

INTRODUCTION TO HEALTH AND FITNESS

Aim

- a) To explain the nature of the health and fitness industries.
- b) To explain the human body at a microscopic level, including the structure and function of cells, tissues, and membranes.

INTRODUCTION

Health and Fitness are simply some of many the different words used to describe people being in good condition. There are many different services and products on offer which promise to improve or maintain a state of wellbeing, and any (or all) of these goods and services might be considered to be part of the health and fitness industry. These can include things as variable as medical services through to sport, recreation, food and natural therapies.

The Health and Fitness industry is not a clearly defined industry. It does have many aspects to it, and it does overlap into many different fields. Your perception of the scope of this field may be limited as you commence this course; but on completing the course it should have broadened considerably; and in doing so your prospects for employment should have also broadened.

Scope of the Health and Fitness Industry

The following are just some of the organisations/businesses which might employ people with management skills in the health and fitness industry:

- Recreation Centres
- Gymnasiums
- Swimming Pools
- Sporting Clubs
- Medical Practitioners
- Chiropractors or Naturopaths
- Health Food Shops
- Health food manufacturers

This is a short list as well as Gymnasium or Sports equipment businesses (retailers or manufacturers), Resorts, Hotels, Tourist industry, and Schools.

There are also many different forms of working with the body for better physical fitness. Modalities such as callisthenics, jogging, and weight training were some of the first forms that became popular. Through the years, many other forms have developed such as aerobics, yoga (which has actually been around for centuries), Pilates and then hybrids from each of these such as yogalates, body pump, and water aerobics as well as many other forms of exercising the body.

REASONS FOR FITNESS

Physical fitness is the capability of the heart, blood vessels, lungs and muscles to function at optimal efficiency - Fitness is broader than just this though! A person's mental attitude towards life is another aspect of fitness. Mental stress (pressures from situations at work, home etc.) can affect a person's fitness just as much as malnutrition or a physical injury. Stress is very often related to physical fitness.

A stressed person can have difficulty with muscles etc. tensing or pulling where they should not pull, placing pressure on nerves, bones etc., and leading to other problems. Allergies to foods, dust, even the common bacteria which can occur in everyone's throat can pose problems to a person's fitness, or complicate already existing problems.

The single most important fact to understand about human fitness is the complexity of the human body, and the fact that this complexity makes fitness a multi-faceted thing. (You will never be fit by just eating right, or just exercising).

In a nutshell, fitness comes only by developing a balanced approach to life in all of the important spheres of life.

Example:

- Eat healthy foods which you are not allergic or sensitive to, which provide all the necessary nutrients in adequate but not excessive amounts
- Exercise all of the parts of the body regularly and adequately
- Know how to relax, to rest the body both physically and mentally.

BASIC COMPONENTS OF PHYSICAL FITNESS

1. Strength

Most people think that to be fit is to be strong. This is true, in a way; but strength isn't all there is to fitness. Strength is the capacity of a muscle to exert maximal force against a resistance. Strength training (exercising to develop strength) will result in some enlargement of muscle fibres and a relative increase in your ability to apply force. Properly conducted weight resistance programs (exercise with barbells for example) are the most efficient ways of gaining rapid strength.

2. Muscular Endurance

Endurance is the capacity of a muscle to exert force repeatedly over a period of time. It is not the same as strength! Muscular endurance can also refer to holding a muscle contracted for a period of time. Your ability to do sit ups or pull ups is a measure of your muscular endurance. The distance which you can jog without stopping to walk is a measure of your muscular endurance. By doing these types of exercises and gradually increasing the repetitions, you will be able to increase your muscular endurance.

3. Flexibility

Flexibility is your ability to use a muscle throughout its full range of movement. It is essentially your ability to move your joints. Someone who can touch their toes is much more flexible than someone who cannot. Exercises such as touching the toes which stretch muscles to their full extent are the best way of increasing flexibility.

4. Motor Skill Performance

This is the ability of the nerves to receive and provide impulses which result in smooth, co-ordinate muscular movement. This is evident in your ability to dodge, control balance, react and move quickly, etc. Motor skill exercises include such things as the vertical jump, agility run, squat thrusts, etc.

5. Cardiorespiratory Endurance

This refers to the capacity of your heart, blood vessels and lungs to deliver nutrients and oxygen throughout the body. Vigorous exercise increases the cells need for oxygen. This means you must breathe in more oxygen and the heart must pump more through the body. Vigorous exercise is the best way to increase cardiorespiratory endurance. Be careful though - too much too soon is dangerous.

THE ROLE OF THE FITNESS LEADER

While most people are at least vaguely aware of the benefits of exercise, the overwhelming majority lack the specific knowledge required to design an exercise program that suits their needs and goals, and is tailored to any specific medical conditions they may have. This is where the fitness leader comes in. The fitness leader is a professional, who should not only possess sufficient knowledge, motivational skills and professionalism but who can also apply them. The fitness leader's role is to facilitate exercise, to guide and instruct people, to make them more knowledgeable and to make exercise enjoyable and beneficial.

Fitness leaders are generally required to work within specific legislation and guidelines and in most countries will have to meet certain licensing criteria, obtain insurance, have qualifications and often professional membership is a good idea. Professional bodies often outline specific ethical and professional behaviour and conduct criteria for their members, which must be adhered to. This can give clients a sense of confidence in the skills and professionalism of a fitness leader.

CELLS & TISSUES – Anatomy and Physiology

What is a Cell?

The word cell is derived from the Latin “*cella*” which means “small room”. Cells are the units from which all living organisms are built. Some organisms (e.g. bacteria) have only one cell in the entire organism. Others are multicellular. A human body can contain an estimated 100,000 billion cells.

Each cell is a self-contained and partially self-sufficient compartment designed to carry out a limited series of functions. While the structure and function of cells is extremely variable, their basic structure is similar. All cells are bound by an outer membrane and contain cytoplasm and DNA.

Cell Theory

The following are the key points of cell theory:

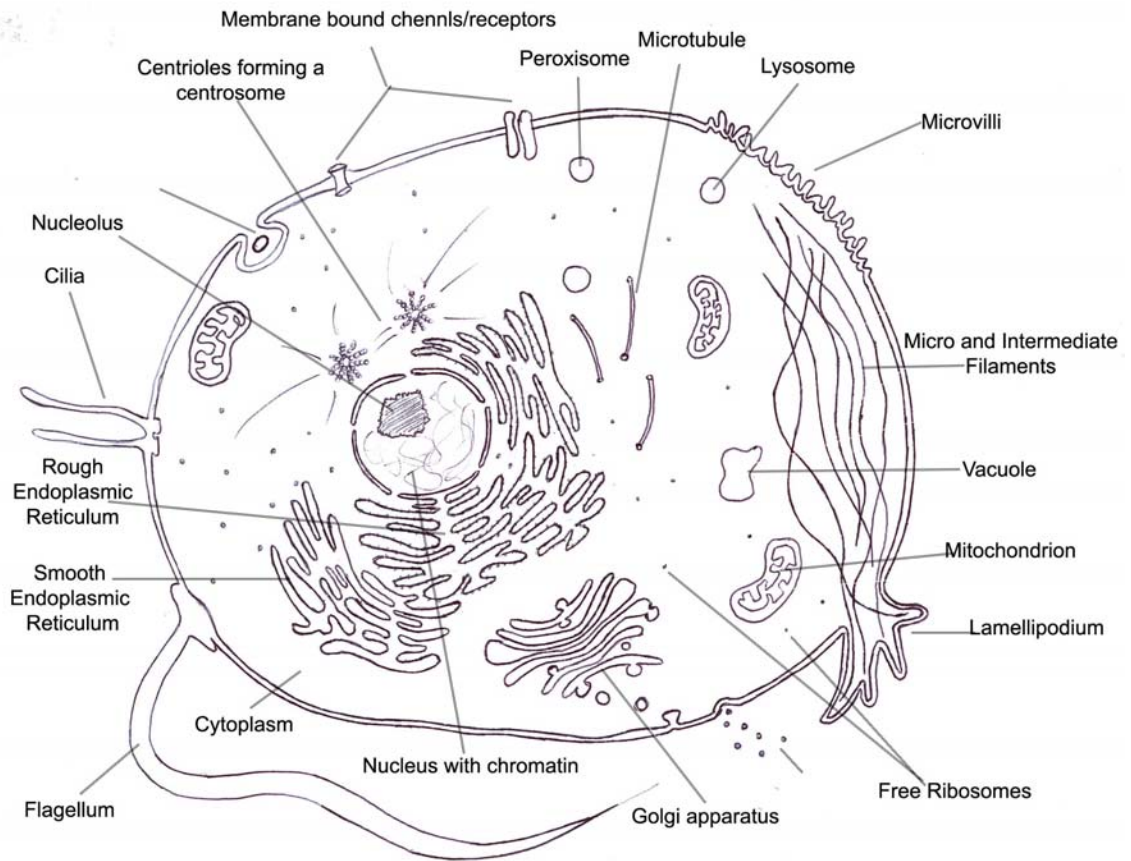
1. All organisms are composed of one or more cells.
2. All cells are derived from previously existing parent cells.
3. Cells contain genetic information that controls the cell's functions.
4. Genetic information is duplicated and transmitted from parent cells into any new cells.

Parts of the Human Cell

Cells are compartmentalised. These compartments are known as organelles and each have specific functions. There are also structural fibres and membranes as outlined below:

- *Plasma membrane*
This is the outer layer of the cell. It gives the cell its shape and holds the liquid inside the cell. It is semi-permeable which means it allows certain things to pass in and out of the cell. The membrane itself is a phospholipid bilayer.
- *Nucleus*
This is the part of the cell which holds the genetic material, the chromosomes and chromatin which are concerned with reproduction of the cell. Inside the nucleus is the suborganelle known as the nucleolus, which functions to make and assemble ribosomes.

- *Cytoplasm*
This is the water based fluid inside the cell which contains salts and other ions and molecules suspended in solution. Within the cytoplasm you will find filaments, proteins, organelles and vesicles.
- *Cytoskeleton*
A network of protein filaments in the cytoplasm that provide a structural framework for the cell, and it is responsible for cell movements. Includes microtubules, microfilaments and intermediate filaments.
- *Golgi apparatus*
This is essentially a large folding membrane. It serves as a processing factory within the cell, primarily working on proteins and lipids. It also packages macromolecules for transport to other regions of the cell, or for secretion.
- *Lysosomes*
These organelles contain powerful enzymes known as hydrolases that break down food molecules, old or unwanted organelles and even invading pathogens.
- *Ribosomes*
Ribosomes are tiny, roughly spherical structures attached to the rough endoplasmic reticulum. They are involved in the synthesis of proteins.
- *Centriole*
Centrioles are barrel shaped organelles made up of triplets of microtubules. Found in pairs they form centrosomes which are important for cell division.
- *Mitochondrion*
Mitochondria (plural of mitochondrion = mitochondria) are concerned with the respiration of the cell. Respiration produces energy for the cell. These are the cell's powerhouses.
- *Endoplasmic reticulum*
Another membrane organelle that associates with the nuclear membrane. Serves a variety of functions, the most important being protein synthesis and folding. Some proteins move on to the Golgi for more modification and final packaging.
- *Peroxisomes*
These organelles contain peroxides that digest lipids and some other foods.
- *Microvilli*
Found on cells that function to absorb, these are small extensions of the cell that serve to increase the cells overall surface area. This in turn provides for more efficient absorption.
- *Secretory Vesicles*
These bud off from different structures, such as the Golgi and contain different biomolecules that the cell either no longer needs, or that have been manufactured by the cell but are required in another cell or part of the body.
- *Flagellum and Cilia*
Found on some cells, these allow movement or migration of cells, or the movement of fluids over cells, in the case of cilia.



FROM CELLS TO BODIES

Humans are multi-cellular organisms. The single cells, many of which are specialised so that they can perform a particular function, are grouped together to form tissues. These tissues in turn form special groups called organs. The groups of organs make up a system, and the systems together form a living body.

HUMAN TISSUES

There are four basic types of tissue found in humans:

- Epithelial tissues
- Connective tissues
- Muscle tissues
- Nervous tissues

Epithelial Tissues

This is a diverse range of tissues that all form linings that for cavities and hollow organs of the body. Examples include the skin, and the intestinal lining, mucous membranes such as that in the oral cavity and so on. Epithelia may be classified according to the cell shape and layering of cells:

- *Squamous*

Cells are flattened and irregular in shape

- *Cuboidal*

Cells are short and fat, (cube shaped)

- *Columnar*

Cells are taller than they are wide

- *Simple*

The epithelium is made up of a single layer of cells

- *Stratified*

The epithelium is made up of more than one layer of cells

- *Pseudostratified*

The epithelium looks like it is made up of more than one layer of cells, but it is in fact only one layer

- *Transitional*

The epithelium is made up of layers of cells that can slide past each other, so if the epithelium is stretched it appears to have fewer layers of cells than when it is relaxed.

Epithelia serve many functions, protection, secretion, absorption and allowing expansion and contraction in some organs. They may be keratinized (the skin for example is keratinised stratified squamous epithelium) or not, and they may have cilia, the linings of the respiratory pathways for example have cilia which beat to move particles over the surface of the epithelium.

(Epithelia = plural, Epithelium = singular)

Connective Tissues

Another diverse class of tissue that typically all serve a structural function. Connective tissues can hold organs and epithelial linings together, can provide shape and structural integrity to organs, form structures such as ligaments and tendons, bones and cartilages. Connective tissue includes:

- *Connective tissue proper*

Loose connective tissue that holds everything in the body in its correct position as well as the tendons and ligaments which hold bones and muscles in place relative to each other and also provide leverage and strength.

- *Bone*

A hard mineralised tissue that provides shape and structure to the human body, and supports and provides attachment for muscles.

- *Cartilage*

Serves a protective function for bones, covering articulating surfaces so they don't grind together during joint movements. Also provides structure to the nose, ears and airways. A dense connective tissue is can also act as a shock absorber as well.

- *Blood*

A fluid connective tissue that serves to transport different minerals, oxygen, carbon dioxide etc around the body.

- *Fat*
Correctly termed adipose tissue this tissue functions serves a protective function, absorbing forces so they don't damage or do less damage to internal organs. It is also the primary energy storage site in the body, as well as functioning in body temperature regulation and providing insulation.

Muscle Tissues

There are three types of muscle tissues:

- *Striated or voluntary muscle tissue*
The type found in your arms and legs and which you can rest as you wish. Skeletal muscle is made up of striated (striped in appearance) muscle fibres supported by connective tissues attached to bone by tendons or an aponeurosis, and stimulated by nerves.
- *Smooth or involuntary muscle tissue*
This type of muscle works automatically and cannot be controlled by you. Involuntary muscle tissue is found in the muscle in the intestine which moves food along through the gut, in the walls of blood vessels, the uterus and bladder and so on. It is not striated.
- *Cardiac muscle tissue*
This type of muscle is also involuntary so it cannot be controlled by you but unlike smooth muscle, it is striated. This type of muscle tissue is found in the heart and some special adaptations to allow the heart to contract and relax continuously without becoming fatigued.

Muscle tissue is made so that it can expand and contract. You contract (shorten) the muscles of your arm when you pick up a brick and expand (lengthen) them when you stretch out your arm. The involuntary muscles of the body expand and contract on their own (think how your heart beats without your control).

Nervous Tissue

The nerve cells which make up this tissue are sensitive to stimuli, such as heat and touch. They can link up charges and transmit impulses through the nervous system. Nervous are either:

- *Motor*
These nerves signal muscle cells to contract or relax

- *Sensory*
These nerves detect sensations such as pain, temperature, touch, movement, tissue damage etc. For example, proprioceptors are sensory nerves found in the muscle tissue and sense muscle tension and joint angle.

CELL PROLIFERATION

Cell growth occurs by a single cell dividing, resulting in two cells. This process can occur by either of two different methods; mitosis or meiosis.

Mitosis

Mitosis is the process where a single (parent) cell copies its genetic material and makes new organelles, then divides in two, forming two new, identical (daughter) cells. This process occurs to generate new tissue (when you have a cut, cells in the skin undergo this process to make new skin to repair the skin tissue) or to replace dead or dying cells. Daughter cells are exact genetic replicas of the original parent cells they were formed from.

Meiosis

Meiosis is another means by which cells can proliferate. It occurs during sexual reproduction and produces gametes (sperm and ova).

During this process the parent cell divides in two stages to produce daughter cells that each have only half the DNA (1 copy of each gene instead of two) of the original parent cell. This is necessary because the gametes will during conception, join together and create a cell with both the sperm and the ovum DNA (giving the new cell a full complement of DNA – 2 copies of each gene).

CELL PROCESSES

Osmosis and Filtration

Cells are enclosed by a special tissue or skin called a semi-permeable membrane. The word permeable means porous or penetrable. Semi-permeable means that the membrane only allows certain things to pass through it. The membrane around cells allows water and other items in solution (i.e. dissolved in water) to pass into or out of the cell.

Osmosis is the process whereby water can pass through a semi-permeable membrane from a weak solution to a stronger solution.

Example:

A and B are two liquids separated by a semi-permeable membrane such as a cell wall. Liquid A is a solution of sugar and contains dissolved sugar particles (or molecules as very small particles are called). Liquid B is pure water, which is called distilled water, and this does not contain any dissolved matter at all. The movement which takes place is of water from Solution B through the semi-permeable membrane to Solution A. This causes Solution A to increase in volume and Solution B to decrease in volume. The pressure exerted by this movement is called osmotic pressure. As Solution B gets less and Solution A increases, this osmotic pressure will increase until water starts being forced back through the membrane from Solution A to Solution B. This counter pressure is called the filtration pressure.

The movement with osmosis is always of water, from a weak to a stronger solution. If Solution A was a strong sugar solution and Solution B was a weak sugar solution, the water movement would go on until both solutions were of equal strength. At this point, movement would stop.

THE OBJECT OF OSMOSIS IS TO HAVE SOLUTIONS OF EQUAL STRENGTH ON EACH SIDE OF THE SEMI-PERMEABLE MEMBRANE.

Hydrostatic Pressure

This is the movement of very small particles of matter, or molecules, across a semi-permeable membrane because the pressure on one side of the membrane is much greater than the pressure on the other side of the membrane. A good example of this force is the blood pressure of the body which is caused by the heart pumping blood around the system. This causes the pressure inside the capillaries to be higher than that in the surrounding fluid. This higher pressure forces particles through the capillary walls.

Active Transport

This is the movement of particles or molecules across a semi-permeable membrane against the force exerted by osmotic pressure or hydrostatic pressure. This movement requires energy before it can take place as it overcomes existing forces.

Phagocytosis

In Greek, "phagos" means eating. Phagocytosis is the action of a cell when it reaches out, engulfs a molecule into a cell and digests it.

Pinocytosis

With pinocytosis, the molecule attaches itself to the cell wall. It is then drawn into the body of the cell although it is still surrounded by a part of the cell wall. The gap is repaired by the cell wall growing together as shown.

Electrochemical Gradient

Some substances form ions when they are dissolved in water. An ion is a particle that has become electrically charged. For example, when common salt (which is called sodium chloride - NaCl for short) is dissolved in water it splits into sodium ions (positively charged) and chlorine ions (negatively charged) as shown.

Where there is an unequal number of positive and negative ions on either side of a semi-permeable membrane, the ions will move across the membrane until balance is reached. Balance occurs when there are equal numbers of positive and negative ions on either side of the membrane. The movement occurs because the attraction of the positive and negative ions sets up an electrical force.

NUTRIENT AND WASTE EXCHANGE IN CELLS

Having looked at the special properties of cells, we can now consider how nutrients pass from the arteries into the cells and how the waste products pass from the cells into the veins.

Both arteries and veins begin at the heart and spread throughout the body. To begin with, they are large tubes about the width of a little finger. They have thick walls. As they spread out, they divide into branches and get progressively smaller and narrower until finally they become very fine, thread-like tubes called capillaries. Capillaries have very thin walls.

The arterial system and the venous system connect up with each other through these capillaries. Notice that between the capillaries and the cells to which they carry nutrients, there is a fluid called interstitial fluid. (Interstitial means "intervening space"). This fluid surrounds the cells and capillaries and acts as a connecting link.

The nutrients carried by the arteries pass through the walls of the artery capillaries; travel through the interstitial fluid and pass through the walls of the cells. Waste products pass in a similar way but in the opposite direction! They travel through the cell walls; into the interstitial fluid and through the venous capillary walls.

Although this sounds a simple procedure, it is a complex operation that makes use of all the special properties of cells (such as osmosis, hydrostatic pressure and the electro-chemical gradient).

RESOURCES

No matter what you study, how you study or where you study;

IT IS VITAL THAT YOU DEVELOP GOOD SOURCES OF INFORMATION

These sources of information can be classified as follows....

Books/Magazines/Newspapers

- Borrowed from libraries, Bought from bookshops or newsagencies.
- NOTE...The school operates a mail order bookshop and can supply you with additional reading should you require any. Booklists are available on request - please state the topics you require booklists on.

Government Departments

Most government departments produce publications -booklets, leaflets, etc. Sometimes these are given away free, sometimes they are sold. Some government departments operate advisory services, etc. Information on recreation, sports and fitness can be obtained from departments such as sports and recreation, health or tourism (e.g. bushwalking, rafting); cooking and food can frequently be obtained from departments such as health which is concerned with what we eat, agriculture which is concerned with growing and marketing foodstuffs; energy (electricity and gas, etc.) which is concerned with the energy used in cooking etc.

Clubs, Societies, Professional Associations

- Look in the yellow pages phone books under "Organisations"

SHOWS and EXHIBITIONS

- Trade shows, displays in Exhibition centres/ showgrounds, shopping centres, etc.

COMMERCIAL ORGANISATIONS

- Businesses supplying goods or services.

PEOPLE

- Individual people with experience to share.
- Make friends, develop professional relationships with others in this field, and build up a number and variety of contacts.

ACCREDITATION, RECOGNITION AND LICENSING

Different positions within the fitness industry require qualifications and some do not. For example, to be a salesperson or manager within a gymnasium or health club **you** may not need Fitness Leaders qualifications. However staff, who deal with, instruct and advise customers in terms of health and fitness would need to be a qualified "Fitness Leader". A swimming coach also needs to be a qualified "Swim Coach".


To be professional, an instructor needs to be capable, competent and to also be a good example for the health and fitness industry. An example may be a good "aerobics instructor" – ie. look after all of the participants of the class, communicates well, looks fit, teaches the class professionally, starts on time, has quality music, professional uniform, states any safety requirements at the start of the class, warms-up the class, cools-down the class, answers questions at the end and is very approachable.

Another important issue is insurance. If you are giving direct (or even indirect) advice on matters that could affect a person's wellbeing, you may be liable if something goes wrong. Clients can challenge you that you were incompetent; and irrespective of whether you have an accredited qualification or not, you may still be judged liable.

To protect yourself against any such liability first and foremost you need to obtain professional indemnity insurance (If you have any difficulty, your tutor can refer you to insurance companies that will accept you upon completing this certificate). Beyond that, you will strengthen your position by doing more substantial studies (eg. Someone who has completed a 100 hour fitness leader certificate will be more easily discredited in court than someone who has done a 600 hour Elite Fitness leader certificate)

Keeping up to date is particularly important for fitness leaders. Many (but not all) fitness leaders may be either registered under a fitness leader accreditation program (eg. Fitness Australia in Australia, CYQ in the UK), or hold membership of a professional or industry association (eg. ACHPER, ICHPER etc); or both. Such affiliations are important in that they can help keep you up to date with practices and industry developments.

Such memberships and accreditations commonly have certain prerequisites (eg. Fitness Australia endorses a particular fitness qualification in Australia; the CYQ endorses a different qualification in the UK).

	SELF ASSESSMENT Perform the self assessment test titled 'Test 1.1', Test 1.2, and 'Test 1.3'. If you answer incorrectly, review the notes and try the test again.
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SET TASK

1. Commence putting together your resource file.

To get started you must submit your resource file on the topics listed below with this lessons assignment. This will enable the tutor to evaluate the way you are filling out the cards, and thus provide either confirmation or guidance to help you continue the file throughout your studies. To start collect information on the following:

- Professional bodies in your area/state/country that you might join
- Networking opportunities you could pursue in your area
- Professional contacts you might pursue in your local area
- Local and federal legislation – try contacting your local council, or appropriate government department a professional association in your region or country, talking with a fitness professional or researching online. Consider rules/regulations/licenses/codes of conduct etc, which pertain to fitness professionals in your area (see task 2).


Each resource should be clearly named, with contact details and a brief description (a couple of sentences).

2. Interview at least two Fitness Professionals, such as a gymnasium manager, fitness leader or sports coach. Use this interview to obtain insights into aspects of the fitness industry. You may ask questions such as the following:

How do you become a fitness leader in this state?

- Are they aware of any legal requirements that need to be met to start a gymnasium or personal training business?
- What professional associations do health and fitness professionals belong to?
- What "code(s) of ethics" (formal or informal) exist in the health and fitness industry?
- How do client complaints get handled in the fitness industry?
- What changes have occurred in the industry over the years?
- What changes are likely to occur in the industry in the future?

3. Spend 20-30 minutes researching online the history of the fitness industry in your country. Make notes.

	ASSIGNMENT Download and do the assignment called 'Lesson 1 Assignment'.
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