

Theoretical foundations that support the teaching of microbiology in the formation of general doctors

Lilianne Dominguez Céspedes ^{1*}, Raysa Hernández Batista ², Roberto Pérez Almaguer ³

^{1*} Doctor, Specialist in Microbiology, MD in teaching Natural Science, Assistant professor, Military Hospital Dr. Fermín Valdez Domínguez, Holguín, Cuba, E-mail: lilianned40@gmail.com, ORCID (<https://orcid.org/0000-0001-7671-0189>).

² PhD in Pedagogical Sciences. Titular Profesor. Holguín University, Cuba. E-mail: raysa@uho.edu.cu. ORCID: <http://orcid.org/0000-0001-8742-1597>

³ PhD in Pedagogical Sciences. Titular Profesor. Holguín University, Cuba. E-mail: robertkeycamila@gmail.com. ORCID: <http://orcid.org/0000-0002-2641-0214>

*Corresponding author

Abstract:

The University is par excellence, the social institution with the greatest capacity to preserve, develop and disseminate culture in its broadest sense. Therefore, it is to be expected that it puts the most advanced knowledge at the service and safeguard of humanity. The research addresses the theoretical foundations that support the teaching of microbiology in higher medical education, which is its objective. **Method:** The discipline of microbiology in the training of the general practitioner is characterized as a synthesis of a preparation that allows the graduate to promote theoretical and practical skills around the microbiological content in the training of the general practitioner. **Findings:** The contents of the discipline and subject of Medical Microbiology have been published through the different study plans, and their contents are interrelated with the different subjects contained in the medical degree program. **Implications for research and practice:** However, we must deepen the treatment of practical microbiological skills during the development of the subject and thus achieve a health professional prepared to respond to the needs of society.

Keywords: Teaching, microbiology, formation, doctor, education

Introduction

The 2030 agenda for sustainable development has 17 objectives, number 4 of which is related to quality education. It is important to note that this objective has goals to meet during its application, among the goals is: to train a professional with a broad profile who meets the demands of the society in which he is trained. (Agenda 2030)

Since its inception, the Cuban Revolution has had culture, education and science among its priorities, characterised by high scientific and technical development, which shows the need to improve the comprehensive training of students who have to face the complex situation. and always changing that technological development has in store for them. Salgado (2016)

In this sense, one of the disciplines that contribute to the above is Medical Microbiology and Parasitology, authors such as Etcheverry and Nesci (2006) propose that the knowledge of microbiology belongs to that of the Natural Sciences, this type of scientific knowledge is a knowledge propositional, which is methodical because it has a method to justify the results it achieves.

Approaching the theoretical references of microbiology teaching and its role in the training of general practitioners is the object of the study of this research.

Development

Higher medical education plays an important role in achieving quality learning as the maxim of studies in the new university of the 21st century. They constitute a mediating link between the social and individual dimensions, as it is, through their educational-training actions in school life as a whole, that the student develops the skills that he or she must achieve as part of the professional

model that is being formed and in this way enriching their personal experiences, they receive scientific knowledge, the most valuable and human personal meanings and meanings related to the knowledge of the biological sciences. Cobas (2018)

Microbiology can be defined, based on its etymology, as the science that deals with very small living beings, specifically those whose size is below the resolving power of the human eye. This means that the object of this discipline is determined by the appropriate methodology, to reveal, and be able to study, microorganisms. Sosa (2011, 2014, 2019)

In the teaching-learning of Microbiology in the Medicine degree, its theoretical, practical, integrative and promotion-prevention aspects are considered. Epistemological and didactic agreements are taken into account, leading to the construction of a common space between different disciplines that make up said career. It is about bringing students closer to understanding medical facts from various dimensions. This subject can have horizontal integration (joint activity with Pathological Anatomy, Pharmacology, Practical Training and/or English) and vertical integration with basic subjects such as chemistry and clinical subjects such as infectious diseases, infectious diseases to which it is closely linked, clinical and surgical specialties. It should be taken into account that the Microbiology subject covers units of Bacteriology, Mycology, Parasitology and Virology and must be parallel to Immunology. Luciano (2019), Estrella, (2023), Céspedes, (2021)

During the deepening of various sources consulted, the teaching of microbiology was not the essence of the doctor's training process, only reference was made to some infectious diseases suffered by the primitive inhabitants, such as pellagra, yellow fever, typhoid fever, numerous parasitosis and diarrheal syndromes. Therefore, for a long time, due importance was not given to the study and deepening of this discipline during the training of medical students. Taking these elements into account, it is necessary to establish a teaching plan in the Faculty of Medicine, at the University of Havana, the only one in the country that included two subjects on hygiene and one on medical police, constituting a step forward in the development of the Teaching microbiology in Cuba. Closely related to this incipient advance, the microscope began to be used, thanks to Dr. Carlos Juan Finlay y de Barrés, who put it at the service of infectious diseases in the country. It is recognized that later new chairs appeared in the medical schools, including Bacteriology and the Pathology of Intertropical Conditions with their clinic. These chairs made the teaching of infectious disease official on the island. Arango (2010), Parte II, A. (2012), Daisy, R. G. (2010).

The evolution of this discipline constitutes an essential element to carry out the teaching of this science very much in tune with the events that are accentuated in terms of epidemiology. In the opinion of this author, it is essential to delve into how, from the teaching-learning process of microbiology at different times, there has been a reduction in the academic component that makes it difficult for the student to be able to face a quality training process.

That is why we agree with Ilizástigui (1985) (1993) that medical schools have constantly changed their curricula throughout the world and a proportional change has arisen in the organization of medical education, which has been manifested in its philosophy, in the programs, in the technologies for teaching and in the evolution of knowledge, which in the field of medical education is the consequence of the impact that scientific-technical development has on such education in the last decades of the 20th century and the first of the 21st, the organization of public health, and the progress of pedagogical sciences.

Since 1985, given the need to train health professionals in charge of comprehensive care for the population, the study plans were modified taking into account the world experiences developed during 1981 and 1982. For this purpose, it was designed a new plan based on the identification of the health problems that the medical professional had to solve to bring qualitative change in the teaching of medicine in Cuba, with the development of family medicine, in order to change the eminently biological approach, focused on the disease, towards a biopsychosocial one, with fundamental actions to promote health and prevent risks and diseases, which marked the transformation in the field of health.

As part of government actions in 1993, after the World Summit on Medical Education, held in Edinburgh, an international movement developed in search of an articulated change between medical education, medical practice and health organization that would enable the training of a

professional who responds to the socioeconomic needs of their respective countries and is capable of facing scientific and technological advances on the basis of cooperation and interrelation.

This is why the medical student constantly needs to relate concepts and integrate them, as well as retain others that are separate; Likewise, you need to learn to relate the parts, as well as synthesize or observe and see the picture in all its breadth, and this, in addition to knowledge about the form or way of learning of students, has guided the great curricular reforms that have occurred on a global scale.

In the opinion of this author, the teaching of the subject Medical Microbiology and Parasitology is essential for the student to have access to images of the different infectious agents, as well as the procedures that enable their diagnosis, since in the didactic order better learning is obtained. when the content under study is visualized and when the student manages to integrate the knowledge system in the experimental part, that is, in the microbiological laboratory, an issue that is currently very deteriorated.

The teaching of this discipline forces the teacher to make profound transformations in the field of objectives, contents, methods, methods of evaluation and technological resources used. Thus, this process must be organized so that students perceive how theoretical knowledge allows them to guide their practical activity and the latter, as a criterion of truth, gives validity. Such a perception becomes possible when students intervene, on the basis of theoretical assumptions, in the planning of experiments they carry out or when they participate in human development projects.

All of this conditions a quality teaching-learning process in this century given the transformations that have occurred in higher medical education, which constitutes a system where both teaching and learning, as subsystems, are based on developmental education, which implies an intentional communication and activity, whose didactic action generates learning strategies for the development of a comprehensive and self-determined personality of the student, within the framework of the school as a social institution that transmits culture.

These processes have a very significant influence on the design and practice of teaching Microbiology in medical students in the preclinical cycle, which demands dynamic methodological work motivated towards meaningful learning that stimulates and encourages the profession.

Characterization of the microbiology discipline in student training in the preclinical cycle of the Medicine degree.

The university as a social institution is the fruit of the entire historical-social development of humanity. Education for all throughout life is Unesco's supreme objective to characterize the new quality of education in the current era.

In this section, a characterisation of the discipline of microbiology is presented in the training of students in the preclinical cycle of the Medicine degree, from the consideration that this is a knowledge that has evolved in the implementation of the different study plans, as well as the epistemic journey on the topic which allows you to determine the following indicators:

- Analysis of the microbiology subject in the medical career in its conception of the transformed Study Plan D.
- Improvement of the subject of Microbiology with the aim of improving the study plan of the medical career, taking into account current conditions.

The training of the medical student has been one of the priorities since its inception, which has allowed in the world and in Cuba a substantial change in the training of this professional, which has been evident in its philosophy, in programs, in teaching technologies and in the evolution of knowledge, which in the field of medical education is the consequence of the impact that scientific-technical development has on such education in the last decades of the 20th century and the first of the XXI, the organization of public health, and the progress of pedagogical sciences.

In 1962, basic medical sciences began with a program integrated by areas, of a horizontal nature, which lasted 3 years and without good results. Starting in 1965, vertical integration was established in preventive and psychological aspects and new subjects were created. Later, in 1969, due to the need for care teaching development and daily teaching work, the integrated medicine plan was designed, based on the horizontal and vertical form of content integration, in which important

medical-social content and a fact appeared. of great importance was consolidated: that students attend primary health care (PHC) in polyclinics. Delgado (1990, 2004, 2008, 2009)

As part of what was happening at the international level in 1978, at the Alma Atá International Conference, the need for the development of primary health care and the strategy to meet the goal of "Health for all by 2000" was raised. Its implementation as a strategy was decisive for health systems, it represents the first level of contact and is aimed at solving the specific health needs and problems of the population.

Starting in 1985, given the need to train health professionals in charge of comprehensive care for the population, the study plans were modified taking into account the world experiences developed during 1981 and 1982. For this purpose, a new plan based on the identification of the health problems that the medical professional had to solve to bring qualitative change in the teaching of medicine in Cuba, with the development of family medicine, in order to change the eminently biological approach, focused on the disease, towards a biopsychosocial one, with fundamental actions to promote health and prevent risks and diseases, which marked the transformation in the field of health.

In 1993, after the World Summit on Medical Education, held in Edinburgh, an international movement developed in search of an articulated change between medical education, medical practice and health organization that would enable the training of a professional who would respond to the socioeconomic needs of their respective countries and was capable of facing scientific and technological advances on the basis of cooperation and interrelation.

The medical university is necessary to train doctors with a broad profile, with a deep mastery of the basic and essential elements of the profession and capable of solving on the basis, in an active, independent and creative way, the most general health problems. That is why medical education in Cuba is based on a series of principles resulting from the interaction of those that govern the educational and public health systems. On the other hand, the organization and curricular design are based on the principles of linking theory with practice and study with work.

The continuity of improvement of the professional of the medical career has been energized with the consecutive changes in the different study plans which have been characterized by the gradual introduction of elements of the microbiological knowledge system, with the purpose of raising the scientific level and theoretical knowledge of this professional and the development of his theoretical-practical skills.

From the improvement of the medical career study plan in 2010 and until 2015 as part of the D study plan, precisely in the preclinical cycle it focused on the introductory stay of Society and Health and this underwent two improvements that become "Introduction to Comprehensive General Medicine". In the opinion of this author, this improvement did not achieve the effective fulfilment of the objectives proposed in the professional model since the subject of Microbiology and medical parasitology is integrated into the Morphophysiology discipline that analyzed subjects such as Anatomy, Embryology, Histology, Biochemistry and Physiology in the University Polyclinic and only in the fourth year of the degree they received a Hygiene and Epidemiology subject, so at this point, the student only had background on microbiological content at a theoretical level without mastering practical microbiological skills as a complement. of the academic and research component.

However, multiple factors have shown that this conception of the professional model does not satisfy the educational and training intentions for which the training of the medical career professional is called, including those related to how to prepare this professional in the field, preclinical cycle for treatment with microbiological content with emphasis on practical microbiological skills.

The essence of the criticism points out that it is recognized that the work of the subject must be perfected, and this professional has an important role; however, from the professional problems and objectives of the model, this purpose is not explicitly recognized.

At the same time, in 2011, the VI Congress of the Communist Party of Cuba was held, where the Guidelines of the Economic and Social Policy of the Party and the Revolution were approved. They declare, among other aspects, to continue the improvement of education (Guideline 143); increase the rigor and effectiveness of the educational teaching process to increase the efficiency of the school year (Guideline 151); and update training and research programs in universities based on the

economic and social development of the country and new technologies (Guideline 152). Higher medical education does not escape from this. That is why, in 2014, Study Plan D began to be implemented, among the elements that characterize it is that "In the teaching-learning process, traditional didactics prevails, using methods, means and organizational forms that do not favour the active role of students in their training process". Minsap (2014)

One of the fundamental premises of this study plan is the continuous increase in quality in the training process, an aspect in which we must continue working because, throughout the entire training process of the medical career student, greater attention is paid to attention in the preclinical cycle, to the theoretical component and the practical part is not established from the class as occurs in the development of the subject of microbiology and medical parasitology.

Precisely in the preparation of this study plan divided into years and semesters, the subject of Microbiology and Medical Parasitology is located in the second year, fourth semester with a total of 90 hours and a duration of 15 weeks, it contributes to the interpretation of the processes infectious diseases as socio-biological phenomena, to the indication and rational use of technological means for the diagnosis of diseases and to control and prophylaxis.

Among its general objectives is to carry out the indications and orientation of sample collection, for microbial, parasitic and immunology examinations, most common in human pathological processes, in hygienic-sanitary alterations of the environment, relating them to the sources and guiding conservation and transportation of said samples, practicing adequate communication between the doctor directly caring for the patient and the staff of the Microbiology and Parasitology Laboratory. Zuazo (2001)

An aspect that in the author's opinion is not achieved during the development of the subject as the training of skills is simplified microbiological practices with emphasis on laboratory work, in the new epidemiological conditions that the country is going through.

Another element is the need to work with the skills that strengthen the adequate application of the clinical method. During the development of the subject, which is part of its thematic plan of the 90 hours provided for in its VI topics, only 9 hours of classes are dedicated to work in the laboratory and of them 2 hours of classes are dedicated to the topic of medical virology of great importance in the current moments.

Therefore, a greater number of hours are required for work in the microbiological laboratory and thus be able to complete objective number 7 of the subject and materialize the research function within the model of this professional related to the application of the scientific method through clinical and epidemiological method, with a social focus, in the identification and solution of health problems in people, families, groups and communities assigned for their care and participation in the analysis of the Health situation as a scientific, methodological instrument, application, with the basic work team and the community, to identify, prioritize and solve community health problems.

On the other hand, when analyzing the system of skills to be developed by this professional as part of their training model, they are grouped into:

General skills, Profession-specific skills, Promotion and prevention skills, Medical diagnostic skills, Medical treatment and rehabilitation skills, Skills linked to environmental health, Skills in relation to medical-legal aspects.

In the opinion of the author, there is a fundamental cause that prevents the student's performance during the development of the subject in the preclinical cycle and it lies in the fact that there is no correspondence between the objectives of the discipline-the skills provided in the professional model and therefore consequence is not made explicit among the objectives of the year, hence the work that must be directed so that the medical career student in the preclinical cycle develops practical microbiological skills that allow him to fulfill the objectives of the subject Microbiology and Medical Parasitology very in tune with the development of this science in the 21st century.

Conclusions

The teaching of microbiology in the world and mainly in our country plays an important role in the training of the general practitioner. The contents of the discipline and subject have been output through the different study plans in the subjects related to Morphophysiology and Microbiology and Medical Parasitology. However, the treatment of practical microbiological skills does not constitute

a potential during the development of the subject and therefore is not explicitly recognized in the academic conception of the curriculum.

BIBLIOGRAFÍA

1. Agenda 2030 para el desarrollo sostenible <http://www.sela.org/media/2262361/agenda-2030-y-losobjetivos-de-desarrollo-sostenible.pdf> (consultado agosto 2016)
2. Arango Rave Ángela. (2010). Evolución histórica de la Microbiología y el Bioanálisis en Colombia. *Hechos Microbiológicos*, 1 (1), 93-100. Recuperado a partir de <https://revistas.udea.edu.co/index.php/hm/article/view/5228>.
3. Céspedes, L. D., & Fonseca, Y. M. C. The Relationship Between Microbiology as a Science and the Microbiology Subject. https://www.researchgate.net/profile/Evelyn-Fatokun-3/publication/357344504_Antibiotic_Susceptibility_Profile_of_Bacterial_Isolates_from_Commercial_Poultry_Farms_in_Ile-Ife_Nigeria/links/61f2a1c8dafcdb25fd55b729/Antibiotic-Susceptibility-Profile-of-Bacterial-Isolates-from-Commercial-Poultry-Farms-in-Ile-Ife-Nigeria.pdf?_sg%5B0%5D=started_experiment_milestone&origin=journalDetail&rtd=e30%3D
4. Cobas V. M. La universidad cubana y su vinculación con la sociedad por el desarrollo sostenible. *EDUMECENTRO*. 2018; 10 (2): 1 -5. [Citado 20 de septiembre 2021] Disponible en: <http://www.revedumecentro.sld.cu/index.php/edumc/issue/view/45>
5. Daisy, R. G., Zuazo Silva, J. L., Macola Olano, S., & Prieto Márquez, G. A. (2010). Aprendizaje y consolidación de la asignatura de microbiología y parasitología médicas en la carrera de medicina. *Revista Habanera de Ciencias Médicas*, 9(1), 0-0. http://scielo.sld.cu/scielo.php?pid=S1729-519X2010000100014&script=sci_arttext
6. Delgado, G. Desarrollo histórico de la enseñanza médica superior en Cuba desde sus orígenes hasta nuestros días. *EducMedSuper* [Internet]. 2004 [citado 28/11/2018];18(1). Disponible en: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0864-21412004000100007&lng=es
7. Delgado, G. El Plan Varona y el desarrollo de la enseñanza superior de la medicina en Cuba. *CuadHist Salud Pública* [Internet]. 2008 [citado 28/11/2018];(103). Disponible en: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0045-91782008000100015&lng=es
8. Delgado, G. Historia de la enseñanza superior de la medicina en Cuba. *CuadHist Sal Pub*. 1990;(75).
9. Delgado, G. Planes de Estudio de Medicina vigentes en la Universidad de la Habana de 1899 a 1958. *CuadHist Sal Púb* [Internet]. 2009 [citado 22/11/2012];105. Disponible en: http://bvs.sld.cu/revistas/his/his_105/histo2.htm
10. Estrella, B. R., Luis Rafael, C. G., Delys Zenia, A. G., Niurka, C. G., & Aliuska, C. M. (2023, October). MICROBIOLOGÍA Y PARASITOLOGÍA MÉDICA. RETOS Y EXPERIENCIAS EN TIEMPOS DE COVID-19. In *CIBAMANZ-2023*. <https://cibamanz.sld.cu/index.php/cibamanz/2023/paper/viewPaper/601>
11. Ilizástigui F. *Salud, Medicina y Educación Médica*. La Habana: Ed. Cien. Med; 1985.
12. Ilizástigui, F. Educación en el trabajo como principio rector de la educación médica cubana. *Actas del Taller Nacional "Integración de la Universidad Médica a la organización de salud: su contribución al cambio y al desarrollo perspectivo"*. La Habana: MINSAP; 1993.
13. Luciano, M. Microbiología: desafío en la enseñanza-aprendizaje en la formación del médico. *Rev. Méd. RosaRio* 85: 128-137, 2019.
14. Ministerio de Educación Superior en Cuba. Documento Base para la elaboración de Planes de estudio "D". Septiembre / 2014.
15. Ministerio de Educación Superior en Cuba. Planes del proceso docente. Planes de estudio "D" Perfeccionados. 2014.

16. Minsap. (2014) Programa de la asignatura Microbiología y Parasitología Médicas, Universidad de Ciencias Médicas de la Habana. Comisión Nacional de Carrera de Medicina. Ciudad de La Habana, Cuba.
17. Parte II, A. (2012). Microbiología y parasitología médicas. <http://www.uvsfajardo.sld.cu/category/asignatura-curso-o-especialidad/microbiologia-y-parasitologia-medicas?page=5>
18. Sosa Díaz RY, Fernández Rodríguez CJ, González Giradles R, Arana Graciaá RM. La Microbiología: historia e inserción en los planes de estudios de la Carrera de Medicina en Cuba. Rev Méd Electrón [Internet]. 2014 Ene-Feb [citado: fecha de acceso]; 36(1). Disponible en: <http://www.revmatanzas.sld.cu/revista%20medica/ano%202014/vol1%202014/tema12.htm>
19. Sosa Y. Apuntes históricos y cronológicos de los Planes de estudio de la Educación Médica en Cuba. Rev Méd Electrón [Internet]. 2019 Ene-Feb [citado: fecha de acceso];41(1). Disponible en: <http://www.revmedicaelectronica.sld.cu/index.php/rme/article/view/3021/4162>
20. Sosa Y. Reflexiones sobre el programa de la asignatura Agentes Biológicos, de la carrera de Medicina. Rev méd electrón [Seriada en línea] 2011;33(2). Disponible en URL: <http://www.revmatanzas.sld.cu/revista%20medica/ano%202011/vol2%202011/tema12.htm> [consulta: marzo 2020]
21. Zuazo, J. La muestra para estudio microbiano. En: Microbiología y Parasitología Médicas. Llop y otros. Editorial de Ciencias Médicas; 2001. p. 152-167