	Mitosis (M)	Cell growth stops at this stage. Mitosis divides the nucleus into two nuclei, followed by cytokinesis which divides the cytoplasm. Two genetically identical daughter cells result.

Source: [https://bio.libretexts.org/Bookshelves/Human_Biology/Book%3A_Human_Biology_\(Wakim_and_Grewal\)/07%3A_Cell_Reproduction/7.2%3A_Cell_Cycle_and_Cell_Division](https://bio.libretexts.org/Bookshelves/Human_Biology/Book%3A_Human_Biology_(Wakim_and_Grewal)/07%3A_Cell_Reproduction/7.2%3A_Cell_Cycle_and_Cell_Division)

Annex 12: Activity: Order the stage of the mitosis and describe what happened in each one

	Order	Name	Description
			
			
			
			

	1	Prophase	First stage of cell division in both mitosis and meiosis. Beginning after interphase, DNA has already been replicated when the cell enters prophase. The main occurrences in prophase are the condensation of the chromatin reticulum and the disappearance of the nucleolus.
			

Source: https://commons.wikimedia.org/wiki/File:Mitosis_cells_sequence.svg

SESSION 7

Annex 13: OBSERVING MITOSIS IN ONION ROOT TIP

Material

- Onion roots
- Scalpel
- Burner
- Wooden tongs
- Orcein A
- Orcein B
- Pipette
- Watch glasses
- Google
- Microscope slides and cover slips
- Microscope

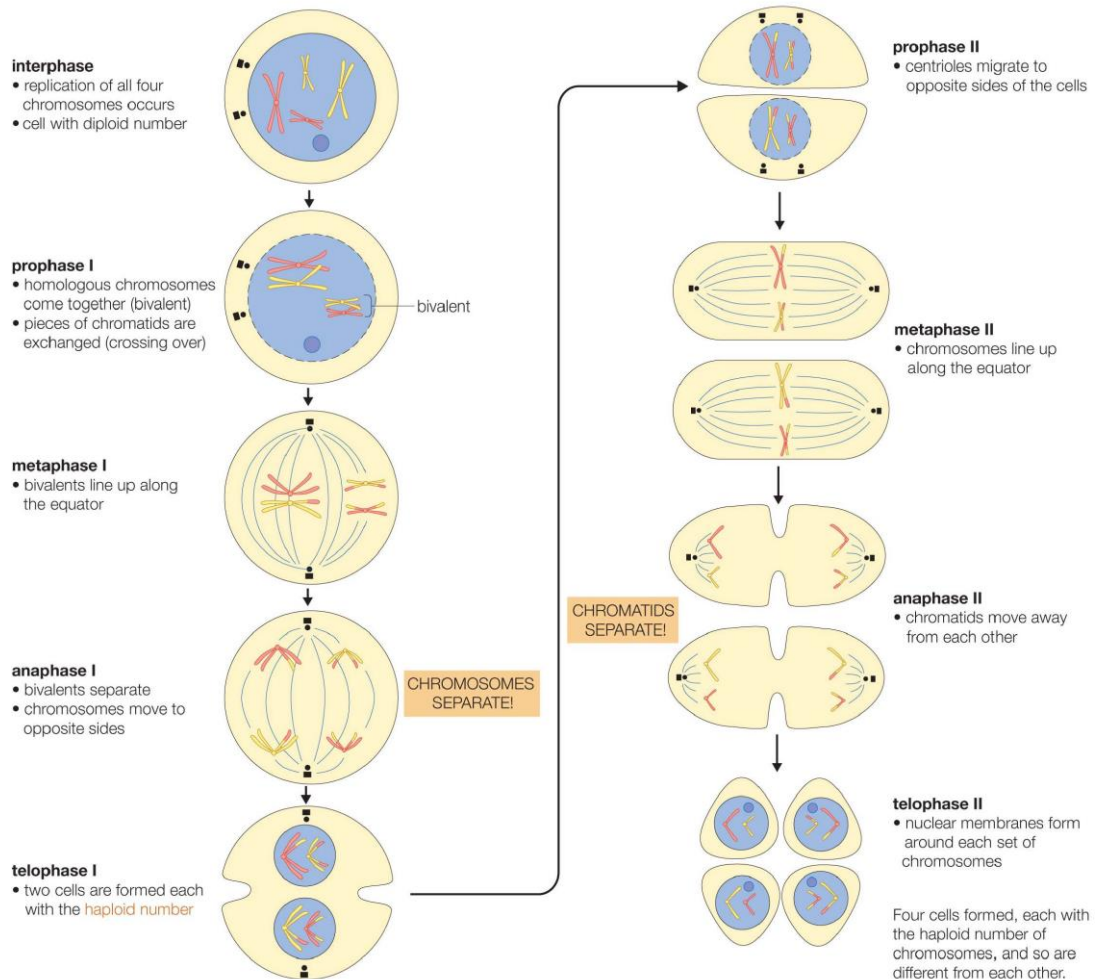
Protocol

1. Cut off about 2-5 mm root tips of some growing roots. (Choose roots tips which are white and have a firm, rounded end; tips that are turning brown will give poor results)
2. Put the root tips in a watch glass containing Orcein A, about 8 minutes. CAUTION: Orcein Ethanoic stain is corrosive, irritant, causes burns, has an irritating vapour and stains. Use eye protection and avoid contact with skin. If contact does occur, wash the area thoroughly with water for 10 minutes. Mop up spillages immediately.
3. Heat it up carefully, do not let the stain boil. CAUTION: Orcein is flammable. Watch out not to heat too much the watch glass, it can be broken.
4. Transfer one of the roots to a clean microscope slide. Add some drops of Orcein B and let it act for 1 minute.
5. Squash: Cover with a cover slip, and blot firmly with several layers of tissue or filter paper. Press gently on the coverslip with the end of a pencil. CAUTION: Too much pressure can make you spoil the whole preparation
6. View under the microscope.

Source: <https://biodeluna.wordpress.com/2010/01/14/mitosis-lab-practice-4eso/>

SESSION 8

Annex 14: Graph of Meiosis



Source: <https://www.onestopenglish.com/download?ac=61506>

Annex 15: Final product

Compare/ Contrast of Mitosis and Meiosis

Similarities	
Mitosis	Meiosis
Interphase - growth and DNA replication	Interphase I - growth and DNA replication
Prophase, metaphase, anaphase, telophase	Prophase II, metaphase II, anaphase II, telophase II
Cytokinesis	Cytokinesis

Differences	
Mitosis	Meiosis
1 cellular division with 1 DNA replication	2 cellular divisions with 1 DNA replication
Daughter cells are completely identical	Daughter cells are not identical due to crossing over
Results in 2 diploid (2n) cells	Results in 4 haploid (1n) cells
Chromosomes align in single file along metaphase plate	Pairs of chromosomes align along metaphase plate in random orientation (metaphase I)
Anaphase = identical sister chromatids are pulled apart	Anaphase I = homologous chromosomes are pulled apart Anaphase II = non-identical sister chromatids are pulled apart
Prophase = chromosomes condense only	Prophase I = chromosomes condense, synapse and non-sister

Source: <https://www.docsity.com/en/difference-between-mitosis-and-meiosis-bsci-10120/6513482/>

Annex 16: Target Evaluation for Unit *"The Cell"*. Block 1 - Biology 4th year of E.S.O.

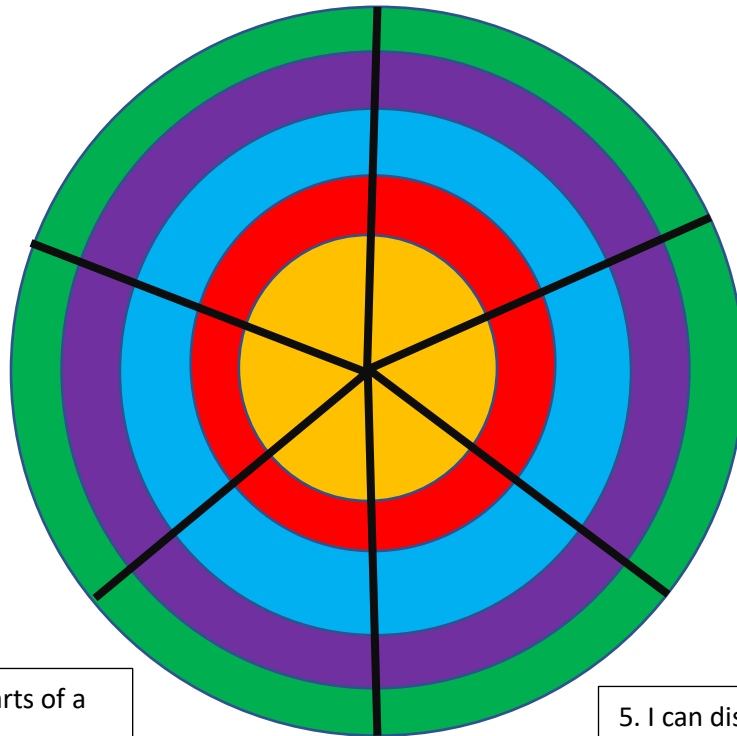
On a scale of 1 to 5- where 1 is "I know perfectly "and 5 is "I am not sure"-please rate the following assessment criteria of our unit.

2. I can recognize the phases of mitosis and meiosis.

3. I can recognise the differences between eukaryotic and prokaryotic cells.

1. I can differentiate the different organelles of animal and plant cells.

4. I can analyze the biological significance of Meiosis and meiosis.



6. I can recognize the parts of a chromosome.

5. I can distinguish the components of the nucleus and their functions according to the different stages of the cell cycle.

1

2

3

4

5

SESSION 9

Annex 17: Test of the Unit “The Cell” (4°ESO)

Surname:

Name:

Date:

1. List the principles of cell theory. (0,5 pts)

2. Define the following concepts: (1 pt)

- Cellular respiration

- Cytoplasm

- Chloroplast

- Autotrophic nutrition

3. Choose the correct answer (can be more than one): (0,75 pts)

- a) The nucleus contains
- ☐ Chromatin
 - ☐ The densest cytoplasmic part
 - ☐ The ribosomes
 - ☐ The chromosomes

b) Chromatin is:

- ☐ The inside of the nucleolus.
- ☐ The genetic material.
- ☐ Something like hyaloplasm, but in the nucleus.
- ☐ The smallest part of a chromosome

c) In which phase within interphase does the cell make final preparations to divide?

- ☐ Mitosis
- ☐ Cytokinesis
- ☐ G₂
- ☐ S

4. Draw a plant cell and label its organelles (1pt)

5. True or false (0,75 pts)

Expressions	True	False
Meiosis gives rise to 2 daughter cells.		
Metaphase is the first phase of mitosis.		
The phases of mitosis are prophase, metaphase, anaphase, telophase.		
Before the end of mitosis, the following takes place cytokinesis		
In the anaphase of mitosis the nucleolus appears		

6. Describe the differences and similarities between prokaryotic and eukaryotic cells using a Venn diagram. (1,25 pts)

7. Biological significance of the meiosis and mitosis. (1,25 pts)

8. What do these images represent? Name the phases and all the elements you recognise (1,25 pts).



Source: <https://www.blinklearning.com/coursePlayer/clases2.php?idclase=160448626&idcurso=2509926>

9. Identify the following organelles and indicate their functions. (1,5 pts)



Source: https://es.123rf.com/photo_105652723_ilustraci%C3%B3n-de-partes-de-c%C3%A9lulas-vegetales-comunes.html?vti=m2x5g031gk11lv14f-1-18

10. Describe the differences between animal and plant cells. (0,75 pts)

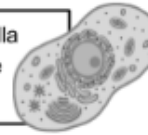
SESSION 10

Annex 18: Reinforcement activities (from Biologycorner.com)

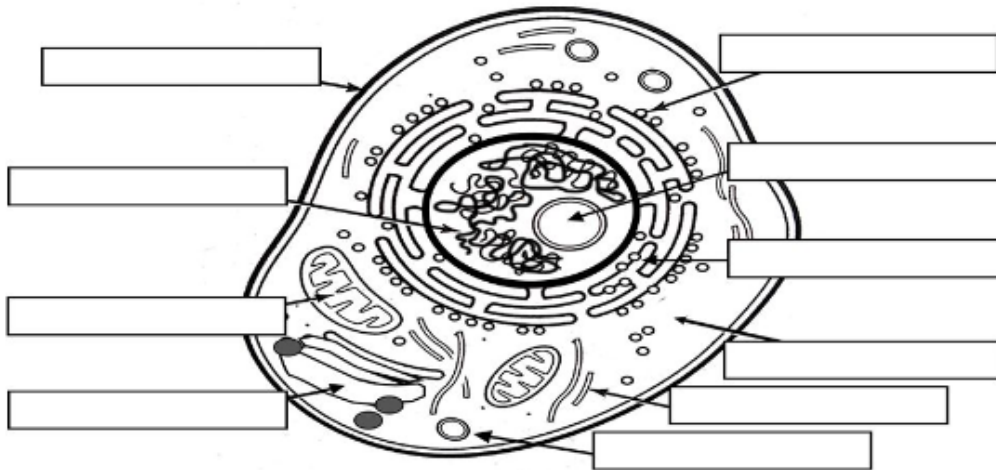
Name: _____ Date: _____

Reinforcement: Cell Structures

cilia	mitochondria	cytoplasm	cell membrane	flagella
chromatin	chloroplasts	endoplasmic reticulum	lysosomes	vacuole
vesicles	nucleolus	microtubules	ribosomes	Golgi body



1. Surrounds the cell and controls the movement of substances in and out: _____
2. Watery material that contains cell organelles: _____
3. Contains the cell's genetic material (DNA): _____
4. Transports proteins and other materials throughout the cell (can be smooth or rough): _____
5. Site of protein synthesis, many located on the ER: _____
6. Contains enzymes that break down materials (digestion): _____
7. Harvests energy for the cell; "powerhouse of the cell": _____
8. Packages and secretes products of the cell: _____
9. Secreted by the Golgi body, they carry products out of the cell: _____
10. Found in the nucleus; makes ribosomes: _____
11. Hairlike structures found on the surface of some cells: _____
12. A long, tail-like structure used for locomotion: _____
13. Structures within the cytoplasm that support and shape cell (part of cytoskeleton) _____
14. Fluid filled container used for storage; large in plant cells: _____
15. Carries out photosynthesis in plant cells: _____



www.biologycorner.com

Source: <https://www.biologycorner.com/worksheets/reinforcement-cell-structures.html>

Interactive game: <http://planeta42.com/biology/cellPuzzle/>

Annex 19: Extension activities

1. Watch the video and answer the questions:

Link to the Video: <https://youtu.be/lpAa4TWjHQ4>

Questions:

- a) What is the main cause of cancer? What other factors can cause it?
- b) What is the function of check points?
- c) What does apoptosis mean?
- d) How does chemotherapy work?
- e) What factors make it difficult to treat cancer cell

Transcription:

Today's topic is the cell cycle and mitosis. But before we get into the cell cycle and mitosis, we want to be sure to talk about why these words are important and how they relate to real life.

So, if I say the word cancer, this words probably means something to you. Either you know somebody who has been diagnosed with cancer or you've heard about it on the news. There are many different types of cancers but one thing they all have in common is that they are caused by uncontrolled cell growth. That means, someone's own cells grow out of control. Now, that doesn't mean that there aren't other contributing factors for example for some cancers having genetic links, meaning it runs in the family, can make someone more likely to develop it, or having excessive exposure to UV light for some cancers. Those are risk factors that can increase your risk. But the main cause of cancer is uncontrolled cell growth. That also means it's something that it is not contagious and that it's something that anyone can develop.

You have to realize that all the cells in your body are very busy. And they're either in one of two different phases. They are either in a phase called interphase and

during interphase they are just growing, replicating DNA, their doing their cell functions or they are in mitosis. Mitosis is a fancy word that means they are dividing; they are making new cells. If you think about the cell cycle, whether they are in interphase or mitosis, it's kind of like a pie graph. They are spending about 90% of their time in interphase.

Most of the time cells are not dividing, most of the time they are in interphase, they are growing, they're doing their daily cell functions and they are replicating their DNA. Most of the time, not dividing. Now, depending on what kind of cell, it might do mitosis more or less often; for example, your hair follicle cells, they do mitosis frequently which is why your hair can grow up to half an inch every month. But other cells like for example your brain cells, your neurons, some of them do not perform mitosis, which is why if you have some type of major injury to the spinal cord or to the brain, sometimes those do not heal very well because those cells do not replicate. So mitosis is very important to generate new cells, which can help with growth and also if you damage your cells.

If you're walking down the street and you have some kind of accident, and you skin your knee, well you're going to need to repair those damaged cells. You're going to need to be able to mitosis to repair those cells. The thing is you don't want your cells to be always doing mitosis because if their always doing mitosis, then they are always dividing and then they're not carrying out their actual function and that's a problem.

That's where check points come in handy. See, along the cell cycle there are check points to check that the cell is growing correctly and replicating it's DNA correctly and doing everything it's supposed to correctly before it divides. And what happens if the cell fails it's check point? The cell does something called apoptosis which basically means the cell destroys itself, it self-destructs. This might seem kind of harsh but actually it's really important because it ensures you don't have these cells that are messed up continue on and divide. You don't want damaged cells to continue on and divide because they might do not do what they are supposed to, they might start to grow out of control, they might not be regulated correctly. That's where cancer cells come in. See cancer cells, as we had said, are your body's own cells that are growing out of control.

So they are not following the rules of these checkpoints, they are flying past the check points going through the cell cycle and frequently doing mitosis, which means they are dividing very, very often. And so by doing that they can grow into these things called tumors which are really a mass of cancer cells. So we're not really sure what causes them to escape these check points. There are a lot of factors that a person can have that will increase their risk of this happening, but when these cells get past these check points and grow out of control, they become a problem. Because many times they can travel through the bloodstream, they started growing out of control, the body can't identify them and destroy them with the immune system and so this becomes an issue and usually one the treatments that someone with cancer will go through is called chemotherapy. And this works by targeting cells that go through the cell cycle quickly and hit mitosis quickly. And that's one reason why many people will lose their hair when they are on chemotherapy because their medication that's targeting fast growing cells and their hair follicle cells are also fast growing cells.

Cancer cells have some other factors that make them difficult to treat. One is that cancers have the ability to secrete their own growth hormone. This is very bad because growth hormone in the sense, think of it as a hormone that says, "FEED ME." What happens is the blood vessels will divert over to those cancer cells and supply the cancer cells with nutrients. This is not good because it means the cancer cells will have the nutrients they need to keep growing out of control. It also can take nutrients away from nearby healthy cells.

There are some medications that are being researched that maybe could stop the growth hormone from cancer cells and in the sense that would be great because the cancer cells would not be able to get the nutrients to grow out of control. Of course, you have to make sure the medication is targeting just cancer cells and that hurting the growth hormone of nearby healthy cells. You wouldn't want that. So it's kind of a tricky situation.

So let's recap what we talked about today. We talked about the cell cycle, how cells are more frequently in interphase than in mitosis. Interphase is when cells are replicating their DNA or their growing and carrying out cell processes. In mitosis, the cells are actually dividing. We talked about how during this cell cycle

there are checkpoints that regulate the cell and keep the cell from being able to continue on if it's damaged...unless we're talking about cancer cells which are cells that have escaped the checkpoints and are growing out of control. Be sure to check out our clip-on mitosis.

This process is really fascinating, but it's also a really important one in order to understand how your body cells work. That's it for the Amoeba Sisters, and we remind you to stay curious!

6. REFERENCES

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Legal Framework

- *Instruction 21/2022, Of July 21, Of the General Directorate Of Educational Planning And Evaluation, On The Organization And Functioning Of The Bilingual Education In Andalusian Schools For The Course 2022/2023*

- Organic Law 3/2020, of December 29, amending Organic Law 2/2006, of May 3, 2006, on Education.
- Order of August 1, 2016, amending the Order of June 28, 2011, which regulates bilingual education in schools in the Autonomous Community of Andalusia.
- Order of January 15, 2021, which develops the curriculum corresponding to the Compulsory Secondary Education stage in the Autonomous Community of Andalusia, regulates certain aspects of the attention to diversity, establishes the organization of the evaluation of the learning process of the students and determines the process of transition between different educational stages.
- Royal Decree 217/2022, of March 29, which establishes the organization and minimum teachings of Compulsory Secondary Education.
- Agreement of January 24, 2017, of the Governing Council, approving the Strategic Plan for the Development of Languages in Andalusia Horizon 2020.