

Biology Curriculums from the Tanzimat Reform To Today*

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ABSTRACT

This study aims to analyze the contents of the courses related to biology education in primary and secondary education institutions and to introduce the related developments and transformations by comparing the period of change and curriculums of those courses from Ottoman Empire from the Tanzimat reform to today. Our study is based on document analysis. As a result of the current study, it is seen that biology curriculum has been given as not an individual course but within an integrated understanding which includes the subjects like nature, agriculture, medicine and geology and information which should be known by a student in daily life during the modernization period of Ottoman Empire as a result of current study. Developments in biology were reflected even partially to curriculum but lack of supporting materials of the course and the fact that courses were always given theoretically and not supported by laboratory and equipment stand out as most important deficiencies. Program for primary schools were handled mainly until 1950s and biology instruction programs were developed in the following years and scientific developments were tried to be followed within these programs in the republic period. A constructivist approach has been adopted and instruction programs have been developed within a cyclical and integrated approach after 2000s.

Keywords: Ottoman Empire; Education; Biology; Curriculum.

INTRODUCTION

Important changes have been experienced in science, art, literature, philosophy and social sphere in Europe since 17th Century. Experimental studies and new inventions were made in other disciplines like physics, mathematics, chemistry and biology. When the importance of the said disciplines in the development and improvement of countries was comprehended, education system didn't remain insensitive to those developments. How to teach the courses for sciences and social sciences in the new education system gained importance, logic was used in instruction programs.

Elementary level Quran School (Sıbyan Mektebi) and madrasahs were the most important institutions where civilians might take education since the foundation of them in Ottoman Empire trying to change education system by modeling itself on western society.

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Even though the ones established individually for medical training were always present in the madrasahs intended to instruct Islamic law, Mathematics and Sciences other than Medicine became the subject of instruction in the environments out of madrasahs but instruction of these sciences remained more constricted. Development of these sciences is generally up to personal interest and effort out of madrasah (Zengin, 2008, p.213).

Any course name associated with the instruction on animals, plants or creatures within classical madrasah training in Ottoman Empire hasn't been found (Ergun, 1996). Since these institutions couldn't meet the requirements of that era; modernization efforts were initiated first in education of military in order to prevent regression. Contemporary sciences were instructed first in militaristic schools, Hendesehane (Engineering School), Muhendishane-i Berri-i Humayun (Imperial School of Military Engineering) and Muhendishane-i Bahri-i Humayun (Imperial School of Naval Engineering). But it is very difficult to say that the sense of experiment in these sciences entered into educational institutions in Ottoman Empire. It is understood that laboratories have not been established in the engineering schools which were the primary education institutions of the first era. Some equipments intended to make measurements in artillery and navigation are available in these schools (Tekeli and İlkin 1999, p. 51-52).

New educational institutions rendering training at the levels of primary, secondary and high schools other than madrasahs and elementary level Quran schools (Sıbyan Mektebi) where civilians may take education were founded in the Tanzimat reform era (Koçer, 1987). Curriculums, course books and school programs were handled again in parallel with the foundation of the institutions like Rusdiyye (Ottoman junior high school), Idadi (high school), Sultani (high school), Daru'l-funun (Ottoman University). Positive sciences providing Europe to develop were included in the curriculums as separate courses; course books were written to be taught in the mentioned courses and new legal regulations were made for the matter concerned.

Ordinance of General Education (Maarif-i Umumiye Nizamnamesi) which is one of the most important ordinances in the modernization process of Ottoman education was accepted on September 1, 1869 in the period of the minister of education, Saffet Pasha. This ordinance constituted a system to lead Ottoman education and is the first complicated legal text intended to regulate the general education in the capital and provinces. Many subjects like rating educational institutions, curriculums, contents of courses, powers of the ones authorized within institutions and financial aspects of education were handled in the ordinance. Furthermore it is possible to reach similar information in the yearbooks for education and other publications published in the following years. It is possible to determine the courses and contents related to biology in primary, secondary and high educations.

This study aims to analyze the contents of the courses related to Biology education in the primary and secondary educational institutions in Ottoman Empire and to introduce the transformations by comparing the period of change and curriculums from Ottoman Empire since the Tanzimat Reform Era to Today and to fill in the blank in the literature for the matter involved.

METHODOLOGY

This study was conducted by using document analysis from qualitative research models. History and historical process of the subject are critically important for a researcher in commenting the findings. In this context researcher may collect two kinds of data: 1- Archive Data, 2- Historical Data. Archive data includes routine records of a community and organization or culture. Records are used to enrich and compare the findings of research. Historical data allows obtaining significant inferences associated with the infrastructure of the research subject in other words history. It requires a researcher to review newspapers,

journals, books and similar documents. Data sources used in collecting historical data are records, reports, official documents, books, journals and similar documents, autobiographies and documentaries, questionnaires, songs, poetries and similar folkloric documents (Bas ve Akturan, 2013). Yearbooks for education (Maârif Sâlnâmeleri), curriculums and course books etc. published by the ministry of education were used in our study. Yearbooks for education were known to be published in 6 issues under the name of Sâlnâme-i Nezaret-i Maârif-i Umûmiyye between A.H. 1316 and 1321 / A.D.1898 and 1903 and 5th issue published in A.H. 1320/1902 hasn't been encountered in the libraries until now. Information regarding primarily history of educational institutions, ministers of education, teachers, schools and libraries and other subjects. In addition to them, tables regarding the permillage rate of the students studying in all schools in the province in the population of that province in that era are available in the yearbooks for education as well as military schools, general examination scales, interest distribution scales of Mulkiye Mekteb-i (Imperial School of Political Sciences) and Mekteb-i Sultani (Imperial High School) (Hızlı, 2008).

Stages of document review may be collected under following titles like reaching documents, checking its authenticity, understanding documents, analyzing and using data (Yıldırım ve Simsek, 2013). The ones pertaining to Ottoman Empire from the documents used in our study were reached from the Periodical Information System of National Library of Turkey located in Ankara and Rare Works Collection at the Hall of Seyfettin Ozege of Ankara University. Authenticity of documents was checked and then transcription of documents was made and then the obtained data was analyzed and considered. Curriculums of the republican period were reached from the official web site of Ministry of National Education. Same stages were followed for these documents.

FINDINGS

Courses of “Ma'lûmât-ı Tabiiye” (Natural Sciences), “Hifz-us-sihhat” (Protection of Health), “Ma'lûmât-ı Nafia” (Useful Information), “Elifba ve Sifahi Ma'lûmât” (Life Sciences) in Rusdiyye schools (Ottoman Junior High Schools), “Hikmet-i Tabiiyye” (A Treatise on Physics) or “Tarih-i Tabiiyye” (A science dealing with the evolution of animals, plants and the world), “Malumat-ı Fenniye ve Hifz-us-sihhat” (Protection of the Health), “İlm-i Mevalid” (Science on Animals, Botanic and Plants) in Mekteb-i Sultani (Imperial High School) and Idadis (Imperial High Schools) giving education at the levels of high schools, courses like “İlm-i Nebatat” (Botanical Science), İlm-i Hayvanat (Animal Science) and “Tarih-i Ulûm-i Tabiiye” (History of Natural Sciences) in the branch of Ulûm-i Tabiiye (natural sciences) of Darulfunun (Ottoman University) are associated with the subjects within the current curriculums of Biology in the educational institutions within the modernization process of Ottoman Empire

1. Courses related to Biology in Rusdiyye schools

What the exact status of Rusdiyye schools in Ottoman educational system is can't be found today. Despite this, Rusdiyye schools were intended to include the education following elementary level Quran School (sıbyan mektebi) and to be a preparatory school for during its foundation. It may be considered as a school providing education over primary school level and under Idadi (Imperial High Schools) level. Process triggering the foundation of rusdiyye schools begun with the firman published by Sultan Abdulmecid for the establishment of a new European-style education system thought to be carried out in 1845. Education system thought to be established in three stages is made up of elementary level Quran School (sıbyan), rusdiyye schools and Darulfunun (Ottoman University). Kemâl Efendi, director of Mekâtib-i Umûmiyye (Public Schools) planned to open the rusdiyye schools intended to give

education following the elementary level Quran school (sıbyan), since the necessary reforms weren't made in the infants' school (Ozturk, 1993).

Even though Mekteb-i Maârif-i Adliyye (School for Learning) and Mekteb-i Ulûm-i Edebiyye (School of Literary Sciences) founded in 1839 are Professional Schools in terms of their contents, they are the first rusdiyye schools founded in Ottoman Empire. Rusdiyye schools were founded in many provinces particularly in Istanbul. Subjects of biology curriculum are observed in the courses of Hifz-us-sihhat" (Protection of the Health), Ma'lûmât-ı Tabiiye" (Natural Sciences), Ma'lûmât-ı Nafia" (Useful Information), "Elifba ve Sifahi Ma'lûmât" (Life Sciences) in the course programs of rusdiyye schools.

1.1. Hifz-us-sihhat (Protection of the Health)

Course of "Hifz-us-sihhat" (Protection of the Health) including the subjects concluded by Biology curriculum is seen in the courses of sciences to be instructed in idadi schools and Rusdiyye schools are giving jointly education in the year 7 of the Course Schedule given by Mahmud Cevad (Mahmud Cevad, 2001, p. 368). These subjects are seen in the 5th grade in the course schedules of same schools in the yearbooks for education. (Salnâme-i Nezâret-i Maârif-i Umûmiyye [SNMU], A.H. 1316/A.D 1898-1899, p. 282-285). The name of this course is not available in the schedules of rusdiyye schools for boys.

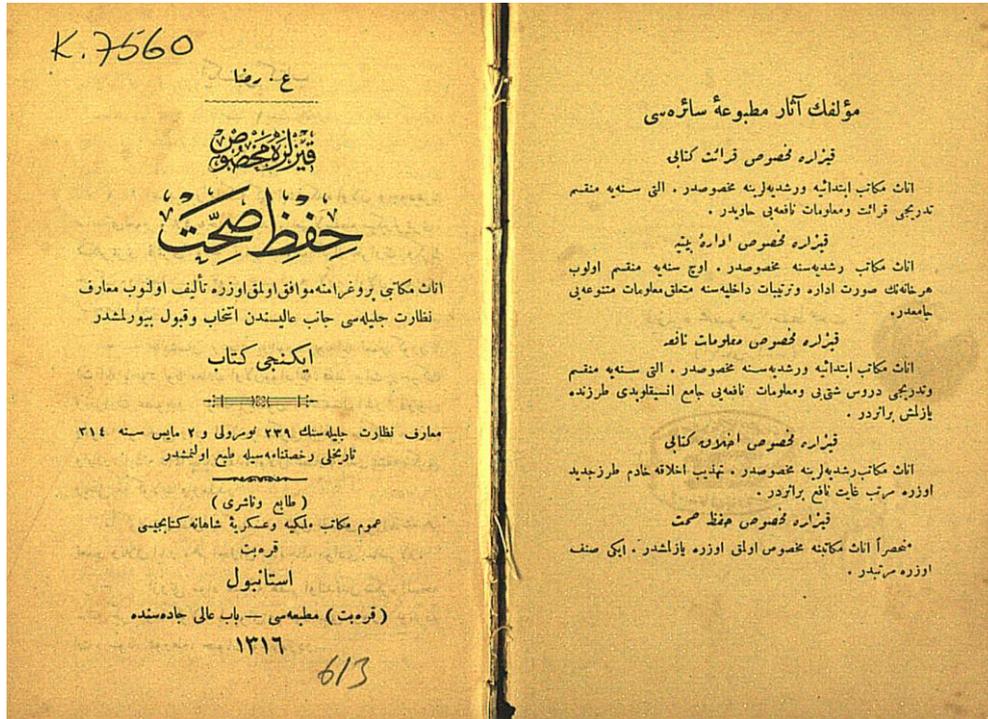
Contents of the course are almost as same as the contents given by Mahmud Cevad in the yearbook. Curriculum of Hifz-us-sihhat is as follows:

Table 1. Course content of Hifz-us sihha (Protection of the Health)

Third Year	Fourth Year	Fifth Year (Rusdiyye Schools for Girls)
Introduction-Microbes (microorganisms):Microbes; Their forms and movements, reproduction, secretions, living and reproduction places of microbes in and out of body, ways of entering into body.	Foods Foods of Animal Origin: Meats and types, hazardous and healthful meats, toxic meats, fresh meats, consomme.	1-Parts of skeleton, functions of muscles and organs 2-Ingestion organ, ingestion, foods 3-Blood, circulatory system, blood circulation 4-Respiratory organs 5-Neural system, nerves, movements and feelings 6-Sense organs (touch, tasting, smelling, hearing, sight)
Water: Potable Waters; Their structure, chemical properties and vital characteristics, water sources; rains, sources, rivers, wells, water treatment, ways of treatment (filtering and boiling). Beverages containing water, ice.	Milk: Components, degradations in components, sterilization, butter. Fish meats: Poisonous mussels and oysters, fish conservation and canned foods Phytonutrients: Bread, potato, mushrooms, vegetables, sugar. Chocolate, salt, mustard, vinegar.	Sixth Year 7-Foods: Foods of Animal Origin and phytonutrients, milks and components, milk to be given to children. 8-Water, potable and non-potable waters, water cleaning & treatment 9-Tea, Coffee and chocolate.
Air: Air and respiration, air composition, Exchange of it by respiration, compressed air, asphyxiation caused by oxygen deficiency, air amount required for life, existence of various gases in the air, air cleaning, air pressure, overpressure and underpressure, respiration through a hole opened on throat, dusts in the air, association of earth and air, marshes.	Beverages: Alcoholic beverages: Wine, bear, raki ve their harmful substances, alcoholic things. Coffee and tea. Clothes: Effect of Clothing substances, dye and weaving Infectious diseases: Description of infectious disease and microbes, protection from infectious diseases. Locations, body cleaning, movement and exercise, regeneration, ways of removing bad smells. Eye health, lighting, and children's health.	10-Drunkenness, types of addictives and pleasure-inducing substances: Tobacco and Persian tobacco, narghile tobacco, snuff and hashish. 11-Air, necessity to treat air, air circulation. 12-Protection of the health of body, movement, comfortable sleep, sanitation, soap and hamam and bathroom. 13-Clothes: Clothes for children, men and women. 14-Location: effect of bedrooms, beds, water-closet, environment and vicinity. 15-Protection from infectious diseases: Ways and modes of transmission, vaccine. 16- First treatments to be made for some accidents. 17-Special health rules

This course was agreed to be instructed in seven-year idadi School in Istanbul in accordance with this curriculum (Mahmud Cevad, 2001, p. 415-416; SNMU, H. 1316/M. 1898-1899, p. 282-285).

Same course was thought one hour in the years five and six within the scope of the 24-hour program per week for the six-year rusdiyye schools for girls containing primary and rusdiyye classes in the yearbook of education for A.H.1317/A.D.1899-1900 (SNMU, A.H.1317/A.D.1899-1900, p.433) and contents of course are stated in Table 1.



Picture 1. *Hifz-us-sihhat* (second book) for girls, 1316, Karabet Printing House, Istanbul.

In 1881, a new curriculum was suggested and “Usûl-i Hifz-us-sihhat” (Ways of protecting the health) was projected to be taught in Mekâtib-i Âliye (Higher Education) upon the determination that the level of the education provided in the ibtidâî and rusdiyye schools was much lower than Christian Schools. In 1982 Course of Ma'lûmât-ı Fenniye (Sciences Teaching) is agreed to be taught 2 hours per week in the grade 4 in the course schedule issued by the commission established with the imperial decree for military and civilian rusdiyye schools (Kaya Doğanay, 2011, p.253).

Course of Hifz-us-sihhat (protection of the health) instructed one hour per week in the grades 6 and 7 within the scope of 30-hour course program in the year 1891-92 for the seven-year Industry School for Girls providing rusdiyye training together with preparatory class (iptidaiye class) has same curriculum with the ones in the rusdiyye schools for girls (Mahmut Cevad, 2001, p. 274). No course for the matter involved isn't available in ibtidai (elementary) and country-village schools. Course of Hifz-us-sihhat is available in the year five in Imperial Tribal School (Mahmut Cevad, 2001, p. 333-337).

Course program in the yearbook for education for 1903/1904 (A.H.1321) was amended and course of Hifz-us-sihhat was removed. But it is seen that the mentioned course has been instructed in some archive documents (Kaya Doğanay, 2011, p. 264).

In 1913, rusdiyye schools were fused into ibtidâî (elementary) schools upon the issuance of Tedrisat-ı İbtidâiye Kanûn-ı Muvakkat (temporary law on primary education school). Course of “Ma'lûmât-ı Tabiiyye and Tatbikat-ı Hifz-us-sihhat” (Natural Sciences and

Health Practices) is not available in the courses to be instructed in ibtidâî (elementary) schools (Dustur, 1896, p. 807-808).

Today, curriculum of Hıfz-us-sihhat is encountered in the programs for the courses of Sciences & Technology and Biology. It is discussed in the subject of “Let’s Know the Microscopic Creatures” in Unit 6 in 5th Grade and in the subject of microbes in the unit of the world of creatures in the course of Biology in 9th Grade, in the unit of “Let’s solve the riddle of our body” in first unit in 4th Grade and in the subject of air, water and respiration in the unit of “human physiology” in 11th Grade in the course of Biology and in the subject of foods in the same unit in 5th grade. Subjects for the year 5 in the rusdiyye schools are discussed today in the unit of “Let’s solve the riddle of our body” in first unit in 4th Grade, in the unit of “The Systems in Our Body” in 6th and 7th Grade and in the unit of “human physiology” in 11th Grade in the course of Biology (Ministry of National Education [MEB], 2005).

Today, Course of Hıfz-us-sihhat has a view of a single course which is an interwoven course intensively in the curriculum of Sciences and Technology and the Curriculums of Hygiene and Biology. The fact that the course subjects of Hıfz-us-sihhat take place spirally every year in the subjects of Sciences and Technology and Biology and Hygiene is a reflection of the constructivist training understanding. But such approach is not observed to have been reflected in the curriculum.

1.2. Ma'lûmât-ı Nâfia (Useful Information)

Course of “Ma'lûmât-ı Nafia” and “Hıfz-us-sihhat” is seen to be taught one hour per week in first year within the course schedule to be followed in the rusdiyye and idadi schools in the yearbook A.H.1316 /A.D.1898-1899 (SNMU, A.H. 1316 /A.D. 1898-1899, p.191). The name of the course called as Ma'lumat-ı Nafia in which the course subjects of Biology are discussed is founded as “Durûs-ı esya and Ma'lûmât-ı nafia” taught 2 hours per week in first three years and one hour per week in the years 4, 5 and 6 in the rusdiyye schools for girls after the combination of Rusdiyye Schools and İptidai Schools. Course of Hıfz-us-sihhat is taught one hour per week in fifth and sixth grades in same program (Mahmud Cevad, 2001, p.247).

Course of Ma'lûmât-ı Nâfia was taught one hour per week in first four year in the schedule showing the quantity of the courses per week within the scope of the ulûm and funûn (science and scholarship) to be taught in rusdiyye and idadi schools giving education together. Course of Hıfz-us-sihhat with the mentioned curriculum above was started to be instructed in the year 5 (SNMU, A.H. 1316/ A.D. 1898-1899, p.278-282).

As it is evident from its name, information on public works is given in this course. The course includes the information which should be known by a student in daily life. A part of the subjects given here are discussed today within the scope of the courses of Science and Technology. It is discussed in the unit of “Let’s solve the riddle of our body” in 4th and 5th grades and in the unit of “the systems in our body” and in the unit of “human physiology” in 11th grade.

Names of main parts of human body like head, hand, arm and food, names of certain animals in our country, names of the plants which serve to nourishment and may be observed by students (common trees and flowers etc. in the yards and gardens) and subjects like colors, day and night, treatment of five senses are available respectively in the section of Sifahî ma'lûmât (verbal information) and in the section of the suggestions on the protection of health in the course of “Elifbâ ve Sifahî Ma'lûmât” (Life Sciences) instructed in the rusdiyye schools for girls. (SNMU, A.H.1317/A.D. /1899-1900, p. 435).

Classification of creatures is outlined in this course.

Since this course was instructed in the ibtidâî (elementary) part of the rusdiyye schools for girls, it is not taught in the rusdiyye schools for boys. Author of the book titled “Hıfz-us-sihhat” (Health Care) as well as the books and booklets accepted to be instructed in the idadi

schools in the yearbook of education of 1900/1901 (A.H. 1318) is Ahmed Rasim (SNMU, A.H. 1318/A.D. 1900/1901, P. 496-498).” Similar subjects are seen to have been discussed within the curriculum of the course of “Life Science” (Mahmud Cevad, 2001, p. 412-415)

Table 2. *Course content of Ma'lûmât-ı Nâfia*

First Year	Second Year	Third Year	Fourth Year
Earth and stars: Earth's movement, shape, evidence of roundness, gravitational force, comparison of earth and sun in size and distance between them, number of movements, seasons, four directions.	Ground: Stones, digging, hammer, Stone pit, Malta stone, marble, granite etc.	Weaving: Copper, lamp, candlestick, candle, gas, petrol, heating, cereal, bread, chocolate, tea, coffee (Wine, beer, jujube), salt, sugar, things intended to dress foods.	Earth from agricultural information, agriculture.
Water: Properties, characteristics, vapor, condensation of vapor, formation of cloud, rain, distillation, solidification of water, ice, snow, hail, well, artesian wells, water mill.	Trees: Types, knowing tree species, timber, pine, oak, chestnut, elm, beech, ash tree, cherry, walnut, boxwood, lathe, saw etc.	Paper, story of a book, equipments for students, descriptions, human body,	Animals
Fire: Properties, non-occurrence of fire in airless environment, hottest level of candle flame, Evidence for air to be ignited and to cause the fire, combustible matters, natural and artificial fire, volcano, benefits of fire in industry, ship, railway (train), thermometer.	Mines and pits: Iron, rust, cast iron, forged iron, Perforated plate intended to make wire from melted substance (Rolling mill), steel, copper, bronze, brass, forged steel, lead, natural lead oxide, basic lead carbonate (ceruse), manufacture of buckshot, tin, solder, canister, being tinned, zinc, galvanization, golden, comparison of golden and iron, silver, gilding, silver plate.	Training of emotions, sight, hearing, smelling, tasting, touching.	Plants
Location: Plan, cabin, cave, base, mast, covering, beam, ceiling, ladder, roof, roofing, terrace, location of housing, coffee tree, tea tree, chocolate, paper.			Metals
Human body: Skeleton, organs Five senses: Sight, force-touching force serving to feel the softness and stiffness of an object, smelling force, tasting force, hearing force, seven colors			

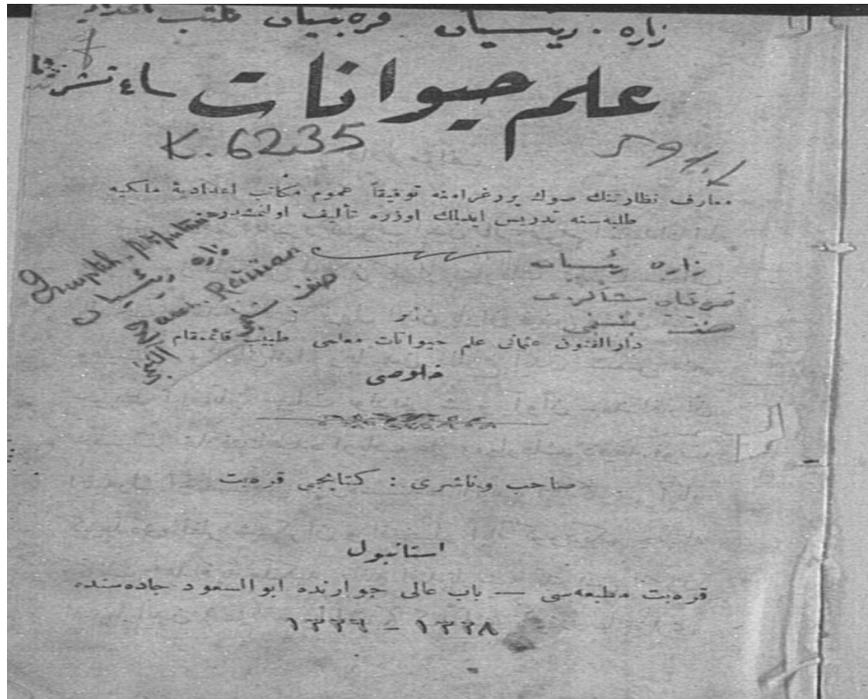
2. Courses related to Biology in the Idadi Schools

The name of the idadi schools intended to fuse Muslim and Christian communities with each other and to raise them in a common culture (MUN, Article 33) was used previously for the preparatory schools intended to complete the imperfect knowledge of the students desiring to study in Military Schools and Military Medical Schools and they were opened in army centers in 1845 and one of them was founded in Bosnia (Ergun, 2000). According to MUN, idadi schools would be opened in the allocation units with a population higher than one thousand residences. But the said provision couldn't be fulfilled completely due to financial difficulty. First civil idadi school was founded in Istanbul in 1873 in the place of the first high school called as Dârulmaârif. They were opened also in the provinces after two years and it was founded in Nauplion subordinated to Janina (Demirel, 2010). Many idadi schools were seen to be opened in the following years

Course of “ilm-i mevalid” (Life sciences) was agreed to be instructed in the idadi schools (Article 38), Mekteb-i Sultani (Imperial High School) (Article 46) and Darulmuallimin schools (teacher training schools) (Article 55) as stated in General Regulations for Education called as Maârif-i Umumiye Nizamnamesi.

According to the program determined in 1892 courses of Ma'lûmât-ı Fenniye (Science Knowledge) and Mevalid and Hıfz-us-sıhhat (Sciences and Health Protection) were agreed to be instructed respectively 3 hours per week in fifth grade and 3 hours per week in 7th grade (Vilayat-i Sahanede Bulunan Leyli ve Nehari Mekatib-i İdâdiyeye Mahsus Olarak Bu Kere Maarif Nezaretince Ta'dilen Kaleme Alınan Ders Programları, Dersâdet 1310, p. 2-12). Course of mevalid (sciences) would be instructed two hours per week in 6th and 7th grades in the idadi schools combined with 7-year rusdiyye schools in the yearbook dated A.H. 1316/A.D. 1898-1899. Course of Ma'lûmât-ı Nafia ve Hıfz-us-sıhhat would be instructed one hour per week in the first five years.

Course of mevalid was taught four hours per week in the final year in the programs for idadi schools, agreed on 1903–1904 (A.H.1321/A.D.1903-1904) (SNMU, A.H. 1321/A.D.1903-1904, P. 25-26).



Picture 2. Cover of the book “İlm-i hayvanat” taught in the idadi schools (Hulûsi, 1326-1328. *Ilm-i Hayvanat*, Karabet Printing Office, Istanbul).

2.1. Ma'lûmât-ı Fenniye and Hıfz-us-sıhhat (Sciences and Medical Knowledge)

Contents of the said course instructed from the first grade in seven-year idadi schools:

Farming: Farmers and farming tools: Anchor, shaft, fork (used in gardening), plough, plow (according to new methods).

Seed planting: seed planting tool in accordance with new method. Harvest: harvest tool, hook, scythe, new style harvest, new style seed planting.

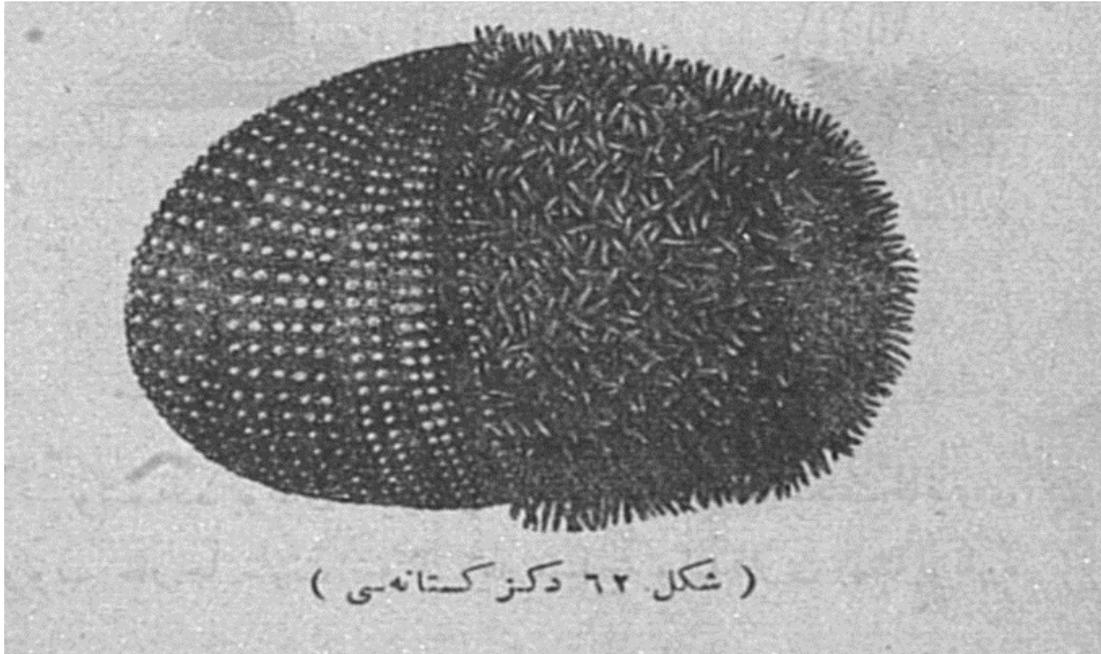
Farm: Livestock, horse, cattle, donkey. Dairy: Sheep, goat and shepherd. Poultry house: chicken, turkey, goose, duck and pigeon. Milk house: milk, butter, cheese. Pastures: Natural and artificial pastures, mowing, fodder. Bees: hive, comb, honey, beeswax. Travel: way, highways, railways, ships, four main directions, compass, magnet. birdhouses, birds' service to humanbeing, caterpillar, insects, pests, butterfly, silk worm. Communication tools: Mail telegram, phone, electricity, pigeon. Lighting equipments: Oils, candles, wax, tallow,

Novelties were cited in the program and scientific developments were followed even partially. Similar subjects are discussed today in the unit of “Let’s solve the riddle of our body” in 4th and 5th grades and in the unit of “human physiology” in 11th grade (Ministry of National Education, 2005).

2.2. İlm-i Mevalid (Science of Nature)

In the courses of sciences taught in all the rusdiyye and idadi schools, courses of Mechanical physics and Chemistry, and mevalid were taught respectively 3 hours in 6th and 7th grades and four hours in seventh grade (two hours animal science an one hour for each one of botanic and species) and course of Hıfz-us-sihhat was taught one hour per week in 3rd, 4th and 7th grades and one hour per week in Dersaadet school (Mahmut Cevad, 2001, p. 368-369).

In the courses of sciences taught in all the rusdiyye and idadi schools, course of mevalid was taught four hours in seventh grade (two hours animal science an one hour for each one of botanic and species) and course of Hıfz-us-sihhat was taught only one hour per week in 3rd, 4th and 7th grades and one hour per week in Dersaadet school (Mahmut Cevad, 2001, p. 368-369) and related curriculum is as follows (SNMU, 1316/ M. 1898-1899, p. 202-204 and 276-278): Information concerned with the said curriculum is available in the course book written by the instructor of zoological sciences (İlm-i hayvanat) in Darulfunûn-i Osmanî (institution of higher education) (Hulûsi, A.H. 1328-1329).



Picture 4. Picture of a “sea urchin” in the book “İlm-i hayvanat” (zoological sciences) taught in the idadi schools (Hulûsi, 1326-1328. İlm-i Hayvanat, Karabet Printing House, Istanbul).

Table 3. Contents of *Ilm-i Mevalid (Science of Nature)*

İlm-i hayvanat (Zoological Science): (two hours per week)	İlm-i nebatat (Botanical Science): (one hour per week)	Tabakatul arz (Geology): (one hour per week)
<p>Description of tarih-i tabîînin (science discussing animals, plants and the evolution of the world), classification, significant organs, range of animals, description of nature, vital ingredients, skeletal parts, main limbs, cell life.</p> <p>Nourishment duty, digestion, digestion organs, nutrients, digestion and absorption of nutrients, chewing and swallowing, saliva, functions of stomach, Gall, functions of pancreas, absorption.</p> <p>Blood, blood circulation, blood circulation organs, information of circulation, Liver and systemic circulation, portal vein, glands related to blood circulation, spleen, thyroid and timus, lymph and lymphatic circulation.</p> <p>Respiration: Respiratory organs, gill, trachea, bronchia, cutaneous respiration, respiration theory, shortness of breath, heat of animals.</p> <p>secretory organs, secretion and sweating, glands, urinary secretion, kidneys, glands and cutaneous secretion, veins, mucous membranes and secretion of the thin membranes covering the significant organs like encephalon, lungs, heart and intestines, their duties against each other, movement, sensory and movement organs.</p> <p>Sensory system, neural system organs, big sympathetic, regressive actions, actions of plants, mind and managing nature.</p> <p>Sensorial Organs, personal sensibilities, dream, dementia, laryngeal, swallowing.</p> <p>Description of animals:</p> <p>First branch: vertebrates, general properties, classification: mammalians, birds, reptiles, frogs, fishes (sediye, tuyur, zahife, difdaiye, esmak).</p> <p>Second branch: invertebrate animals, insects, caterpillar, spiders, crustaceans, earthworms, birds like nightingale, ouzel, grackle</p> <p>Third branch: mollusks,</p> <p>Fourth branch: radiolaria or plants</p>	<p>Classification of plants, general characteristics of plants, parts of plant, chemical contents of leafs, main structures, nutritive organs, root and structures of roots, scape, extrusions, growing of leaf, needle leaved plants(ehdab), lamelled plants (harasif), plants in form of briar patch (esvak and leeches), respiration and sweating, growing of plants, vaccination(telkih), plant nutrition and foods obtained from plants.</p> <p>Reproductive organs: Types, types of flowers, transformation in plants, flowering, flower leaves, nectar (pollen), egg(buyeyizat), movement, sleep.</p> <p>Fruit: Basic parts, formation and contents, classification, seed(entas), development from seed to fruit, content, classification of fruits in accordance with their fruits in three branches.</p> <p>Zatul filkateyn (magnoliopsida), vahidul filkateyn (monocotyledons), acalycine plants, classification of animals and plants</p>	<p>Structure and layers of the world, information on the geological structure of the world, heat center, heat source, formation of mountains, volcanoes and earthquakes, lava stone and sediment stone, layer forming earth's crust, organic rocks, porphyry, basalt, slate, quartz, sand, grind stone. Hard rocks, marble, stones, chalk, gypsum, flammable rocks, diamond, coal, petrol, combination of plant field.</p> <p>Health ruled to be obeyed in physical and mental works, health rules for schools, foods, beverages, housing sanitation, cleaning, baths, shortness of breath and preliminary precautions to be considered for hyperemia towards a certain point of body, smallpox vaccine, preliminary precautions required to be taken in case of contagious disease outbreak</p>

Subjects of the course of *Ilm-i hayvanat* correspond to the ones in the curriculum of today's biology course to a large extent (Ministry of National Education, 2005). But there is not any subject title on the cell discovered by Robert Hooke in year 1665. It is observed that artificial classification is taken as a basis for the classification of creatures and that classification steps weren't formed on the basis of phylogenetic classification in the classification of animals. This shows that scientific developments and changes arising out weren't reflected very quickly in the curriculum programs.

Similar information is available in the course book titled as "*Ilm-i nebatat*" written by Dr. Esad Serafeddin in A.H.1329 to be instructed in the idadi schools (Doktor Esad Serafeddin, 1329).

Course of sciences and technology in the curriculum of the course of *Ilm-i nebatat* for sixth grade has similarities with the curriculum of Biology for 9th and 12th grade. It is seen

that phylogenetic classification is not taken as a basis for classification (Ministry of National Education, 2005).

Course of “fenn-i hifz-us sihhayı umumiye” (scientific general health care) was taught in the last grade of the idadi branch of Mekteb-i sultani which is one of the other important secondary education institution.

3. Higher Education

Courses of sciences and mathematics were given as conferences in the Darulfunun founded first in 1863. It was decreed in 1863 that hikmet-i tabiiyye (treatise on physics) is taught by Superintendent of the Imperial Mines in Darulfunun, Dervis Pasha and that existing equipments are transferred thereto, and then Dervis Pasha started to give training on 13rd January 1863. Course of chemistry was taught by Aziz Bey who had completed his education in tibbiye-i askeriye (Military School of Medicine) and is well-known with his work called as “Kimya-i tibbi” (medical chemistry). Salih Efendi who had studied also in military school of medicine and is an expert in the courses of ilm-i mevalid started to give education on 16th February 1863 in Darulfunun (Mahmud Cevad, 2001, p. 209). But no branch was discriminated and a program was issued, where all students would receive the same courses in Darulfunun founded for the second time following the failure of the first intervention for the said formation in 1870. Courses of ilm-i hayvanat (zoological science), ilm-i nebatat (botanical science), heyet and hikmet-i tabiiyye (astronomy and physics) and ilmi tabakatul arz (geology) were stated to be instructed in the Ordinance of General Education (Maârif-i Umumiye Nizamnamesi). The said courses that we may call as Botanic, zoology and geology were planned to be taught individually. But because of the trouble in finding an instructor and a book, the said courses were taught under the name of ilm-i mevalid without making any discrimination for branch (Ishakoğlu, 1998, p. 322). Even though the courses of sciences were taught intensively in the first two grades in the third intervention in 1873, that intervention wasn't long-lived. Courses of sciences and education were agreed to be taught in the branch of ulum-i riyaziye (mathematical sciences) and tabiiye (biology) with three-year educational period in Darulfunun-ı Sahane (Imperial University) founded on September 1, 1900. Darulfunun was divided in five branches under the supervision of Emrullah Efendi in 1912, nebatat-ı umûmî (general botanics) and ilm-i arz (geology) and ilm-i maden (mining) were included by the courses of ulum-ı tabiye (Biological Sciences) (Ishakoğlu, 1995, p. 230-232). Courses of “ilm-i hayvanat” (zoological science), “ilm-i nebatat” (botanical science), and “ilm-i nebatat ve tabakatul arz” (Botanical Science and Geology) were taught 2 hours per week in the course program 1903-1904 in the department of sciences in the branch of sciences. (Ishakoğlu, 1995, p. 255).

Osman Ergin (1977) stated that courses in the branch of ulum-i riyaziye (mathematical sciences) and tabiiye (biology) are theoretical, they are followed through books and notes and there is no laboratory to allow any operation or experiment. He declared also that books aren't printed on colored papers appropriately (Ergin, 1977, p. 1223-1224).

In 1897 examinations of nazar-ı mebadi-i ilm-i hikmet-i tabiiyye (biology), kimya-yı madeni (mining chemistry), and tarih-i tabiidan ilm-i hayvanat (zoology) and then hikmet-i tabiiyye (Biology), kimya-yı madeni (mining chemistry) uzvi ve sınai (Organic and Industrial), hayvanat (zoology), nebatat (botanic) and madeniyyat (mineralogy) were agreed to be done respectively in the second grade and the fourth grade for the students to be recruited in Mekteb-i Mulkiye (School of Political Science) (Mahmut Cevad, 2001, p. 164). Courses of hikmet-i tabiiyye (biology), kimya-yı madeni (mining chemistry) uzvi ve sınai (Organic and Industrial), ilm-i hayvanat (zoology) intended for farming and ilm-i nebatat intended for (agriculture) take place in the course program of the said year. (Mahmut Cevad, 2001, p. 170).

Course of ilm-i mevalid was agreed to be instructed in the Darulmuallimin schools founded in Istanbul in the Ordinance of General Education (Maârif-i Umumiye Nizamnamesi) (Article 55) in order to meet the need for teachers in the rusdiyye schools on March 16, 1848. Course program of the branch of Mekatib-i Ali (college) of Darulmuallimin in 1880 includes ilm-i hayvanat (zoology), nebatat (botanic), hikmet-i tabiiyye (biology) and chemistry (Mahmud Cevad, 2001, p. 179).

Mekteb-i Maârif-i Adliyye (School for Learning) had been increased to three year and focused on governmental officer training since the years 1862-63 and then replaced by Mekteb-i Aklam and Mahrec-i Aklam respectively (Akyuz, 2011, p. 171). Courses of hikmet-i tabî'yye (biology) and chemistry are seen to have been taught in the third grade of the course program of Mahrec-i Aklâm (school for education of state officials) in 1875. But there is not any course related to the curriculum of biology and there is not also any course related to sciences in the course programs of Darulmuallimat (teacher's training school) (Mahmut Cevad, 2001, p. 142-143).

4. Biology Training in the Republic Period

Biology training was continued based on the translation of the books of foreign researchers until the era of the republic era (Tekeli and İlkin, 1999). Contemporary sciences education implemented since the foundation of republic was modified from times to times and affected by external developments (Yılmaz and Morgil, 1992). Turkish and foreign experts were taught in order to enrich the contents of programs as a result of the fundamental changes between 1923 and 1946. Program studies performed until 1950s were generally intended for primary education and studies to develop program in Turkey are performed by preparing the lists of courses and subjects (Ayas, Çepni & Akdeniz, 1993).

Developments in sciences and then biology are observed to have gained acceleration upon the scientific and technological developments affecting all stages of training. It became necessary to integrate new biology, physics, chemistry programs and to develop related instruction materials and this causes modern instruction techniques, methods and curriculums, sciences and scientific study methods to be included in the system. Developments in biology training and curriculum after the foundation of republic may be listed as follows:

*Many studies intended to develop the trainings on sciences and biology were completed successfully in parallel with the scientific development in 1950s (Gezer vd., 2003). TÜBİTAK initiated its first studies on "Modern Biology Instruction Program" in 1959. Students were intended to participate more actively in the courses by the use of this program prepared within a short time. Thus classical biology instruction program until that time was improved and modernized. But implementation of program was ceased upon the withdrawal of its support from TÜBİTAK on the projects of sciences (Yılmaz ve Soran, 1999).

*Foundation of Ankara science high school in 1964 is an important result of the effects of the activities developing the science instruction in the world in our country.

*Toing and foing on Project supports and coordinated works were experienced between Ministry of National Education and TÜBİTAK from 1950s to 1980s and the related collaboration has lost its function completely since 1980s. MEB couldn't receive enough support from universities and TÜBİTAK and this causes biology program not to be modernized enough in the years when new technological and scientific developments were experienced.

*Both the lack of well-trained teachers and the lack of course equipment and tools in biology training cause Ministry of National Education to make a revision in the contents of modern biology training on which modernization studies were performed in 1980s (Turgut, 1990).

*Ministry of National Education re-regulated the instruction of Biology course within a single book in 1985. Related program is as follows (MEB, 1985):

High School-Grade 1: Introduction to biology, what is science, diversity of creatures, populations, animal groups and communities, life unions, life in an animal cell, multi-cell organisms and tissues.

High School-Grade 2: Managing molecules and genetic code, reproduction and development, inheritance, handling systems, respiratory systems, digestive systems, urinary system, musculoskeletal system, endocrine systems, and neural system.

High School-Grade 3: Chemical energy and life, luminous energy and life, oxygen and life, managing molecules, generic code, reproduction, development, population genetics, transportation, respiration, musculoskeletal system, endocrine and neural system.

Biology course program wasn't renewed and only biology subjects for the course of advanced sciences were made detailed and appropriate for the hours of courses in the periods where passing grade and credit system are implemented (Yılmaz and Soran, 1999).

Units of biology course and distribution of the subjects taking place in the instruction program of the courses of Sciences and Technology are as follows (MEB, 2013):

Table 4. *Distribution of the Units and Subjects in the course programs of Sciences and Technology (MEB, 2013)*

Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
UNITS	UNITS	UNITS	UNITS	UNITS
Unit 1:Let's solve the riddle of our body Creatures and Life	Unit 1: Let's solve the riddle of our body Creatures and Life	Unit 1: Systems in our body / Creatures and Life	Unit 1 :Systems in our body / Creatures and Life	Unit 1: Reproduction, Growing and Development of Human being / Creatures and Life
Recommended Subject Headings • Support and Movement • Breathing •Blood Circulation in Body •Let's exercise • Microscopic creatures and Our environment	Recommended Subject Headings • Nutrients and their properties • Digestion of nutrients •Urinary system in our body	Recommended Subject Headings •Cell •Support and movement system. •Respiratory System •Circulatory System	Recommended Subject Headings • Digestive System • Urinary System • Supervisory and regulatory systems • Sensorial Organs •Donation and transplantation of organs	Recommended Subject Headings • DNA and Genetic Code • Mitosis - Meiosis • Reproduction, Growing and Development of Human being • Adolescence and Health
Unit 6. Let's solve the riddle of our body / Creatures and Life	Unit 5: Let's know and travel around the world of creatures / Creatures and Life	Unit 5: Reproduction, Growing and Development of Animals / Creatures and Life	Unit 5: Human being and Environment	Unit 5: Relation between creatures and energy/ Creatures and Life
Recommended Subject Headings • Let's know the assets in our environment • The Environment where we live in •Living Spaces •Environment Pollution •Environment Protection	Recommended Subject Headings • Let's know the creatures • Relation between human being and environment	Recommended Subject •Plants and Reproduction, growth and development of plants	Recommended Subject Headings • Ecosystems • Biodiversity	Recommended Subject Headings • Energy Flux in food chain • Matter cycles • Sustainable Development • Biotechnology

Modifications were performed in the course program of biology upon the extension of high school period to four years. Grades and course programs were reshaped. Units and subjects are distributed as follows:

Table 5. *Instruction Program of Biology Course in 2013*

Grade 9	Grade 10	Grade 11	Grade 12
UNITS	UNITS	UNITS	UNITS
Life Science-Biology	Reproduction	Energy Transformations in Creatures	From gene to protein
.Nature of Scientific Information and Biology .Common Properties of Creatures . Basic Components in the structure of the creatures	.Mitosis and Asexual Reproduction .Meiosis and Sexual Reproduction .Growth and Development	. Liveliness and Energy . Photosynthesis . Chemosynthesis . Respiration	. Discovery and Significance of Nucleic Acids .Genetic code and protein synthesis
World of Creatures	General Principles of Heredity	Human Physiology	Plant Biology
. Basic Unit of Liveliness .Diversity and classification of creatures . World of Creatures and Their Properties	.Heredity and Biodiversity .Modern Genetic Applications	. Tissues .Nerves, hormones and homeostasis . Support and Movement System Blood Circulation Lymphatic Circulation . Respiratory System . Urinary System	.Structure of Plants .Growth Movement .Agent Transport in Plants . Sexual reproduction in plants
Actual Environmental Problems	Our World	Behavior	Community and Population Ecology
. Actual environmental problems and human being .Preservation of natural sources and biodiversity	.Ecosystem Ecology .Biomes	.Behavior	. Community Ecology .Population Ecology .Beginning of Live and Evolution

CONCLUSION and DISCUSSION

Courses of “Ma’lûmât-ı Tabiiye” (Natural Sciences), “Hıfz-us-sıhhat” (Protection of Health), “Ma’lûmât-ı Nafia” (Useful Information), “Elifba ve Sifahi Ma’lûmât” (Life Sciences) in Rusdiyye schools (Ottoman Junior High Schools), “Hikmet-i Tabiiyye” (A Treatise on Physics) or “Tarih-i Tabiiyye” (A science dealing with the evolution of animals, plants and the world), “Malumat-ı Fenniye ve Hıfz-us-sıhhat” (Protection of the Health), “İlm-i Mevalid” (Science on Animals, Botanic and Plants) in Mekteb-i Sultani (Imperial High School) and Idadis (Imperial High Schools) giving education at the levels of high schools, courses like “İlm-i Nebatat” (Botanical Science), İlm-i Hayvanat (Animal Science) and “Tarih-i Ulûm-i Tabiiye” (History of Natural Sciences) in the branch of Ulûm-i Tabiiye (natural sciences) of Darulfunun (Ottoman University) are associated with the subjects within the current curriculums of Biology in the educational institutions within the modernization process of Ottoman Empire

Contemporary sciences were instructed first in militaristic schools, Hendesehane (Engineering School), Muhendishane-i Berri-i Humayun (Imperial School of Military Engineering) and Muhendishane-i Bahri-i Humayun (Imperial School of Naval Engineering). Subjects in the curriculums of biology are encountered in the courses of “Hıfz-us-sıhhat” (Sanitation), “Ma’lûmât-ı Tabiiye” (Natural Sciences), “Ma’lûmât-ı Nafia” (Useful Information), “Elifba ve Sifahi Ma’lûmât” (Life Sciences) in the course programs followed in the Rusdiyye schools which were founded following the said schools where theoretical information was taught. Information on physiological anatomy and health protection in the

rusdiyye schools for girls where microbes, waters, air and foods were discussed in the course of “Hıfz-us-sihhat”. Subjects like earth, stars, water, fire, residence, human body, trees, mines, agriculture, animals and human body, nutrition, health protection were taught as useful information respectively in the courses of “Ma’lûmât-ı Nafia” and “Elifba ve Sifahi Ma’lûmât”. Subjects constituting the curriculum of biology cited in these courses are seen to be intended to offer the practical information used in daily life and not to go beyond the theoretical information.

Subjects of biology started to be stated as a discipline in the idadi schools and the name of course was called as ilm-i mevalid (science of nature). Assets, creatures and non-creatures, description and contents of zoology, difference between animals and plants, structure and texture of animals, classification of animals, organs of animals, digestive organs of animals, digestive organs of human beings, details and function of digestive organs in animal types, types of circulation system, respiratory system and its types, respiratory system, skeleton, muscles, nerves, five sensorial organs, significant and useful types of animals were stated briefly in the course of “İlm-i Mevalid”. Furthermore the structure, the texture, duties of the plants, scopes and duties, buds, hook and its function, flowers and respiratory organs, fruits, vegetables, nutrition of plants, absorption, respiration, proper nutrition and saliva, brief classification of plants, germination and reproduction, important and useful plants are stated to be described generally in the course of “İlm-i Mevalid”. Subjects like farming, seed planting, livestock, bees, birds etc. were discussed and classification of animals, segmentation of plants, layers of the world and mines, weather events and goods were tried to be taught in the course of Ma’lûmât-ı Fenniye ve Hıfz-us-sihhat.

Actually it is observed that a confusion was experienced and subjects of biology were stated again and again under different names, in different subjects in the course of the determination of new programs in the modern schools founded in the period of Ottoman Empire. Change in the course programs and names of the courses for the years may be observed with the instabilities on which subject would be in which grade, in which course. This situation was tried to be removed but the problem about the curriculum of the courses was inherited to new republic upon the collapse of Ottoman Empire. Proclamation of the republic, innovations made and alphabet reform drew all attention towards primary school and especially literacy. Preparation of instruction programs were neglected for a long time.

Biology education in the republic eras based on the translation of foreign books until 1950s caused later and then studies on modern biology caused the course books of biology to be collected in a single book. Studies were continued to be performed through various projects between the Ministry of National Education and TÜBİTAK until 1980s and were collected by MEB within a single book in 1985. Finally MEB reshape its curriculum of biology in 2005 and 2013. Many subject titles were found hereby to be common in the curriculum of biology from Tanzimat era to today.

Curriculum of the courses related to biology after Tanzimat reform in Ottoman Empire are seen to be close the curriculum of today. Today, curriculum of Hıfz-us-sihhat is encountered in the programs for the courses of Sciences & Technology and Biology. The fact that the course subjects of Hıfz-us-sihhat take place spirally every year in the subjects of Sciences and Technology and, Biology and Hygiene is a reflection of the constructivist training understanding. But it is seen that such approach has been reflected in the curriculum. As a result of current study, it is seen that biology curriculum in Ottoman Empire has been given as not an individual course but within an integrated understanding which includes the subjects like nature, agriculture, medicine and geology and information which should be known by a student in daily life during the modernization period of Ottoman Empire. Developments in biology were reflected even partially to curriculum but lack of supporting materials of the course, the fact that the courses were always given theoretically and not

supported by laboratory and equipment stand out as most important deficiencies. Subject of cell is one of the basic subjects of biology and almost half of the subjects in the curriculum of Biology is associated with cell. Developments going on until 1665 and continuing with the discovery of cell and especially the subject of cell were not seen to be cited enough and thus it gives the impression of a delay in following scientific developments.

One of the most important indicators of the delay in following the scientific developments is the fact that artificial classification is taken as a basis in the classification of creatures. For instance steps of classification are not seen to be made on the basis of phylogenetic classification in the classification of animals.

REFERENCES

- Ayas, A., Çepni, S. ve Akdeniz, A.R. (1993), "The Development of the Turkish Secondary Science Curriculum", *Science Education*, 77(4), 433-440.
- Bas, T. ve Akturan, U. (2013). *Nitel araştırma yöntemleri*. Ankara: Seçkin Yayıncılık
- Demirel, F. (2010). *Mekteb-i İdâdî*. Yayımlanmamış Doktora Tezi. Ataturk Üniversitesi Sosyal Bilimler Enstitüsü, Erzurum.
- Doğanay, F. K. (2011). *Tanzîmât'tan Cumhuriyet'e Rusdiye Mektepleri*. Yayımlanmamış Doktora Tezi, Ataturk Üniversitesi Sosyal Bilimler Enstitüsü, Erzurum.
- Doktor Esad Serafeddin, (A.H. 1329). *İlm-i nebatat*, Karabet Matbaası, İstanbul.
- Dustûr*. (13 Aralık 1896). I. Tertip.
- Ergun, M. (2000). Medreseden Mektebe Osmanlı Eğitim Sistemindeki Değişme, *Yeni Türkiye*. Ankara. 3, 747 -748.
- Ergun, M., (1996).*İkinci Mesrûtiyet Devrinde Eğitim Hareketleri (1908-1914)*, Ankara.
- Gezer, K., Köse, S., Durkan, N., Usak, M. (2003). Biyoloji Alanında Yapılan Program Gelistirme Çalışmalarının Karşılaştırılması: Türkiye, İngiltere ve ABD Örneği, *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi*, 14 (2), 49-62.
- Hızlı, M. (2008). Osmanlı Eğitim Tarihi'nin arşiv ve yazma kaynakları, *Türkiye Araştırmaları Literatür Dergisi*. 6, 577-592.
- Hulûsi, (1326-1328). *İlm-i Hayvanat*, Karabet Matbaası, İstanbul.
- İshakoğlu, S. (1995), 1900-1946 Yılları Arasında Darulfunun ve İstanbul Üniversitesi Fen Fakültesi'nde Matematik ve Fen Bilimleri Eğitimi, *Osmanlı Bilimi Araştırmaları*, ed. Feza Gunergun, İ.U. Edebiyat Fakültesi, İstanbul, 217-283.
- İshakoğlu, S. (1998), 1900-1946 Yılları Arasında Darulfunun ve İstanbul Üniversitesi Fen Fakültesi'nde Botanik, Zooloji ve Jeoloji Eğitimi, *Osmanlı Bilimi Araştırmaları II*, ed. Feza Gunergun, İstanbul, İ.U. Edebiyat Fakültesi, 319-348.
- Kızlara Mahsus Hıfz-us-sıhhat (İkinci Kitap)*, 1316, Karabet matbaası, İstanbul.
- Koçer, H.A. (1987), *Türkiye'de Modern Eğitimin Doğusu*, Uzman Yayınları, Ankara.
- Mahmud Cevad (2001). *Maârif-I Umûmiyye Nezareti Tarihçe-i Teskilat ve İcraatı XIX. Asır Osmanlı Maârif Tarihi*. Ankara: Yeni Türkiye Yayınları.
- MEB, (2013). Biyoloji Dersi (9, 10, 11 ve 12. Sınıflar) Öğretim Programı, <http://ttkb.meb.gov.tr/www/ogretim-programlari/icerik/72> (30.05.2015).
- Milli Eğitim Bakanlığı [MEB], (1985). *Lise ve Dengi Okullarda tek Tip uygulanacak Olan Fizik, Kimya, Biyoloji, Öğretim Programları*. Talim ve Terbiye Kurulu, 150, Ankara.
- Salnâme-i Nezâret-i Maârif-i Umûmiyye*. (A.H. 1316, 1317, 1318, 1319, 1321).
- Turgut, F. (1990). Türkiye'de Fen Ve Matematik Programlarını Yenileme Çalışmaları, *H.U. Eğitim Fakültesi Dergisi*, 5, Ankara.
- Vilayat-i Sahanede Bulunan Leyli ve Nehari Mekatib-i İdâdiyye Mahsus Olarak Bu Kere Maarif Nezaretince Ta'dilen Kaleme Alınan Ders Programları*, Dersâdet 1310.
- Yıldırım, A. ve Simsek, H. (2013). *Sosyal bilimlerde nitel araştırma yöntemleri*. (5. Baskı). Ankara, Seçkin Yayıncılık.
- Yılmaz, A. (1990), "Türkiye'de Fen Öğretiminin Genel Bir Değerlendirmesi", *Sonuçları ve Öneriler*, Yayımlanmış Bilim Uzmanlığı Tezi, H.U. Eğitim Fak., Ankara.
- Tekeli, İ. ve İlkin, S. (1999). *Osmanlı İmparatorluğu'nda Eğitim ve Bilgi Üretim Sisteminin Olusumu ve Dönüşümü*. Ankara: Turk Tarih Kurumu Yayınları.
- Yılmaz, M. Ve Soran, H. (1999). Ortaöğretimde Değişen Eğitim Sistemlerinin Biyoloji Derslerine Etkileri. *H.U. Eğitim Fakültesi Dergisi*, 16-17, Ankara.
- Yinilmez Akagunduz, S. (2013). Osmanlı Devleti'nde Okutulan İlk Fizik Kitabı: Usûl-i Hikmet-i Tabiiyye (Doğa Felsefesine Giriş), *Türk Tarih Eğitim Dergisi*,2(2), 58-77.
- Zengin, Z. S. (2008). Medreseden Üniversiteye, *Çukurova Üniversitesi İlahiyat Fakültesi Dergisi*, 8 (2), 211-221.