

MODULE DESCRIPTION (ANALYTICAL PROGRAM).

1. Module Information Code:	
• Name of the Institution and School	Universidad Autónoma de Nuevo León, School of Medicine
• Name of the Learning Unit	Embryology
• Total classroom hours for theory and/or practice.	140 hours
• Total extra classroom hours	70 hours
• Course Modality	Schooled
• Type of academic period in which the module is offered	1st semester
• Type of Learning Unit in the Curriculum	Compulsory
• Curriculum area:	ACFB Basic
• UANL credit points	7
• Date of module creation:	February 17, 2014
• Date of last amendment:	August 6, 2020
• Person(s) responsible for the module design and amendments:	Dr. med. Norberto López Serna
2. Introduction	
The module of Embryology is part of the Morphological Sciences which are taught to the students during the first year at the Bachelor as Medical Surgeon and Obstetrician. It belongs to the ACFB Basic area, and it offers the student an outlook on the development the conception's product has since the moment of fertilization to the very birth, considering morphological aspects as well as the molecular and genetic ones that take part in such process. At the same time, it analyzes variations on the normal development patterns of an individual or individuals (in case of a multiple pregnancy), their causes, as well as the reasons which produce the congenital defects and will frequently have to be detected by the future health professional during his clinical practice. It also studies the placenta's formation and destination, the gestation annexes, as well as the abnormalities which show up more frequently in these. To achieve all these mentioned aspects, this Learning Unit has been divided in 5 stages: basic concepts, from gametogenesis to fecundation, development of the embryo, placentation, and development of organ systems.	

3. Purpose(s)

This learning unit provides scientific basis and the development of the competences needed to integrate knowledge regarding to Human Embryology. In this way, the graduate student will be able to explain the etiology and morphological mechanisms that the most common congenital abnormalities have, using scientific vocabulary properly to communicate with the rest of the health center team. All these will be done practicing professional and ethical values. As part of the curriculum map, Human Embryology is a module which is related to: 1) Human Anatomy, because Human Embryology provides the students a comprehensive vision on how the human body is formed before birth, which is essential to understand an adult's anatomy; also, with 2) Cell and Tissue Biology because it provides the knowledge needed to understand the microstructures and cell mechanisms which give support to the morphological development from the conception's product; with 3) Biochemistry, too, because students require from this knowledge to understand the molecular mechanisms which originate life from the conception's product and control the subsequent development; with 4) Molecular Biology, which provides knowledge regarding the genetic mechanisms which give place to morphological events during the conception's product development. Likewise, Human Embryology gives sense to the knowledge acquired at Molecular Biology.

The learning unit is related to the general skills because they promote autonomous learning, the use of formal language, information technologies, and collaborative learning and work. In an important way, the learning unit establishes in the student that one of the ethical values that all graduate general practitioners from UANL must have is having respect for the conception's product life.

Regarding to the specific skills, the learning unit provides basic knowledge so that students, through the use of scientific thinking and a holistic approach, can identify the normal development of the conception's product, as well as the clinical signs of congenital malformations and their causes (health-disease relationship, interaction between man and physical environment).

4. Competences of the graduate profile

a. General competences contributing to this learning unit.

Instrumental skills:

1. Apply autonomous learning strategies in the different levels and fields of knowledge that allow them make appropriate and relevant decisions in the personal, academic and professional fields.
2. Use the logical, formal, mathematical, iconic, verbal and non-verbal languages according to their stage of life, in order to understand, interpret and express ideas, feelings, theories and streams of thinking with an ecumenical focus.
3. Use the information and communication technologies as access tools to information and its transformation in knowledge, as well as for learning and collaborative work with cutting-edge techniques that allow its constructive participation in society.

Personal and social interaction skills

9. Maintain an attitude of commitment and respect towards the diversity of social and cultural practices that reaffirm the principle of integration in

the local, national and international context with the purpose of promoting environments of peaceful coexistence.

11. Practice the values promoted by the UANL: truth, equality, honesty, liberty, solidarity, respect for life and anyone's, peace, respect for nature, integrity, ethics behavior and justice, within their personal and professional environment in order to make a sustainable society.

Integrative skills

13. Take the lead according to social and professional needs to promote relevant social change.

14. Resolve personal and social conflicts in accordance with specific techniques in the academic field and their profession for the proper decision making.

b. Specific competences of the graduate profile that contributes to the learning unit

Scientific Base of Medicine

1.- To use the scientific foundations of medicine by considering the economical, psychological, social, cultural and environmental factors which contribute to the development and evolution of diseases in order to make decisions and take medical actions.

Professional Clinical Practice

2.- To solve clinical problems through deductive reasoning, interpretation of findings and the definition of their nature in order to make decisions and determine principles of actions of the medical practice to be followed in a responsible way, impacting individual and collective health.

Critical thinking and research

7.- To apply the scientific method in the resolution of medical problems with an innovative, analytical and self-critical attitude toward the prevention, diagnosis and treatment of diseases.

Professional Values and Ethics

8.- To integrate professional values and ethics in medical practice, without distinction as to gender, race, political or sexual preference,

religious beliefs, activities performed, disabilities or socioeconomic status; promoting social inclusion and contributing to the population's well-being, its quality of life and human development.

9.- To respect patient's integrity by keeping his medical information as an essential part of the professional secrecy in order to guard his rights.

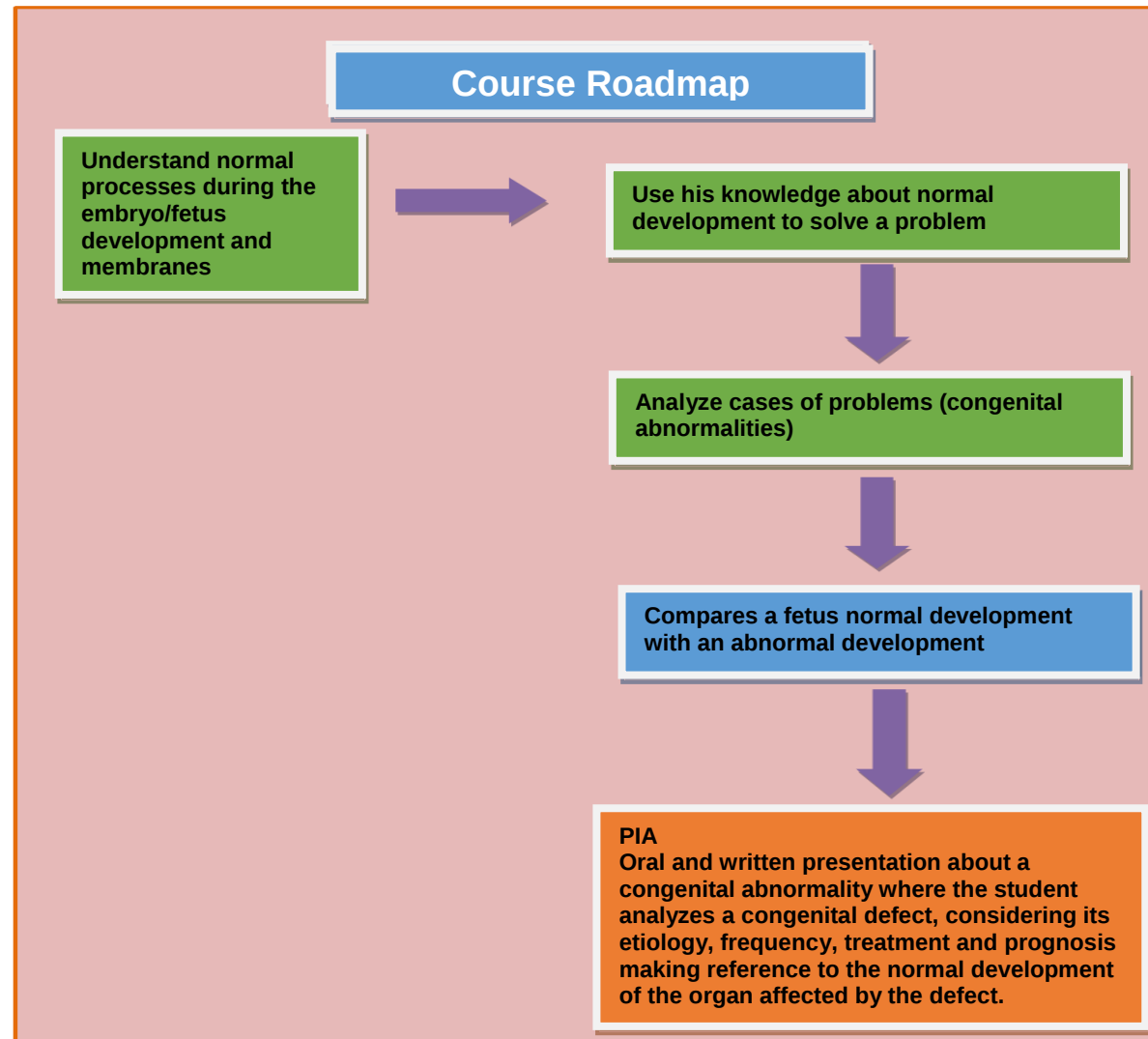
Organizational work

10.- To promote an organizational work culture in the health field, acknowledging the multidisciplinary work, the respect for institutional policies and the observance of rules in order to contribute to a comprehensive treatment of patients.

Communication

11.- To apply the principles of effective communication by establishing a respectful and empathetic relationship with the patient, relatives, the community and other health professionals in order to use the information properly.

5. Course roadmap:



6. Structuring into stages or phases

Phase 1. Basic Concepts

Component(s) of the competence:

Recognizes the different normal and abnormal development processes as well as the structures location and movement, applying basic concepts from Human Embryology in order to use the embryo terminology correctly and time-space location.

Evidence of student learning	Performance Criteria	Learning activities	Contents	Resources
Resolution of a case on congenital abnormalities.	Identifies correctly the embryological terminology. Recognizes and interprets embryonic structures in images or through the use of a microscope. Correctly synthesizes the embryonic development of tissues and organs. Develops the embryological perspective for its application in the clinical area. Applies the knowledge acquired correctly. Presents the complete assignment and it has the suggested structure or format (introduction, body and conclusions).	Facilitation activities Exposition in class, case discussion, embryonic images analysis during plenary sessions. Learning activities Written report about readings on cell division. Elaboration of concept maps with anatomy terms of position, development mechanisms, and cell division. Content analysis through the use of images and cases of congenital abnormalities. Class exposition on the normal and abnormal development, as well as the location and movement of structures.	Conceptual Content: Anatomical terminology related to position and movement. Anatomical terms of position: • Cephalic (ad) • Caudal (ad) • Ventral (ad) • Dorsal (ad) • Medial (ad) • Lateral (ad) • Embryo axes DEVELOPMENT MECHANISM • Potency • Restriction • Determination • Cell differentiation • Induction • Apoptosis • Cell migration	• Medschool Classrooms • Textbook • Images • Histological sections • Embryonic models • Microscope • Digital platform • Videorecordings • Embryology museum • Embryology Laboratory • Reference books • Manual (workbook) • Electronic references

	Includes the elaboration of a diagnostic and images. Uses Arial 12 as font in the assignment.	Revision of embryonic sections with a microscope. Self-evaluation through an analysis and interpretation of images from anatomy terminology	CELL DIVISION • Diploid, haploid, euploidy and aneuploidy cells: prophase, metaphase, anaphase and telophase. • Mitosis: prophase, metaphase, anaphase and telophase. • Meiosis: Reduction of chromosomes, exchange of genetic material. LABORATORY TECHNIQUES MORE USED IN EMBRIOLOGY • Histological section: - Hematoxylin and eosin stain, - Masson's trichrome stain, - Argentaffin impregnation, toluidine blue stain • Dawson's clearing technique. • Pap test. CONGENITAL ANOMALIES • Definition and morphological classification: malformations, alteration, deformity, syndrome, association and	
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			sequence. • Etiological Classification • Genetic factors • Alteration of chromosomes number: aneuploidy y polyploidy; • Nondisjunction: Down syndrome, Klinefelter syndrome. Turner syndrome). • Environmental factors. • Biological factors: Viruses (rubella, varicella), and bacterial (syphilis). • Chemical factors. • Drugs (thalidomide, anticonvulsant, antibiotics, vitamins and hormonal); alcohol. • Physical factors: radiation. • Gestational diabetes. Procedural content: • Uses the photonic and stereoscopic microscope correctly • Structure information hierarchically • Schematize . • Apply concepts to diagnose a congenital abnormality Attitudinal content : • Self-study habits. • Discipline	
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			• Respect to human material • Take care of the educational facilities • Respect among peers. • Respect for professors, acholarship assitants, and administrative personnel. • Correct use of language. • Wear properly the laboratory coat. • Development of creative thinking.	
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Phase 2: From gametogenesis to fecundation				
Component(s) of the competence: Analyze the fecundation process through a correct integration in time of the involved elements in it to establish optimal conditions for pregnancy.				
Evidence of student learning	Performance Criteria	Learning activities	Contents	Resources
Resolution of a clinical case on fecundation	Identifies correctly the embryological terminology. Recognizes and interprets embryonic structures in images or through the use of a microscope. Correctly synthetizes the embryonic development of tissues and organs. Develops the embryological perspective for its application in the clinical area. Applies the knowledge acquired correctly. Presents the complete assignment and it has the suggested structure or format (introduction, body and conclusions). Includes the elaboration of a diagnostic and images. Uses Arial 12 as font in the assignment.	Facilitation activities Exposition in class, case discussion, analysis of reproductive organs images, gametogenesis, menstrual cycle, and fecundation during plenary sessions. Learning activities Content analysis through the use of images and clinical cases. Elaboration of concept maps about the fecundation process. Written report about readings on the menstrual cycle. Revision of embryonic sections with a microscope. Self-evaluation through an analysis and interpretation of images of gametogenesis	Conceptual Content: REPRODUCTIVE SYSTEM ORGANS: • Male • Female GAMETOGENESIS • Origin of germ cells • Spermatogenesis and its hormonal control • Morphological characteristics and morphological anomalies of normal sperm. • Oogenesis and its hormonal control. • Characteristics of the ovum and its difference with sperm. • Morphological characteristics of the gametes and the difference between sperms and ova. MENSTRUAL CYCLE (SEXUAL) • The hypothalamus–pituitary-gonadal axis. • Ovarian cycle	• Medschool Classrooms • Textbook • Images • Histological sections • Embryonic models • Microscope • Digital platform • Videorecordings • Embryology museum • Embryology Laboratory • Reference books • Manual (workbook) • Electronic references and

			• Ovary follicle maturation and it hormonal control. • Luteal phase • Endometrial cycle • Proliferative phase • Secretory phase • Menstruation FECUNDATION • Total sperm count in ejaculate. • Fecundation phases • Germ cells transport • Fertilization process • Cortical and zona reactions • Pronucleus phase • Amphimixis • Oocyte activation Procedural content: • Uses the photonic and stereoscopic microscope correctly • Analysis and synthesis of information • Elaborations of concept mas, summaries, schemes, etc. • Apply concepts to diagnose a congenital abnormality Attitudinal content: • Self-study habits. • Discipline • Respect to human	
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			material • Take care of the educational facilities • Respect among peers. • Respect for professors, acholarship assitants, and administrative personnel. • Correct use of language. • Wear properly the laboratory coat. • Development of creative thinking.	
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Phase 3: Development of the embryo				
Component(s) of the competence : Analyze the morphogenesis of the embryo and its annexes since its first stages until the last of the embryonic period, to diagnose the embryonic age.				
Evidence of student learning	Performance Criteria	Learning activities	Contents	Resources
Case resolution on the embryo external morphology and the embryonic attachments (anexos)	Identifies correctly the embryological terminology. Recognizes and interprets embryonic structures in images or through the use of a microscope. Correctly synthesizes the embryonic development of tissues and organs. Develops the embryological perspective for its application in the clinical area. Applies the knowledge acquired correctly. Presents the complete assignment and it has the suggested structure or format (introduction, body and conclusions). Includes the elaboration of a diagnostic and images. Uses Arial 12 as font in the assignment.	Facilitation activities Exposition in class, case discussion, analysis of images about morphogenesis during plenary sessions. Learning activities Morphogenesis analysis through revision and use of images and clinical cases. Elaboration of concept maps. Written report about readings on folding and derivatives of germ layers. Revision of embryonic sections with a microscope. Self-evaluation through an analysis and interpretation of images from regarding segmentation and first stages of development.	Conceptual Content SEGMENTATION AND EARLY STAGES OF DEVELOPMENT • Bicellular stage. • Morula. • Blastocyst. • Bilaminar embryonic disc. • Gastrulation: anomalies. • Embryonic axis. • Mesoderm segmentation. • Neurulation. FOLDING AND DERIVATIVE OF GERM LAYERS • Sagittal plane folding • Longitudinal plane folding • Derivatives of the ectodermal germ layer. EXTERNAL MORPHOLOGY • Morphology characteristics of embryo between 4th to 8th development week	• Medschool Classrooms • Textbook • Images • Histological sections • Embryonic models • Microscope • Digital platform • Videorecordings • Embryology museum • Embryology Laboratory • Reference books • Manual (workbook) • Electronic references and

			• Gestation period and birth day probability. EMBRIONIC ANNEXES • Amnion • Yolk sac • Allantois • Chorion • Umbilical cord • Anomalies and its clinical implications: • Amnion: Hydramnios (polyhydramnios), Oligohydramnios, amniotic bands, • Yolk sac: Vitellin fistula, fibrous cord y ileal diverticulum. • Allantois: Uracal fistula. • Trophoblast: Hydatidiform mole, choriocarcinoma. • Umbilical cord: long cord, agenesis y circular cord. Procedural content: • Uses the photonic and stereoscopic microscope correctly • Analysis and synthesis of information • Elaborations of concept maps, summaries, schemes, etc. • Apply concepts to diagnose a congenital abnormality	
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			Attitudinal content: • Self-study habits. • Discipline • Respect to human material • Take care of the educational facilities • Respect among peers. • Respect for professors, acholarship assitants, and administrative personnel. • Correct use of language. • Wear properly the laboratory coat. • Development of creative thinking.	
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Phase 4. Placenta				
Component(s) of the competence: Analyze the information of the placenta since the embryo implantation, considering its morphology and physiology to understand the abnormal process				
Evidence of student learning	Performance Criteria	Learning activities	Contents	Resources
Resolution of a case on congenital abnormalities in the placenta and twin abnormalities	Identifies correctly the embryological terminology. Recognizes and interprets embryonic structures in images or through the use of a microscope. Correctly synthesizes the embryonic development of tissues and organs. Develops the embryological perspective for its application in the clinical area. Applies the knowledge acquired correctly. Presents the complete assignment and it has the suggested structure or format (introduction, body and conclusions). Includes the elaboration of a diagnostic and images. Uses Arial 12 as font in the assignment.	Facilitation activities Exposition in class, case discussion, analysis of images about the different stages in placenta development during plenary sessions. Learning activities Text analysis and review on book references about placentation. Written report about readings on morphogenesis and placenta physiology. Elaboration of concept maps about the placenta morphogenesis. Analysis of the placenta's morphology and physiology through the study of images and clinical cases. Revision of embryonic sections with a microscope. Self-evaluation through an analysis and interpretation of images from the implantation process.	Conceptual Content IMPLANTATION • Blastocyst implantation • Differentiation of the trophoblast: cytotrophoblast and syncytiotrophoblast. • Decidual reaction and regional differentiation • Trophoblastic lacunae formation • Normal and abnormal implantation sites: • Intrauterine: placenta previa. • Extrauterine: Tubal, ovarian and abdominal. PLACENTAL MORPHOGENESIS • Formation of chorionic plate • Formation of intervillous space • Formation of chorionic villi: • primary, secondary, tertiary • Formation of decidua septum and cotyledons. • Placental circulation	• Medschool Classrooms • Textbook • Images • Histological sections • Embryonic models • Microscope • Digital platform • Videorecordings • Embryology museum • Embryology Laboratory • Reference books • Manual (workbook) • Electronic references

			• Placenta normal morphology. • Placental anomalies (battledore placenta, succenturiata) PHYSIOLOGY OF PLACENTA • Exchange of gases: Oxygen, carbon dioxide, carbon monoxide. • Exchange of nutrients and electrolytes: amino acids, fatty acids, carbohydrates, vitamins. • Transmission of maternal antibodies: Immunoglobulins, maternal IgG. • Hormones production: Human chorionic gonadotropin (hCG), estrogens, progesterone, somatomammotropin. MULTIPLE PREGNANCY Classification: • Monozygotic and dizygotic twins • Etiology: genetic, maternal age, procedure to increase unknown fertility. • Types: twins triplets quadruplets, etc. • Anomalies:	
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FIRST PARTIAL EXAM			Parasitic fetus, evanescent twin syndrome, twin-twin transfusion syndrome, conjoined twins. Procedural content: • Uses the photonic and stereoscopic microscope correctly • Structure information hierarchically • Schematize . • Apply concepts to diagnose a congenital abnormality Attitudinal content : • Self-study habits. • Discipline • Respect to human material • Take care of the educational facilities • Respect among peers. • Respect for professors, scholarship assistants, and administrative personnel. • Correct use of language. • Wear properly the laboratory coat. • Development of creative thinking.	
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Phase 5. Organs and systems development.

Component(s) of Competence:

Analyze the normal development of tissue and organs of embryo and fetus

Evidence of student learning	Performance Criteria	Learning activities	Contents	Resources
Resolution of a case on congenital abnormalities.	Identifies correctly the embryological terminology. Recognizes and interprets embryonic structures in images or through the use of a microscope. Correctly synthesizes the embryonic development of tissues and organs. Develops the embryological perspective for its application in the clinical area. Applies the knowledge acquired correctly. Presents the complete assignment and it has the suggested structure or format (introduction, body and conclusions). Includes the elaboration of a diagnostic and images.	Facilitation activities Exposition in class, case discussion, analysis of images of several embryo and fetus systems during plenary sessions. Learning activities Text analysis and review on book references about organs and systems development. Elaboration of concept maps. Written report about readings on abnormalities and changes during the organs and systems morphogenesis. Content analysis through the use of images and cases of congenital abnormalities. Exposition in class. Revision of embryonic sections with a microscope.	Conceptual Content: INTEGUMENTARY, SKELETAL AND MUSCULAR SYSTEM Integumentary system • Development of epidermis and migrant cells towards epidermis: Langerhans, Merkel and melanocytes cells • Dermis development. • Skin annexes: hair papilla, hair shaft, root sheath, mammary gland. • Anomalies: Pigmentary: Piebaldism, Waardenburg syndrome. Keratinization disorders: Ichthyosis. Mammary glands anomalies: polythelia, polymastia and inverted nipple. Skeletal system • Skeleton: axial and appendicular. • Paraxial mesoderm	• Images • Histological sections • Embryonic models • Microscope • Medschool Classrooms • Textbook • Digital platform • Videorecordings • Embryology museum • Embryology Laboratory • Reference books • Manual (workbook) Electronic references

	Uses Arial 12 as font in the assignment.	Self-evaluation through an analysis and interpretation of images from the normal organs and system development process.	(somite regions), lateral mesoderm and neural crest participation in skeletal system. • Ossification types: intramembranous and endochondral. Skull Developments: • Membranous and cartilaginous neurocranium; membranous and cartilaginous viscerocranium • Anomalies: creaniosynostosis (scaphocephaly, plagiocephaly, brachycephaly) • Axial skeleton development Anomalies: Spina bifida occulta, cystic (meningocele and myelomeningocele); Klippel-Feil sequence • Appendicular development skeleton (during fourth and eighth week) • Anomalies: amelia, meromelia, focomelia, micromelia, polydactyly, syndactyly, brachydactyly, ectrodactyly, hand and foot cleft.	
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			Muscular system • Skeletal muscle histogenesis: myoblast, myocyte y myotube. • Morphogenesis of skeletal muscle: limb muscles, muscles derived from epimere and hypomere of thorax and abdomen. • Histogenesis of muscles derived from splanchnic layer: cardiac muscle; smooth muscle of the digestive, respiratory and genitourinary system. • Anomalies: Poland Anomaly, Prune belly syndrome. Duchenne's muscular dystrophy. CARDIOVASCULAR SYSTEM Hematopoiesis: Hematopoietic sites (yolk sac, liver and bone marrow). • Primitive cardiac tube formation. • Torsion of the cardiac tube. • Formation of the venous sinus. • Atrial septation process. • Ventricular septal process. • Formation and septation	
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			of the arterial cone. • Development of aortic arches. • Fetal circulation and it changes at birth. • Anomalies: Heart position: Ectopia cordis, dextrocardia. Comunication interatrial by: Foramen primum persistency, excessive resorption of the septum primum, hypoplasia of septum secundum, patent foramen ovale, cor triloculare biventriculare. Interventricular communication: membranous septal defect and muscle wall defect. Arterial trunk: Fallot Tetralogía de Fallot, persistent arterial trunk, DiGeroge sequence. Aortic arches: aorta coarctaction, right aortic arch. Fetal circulation and it changes with birth: persistent arterial duct.	
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			HEAD AND NECK Pharyngeal region • Pharyngeal arch and their derivatives: muscles, bone, ligaments, irrigation e innervation. • Anomalies: Treacher Collins syndrome, Robin sequence, Goldenhar syndrome • Derivatives of grooves (external auditory duct). • Anomalies: Gill fistula, lateral cervical cyst. • Pharyngeal pouch derivatives. Anomalies: DiGeorge syndrome, parathyroid ectopic tissue. • Pharyngeal membranes derivatives: tympanic membrane. • Tongue development and it innervation. Anomalies: Ankyloglossia, macroglossia, cleft tongue, bifid tongue and microglossia. • Thyroid gland development. Anomalies: tiroglossal cyst, thyroglossal duct fistula, aberrant thyroid	
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			tissue, ectopic thyroid. • Development of the face. Anomalies: lateral and middle cleft lip; cleft palate, oblique facial cleft. RESPIRATORY SYSTEM AND Y BODY CAVITIES Lung development • Formactio of respiratory diverticulum. • Development of trachea, bronchi and lungs, histogenesis of pulmonary development. • Formation of visceral and parietal pleura. • Anomalies: Pulmonary agenesis and hypoplasia. Body cavities • Intraembryonic celloma. • Celoma tabication • Pleural cavity formation. • Pericardial cavity formation. • Diaphragm formation • Anomalies: Congenital diaphragmatic hernia, esophageal hernia (hiatal). DIGESTIVE SYSTEM • Primitive intestine and its divisions. • Anterior intestine:	
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Second Partial Exam			esophagus, stomach, first portion of duodenum development. • Anomalies: Atresia and esophageal stenosis; short esophagus and congenital hiatal hernia, pyloric stenosis. • Middle Intestine: Formation of distal region of duodenum. • Formation of jejunum, ileum, appendix, ascending colon and proximal segment of transversal colon. • Anomalies: Onphalocele, abnormal and inverted rotation of the loop. • Posterior intestine posterior: formation of distal segment of transversal colon, descending and sigmoid colon • Anomalies: congenital megacolon. GENITOURINARY SYSTEM Urinary system • Renal morphogenesis: pronephros,	
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			mesonephros and metanephros. • Urinary tract morphogenesis. • Anomalies: • Metanephros: multicystic dysplastic kidney, uni and bilateral renal agenesis, duplications of urinary tract. • Positional changes: pelvic kidney, horseshoe kidney, accessory renal arteries. • Development of urogenital sinus: bladder, prostate gland, prostatic urethra, uraco. • Anomalies of urogenital sinus: Vesical exstrophy, uracal fistula, uraco cyst. Genital system • Development of gonads • Genetic determination of genre. • Germ cells migration. • Gonads development and differentiation • Ovary differentiation • Differentiation and descent of testis. Anomalies: Cryptorchidism, ectopic testicles, congenital inguinal hernia, testicular hydrocele.	
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			Internal Genitals Development of genital ducts: Indifferent stage: mesonephric ducts (Wolff) and para-mesonephric ducts (Müller). • Differentiation of the genital duct in male: - epididymis, vas deferens, seminal vesicles, ejaculatory duct. • Differentiation of the genital duct in female: Fallopian tubes, uterus and vagina. • Remains of the ducts in female • Congenital anomalies of the female genital ducts: uterine agenesis, didelfus uterus with double or single vagina, arched uterus, uterus bicornuate, unicornuate uterus, cervical atresia, vaginal duplication, vaginal atresia, imperforate himen. Development of external genitals Indifferent stage. • Differentiation of male genitals. Anomalies: Hypospadias, epispadias, micropene, bifid penis.	
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			• Differentiation of genitals female and gonadal intersexual stage. Androgen insensibility syndrome. • Sexual development disorder: 46XX, 46XY • Differentiation of male genitals. NERVOUS SYSTEM Generalities • Neurulation. • Ventricular system and choroid plexus. • Histogenesis of the nervous system. • Development of the spinal cord and meninges • Differentiation of neural tissue. • Formation of meninges. • Spinal cord development. Myelination. • Position of spinal cord in embryo, fetus, new born and adult. • Congenital anomalies of spine: hidden spina bifida, cystic spina bifida (meningocele, myelomeningocele), Chiari malformation. Encephalon development Cerebral vesicles, primary	
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			and secondary. • Morphogenesis of rhombencephalon: cranial nerves (Glossopharyngeal IX, vagus X, Spinal XI and Hypoglossal XII). • Morphogenesis of metencephalon: bulge, cerebellum and cranial nerves: Trigeminal V, external ocular motor VI, Facial VII, Auditory VIII. • Morphogenesis of midbrain: Roof, tegment and peduncular region, Edinger Westphal nuclei and cranial nerves: common ocular motor III and trochlear IV. • Morphogenesis of diencephalon: Epiphysis, epithalamus, thalamus and hypothalamus, mamillary bodies, infundibulum. • Development of neuro and adenohypophysis • Morphogenesis of telencephalon: Development of striatum and basal ganglia (caudate and lenticular nucleus). • Congenital anomalies: Hypophysis (pharyngeal hypophysis and	
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			creaniopharyngeoma), holoprosencephaly, meningocele, meningoencephalocele, meningohydroencephalocle, anencephaly, exencephaly, hydrocephaly, microcephaly. Eye development • Components. • Formation of the optic cup, cornea, crystalline; sclera and choroid; conjunctiva and eyelide • Congenital anomalies: Anophthalmia, cyclopia, synophthalmia, iris coloboma, aniridia, aphakia and congenital cataract. Ear development Internal development: • Formation of otic placode • Derivatives of saccule: cochlear duct, Corti organ. • Derivados del utricule: Semicircular ducts and ampollas. Middle ear development: • Timpánic cavity, Eustachian tube,	
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			External ear development: • External auditory canal, eardrum • Anomalies: Persistence of meatal plug, meatal, anotia, appendix and pits. Procedural content: • Uses the photonic and stereoscopic microscope correctly • Analysis and synthesis of information • Elaborations of concept maps, summaries, schemes, etc. • Apply concepts to diagnose a congenital abnormality Attitudinal content: • Self-study habits. • Discipline • Respect to human material • Take care of the educational facilities • Respect among peers. • Respect for professors, scholarship assistants, and administrative personnel. • Correct use of language. • Wear properly the	
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Third Partial Exam			laboratory coat. • Development of creative thinking.	
Final exam				

7. Summative Evaluation:

Clinical correlated Case resolution	5%
Self-evaluation on workbooks.....	10%
Reading reports on general and special embryology	3%
Oral presentation on general and special embryology	2%
Midterm exams.....	
Theoretical	40%
Practical	10%
Final exam.....	20%
Course Integrative Product.....	10%
Total.....	100%

8. Course Integrative Product.

Written report and Oral Presentation on a congenital abnormality which involves the correlation clinical-basic. It's integrated in two sections: the first one, an extensive printed document with the case research. The second part, an oral presentation in front of the class using electronic tools and devices.

9. References

- López Serna N. (2017). *Cuaderno de trabajo de Embriología*. Monterrey, México: Departamento de Embriología, Facultad de Medicina, UANL.
- López Serna, N. (2018). *Cuaderno de ejercicios para la aplicación del conocimiento por competencias*. Monterrey, México: Departamento de Embriología, Facultad de Medicina, UANL.
- López Serna, N. (2004). *Atlas de embriología*. México: McGraw-Hill/Interamericana.
- Moore, K.L. & Persaud, T.V.N. (2016). *Embriología clínica*. España: Elsevier.

Additional references:

- Brooker. C. (2010). *Diccionario Médico*. México: El Manual Moderno.
- Carlson, B.M. (2014). *Embriología humana y biología del desarrollo*. Barcelona: Elsevier-Mosby.
- Gilbert, Scott F. (2015). *Biología del desarrollo*. Buenos Aires: Médica Panamericana.
- Sadler, T.W. (2016). *Langman embriología médica*. Philadelphia, PA: Lippincott Williams & Wilkins.
- Schoenwolf, G. C. (2014). *Larsen's human embryology*. Philadelphia, PA: Elsevier/Churchill Livingstone.

Electronic sources:

- Indiana University. (2015). Human embryology animations. Recuperado de http://www.indiana.edu/~anat550/embryo_main/
- University of Michigan. (2015). The multidimensional human embryo. Recuperado de <http://embryo.soad.umich.edu>
- Hill, M.A. (2015). Embryology Main Page. Recuperado de https://embryology.med.unsw.edu.au/embryology/index.php/Main_Page

APPENDIX.

ASSESSMENT AND WORKLOAD

Module workload		Number of hours	Percentage
Contact hours	Class-based instruction	80h (57.1%)	66.6% = 140 hours
	Clinical case resolution	6h (4.2%)	
	Self-evaluation on workbooks	40h (28.5%)	
	Reading reports	5h (3.5%)	
	Oral presentation	2h (1.4%)	
	Course Integrative Product (CIP)	2h (1.4%)	
	Exam taking	5h (3.5%)	
Independent study	Study	60h (85.7%)	33.3%= 70 hours
	Exam preparation	10h (14.2%)	
Total hours of the workload: 30 hours X 7 credits UANL/ECTS*		210 h	

*European Credit Transfer and Accumulation System
1 UANL credit = 30 hours

NOTE: Rubrics, checklists and evaluation formats are elaborated by using the performance criteria described in each stage of the module.

SUPLEMENTO COVID-19

Siguiendo las recomendaciones de la Secretaría de Salud del país y la Rectoría de la Universidad, ante la coyuntura de salud COVID-19, la organización de la docencia desde marzo del 2020, seguirá un modelo híbrido, donde la docencia se ajustará a los horarios aprobados por la Secretaría de Salud siguiendo un modelo de Presencialidad / No presencialidad en la medida en que las circunstancias sanitarias y la normativa lo permitan. Los estudiantes asistirán a las clases de manera no presencial mediante la transmisión de las mismas de manera síncrona/asíncrona vía “on line”.