

医学英语读写译教程

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编者的话

国家教育部新颁布的全国《大学英语教学大纲》(修订本)明确指出:“本科学生在完成基础阶段的学习任务,达到四级或六级后,都必须修读专业英语,以便从基础学习阶段过渡到应用阶段。”根据《大纲》的要求,我国绝大多数普通高等医学本科院校均开设了医学英语阅读课程。但是,近几年来,我们发现大约有50%的本科医学生在基础英语学习阶段结束时仍未能通过英语四级考试,因此在上医学英语课时往往一心挂两头。如何使50%左右的本科生在学习医学英语的同时,又能复习巩固所学的语言知识,再次备考英语四级?如何使大多数医学生能在毕业时看懂英语医学刊物,撰写医学论文的英文摘要,从事中等难度的医学英语汉译?针对这一难题,我们组织编写了这本《医学英语读写译教程》,旨在帮助医学以及医学相关学科本科生顺利地基础英语学习阶段过渡到英语应用阶段。

本书内容共分为三大部分:第一部分(Part I),由20个单元组成,每个单元均包括4项内容:医学专业阅读课文(Text)1篇(篇幅较长);普科医学阅读理解测试短文2篇(Passage A, B),按四级要求设计5个理解题;科普医学英译汉练习短文1篇(English - Chinese Translation Practice);汉译英练习句子5个(Chinese - English Translation Practice)。每隔一个单元,增设了一篇医学知识短文摘要写作练习(Summary Writing)。第二部分(Part II)由涉及临床医学专业知识的16篇英语短文组成(中等篇幅),供学生课后作翻译练习使用。第三部分(Part III)由5个附录内容构成:附录I,第二部分(Part II)16篇英语短文参考译文;附录II,比较全面的医学术语构词法;附录III,药物说明书,医疗器械广告,医学论文和摘要的英文写作,篇章结构,医学英语汉译技巧和医学英语长句、难句分析例解;附录IV,第一部分(Part I)20个单元的课文和英译汉练习短文的参考译文;附录V,我国主要医疗机构名称汉译英介绍。

本书的选材不仅涉及传统医学领域,如生殖器官、胚胎细胞、人体系统功能和常见的疾病及其诊断和治疗,而且涉及现代医学的新兴领域,如营养学、免疫学、精神病学、生物遗传工程和现代医学检测手段等。此外,本书还选用了传统中医诊断和针灸的内容。

本书具有较强的针对性和实用性。为了教与学的方便,提高教学效果,本书第一部分的阅读理解测试短文和汉译英练习句子以及短文摘要写作练习,均未将其答案和参考译文以及范文附在书后,而是掌握在教师手中。这样十分有利于提高学生学习的积极性,提高他们的阅读理解、写作和翻译能力。本书适用于80~100学时的教学任务。

本书由硕士研究生导师贾德江、刘明东两位教授编著,医学博士、博士研究生导师廖端芳教授主审。贾德江教授负责了全书的策划和终审。参加本书编写工作的有周笃宝教授、彭良林副教授、周邵玲讲师和欧忆讲师。参加本书校阅工作的有李坤、靳宁、刘晓云、冯巧妮、殷习芳和魏薇6位在读研究生,在此一并致以诚挚的谢意。虽然编者竭尽全力想给读者提供最佳产品,但因时间仓促,且水平有限,书中错误遗漏之处在所难免,恳请读者使用时不吝赐教。

编著者

2004年11月

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P a r t I

T e a c h i n g U n i t s

Unit One

Text: V i t a m i n s

In 1912 ,investigators found that animals could not survive on a diet of purified carbohydrates , proteins and fats , but that accessory growth factors or vitamins were necessary. Since at first the chemical structure of these substances was unknown ,they were referred to as Vitamin A ,Vitamin B and Vitamin C , which prevented night blindness and rickets , beriberi and scurvy respectively. Today , the chemical structure of nearly all of them is known , and most of them have been made synthetically. The original Vitamin A and Vitamin B are complexes of several vitamins , Vitamin A being subdivided into Vitamin A ,Vitamin D and Vitamin E , while Vitamin B consists of almost a dozen different ones. The vitamins of known chemical structure are usually referred to by their chemical names , e. g. thiamine rather than Vitamin B₁.

The function of a number of vitamins has been discovered ; each one has been found to serve as an integral part of a coenzyme for one or more of the fundamental enzyme reactions common to all protoplasm.

Vitamin A occurs only in animal products such as butter , eggs and fish liver oils ,but plants contain a yellowish substance , called carotene or provitamin A , which is easily changed into Vitamin A in animal cells. Vitamin A itself is fat-soluble and can be stored in the body.

This vitamin is necessary for the maintenance of the epithelial cells of the skin , eyes , digestive and respiratory tracts. In Vitamin A deficiency these cells become flat , brittle and less resistant to infection than normal. In advanced cases of the deficiency the eye epithelium forms a dry and horny film over the cornea ,resulting in a characteristic type of blindness called xerophthalmia. Vitamin A is necessary also for the maintenance of normal nerve tissue and for the growth of bone and the enamel of teeth.

Another fat-soluble vitamin , Vitamin D , or calciferol , is unique in that it can be made in the body under the influence of sunlight from a substance called ergosterol normally present in the skin. Calciferol is also found in fish liver oils , butter , eggs and milk , and any excess manufactured in the skin during the summer months is stored in the liver. This substance is necessary for the normal absorption of calcium and phosphorus from the intestine. When there is a deficiency of calciferol , calcium and phosphorus are not absorbed in normal amounts , so the formation of bones and teeth is retarded for lack of raw material. This results in the disease known as rickets , characterized by soft , weak bones , enlarged ankles , knees and wrists , bowing of the legs , beaded ribs , and defective tooth

development. There is danger in overdosing a person with Vitamin D , however , because it may lead to calcification of the soft tissues and death.

Vitamin E (tocopherol) is necessary to prevent sterility. If it is absent from the diet , male animals become sterile , owing to degenerative changes in the testes ,and females are unable to complete pregnancy successfully , since the embryos die and are resorbed. So far it has not been shown that a deficiency of Vitamin E is responsible for human sterility , but this is possible. Vitamin E is so widespread in both vegetable and animal oils that a deficiency in any normal diet is almost impossible.

Experiments have shown that a deficiency of Vitamin E produces progressive deterioration of the muscles and paralysis ,presumably by degeneration of the nerves. Certain types of paralysis in human beings have been treated with Vitamin E preparations , with beneficial results.

The deficiency disease ,scurvy ,resulting from a lack of Vitamin C ,is characterized by bleeding gums ,bruised skin , painful swollen joints , and general weakness. It occurs whenever people are deprived of fresh fruits , vegetables and meat for long periods of time.

The scurvy-preventing vitamin was isolated in 1933 and proved to be ascorbic acid (or hexuronic acid). Ascorbic acid is rather unstable and is rapidly destroyed by cooking ,so that the best sources of it are fresh fruits and juices. The exact role of ascorbic acid in metabolism is unknown , but it plays some part in cellular oxidation , particularly in the oxidation of one of the amino acids , tyrosine. It is necessary for the maintenance of normal connective tissue. In its absence the capillaries become exceedingly fragile and easily ruptured ,resulting in hemorrhages under the skin and in the joints. The development of bones and teeth also is abnormal.

The original Vitamin B was characterized as the anti-beriberi factor , but from the same extracts of liver , yeast or rice hulls which yield an anti-beriberi substance , nine other materials with specific biologic effects have been separated. They are now all grouped together as members of the B complex , not because they are similar chemically or in their effects , but because they tend to occur together. Individual members of the B complex are referred to by their chemical names.

Thiamine (Vitamin B₁) prevents beriberi. It is a white , crystalline material with a yeastlike odor , found in small quantities in a wide variety of foods. Yeast , liver , nuts , pork , and whole grain cereals are the best sources of all the Vitamin B complex. The function of thiamine in the body is to form the active part of " coenzyme " of certain enzymes involved in the metabolism of carbohydrates , particularly of pyruvic acid. When a thiamine deficiency interferes with carbohydrate metabolism , a number of characteristic symptoms appear : in mild deficiencies there is fatigue , loss of appetite , weakness and muscular cramps ; in more marked deficiencies these symptoms are accentuated , and there is also a painful degeneration of the nerves and a secondary wasting of the muscles resulting in paralysis. This condition is known as beriberi.

Riboflavin (Vitamin B₂) is a yellow pigment found in both plant and animal tissues ; it occurs most abundantly in foods rich in thiamine : yeast , liver , wheat germ , meat , eggs and cheese. Riboflavin forms part of coenzymes necessary for the functioning of enzymes involved in the metabolism of glucose , amino acids and certain cellular oxidative processes. A deficiency of riboflavin is marked by the appearance of cracks in the corners of the mouth , a characteristic purplish-red color of the tongue , and stunted growth.

Niacin or nicotinic acid is a component of two different coenzymes which are the active parts of many different enzymes in cellular metabolism. It is found in yeast ,fresh vegetables ,meat and beer. The deficiency disease is pellagra. It is characterized by dermatitis ,diarrhea and dementia. The normal functions of niacin are the maintenance of the epithelia of the skin and digestive tract and of normal nerve functioning. These processes depend upon its action as the coenzyme of one or another of many different enzymes.

New Words

purify['pjʊərɪfaɪ] 增援	提纯 ,使洁净	ergosterol[əɪ'gɒstərɒl] 火援	麦角甾醇
accessory[æk'sesəri] 葬援	附加的 ,附属的	calcium['kælsiəm] 火援	钙
investigator[in'vestigeɪtə] 火援	研究者 ,调查者	phosphorus['fɒsfərəs] 火援	磷
blindness['blaɪndnis] 火援	失明	retard[ri'tɑ:d] 增援	延迟 ,使停滞
rickets['rɪkɪts] (瘰癧) 火援		beaded['bi:did] 葬援	串珠状的
(用作单或复数) 软骨病 ,佝偻病		rib[rɪb] 火援	肋 ,肋骨
beriberi['beri'beri] 火援	脚气(病)	over-dosing 火援	给...过量服药
scurvy['skɜ:vi] 火援	坏血病	calcification[,kælsɪfɪ'keɪʃən] 火援	钙化
respectively[rɪs'pektɪvli] 葬援	各自 ,分别地	tocopherol[təu'kɒfərɒl] 火援	生育酚
synthetically[sɪn'tetɪkəli] 葬援	合成地 ,综合地	sterility[ste'rɪlɪti] 火援	不育
subdivide['sʌbdɪ'vaɪd] 增援	再分 ,细分	degenerative[dɪ'dʒenərətɪv] 葬援	
thiamine['θaɪəmin] 火援	硫胺素		退化的 ,变质的
integrate['ɪntɪgrəl] 葬援		testis['testɪs] (睾囊) testes['testɪz] 火援	睾丸
构成整体所必要的 ,组成的		embryo['embriəu] 火援	胚 ,胚胎
coenzyme[kəu'enzaim] 火援	辅酶	resorb[ri'sɔ:b] 增援	再吸收
enzyme['enzaim] 火援	酶	progressive[prə'gresɪv] 葬援	进行性的 ,进步的
protoplasm['prəutəplæzəm] 火援		deterioration[dɪ'tɪəriə'reɪʃən] 火援	
	原生质 ,细胞质		退化 ,恶化 ,衰退
carotene['kærəti:n] 火援	胡萝卜素	paralysis[pə'ræləsɪs] 火援	麻痹 ,瘫痪
provitamin[prəu'vɪtəmin] 火援		bleed[bli:d] 增援	出血 ,流血 ,使出血
维生素原 ,前维生素		gum[gʌm] 火援	牙龈 ,牙床
fat-soluble 葬援	脂溶性的	bruise[bru:z] 增援 火援	使青肿 ,青肿 ,伤痕
epithelia[,epɪ'ti:liəl] 葬援	上皮的	joint[dʒɔɪnt] 火援 增援	关节 ,连接
respiratory[rɪ'spaɪərətəri] 葬援	呼吸的	ascorbic acid[əs'kɔ:bɪk 'æsid] 火援	抗坏血酸
flat[flæt] 葬援	平的 ,扁平的	hexuronic acid[,heksjuə'rɒnɪk'æsid] 火援	己糖醛酸
brittle['brɪtl] 葬援	易碎的 ,脆弱的	cellular['seljʊlə] 火援	细胞的
epithelium[,epɪ'ti:ljəm] 火援		oxidation[,ɒksɪ'deɪʃən] 火援	氧化(作用)
(pl. epithelia[,epɪ'ti:liə]) 火援	上皮	amino['æmɪnəu] 葬援	氨基的
horny['hɔ:ni] 葬援	角的 ,角状的	fragile['frædʒaɪl] 葬援	脆的 ,易碎的
cornea['kɔ:niə] 火援	角膜	tyrosine['taɪərəsɪ:n] 火援	酪氨酸
xerophthalmia[,ziərəf'tælmiə] 火援	干眼症	rupture['rʌptʃə] 火援 增援	破裂
enamel[i'næməl] 火援	珐琅质	hemorrhage['hemərɪdʒ] 火援	出血
calciferol[kæl'sɪfərɒl] 火援	钙化醇	yeast[ji:st] 火援	酵母
			· 猿 ·

hul[hʌl] 火援	壳	riboflavin[,raibəu'fleivin] 火援	核黄素
crystalline['kristəlain] 火援	晶体的, 水晶的, 结晶体	pigment['pigmənt] 火援	色素, 颜料
yeastlike['ji:stlaik] 火援	酵母样的	glucose['glu:kəus] 火援	葡萄糖
odor['əudə] 火援	气味, 味道	stunted['stʌntid] 火援	发育受阻的
cereals['siəriəl] 火援	谷类的, 谷物	niacin['naiəsɪn] 火援	烟(碱)酸
pyruvic acid[paɪə'ru:vɪk 'æsid]	丙酮酸	nicotinic acid[,nikə'tɪnɪk'æsid] 火援	烟(碱)酸(niacin)
symptom['sɪmptəm] 火援	症状, 征兆	pellagra[pə'leɪgrə] 火援	糙皮病
fatigue[fə'ti:g] 火援	疲劳	dermatitis[,dɜ:mə'taɪtɪs] 火援	皮炎, 皮肤炎
cramp[kræmp] 火援	(肌肉)痉挛	diarrhea[,daɪə'riə] 火援	腹泻
accentuate[æk'sentʃueɪt] 火援	增强, 强调, 加剧, 增强	dementia[di'menʃiə] 火援	痴呆

Reading Comprehension Quiz:

Passage A

Three Yale University professors agreed in a discussion tonight that the automobile was what one of them called "Public Health Enemy No. 1 in this country". Besides polluting the air and congesting cities, cars are involved in more than half the disabling accidents, and they contribute to heart disease because we don't walk anywhere anymore," said Dr. H. Richard Weinerman, professor of medicine and public health. Dr. Weinerman's sharp indictment of the automobile came in a discussion of human environment on Yale Reports, a radio program broadcast by Station WTIC in Hartford, Connecticut. The program opened a three-part series on "Staying Alive". For the first time in human history, the problem of man's survival has to do with his control of manmade hazards," Dr. Weinerman said. "Before this, the problem had been the control of natural hazards."

Relating many of these hazards to the automobile, Arthur W. Ralston, a professor of biology, said it was possible to make a kerosene burning turbine car that would "lessen smog by very large factor". But he expressed doubt that Americans were willing to give up moving about the countryside at 90 miles an hour in a large vehicle. "America seems closely related to the motor car: every family has to have at least two, and one has to be a convertible with 300 horsepower," Professor Ralston continued. "Is this the way of life that we choose because we care for these values?"

For Paul B. Sears, professor of conservation, part of the blame lies with "a society that regards profit as a supreme value, under illusion that anything that's technically possible is, therefore, ethically justified." Professor Sears also called the country's dependence on its modern automobiles "lousy economics" because of the large horsepower used simply "moving one individual to work". But he admitted that Americans have painted themselves into a corner by allowing the national economy to become so reliant on the automobile industry.

According to Dr. Weinerman, automobiles, not factories, are responsible for two-thirds of the smog in America's cities, and the smog presents the possibility of a whole new kind of epidemic, not due to one germ, but due to polluted environment. "Within another five to ten years, it's possible to have an epidemic of lung cancer in a city like Los Angeles. This is a new phenomenon in health concern," he said.

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“ The solution ” he continued “ is not to find a less dangerous fuel , but a different system of inner-city transportation. Because of the increasing use of cars , public transportation has been allowed to disappear and degenerate , so that if you can’t walk to where you want to go you have to have a car in most cities , ” he asserted. “ This , in turn , ” Dr. Weinerman argued “ is responsible for the arteriosclerosis of public roads , for the blight of the inner city and for the middle-class movement to the suburbs. ”

1. According to the passage , which of the following is NOT true ?
A) Automobiles are responsible for heart diseases.
B) Smog is a type of pollution.
C) Kerosene engines are more desirable than gasoline engines because they will increase speed.
D) The dirty air in major cities is related to the number of automobiles in the area.
2. The main idea of this passage is _____.
A) Americans are too attached to their cars
B) American cars are too fast
C) Automobiles endanger health
D) Factories cause less pollution than automobiles
3. Professor Ralston says in Paragraph 2 that kerosene-powered cars would _____.
A) reduce air pollution
B) increase air pollution
C) not change air-pollution levels
D) go faster than gasoline-powered cars
4. According to Paragraph 4 , Dr. Weinerman implies that _____.
A) factories cause less pollution than automobiles
B) an epidemic is caused by germs
C) smog could cause an epidemic of lung cancer in the future
D) smog is formed from coal fires
5. Dr. Weinerman would probably agree that , if public transportation were improved _____.
A) the inner city might improve
B) the middle class would move to the suburbs
C) public roads would get worse
D) Both B and C

Passage B

Are you aware that you actually possess six senses ? The sixth is a muscular sense responsible for directing your muscles intelligently — to the exact extent necessary for each action you perform. For example , when you reach for an object , the sensory nerves linking the muscles to the brain stop your hand at the correct spot. This automatic perception of the position of your muscles in relation to the object is your muscular sense in action.

Muscles are stringy bundles of fibers varying from one five-thousandth of an inch to about three inches. They have three unique characteristics : they can become shorter and thicker ; they can

stretch ; they can react to their original positions. Under a high-powered microscope , muscle tissue is seen as long , slender cells with a grainy texture like wood. More than half of a person's body is composed of muscle fibers , most of which are involuntary — in other words , work without conscious direction. The voluntary muscles , those that we move consciously to perform particular actions , number more than five hundred. Women have only 60 to 70 per cent as much muscle as men for their body mass. That is why an average woman can 't lift as much , throw as far , or hit as hard as an average man.

6. According to this passage , the muscular sense is responsible for _____.

- A) the efficiency of our muscles
- B) the normal breathing function
- C) directing our muscles intelligently
- D) the work of only our involuntary muscles

7. Intelligent use of the muscles means that _____.

- A) one always knows what his muscles are doing
- B) one performs simple actions without working
- C) one 's muscles are used only to the extent necessary for each action they perform
- D) one improves muscular action consciously

8. Under a microscope muscle cells appear to be _____.

- A) textured like wood
- B) colored like wood
- C) smooth and red
- D) short and thick

9. According to the passage , more than half of a person 's body is composed of _____.

- A) voluntary muscles
- B) involuntary muscles
- C) muscle fibers
- D) sensory nerves

10. An average woman is weaker than an average man because she has _____.

- A) more voluntary muscles than an average man
- B) only 60 to 70 per cent as much muscles as men for her body mass
- C) 60 to 70 per cent less muscle for her body mass
- D) less muscle fiber for her body weight

English-Chinese Translation Practice :

The Truth About Calcium

Are calcium-fortified foods any better ? The calcium added to an increasing number of foods may be beneficial for those without a balanced diet. But milk is still the best source of calcium. And for those who can 't drink milk , products that are calcium-fortified show promise.

Recent research suggests boron may be a key factor in hardening bones. In a 1987 study at the Agricultural Research Service in Grand Forks , N. D. nutritionist Forrese H. Nielsen and anatomist Curtiss D. Hunt put a group of women , ages 48 to 82 , on a 17-week lowboron diet , and the women had a high loss of calcium in their urine. Daily for the next seven weeks , they were given a 3-mg boron supplement , representing the intake from a well-balanced diet ; during that period , they retained an average of 58 mg more calcium each day.

Because too much boron can prove toxic and safe dosage levels are not known ,Nielsen adds , supplements are not recommended. But people can get ample boron by eating plenty of fruit — especially apples ,pears and grapes — and nuts ,leafy vegetables and legumes.

A hormone called calcitonin has just been approved by the Food and Drug Administration as a treatment for osteoporosis. But calcitonin must be injected several times a week. Other treatments , including those with fluoride and diphosphanates , are still in research. All must be used in combination with adequate calcium intake — and the best way to get that is from dairy products , or from a balanced diet that includes calcium-rich foods.

There are many interrelated causes of osteoporosis , the painful , crippling fragile-bone disease that affects over 24 million Americans. However , the good news is that the simplest and most effective nutritional safeguard appears to be adequate calcium intake throughout life.

New Words

calcium-fortified['kælsiəm 'fɔ:tifaɪd] 葬	legume['legju:m] 灶	豆类
钙强化的 ,强钙的	calcitonin[,kælsi'təʊnɪn] 灶	降钙素
boron['bɔ:rən] 灶	fluorid['fluəraɪd] 灶	氟化物
toxic['tɒksɪk] 葬	diphosphanat[dai'fɒsfəneɪt] 灶	二磷酸盐
有毒的 ,中毒的		

Chinese 鄞nglish Translation Practice :

1. 与其他营养素相比 ,维生素和矿物盐的需要量较少。
2. 缺乏维生素 C 会引起坏血病 ,即具有肌肉疼痛、衰弱、出血、骨脆、牙松动和龋齿症状的一种疾病。
3. 维生素是按字母分类的 ,如维生素 A、维生素 B、维生素 C、维生素 D、维生素 E、维生素 K 和复合维生素 B 等。
4. 营养学是研究食物如何影响人体的科学。
5. 有人认为 :维生素 C 可改善短期记忆 ,甚至可“治愈”精神分裂症。

Summary Writing (1):

Tips and Advice for Workaholics

Lately ,your job has taken up much of your time. You’ve even started bringing work home and you keep working until the wee hours of the morning. You spend Saturdays and Sundays with your head bent over your work ,And you’re supposed to spend these days with your family ,or friends ,or for your relaxation !

No longer do you work in order to live ,but you now live in order to work. Work is now the center of your daily life ,while the more important things have been relegated to the trunk of your car ,or in the backseat.

A workaholic. This is what you have become. The only time you don’t think of work is during the three or four hours a day that you spend sleeping. You devote 16 hours of your day each day to working furiously ,making money ,reaching goals ,working on giving your families the best ,planning and mobilizing yourself for success.

But little do you realize that by being too caught up with work ,you gradually forget the reasons why you work ,your family. Sure ,you work to earn lots of money for them ,but when was the last time you spent a full hour of quality time with your kids ? Or your mom and dad ? Or your friends ? When was the last time you did something you used to do and enjoy before you mutated into a workaholic ?

Here are a few tips to help you ,the workaholic ,re-focus and get the best out of life (and keep you healthy and alive in the ling run too !) :

EIGHT HOURS OF SLEEP ! Make it a point to get at least eight hours of sleep and plenty of rest. While food has substitutes in the form of natural medicines or artificial foods ,there are no substitutes for sleep and rest. Don't believe that you can always" catch some sleep or rest later. "Your body cannot make up for lost sleep or rest time because it is not physiologically possible.

STRICTLY FAMILY ON WEEKENDS ! Resolve to make Saturdays and Sundays strictly for family time ,And stick to this ! Mondays until Fridays you make an excuse not to relax and spend time with your family because it's work time ,why not make a similar excuse for Saturdays and Sundays ?" I can't work today because I'm spending time with my family. "

GET SOME FOOD IN ! Make sure you get food in your stomach. Workaholics are known to be food-skipppers. If you can't afford to get away from your desk or doing paper-work ,have food delivered to you. It's always a good idea if you have crackers in your drawer to ease the hunger pangs.

CONFINE WORK ! Resolve to confine work in your office. Don't bring work to your home ! Keep those files in your office desk where they belong. If you work from home ,keep your work stuff in the confines of your home office. Keep them there until the next day when you start work. Practice working only within your working hours. If you have an eight-to-five working schedule ,stick to it.

WORK UP THOSE MUSCLES ! Exercise ,exercise ,exercise ! Set aside at least an hour each day or every other day for exercise. Your body needs to be conditioned ,and working non-stop isn't going to give it the proper physical conditioning it needs. Since most workaholics tend to have their behinds stuck on their chairs ,it's even more important that you get some exercise.

MAKE A PLAN ! Plan your day. Work on only one or two things at a time. It's much easier to work on something and finish it first and then move on to the next rather than do a number of things all at the same time and never finish or accomplish anything by the end of the day. Make out a list of priorities. Write down things that need to be worked on immediately or are urgent ,keeping the lesser ones at the bottom of your list. After you've done this ,be guided by this list. Turning this activity into a habit will also help you manage your time better ,be more organized ,and accomplish more.

WORK TO LIVE ! Always keep in mind that work so you can live and have a comfortable life. Always remember that you don't live to work. Working is just one of the many useful and fruitful activities you do that enables you to live a good life and give your family (or any of your dependents)their needs. Don't make work your life.

Unit Two

Text: Regulation of Metabolism

Preamble

The survival of a cell or organism depends upon its ability to alter metabolic flux in response to changing conditions although the result may be a maintenance of the status quo (called homeostasis in whole animals). Examples are :the switch from glucose to fatty acid metabolism in the starving mammalian liver ,the induction of enzymes to metabolize lactose in *E. coli* when that sugar is included in the medium ,and the inhibition of cholesterol synthesis in fibroblasts when they are presented with cholesterol in low density lipoproteins. Chapters in books and examination questions often approach the phenomena of regulation in general terms ,and are adorned with words such as “ regulation ” , “ control ” , “ modulation ” and so on. The precise definition of these words and their implications for teleology need not concern us at this level since we are again aiming at simplification for ease of regurgitation. As ever ,the approach is to identify the essentials of the topic (in this case ,regulatory factors) to try to classify them and to discuss them briefly. Then ,it is hoped ,we sum up overall with a clear memorizable diagram. But two preliminary points can be made.

(1) It is at present difficult to classify regulatory factors ,since primary effects cannot always be distinguished from secondary ones. Thus cAMP and glucagon both cause lipid breakdown in liver , but glucagon's role is as an effector for cAMP synthesis. In this case the relationship is known ,there are many other cases where the hierarchy of effectors remains obscure.

(2) It is the catalytic of enzymes which is the basis of metabolism ,so that regulation of metabolism ought to be explicable ,ultimately ,in terms of rates of transformation due to enzyme catalysis.

Following up the latter point ,the rate of flow of atoms through an enzyme-catalysed reaction is dependent upon :① the amount of substrate or product present ;② the amount of enzyme available ; ③ the catalytic efficiency of the enzyme.

All dietary ,hypothalamic , endocrine , and nervous controls should be reducible ,perhaps through many levels of effector , to ① ,② ,and ③ ,either singly or in combination. We set down what we know about each.

Regulation of the Rates of Enzymic Reactions

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In the glucokinase reaction in the liver ,glucose + ATP $\longrightarrow$ glucose 6-phosphate + ADP. The nature of the enzyme is such (high K_m for glucose)that at low glucose concentrations the reaction cannot proceed. Thus glycolysis is slowed down because there is just not enough glucose available. Although this is a coarse(insensitive) control ,it is fast because in itself it involves no synthesis or transport mechanisms.

If a substrate is confined by a membrane then it is not accessible to catalytic activity by an

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enzyme on the other side of the membrane. Thus, acetyl CoA cannot cross the mitochondrial membrane so that when it is generated in the mitochondria it leak out to be converted to fat by the action of acetyl CoA carboxylase. When energy is required, presumably the primary consideration it is oxidized within the mitochondria. Only where ATP is plentiful is it transported outside as citrate; limitation of the rate of lipogenesis then is due to compartmentation of acetyl CoA.

Enzyme Induction and Repression

When an enzyme is synthesized in response to chemical stimulus the phenomenon is known as induction. When normally-proceeding enzyme synthesis is slowed, there is repression. Induction is normally associated with control of catabolism, repression with control of anabolism. An example of induction is the synthesis of penicillinase by *penicillium notatum* in response to appearance of penicillin in growth medium. An example of repression is when *Salmonella typhimurium*, synthesizing leucine because it is lacking in the growth medium, ceases to synthesize appropriate enzymes when sufficient leucine has accumulated. Inducible enzymes in mammalian tissues include lactase (synthesized by adult intestine in response to a milk diet) and liver arginase (synthesized in response to a high protein diet; it is necessary for urea production). Other terms used in this context are as follows:

Constitutive enzyme: an enzyme present in a cell in fairly constant amounts, that is non-inducible.

Coordinate induction: a single inducer may bring about synthesis of a number of inducible enzymes. The inducer is normally the first substrate in the pathway. Complementary to this is coordinate repression.

Derepression is the cancelling of repression, so that an induction is apparently observed — a negative cancelling a negative appears as a “positive”.

Induction and repression are thought to be the result of modification of gene expression. The smallest unit of genetic expression is the cistron, a structural gene coding for the synthesis of an enzyme subunit. The cistrons are functionally combined in a unit called the operon, which may be described as a regulated gene cluster.

There is no escaping from the lac operon in this context, observation of which first suggested the concept. *E. coli* grown on a lactose-free medium has very low activities of lactase (β -galactosidase), but the enzyme appears (is induced) on introduction of lactose. Not only that, but a protein termed a permease is detectable. The permease is a carrier to effect penetration of the inducer lactose into the cells. Genetic mapping techniques indicated that the operon or gene cluster for this coordinated protein synthesis consists of (a) structural genes for the permease and lactase proteins (b) an operator gene; (c) a regulator gene. The regulator gene transcribes RNA for repressor at a constant rate so the repressor is constitutive. The repressor binds with high affinity to the operator gene, which prevents the initiation of transcription at the structural genes. When allolactose (the physiological inducer, with glucose and galactose 1,6 linked rather than 1,4 as in lactose) is present, it binds to the repressor, detaching it from the operator gene. This allows initiation of transcription on the structural genes. Lactase permease then allows utilization of lactose in the medium.

In eukaryotes, genes coding for metabolically-related sequences of enzymes are not in general closely linked to form an operon. Protein synthesis is often associated with endocrine stimulation