МИНИСТЕРСТВО СЕЛЬСКОГО ХОЗЯЙСТВА РФ

ФГБОУ ВО Брянский ГАУ

Кафедра иностранных языков

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ENGLISH FOR PHD STUDENTS

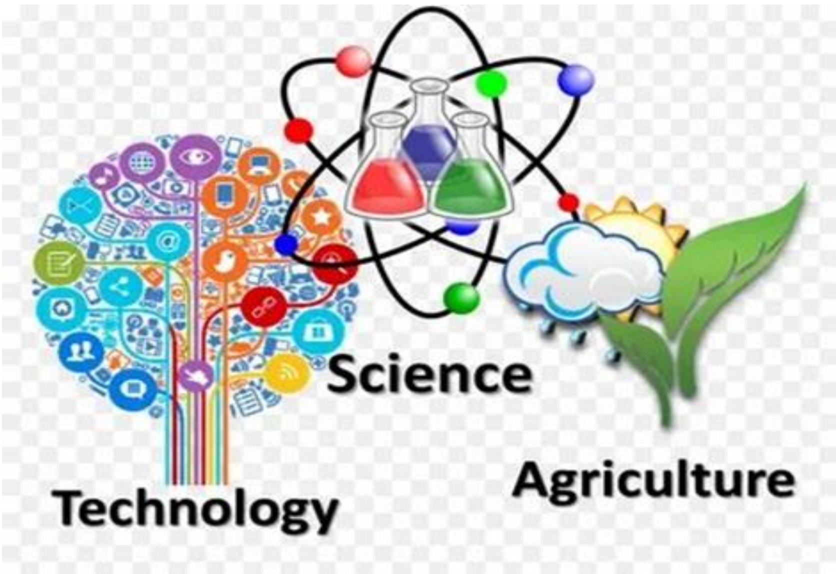
АНГЛИЙСКИЙ ЯЗЫК ДЛЯ АСПИРАНТОВ

по научным специальностям:

4.1.1. Общее земледелие и растениеводство

4.1.2. Селекция, семеноводство и биотехнология растений

4.1.3. Агрохимия, агропочвоведение, защита и карантин растений



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Учебное пособие предназначено для проведения аудиторных занятий и организации самостоятельной работы аспирантов и соискателей, изучающих английский язык с целью подготовки к сдаче кандидатского экзамена по программе обучения в аспирантуре. Пособие способствует формированию и развитию навыков чтения, перевода, аннотирования и реферирования научных и профессиональных текстов, коммуникативных умений, необходимых аспирантам в ситуациях профессионального и академического общения на иностранном языке.

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ПРЕДИСЛОВИЕ

Учебное пособие адресовано аспирантам, соискателям и научным работникам, готовящимся к сдаче кандидатского экзамена по английскому языку.

Пособие имеет практическую направленность. Целью пособия является развитие умений различных видов чтения и перевода, овладение общенаучной терминологией, а также формирование навыков монологической и диалогической речи, навыков аннотирования и реферирования научной и специальной литературы. Материал разделов и задания к нему способствуют формированию у обучаемых готовности участвовать в работе российских и международных исследовательских коллективов по решению научных и научно-образовательных задач и готовности использовать современные методы и технологии научной коммуникации на государственном и иностранном языках.

Пособие состоит из восьми разделов, каждый из которых включает несколько оригинальных текстов по теме раздела, а также комплекс условно-речевых и речевых упражнений, образцы коммуникативных ситуаций диалогической и монологической речи, что отвечает принципам современной коммуникативной методики.

При отборе текстов авторы стремились к тому, чтобы каждый текст носил общенаучный характер и был насыщен лексикой, связанной с научной работой. Материалы пособия направлены на формирование у аспирантов компетенций, обеспечивающих их готовность участвовать в научной коммуникации на английском языке, работать в международных исследовательских коллективах и решать научные и научно- образовательные задачи.

Учебное пособие предназначено как для аудиторных занятий, так и для самостоятельной работы.

UNIT 1

WHAT IS SCIENCE

Text 1. Science

1. Read and translate the text

Science (from Latin *Scientia*, meaning "*knowledge*") is an enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the world. An older and closely related meaning still in use today is that of Aristotle for whom scientific knowledge was a body of reliable knowledge that can be logically and rationally explained.

Since classical antiquity science as a type of knowledge was closely linked to philosophy. In the early modern era the words "science" and «philosophy» were sometimes used interchangeably in the English language. By the 17th century, natural philosophy (which is today called "natural science") had begun to be considered separately from "philosophy" in general, while, "science" continued to be used in a broad sense denoting reliable knowledge about a topic, in the same way it is still used in modern terms such as library science.

However, in modern use, "science" is still mainly treated as synonymous with natural and physical science, and thus restricted to those branches of study that relate to the phenomena of the material universe and their laws, sometimes with implied exclusion of pure mathematics. This is now the dominant sense in ordinary use. The word "science" became increasingly associated with the disciplined study of physics, chemistry, geology and biology. This sometimes left the study of human thought and society in a linguistic limbo, which was resolved by classifying these areas of academic study as social science.

In its turn the term "humanities" or "arts" refers to the subjects of study that are concerned with the way people think and behave, for example literature, language, history and philosophy (as it understood nowadays).

2. Какие из приведенных ниже предложений истинны (T), а какие ложны (F)?

1. The term "science" is applied only to natural science.
2. The word "knowledge" is derived from the negation "no", meaning the path leading from ignorance to understanding the world.
3. Natural and physical sciences deal with testable explanations and predictions.
4. Aristotle studied the body of a human being and gained a reliable knowledge in this sphere.
5. There was a time when «science» and «philosophy» meant the same.

6. The word “science” and the word combination “natural and physical science” are looked upon as synonymous.

7. Pure mathematics is included into the notion «natural and physical science».

8. Library science naturally belongs to humanities.

3. See if you remember: to meet human needs; to refer to, to distinguish to encounter difficulties, to emerge; at great expense; search for truth; to point out.

4. Look through the text and write an outline, either in Russian or in English.

Text 2. The Origin of Science

1. Read and translate the text

For many thousands of years the earth was inhabited by creatures who lived and died without passing on their experiences to following generations. These early fish, reptiles, birds and mammals could only “talk” to each other through the roars, calls and screams of the jungle. Yet, somehow, from these prehistoric beings a more intelligent animal evolved with a brain able to form the controlled sounds of speech.

This human being began to use rocks and trees to fashion weapons to help him hunt for food. Stones and spears were probably the first tools used by humans as extensions of their own bodies – the spear could travel faster in flight than man could run – and this ability to invent tools and pass on knowledge gave man a growing control of his surroundings. His search for new ways to survive and to improve his way of life continued through the ages thus the story of man’s world of science and invention was shaped.

Writing is known to contribute much to man’s experience accumulation, books printing being his greatest brainchild. As knowledge grew and the art of writing developed, parts of the story were recorded – some in one book, some in another. No man could remember all there was to know and writers found it useful to classify their knowledge under separate headings – much like a library arranges its books in sections so that the reader will know where to look for each subject. Science became separated into various branches. But its progress began only when man started to search for natural laws and principles, and produced theories, applying to scientific methods, such as: observation, analysis, synthesis, induction, deduction, hypothesis and experimentation.

2. Match the words to their definitions

1) observation	a) a formal set of ideas that is intended to explain why smth happens or exists.
2) induction	b) the process of using information or finding the answer to the problem.

3) deduction	c) a method of discovering general rules and principles from particular facts and examples.
4) analysis	d) an idea or explanation of smth that is based on a few known facts but has not yet been proved to be true or correct.
5) synthesis	e) the act of watch smth carefully for a period of time, esp. to learn smth.
6) hypothesis	f) the detailed study or examination of smth in order to understand more about it.
7) experiment	g) the act of combining separate ideas, beliefs, styles; a mixture or combination of them.
8) theory	h) a scientific test that is done in order to study what happens and to gain new knowledge.

Text 3. What is science?

1. It can be said that science is a cumulative "body" of knowledge about the natural world, obtained by the application of a peculiar method practiced by the scientist. It is known that the word science itself is derived from the Latin «scire», to know, to have knowledge of, to experience. Fundamental and applied sciences are commonly distinguished, the former being concerned with fundamental laws of nature, the latter engaged in application of the know ledge obtained. Technology is the fruit of applied science, being the concrete practical expression of research done in the laboratory and applied to manufacturing commodities to meet human needs.

2. The word "scientist" was introduced only in 1840 by a Cambridge professor of philosophy who wrote: "We need a name for describing a cultivator of science in general. I should be inclined to call him a scientist. "The cultivators of science" before that time were known as "natural philosophers". They were curious, often eccentric, persons who poked inquiring fingers at nature. In the process of doing so they started a technique of inquiry which is now referred to as the "scientific method".

3. Briefly, the following steps can be distinguished in this method. First comes the thought that initiates the inquiry. It is known, for example, that in 1896 the physicist Henri Becquerel, in his communication to the French Academy of Sciences, reported that he had discovered rays of' an unknown nature emitted spontaneously by uranium salts. His discovery excited Marie Curie and together with her husband Pierre Curie she tried to obtain more knowledge about the radiation. What was it exactly? Where did it come from?

4. Second comes the collecting of facts: the techniques of doing this will differ

according to the problem which is to be solved. But it is based on the experiment in which anything may be used to gather the essential data - from a test-tube to an earth-satellite. It is known that the Curies encountered great difficulties in gathering their facts, as they investigated the mysterious uranium rays.

5. This leads to step three: organizing the facts and studying the relationships that emerge. It was already noted that the above rays were different from anything known. How to explain this? Did this radiation come from the atom itself? It might be expected that other materials also have the property of emitting radiation. Some investigations made by Mme Curie proved that this was so. The discovery was followed by further experiments with "active" radio elements only.

6. Step four consists in stating a hypothesis or theory: that is, framing a general truth that has emerged, and that may be modified as new facts emerge. In July 1898, the Curies announced the probable presence in pitchblende ores of a new element possessing powerful radioactivity. This was the beginning of the discovery of radium.

7. Then follows the clearer statement of the theory. In December 1898, the Curies reported to the Academy of Sciences: "The various reasons enumerated lead us to believe that the new radioactive substance contains a new element to which we propose to give the name of Radium. The new radioactive substance certainly contains a great amount of barium, and still its radioactivity is considerable. It can be suggested therefore that the radioactivity of radium must be enormous?

8. And the final step is the practical test of the theory, i. e. the prediction of new facts. This is essential, because from this flows the possibility of control by man of the forces of nature that are newly revealed.

9. Note should be taken of how Marie Curie used deductive reasoning in order to proceed with her research, this kind of "detective work" being basic to the methodology of science. It should be stressed further that she dealt with probability - and not with certainty - in her investigation. Also, although the Curies were doing the basic research work at great expense to themselves in hard physical toil, they knew that they were part of an international group of people all concerned with their search for truth. Their reports were published and immediately examined by scientists all over the world. Any defects in their arguments would be pointed out to them immediately.

1. Give Russian equivalents of: a cumulative body of knowledge, a peculiar method practiced by the scientist, manufacturing commodities to meet human needs.

2. Identify the words used by the author as equivalent to*:* направляя свой пытливый ум на . . .

3. Identify the words used by the author as equivalent to: doing so, a technique of inquiry.

Text 4.

1. Read the text to yourself and be ready to do some exercises:

1. Should any one attempt a brief characterization of the present-day environment problems he would find it beyond the competence of an individual scientist? For the environmental situation has long become a subject of separate and joint research efforts of biologists, chemists, and biochemists who have to combine their knowledge with the information supplied by students of geology, oceanography and meteorology, with experts in sociology, psychology and philosophy hurriedly joining in. Yet, if stated briefly, one of the causes of the present-day environmental situation should be sought in the lack of a balanced development of particular fields of knowledge, and of an adequate picture of the intricately operating whole which is our planet. The rapid and ever-growing advances in certain highly specialized fields have brought mankind far ahead of our general fundamental knowledge of the long-range effect of some technological developments, spectacular though they may appear, especially of their interplay and interdependence. It is man's intervention in nature that has singled him out from the rest of the animal world since his early days. It is this very intervention that has landed him nowadays in this highly technological world of ours, with the rate of progress in particular applied fields being faster than that in our fundamental knowledge of the general operation of the Earth. It is precisely this discrepancy between the two rates which seems to be at the root of most of today's problems. This is by no means an exhaustive explanation, ignoring as it does, the social factor.

2. The threat to his environment is a second major problem man is faced with in the mid-20th century, the first being a menace of a nuclear catastrophe. What is so peculiar about the environmental problem when compared to the other one? Surely not its global character and everybody's involvement. A nuclear catastrophe, as seen nowadays by practically everybody everywhere, would inevitably involve every country, no matter how small or big it is, and would concern every individual, whatever secluded life he might be living. Should it happen, its inescapability is too obvious to be; disputed. So is its explosive character. In contrast to this, the environmental crisis is of a cumulative nature. It is just the obscure and intricate pattern of the interaction of all factors that makes it so dangerous. For no single action taken, or decision made, can bring about an immediate catastrophe, nor could there be the last straw or the last step that would set in motion an avalanche of irreversible and immediate events leading to the ultimate gloomy end. It is only step by step that we approach the critical point, were there such a thing as "point" in this context.

3. Consequently, what is needed first and foremost is that we realize the possible adverse impact of the long-range effects of our actions, however noble the motives may seem to us at present, on the entire human race. Out of this realization may come

an entirely new approach to the problem, the new approach as proclaimed by Vernadsky of the biosphere governed and operated in accordance with the laws of the human mind. Next comes the urgent need for basic research to get more profound knowledge of the cause-effect relationship, the time factor necessarily taken into account, in the whole realm of human environment, both natural, man-disturbed and man-initiated. Fundamental and irreversible as they may often be, the changes in our environment are not likely to bring mankind to the brink of annihilation overnight. It would take us some time yet to reach there. So let us use the time for learning how to preserve our planet in good shape and in running order for an indefinitely long time.

2. Find the words equivalent to: недостаточно равномерное развитие конкретных областей знания и правильного представления о сложном взаимодействии процессов, происходящих внутри единого целого; невозможно скрыться от; характер постепенного нарастания; скрытый и сложный механизм взаимодействия.

3. Give Russian equivalents of: spectacular though they may appear, it is this very intervention that has landed him; ignoring as it does; no matter how small or big it is; first and foremost, however noble the motives may seem to us; to bring mankind to the brink of annihilation overnight; it would take us some time yet to reach there.

Text 5. Scientific Progress

1. *Read and translate the text*

Science is often distinguished from other domains of human culture by its progressive nature: in contrast to art, religion, philosophy, morality, and politics, there exist clear standards or normative criteria for identifying improvements and advances in science. For example, the historian of science George Sartor argued that "the acquisition and systematization of positive knowledge are the only human activities which are truly cumulative and progressive", and "progress has no definite and unquestionable meaning in other fields than the field of science".

However, the traditional cumulative view of scientific knowledge was effectively challenged by many philosophers of science in the 1960s and the 1970s, and thereby the notion of progress was also questioned in the field of science.

Debates on the normative concept of progress are at the same time concerned with axiological questions about the aims and goals of science. The task of philosophical analysis is to consider alternative answers to the question: What is meant by progress in science? This conceptual question can then be complemented by the methodological question: How can we recognize progressive developments in science? Relative to a definition of progress and an account of its best indicators, one may then study the factual question: to what extent, and in which respects, is science progressive?

2. В англо-русском словаре под редакцией В. К. Мюллера, приводятся следующие значения глагола «to challenge»:

1) вызывать, бросать вызов;
2) сомневаться, отрицать;
3) оспаривать, подвергать сомнению;
4) требовать (внимания, уважения и т. п.);
5) окликать (о часовом), спрашивать пароль;
6) (мор.) показывать опознавательные знаки;
7) (юр.) давать отвод присяжным;

3. Подходит ли хотя бы одно из указанных значений для перевода слова «challenge» в подчеркнутом предложении? Попробуйте дать свой вариант слова и всего предложения.

4. Переведите тексты 7 и 8 письменно.

Text 6. Scientific Literature

An enormous range of scientific literature is published. Scientific journals communicate and document the results of research carried out in Universities and various other research institutions, serving as an archival record of science. The first scientific journals began publication in 1665. Since that time the total number of active periodicals has steadily increased. By the end of the last century, one estimate for the number of scientific and technical journals in publication was 11,500. Today this figure is left far behind.

Most scientific journals cover a single scientific field and publish the research within that field; the research is normally expressed in the form of a scientific paper. Science has become so pervasive in modern societies that it is generally considered necessary to communicate the achievements, news, and ambitions of scientists to a wider populace.

Science books engage the interest of many more people. The science fiction genre, primarily fantastic in nature, engages the public imagination and transmits the ideas, if not the methods, of science.

Text 7. Pseudoscience, fringe science, and junk science

An area of study or speculation that masquerades as science in attempt to claim a legitimacy that would not otherwise be able to achieve is sometimes referred to as pseudoscience, fringe science, or alternative science. Another term, junk science, is often used to describe scientific hypotheses or conclusions which perhaps legitimate in themselves, are believed to be used to support a position that is seen not legitimately justified by the totality of evidence. There is a special sort of pseudoscience that has a formal trapping of science but lack a principle of scientific thought. Various types of commercial advertising, ranging from hype to fraud, may fall into these categories.

There also can be an element of political or ideological bias on all sides of such debates. Sometimes, research may be characterized as «bad science», research that is well-intentioned but is seen as incorrect, obsolete, incomplete, or over simplified expositions of scientific ideas. The term «scientific misconduct» refers to situations such as where researchers have intentionally misrepresented their published data or have purposely given credit for a discovery to the wrong person.

5. Сравните Ваш перевод с переводом представленным ниже. Как вам удалось преодолеть трудности, потенциально возможные в процессе перевода данного текста?

Лженаука, научный «мусор» и околонаучные исследования

Область исследований или размышлений, маскируемых под науку, в своих попытках достичь статуса научности, иначе для них не достижимого, иногда называют «лженаукой», околонаучными студиями или «альтернативной» наукой. Существует еще один термин – «джанк сайнс» (от англ. «junk» – ненужный хлам) – служащий для описания научных гипотез и выводов, которые, хотя сами по и себе являются обоснованными, служат, тем не менее, для защиты положений, не подтверждаемых корпусом необходимых доказательств. Имеется особый тип псевдонауки, с формальной точки зрения подводимый под соответствующую рубрику, но абсолютно лишенный принципов истинно научного мышления. Различные виды коммерческого рекламирования, начиная от его навязчивого варианта и заканчивая откровенным обманом, могут быть подведены под эту же категорию. В научных спорах по всем направлениям возможны также элементы политических или идеологических пристрастий. Иногда исследования признаются «плохими», если при всей их благонамеренности они представляют ошибочные, устаревшие, необдуманные или сверх- упрощенные научные идеи. Термин «научные правонарушения» соотносится с ситуациями, при которых исследователи преднамеренно искажают опубликованные данные, или на том же основании приписывают их другому лицу, нарушая тем самым авторские права.

Text 8.

1. What do you know about science and technology? Before you read the Text "The Role of Science and Technology in Our Life", discuss these questions with your group mates.

2. Read the Text to find out if you are right or wrong.

The Role of Science and Technology in Our Life

To understand and explore the importance of science and technology in our daily lives, let us first start by defining the terms *science* and *technology*. Science covers the broad field of knowledge that deals with observed facts and the relationships among those facts. Technology refers to the use of tools, gadgets and resources that help us control and adapt to our environment. The term also refers to the use of machines and utensils which make our daily lives simpler and more organized.

The scientific revolution that began in the 16th century was the first time that science and technology began to work together. Today, science and technology are closely related. Many modern technologies such as space flights or nuclear power depend on science and the application of scientific knowledge and principles. In turn, technology provides science with up-to-date instruments for its investigation and research. Science provides the basis of much of modem technology.

Science and technology are part of almost every aspect of our lives. Although we rarely think about it, they make extraordinary mgs possible. At the flick of a switch, we have light and electricity, lien we are ill, science helps us get better. Science and technology create ways to improve our future.

Modern science and technology have changed our lives in many dramatic ways. Airplanes, automobiles, communications satellites, computers, plastics, and television are only a few of the scientific and technological inventions that have transformed human life. Research by nuclear physicists has led to the development of nuclear energy as a source of power. Agricultural scientists have developed better varieties of plants and highly effective fertilizers. The development of antibiotics and other new drugs has helped to control many infectious diseases. And now we live in the information era when the computer network embraces the globe and connects not only the countries and space stations but a lot of people all over the world. All these things prove the power and the greatest progressive role of science and technology in our life.

Although scientific and technological achievements have benefited us in many ways, they have also created serious problems. The rapid growth of industrial technology, for instance, has resulted in such grave effects as environmental pollution and fuel shortages. Breakthroughs in nuclear research have led to the development of weapons of mass destruction. Some people fear that biological research will produce new disease-causing bacteria or viruses that resist drugs. People are also concerned that computerized information systems may destroy personal privacy.

But science itself is neither good nor bad. The uses that people choose to make of scientific knowledge determine whether that knowledge will help or harm society.

1. What do science and technology cover?
2. How are science and technology related?
3. Are science and technology part of every aspect of our lives?
4. How have science and technology changed our lives?
5. What are harmful effects of scientific and technological achievements?
6. What do the uses that people choose to make of scientific knowledge determine?

UNIT 2
SCIENCE IN DIFFERENT COUNTRIES

1. Read and discuss texts 1 and 2

Text 1. Science in Russia

The Russians made a great contribution to world science. Peter I founded the St. Petersburg Academy of Sciences as early as 1724. It is there that the great scientist Lomonosov worked in the fields of physics, chemistry, astronomy and the foundation of the Russian literary language. The peoples of our country produced many geniuses such as D.I. Mendeleyev who gave the world the Periodic Table of Elements, mathematicians like N.I. Lobachevsky who is known all over the world as “Copernicus of Geometry” and many others.

The peoples of Russia are rightly proud of scientists like A.S. Popov, who invented the radio, A.N. Lodygin, who produced the electric lamp, K.E. Tsiolkovsky, who was the founder of the modern theory of space rockets. Among the peominent scientists we must also mention the names of I.I. Mechnikov, N.N. Zinin, S.V. Lebedev, I.Z. Kondakov, Academician I.P. Pavlov and many others whose names are known far and wide.

Our scientists and inventors have enriched science and technology with many outstanding achievements which enable them to solve the most complex problems. Many inventions have not only brought fame to our science, but also rank among the greatest achievements of mankind.

The development of the theory of chain reactions is linked with the name of the Russian scientist N.N. Semyonov, a Nobel Prize winner, N.D. Zelynsky’s works formed the basis for the synthesizing of a large number of new chemical compounds.

Space research has opened a new era of scientific knowledge. It is in our country that the first artificial satellite for the research in outer space was launched. It was created by the Academician S.P. Korolev, and it was Yury Gagarin who accomplished the first space flight.

Academicians I.V. Koorchatov and G.N. Flerov made a great contribution to the development of the theory of the construction of the atom. It was in our country that the first atomic power station in the world was built and the first atom-powered ice-breaker was launched. Our scientists, engineers and workers have done a lot in order to ensure that the energy of the atom should bring people well-being and prosperity instead of terror and death.

Text 2. Science and Society in the USA

Science on the scale that it exists and is needed today can, however, be maintained only with large amounts of public support. Large-scale public support will be provided only if science and technology are meeting the critical needs of society. Intellectual progress, as measured by advances in specific public disciplines, is not in itself sufficient to generate such support. Perhaps it should be, but it is not. Public support for science may be wise policy, but is not an entitlement.

The central problem is that the costs of meeting the needs of society are too high, and the time scale for meeting them is too long. Both the ideals and the pragmatics of American society are based on improvement in the quality of life. We expect better health care, better education, economic security. We expect progress towards the reduction, if not outright elimination of poverty, disease, and the environmental degradation.

Progress towards these goals has recently been frustratingly slow and increasingly expensive. The heavy costs of providing and improving health care and education are examples.

The situation has produced a volatility in public opinion and mood that reflects a lack of confidence in the ability of government and other sectors of society, including science and technology, to adequately address fundamental social needs.

If this mood hardens into a lack of vision, of optimism, of belief in the future, a tremendous problem for science will result. Science, in its commitment to innovation and expanding frontiers of knowledge, is a thing of the future.

The vistas of science are inspiring. Condensed matter physics is embarked on materials by design, nanotechnology and high temperature superconductivity, each containing the seeds of new industries as well as new scientific understanding. Molecular biology is in full bloom with a vast potential for further intellectual progress, betterment of human (and plant and animal) health, and commercialization. Neuro-science seems poised for dramatic progress.

Research into the fundamental laws of physics is aiming at a pinnacle. There is a candidate theory - the superstring theory – which is proposed as a unification of all the known fundamental forces in nature and which is supposed to give an account, complete in principle, of all physical phenomena, down to the shortest distances currently imaginable. At the largest scales of distance, observational astronomy is uncovering meta-structures which enlarge the architecture of the universe a deepening of the problem of cosmology preliminary to its resolution.

Underpinning much of this progress, and progress in countless other areas as well, has been the emergence of scientific computing as an enabling technology.

All this is first-rate science. All this is not enough – either to forestall change or to ensure adequate support for science in the present climate. Why it is not enough – and what else is required – are the subjects of a special inquiry.

Discussion

1. Are there statements in the text that you disagree with? What are they?

2. Are you aware of the latest achievements in your field of science? What are they?

3. Do you think the achievements of science are not sufficient to ensure adequate support for science?

4. If you were in power what would you do to support science in Russia?

1. Define the main idea of the texts

Text 3.

How British Science Is Organized

John B.S. Haldane

1. Read and translate the text

The British Association for the Advancement of Science was founded in 1831, and at that time almost every serious scientist in Britain belonged to it. There were so few of them that most of the year's work in a given branch of science could be discussed in a few days. In fact it merited title of «Parliament of Science» which is still bestowed on it by some newspapers.

Since then the situation has completely changed. At present there are a number of societies, for example the Royal Astronomical Society, the Chemical Society, the Genetical Society, the Geological Society and the Physiological Society which are composed of scientists only. Finally there is the Royal Society of London for Improving Natural Knowledge. This has 384 scientific fellows, 49 foreign members, and 15 British fellows. When it was founded nearly 300 years ago, it included every scientist in England, and many others, such as Samuel Pepys, who were interested in science. But now it only includes a small fraction of scientists, and its discussions are less lively than those of the societies concerned with individual sciences. On the other hand, the British Association is concerned with matters other than science. It has sections devoted to psychology, which is still only partially scientific, and to education and economics, which in this country at any rate are hardly so at all. So it has fallen away from its former scientific spirit to a certain extent.

But except for the Royal Society, the scientific societies have not the money to subsidize research. This is done by universities, the government, industrial firms, and endowed bodies. There is no organization of research on a national scale. Some of the government and industrial research is secret, and therefore of no value to science. For science means knowledge.

The British Association is able to spare a few hundred pounds yearly for grants in aid of research. But its main function now is discussion. New results are generally announced at meetings of smaller societies, and the public hears very little of them.

If science is to advance in this country as it should, we need more democracy in the laboratories, also more democratic control of expenditure on research. This will only be possible if the people are educated in science, and they are at present deliberately kept in the dark. For a knowledge of science leads to a realization of the huge amount of knowledge which could be applied to the public benefit if industry, agriculture and transport were organized for use and not for profit.

2. Answer the questions:

1. Who belonged to the British Association for the Advancement of Science in the 19th century?
2. Were there many scientists there at that time?
3. It merited title of “Parliament of Science”, didn’t it?
4. Has the situation changed since then?
5. Whom does the Royal Society of London for Improving Natural knowledge include?
6. What issues is the British Association concerned with?
7. It has fallen away from its former scientific spirit, hasn’t it?
8. Do the scientific societies have the money to subsidize research?
9. There is no organization of research on a national scale, is there?
10. Does the public hear much of the research results?
11. What is necessary for the science to advance in Britain?

3. Give some facts from the text to prove the following: The British Association is concerned with matters other than science.

4. Do you agree that “Science means knowledge”? Speak on the issue

5. Read the text for the information on a scientific institution in England. Use the information when doing the assignments that follow.

UNIT 3

TAKING A POST-GRADUATE COURSE

Text 1

1. Read the text

1. Last year by the decision of the Scientific Council I took post-graduate courses to increase my knowledge in economics. I passed three entrance examinations – in History, English and the special subject. So now I am a first year post-graduate student of the Bryansk State University. I'm attached to the Statistics Department. In the course of my post-graduate studies I am to pass candidate examinations in philosophy, English and the special subject. So I attend courses of English and philosophy. I'm sure the knowledge of English will help me in my research.

2. My research deals with economics. The theme of the dissertation (thesis) is "Computer-Aided Tools for…" I was interested in the problem when a student so by now I have collected some valuable data for my thesis.

3. I work in close contact with my research adviser (supervisor). He graduated from the Moscow State University 15 years ago and got his doctoral degree at the age of 40. He is the youngest Doctor of Sciences at our University. He has published a great number of research papers in journals not only in this country but also abroad. He often takes part in the work of scientific conferences and symposia. When I encounter difficulties in my work I always consult my research adviser.

4. At present I am engaged in collecting the necessary data. I hope it will be a success and I will be through with my work on time.

2. ***Read passage 2 and answer the following question***: What is the theme of your dissertation?

3. ***Read passage 3 and speak about your research adviser according to the following plan:*** 1. Doctor's degree. 2. Scientific publications. 3. Participation in the work of scientific conferences.

4. ***Inform your colleague:***

a) what candidate examinations you have already passed;
b) what the theme of your dissertation is;
c) how many scientific papers you have published;
d) if you are busy with making an experiment.

Text 2

1. Before you read Text 1 "Postgraduate Degrees", discuss these questions with your group mates or teacher.

1. What does postgraduate education involve?
2. Does postgraduate education vary in different countries?
3. What is its organization in most countries?
4. Do postgraduate programs require any examinations?
5. What characteristics of Doctoral studies do you know?
6. What are the criteria for award of a Doctorate degree?
7. What is habilitation?
8. What is the structure of postgraduate education in Russia?
9. What degrees are the Russian postgraduate degrees of *kandidat nauk* and *doctor nauk* equivalent to as awarded in many countries?

2. Read and translate Text 21 Find out if your answers are right or wrong. Use the introductory phrases, like: Exactly. It's (partly) true. Just the opposite. I don't think so. That's right. That's wrong.

Text 2. Postgraduate degrees

Postgraduate education (or graduate education in North America) involves learning and studying for degrees or other qualifications for which a first or Bachelor's degree is generally required. The organization and structure of postgraduate education varies in different countries, and also in different institutions within countries.

In most countries, the hierarchy of postgraduate degrees is as follows:

1. *Master's degrees.* These are sometimes placed in a further hierarchy, starting with degrees such as the Master of Arts and Master of Science, then Master of Philosophy, and finally Master of Letters. Many Master's students will perform research culminating in a paper, presentation, and defence of their research. This is called the Master' thesis

2. *Doctorates.* An academic doctorate can be awarded as a PhD (Doctor of Philosophy). In the context of academic degrees, the term *philosophy* does not refer solely to the field of philosophy, but is used in a broader sense in accordance with its original Greek meaning, which is *love of wisdom.*

Many postgraduate programs require students to pass one or several examinations in order to demonstrate their competence as scholars. In some departments, a comprehensive examination is often required in the first year, and is designed to test a student's background undergraduate-level knowledge. Most postgraduate students perform teaching duties.

Doctoral programs often require students to pass more examinations. Programs often require a Qualifying Examination, a PhD Candidacy Examination, or a General Examination, designed to students' grasp of a broad sample of their discipline, and/or one or several Special Field Examinations which test students in their narrower selected areas of specialty within the discipline. These exams must be passed to be allowed to proceed on to the thesis.

The criteria for award of Doctorates vary somewhat throughout the world, but typically require the submission of a substantial body of original research undertaken by the candidate. This may take the form of a single thesis or dissertation, and will usually be assessed by a small committee of examiners appointed by the university. Doctorates are awarded to students who have demonstrated:

- the creation and interpretation of new knowledge through original research of a quality to satisfy peer review, extend the forefront of the discipline, and merit publication;
- a systematic acquisition and understanding of a substantial body of knowledge which is at the forefront of an academic discipline or an area of professional practice;
- the general ability to conceptualize, design and implement a project for the generation of new knowledge, applications or understanding at the forefront of the discipline;
- a detailed understanding of applicable techniques tor research and advanced academic enquiry.

In total, the typical Doctoral degree takes between three and eight years from entering the program to completion, though this time varies depending upon the department, thesis topic, and many other factors.

Habilitation (lat. habilis - *fit, proper, skilful*) is the highest academic qualification a scholar can achieve by his or her own pursuit in several European and Asian countries. Earned after obtaining a research Doctorate, such as a PhD, habilitation requires the candidate to write a professorial thesis/dissertation (often known as a Habilitation thesis/dissertation) based upon independent scholarship, reviewed by and defended before an academic committee in a process similar to that for the doctoral dissertation. However, the level of scholarship has to be considerably higher than that required for a research doctoral (PhD) dissertation in terms of quality and quantity, and a Habilitation dissertation must be accomplished independently, in contrast with a PhD dissertation typically directed or guided by a faculty supervisor.

Habilitation qualification (Habil. Dr.) exists in France, Switzerland, Germany, Austria, Denmark, Bulgaria, Poland! Portugal, Sweden, Finland, the Czech Republic, Slovakia, Hungary, Slovenia, Armenia, Azerbaijan, Latvia, Lithuania, Moldova, Kyrgyzstan, Kazakhstan, Uzbekistan, Ukraine, Belarus, and Russia (Doktor nauk). Those who have achieved habilitation can denote the fact by placing the abbreviation *Dr hab.* or *Dr habil.* before their names.

Many post-Soviet countries, including Russian Federation, have a two-stage research degree obtaining path, generally similar to the doctorate system in Europe. The first stage is named Kandidat nauk (literal translation means *Candidate of Sciences).*

According to par. 262 International Standard Classification of Education (ISCED) UNESCO 2011, for purposes of international educational statistics Candidate of Sciences is equivalent to Doctor of Philosophy (PhD) degree as awarded in many English-speaking countries. It allows its holders to reach the level of the Associate Professor (Docent). The Candidate of Sciences degree requires at least (and typically more than) three, four or five years of postgraduate research which is finished by defense of a dissertation or a thesis. Additionally, a seeker of the degree has to pass three examinations (a so-called Candidate minimum): in his/her special field, in a foreign language, and in the history and philosophy of science. After additional certification by the corresponding experts, the Candidate degree may be recognized internationally as an equivalent of PhD. The second stage is Doktor nauk (Doctor of Sciences). It requires many years of research experience and writing a second dissertation. The degrees of Candidate and Doctor of Sciences are only awarded by the special governmental agency (Higher Attestation Commission). A university or a scientific institute where the thesis was defended can only recommend awarding a seeker the sought degree.

3. Complete the following sentences with details from the Text.

1. ____ Master's degree programs usually include __________.

2. ____ The degree of an academic doctorate is called________.

Examinations are required to test__________________.

3. ________________________________Typically a doctorate degree takes________to complete.

4. ____________________________is earned after obtaining a PhD degree.

5. ____ The first stage research degree in Russia is___________. _________________________

6. ____ The second stage research degree in Russia is________.

4. Locate the following details in the Text. Give the line numbers.

1. In which lines does the author explain the meaning of the term *philosophy* in the context of academic degrees?

2. Where in the Text does the author first mention the requirements for Doctoral degree programs?

3. Where in the Text does the author discuss what doctoral students are expected to demonstrate to be awarded a PhD degree?

4. At what point in the Text does the author discuss the level of scholarship required for habilitation?

5. In which lines does the author explain the equivalence of Russian postgraduate degrees to the ones recognized internationally?

5. Underline the detail that is NOT mentioned in the Text in each of the sentences below.

1. Postgraduate education includes Bachelor's degrees, Master's degrees, and Doctor's degrees.

2. Doctoral degree programs require students to pass a qualifying examination, a comprehensive examination, a special field examination, and a PhD candidacy examination.

3. Habilitation qualification exists in France, Austria, Denmark, Bulgaria, Great Britain, Poland, Russia and other countries.

6. Answer the following detail questions.

1. According to the Text, Master's degree students complete their research with

a) examinations.

b) the defense of a thesis.

c) a paper.

2. According to the Text, postgraduate students perform

a) work as assistants.

b) interviews for postgraduate candidates.

c) teaching duties.

3. According to the Text, a thesis is assessed by

a) an examiners' committee.

b) a professors' council.

c) an attestation committee.

4. According to the Text, a habitation thesis is accomplished

a) with the help of a faculty supervisor.

b) independently.

c) with the help of an academic committee.

5. According to the Text, what examinations do Candidate of Sciences degree seekers have to pass?

a) in a special field, science, and a foreign language

b) in a special field, local history, and a foreign language

c) in a special field, the history and philosophy of science, and a foreign language

7. Mark the main ideas of the Text and retell it in English.

8. Read the text carefully and find some differences and simile

Postgraduate Training Programs

All further education which comes after baccalaureate can be regarded as postgraduate education. It presupposes carrying a lot of research work, acquiring knowledge of new methodologies and new trends. It may lead to either a Master's degree (a three-year program of study) or PhD (usually a two-year course of study).

Postgraduate programmers are either research degrees or taught courses. ***Taught courses*** last one or more years and are either designed so that you deepen your knowledge gained from your first degree or for you to convert you expertise to another field of study. Examples of these include changing to law to become a solicitor and training to become a teacher.

Degrees by instruction are very similar to undergraduate courses in that most of the time is devoted to attending lectures. This may take up the first eight or nine months of the course and is followed by written examinations. A period of research lasting from two or three months usually follows and the results of it are presented in the form of a thesis. Finally, an oral examination is held, lasting perhaps an hour or two, to test the knowledge accumulated throughout the year. Most programmers, which involve classes and seminars, lead up to a dissertation.

Research course is quite a different type of study from a taught course. First of all it lasts longer, for about three years providing Master's or doctorate qualifications.

They allow you to conduct investigations into your own topic of choice and are of use in jobs where there are high levels of research and development.

The most well-known research qualification is the Doctor of Philosophy (PhD, a three-year study programmer). There is a shorter version called a Master of Philosophy (MPh) which takes the minimum amount of time of two years.

Both of these qualifications require the students to carry out a piece of innovative research in a particular area of study. Also possible is the research based on Master of Science (MSc.) and Master of Arts (MA) degrees. A recent development is the Master of Research (MRes), which provides a blend of research and taught courses in research methods and may be a taken as a precursor to a PhD.

It is a common practice for students to be registered initially for the MPhil and to be considered for transfer to the PhD after the first year of study, subject to satisfactory progress and to a review of the proposed research. All research degree programmers involve an element of research training designed to ensure that students are equipped with the necessary skills and methodological knowledge to undertake original research in their chosen field of study. The training programmer includes the development of generic skills relevant to the degree programmer and a future career.

Although the training element is not a formal part of the assessment for the degree, it constitutes an important basis for research and may take up a significant part of the first year.

The start of a research degree involves a very extensive survey of all previous works undertaken in that area. At the same time, if a student is planning to carry out any practical experimentation, the necessary equipment must be obtained.

This preliminary part of the study can take up to six months, but it is important to note that the process of keeping up to date with other work going on in the subject must continue throughout the entire period of the research.

The next stage of a research course usually involves collecting information in some way. This might be through experimentation, in the case of arts, social sciences or humanities degree. The important thing is that something new must be found.

This second part of the procedure takes about two years in the case of a PhD.

The research is written up in the form of a thesis during the final six months of the three-year period. Typically, this will contain an introduction, methodology, results and discussion. As in the case with taught degrees, the research must then be examined orally. Occasionally, if the examiners are not completely happy with the work they may ask the candidate to rewrite parts of the thesis.

Hopefully, a good supervisor will make sure this does not happen! Different types of study require similar qualities from the people who undertake them. Both demand an inquisitive mind that will maintain the motivation to learn and discover new information.

They also both demand a high level of intellectual ability in order to cope with the pressures of understanding the possible complex arguments, facts or theories. Both require a high degree of organizational ability and time management, as so many different things need to be attended to.

UNIT 4
MY RESEARCH WORK AND ACADEMIC CAREER

1. Memorize the active vocabulary

degree – степень (ученая)
to award/confer a ~ – присвоить степень
to get/take/receive a ~ – получить степень
to hold/have a ~ – иметь степень
first ~ – диплом бакалавра наук
Bachelor’s ~ – степень бакалавра
higher ~ – ученая степень
Master’s ~ – степень магистра

Doctorate ~ (PhD) – степень кандидата наук
~ of Candidate of sciences (Candidate's degree) – степень кандидата наук
~ of Doctor (Doctor of sciences) – степень доктора наук
dissertation/ thesis – научная работа, диссертация
to defend one's ~ – защитить диссертацию
to submit a ~ for hearing at the session of the Academic Council – представить диссертацию для обсуждения на заседании Ученого совета
field of study – область исследований
To graduate from- окончить высшее учебное заведение
To graduate in economics - окончить эконом. факультет
a full-time (a part-time) post-graduate - аспирант-очник (заочник)
an applicant - соискатель
To take / have a post-graduate course - учиться в аспирантуре
To carry out (conduct) research in the field of... - проводить исследования в области...
To be published in the Proceedings of the Conference - быть напечатанным в сборнике материалов конференции
To work at one's thesis (dissertation) under the guidance (supervision) of ... - работать над диссертацией под руководством...
To work in collaboration with... - работать совместно с...
To submit one's thesis to public hearing in due time - представить диссертацию к защите в срок
To survey modern literature on the problem - делать обзор современной литературы по проблеме
The problem arises in connection with... - эта проблема встает в связи с...
We turn our attention to a new and more urgent problem - Мы обращаем внимание на новую и более насущную проблему
The problem of studying ... demands special care in using... - Проблема изучения... требует особого внимания к использованию...
We shall touch upon a question of...- мы коснемся вопроса...
The core of the problem is... - Суть проблемы заключается...
It would be instructive to examine in detail... - Было бы полезно детально изучить...
The object of our investigations is... - объектом нашего исследования является...
...is the subject of our research - ... является предметом нашего исследования
We are engaged in the study of... - Мы занимаемся изучением...
We shall make a thorough study of...- мы подвергнем тщательному изучению...
The aim of the paper is...- Цель данной работы заключается...

In the framework of... the first objective to achieve is... - В рамках... основной целью является...
The purpose of my work is to examine and investigate... - Цель моей работы заключается в изучении и исследовании...
The primary task is to study... - Первоочередной задачей является изучение...
The conventional approach to this problem is based on... - Обычный подход к этой проблеме основан на...
We shall turn to another trend. - Мы обратимся к другому направлению
It is worth analyzing precisely... - Стоит тщательно проанализировать...
One of the most promising problems is believed to deal with... - Считается, что одной из наиболее перспективных проблем является...
The problem became more acute, it took a new form. - Проблема стала более острой, она приобрела новую форму
It seems essential to emphasize that... - Представляется важным отметить, что...
So far we have discussed... - До сих пор мы обсуждали...
It provides a basis for - Это служит основой...
For (at) the moment... - В настоящий момент...
We are intended to conclude that... - Мы намерены заключить...
To sum up it should be noted that... - Подводя итог, следует отметить, что...
Degree of candidate of sciences; candidate's degree (less formal) - степень кандидата наук
To do academic work / research - / выполнять научную работу / исследование
To devote oneself to academic / research work - посвятить себя науке
a branch of knowledge - отрасль науки;
an academic work - научный труд
an academic approach - научный подход
department - кафедра
a research worker / a researcher - научный работник
topical - актуальный
analogous - аналогичный
academician - академик
post-graduate - аспирант
post graduate course- аспирантура
candidate of science - кандидат наук
doctor of science -доктор наук
assistant professor -доцент
Associate Professor at the Department of - доцент кафедры (конкретной)
head of the department - заведующий кафедрой

professor - профессор
rector - ректор
deputy rector - проректор
university administration - ректорат
scientific degree -ученая степень
academic rank -ученое звание
dean -декан
scientific field (branch) - научная область
research work - научно-исследовательская работа
scientific journal - научный журнал
exact sciences - точные науки
applied science - прикладные науки
agricultural sciences - с/х науки
natural sciences - естественные науки
to devote oneself to - посвятить себя науке
scientific experience - научный опыт
summary, abstract - реферат, аннотация
to get data (obtain) - получать данные
collect data on ... - собирать данные о
to make a research - проводить исследование
to solve a problem - решать проблему
to do (carry out, conduct) a research - заниматься (проблемой), проводить исследования
to draw up a study plan - составить план исследования
the aim of the research - цель исследования

2. Before you read Text "PhD Thesis", discuss these questions with your group mates or teacher.

1. What is a PhD thesis?
2. What is the most important part of a PhD thesis?
3. Does a PhD thesis require approval?
4. What is the purpose of the review chapter?
5. What is the procedure of defending a PhD thesis?
6. What similarities and differences can you find between a PhD thesis and a *kandidatskaya* thesis?

3. Read and translate the Text.

PhD thesis

The PhD thesis or dissertation is a monograph, i.e. a self- contained piece of work written solely by the PhD candidate and no-one else. It sets out a certain problem that the candidate has worked on, possibly within a larger team, under guidance of one or more academic advisors. It motivates and defines the problem, reviews existing approaches to the problem, identifies through critical analysis a clear gap for a possible novel academic contribution, and spells out a so-called hypothesis, which is a proposed explanation for the problem or a proposed solution to the problem. The thesis also explains in sufficient detail, and justifies the work undertaken to decide on the hypothesis (or hypotheses as the case may be). This work typically involves a combination of further literature studies, theoretical analysis, experimental design, data collection, carrying out the experiments, data analysis, and drawing conclusions. A good thesis also delineates the limitation of the work done or the conclusions drawn and outlines possible future research directions.

The format of a PhD thesis is not very different from any other formal research dissertation or study paper. However, a PhD thesis requires much more research and evaluation on the topic.

To start a PhD thesis, you will need to submit a written proposal in to your advisor. The length of this proposal will vary, and is dependent upon your advisor's specifications and the topic that the paper is written on. The body of the proposal contains certain elements that must be included.

The most important part of your PhD proposal is coming up with a hypothesis for your research questions. This is where your successful for your research study will begin. In most cases this requires the researcher to do background work ahead of time in order to choose a direction for which his or her thesis should go, as well as the research will need to be done to prove his or her point.

The second stage of the process is actually beginning your PhD thesis. This requires approval of your proposal first. The first chapter will be the basic introduction to your subject, including the reasons why you decided on this topic for your research. The introduce on also takes a look at other work that a researcher has done that is pertinent to the PhD thesis, and what new achievements he or she is trying to do through the study.

The second chapter looks at the literature that deals with the same subject matter. Keep in mind that the literature should only be high quality, and include items such as journals and books. While the review chapter does not directly relate to the thesis work-itself shows the reader what the researcher was thinking when he or she began working on the research topic.

She third chapter looks at the research question with a detailed discussion of the

PhD thesis statement. It will also include the information like the statement of the problem, and the hypothesis and predictions. It summarizes what the researcher is trying to accomplish through the course of the study.

The fourth chapter of your thesis takes a look at your research and the method that you used when coming up with the data. This chapter can be very different from one thesis to another, as it will depend on what method the research used, including comparative analysis, scientific technique, regression analysis and more. This chapter also includes information such as the variables that used, as well as why you used them and the theories you had behind choosing them.

The fifth chapter looks at the study that has been done so far and what results were obtained during this study. It also looks at what methodology was applied during the study.

The sixth chapter looks at the results in greater detail. It will also evaluate the results against the previous information already known or what the researcher has discovered. The limitations of the study are also discussed in this chapter, which includes the factors that the study did not look at or incorporate. It can also include the information about the research that the author discovered that was not related to the original thesis and hypothesis because it was not addressed with the original specifications of the variables.

The seventh chapter is the critical analysis. This includes the information that was discovered during the research, as well as the areas of the study that may be open to further research in the future.

The final chapter sums up the results of the research and allows the author to give his or her interpretations and thoughts on the study itself.

Writing your thesis is not the end of the study. You will also be required to put together a defense of your research, which entails being able to verify all of the information that is included in your thesis. To do this, you will be put in front of a panel of experts who will question your research. Therefore, you need to make sure that your evidence is accurate, proves what it needs to, is relevant to the issue, can be easily understood, and that it is convincing enough that the readers will believe what you have to say.

4. Complete the following sentences with details from the Text.

1. The PhD thesis sets out ________.
2. You will need _______ to begin a PhD thesis.
3. The introduction chapter studies ________.
4. The methodology you applied is discussed in _______.
5. The critical analysis chapter includes the information _______.

5. Locate the following details in the Text. Give the line numbers.

1. In which lines does the author explain what PhD dissertation writing involves?

2. Where in the Text does the author mention the statement of the problem in the dissertation?

3. At what point in the Text does the author discuss the research methods to be used in a PhD dissertation?

4. Where in the Text does the author explain what scientific evidence is characteristic of?

6. Underline the detail that is NOT mentioned in the Text in each of the sentences below.

1. A PhD dissertation motivates and defines the problem that the candidate has worked on independently, defines the hypothesis, and outlines future research directions.

2. The chapter studying the PhD thesis statement includes the hypothesis, predictions, and literature review.

3. The factors that the study did not incorporate and the results obtained are discussed in the sixth chapter.

7. Answer the following detail questions.

1. According to the Text, a hypothesis is

a) a possible academic contribution.

b) a proposed solution to the problem.

c) a theoretical analysis.

2. According to the Text, the length of a written proposal depends on

a) the number of certain elements to be included.

b) the topic specifications.

c) your advisor's recommendations.

3. According to the Text, what does the first chapter look at?

a) the reasons for choosing a particular topic for the research

b) the achievements the candidate has done

c) the details of the research

4. According to the Text, the second chapter relates to

a) the thesis work itself.

b) the information discovered during the research.

c) the researcher's ideas at the initial stage of the research.

5. According to the Text, what does the eighth chapter include?

a) the research methods applied

b) the research summary
c) the critical analysis

8. Answer the questions. Use the following cliché

CLICHÉ

(stereotype block of expressions and patterns)

for a research work story

1. I'm a postgraduate (research student)...	1. Я аспирант (соискатель)...
2. My scientific adviser (supervisor) is...	2. Мой научный руководитель...
3. The subject of my research is...	3. Предмет моего исследования...
4. The reasons for my choice are...	4. Причины моего выбора следующие...
5. My investigation has both theoretical and practical parts...	5. Моя научно-исследовательская работа включает в себя как теоретическую, так и практическую части...
6. I'm going to deal with...	6. Я планирую заниматься...
7. I'll make use of... methods...	7. Я собираюсь использовать ... методы...
8. My work requires the collection of a good deal of material...	8. Мне требуется собрать большое количество материала для моей работы...
9. Currently I'm busy with collecting theoretical data on my subject.	9. В настоящее время я занимаюсь подбором теоретических данных по моей теме.
10. I have to read articles (monographs, journals) of our and foreign authors.	10. Мне приходится читать статьи (монографии, журналы) наших и зарубежных авторов.
11. One of the main aims of my research work is...	11. Одной из главных задач моей научной работы является...
12. I'm going to analyze (to generalize) the common practice of...	12. Я собираюсь проанализировать (обобщить...)
13. As result of my research I plan to elaborate some practical recommendations for ... , to work out a new method (theory)...	13. В результате своих исследований я планирую разработать практические рекомендации по..., разработать новый метод (теорию)...

14. At present I'm busy with the survey of special literature	14. В настоящее время я занят обзором специальной литературы.
15. I have already completed my experiments on	15. Я уже закончил проведение экспериментов...
16. My next aim is to organize the data, to analyze the information; to examine the results; to evaluate the data; to summarize the results to ………	16. Моя ближайшая задача привести в порядок данные, проанализировать информацию, оценить данные, обобщить результаты, сделать необходимые расчеты...
17. I expect to be through with my research (to finish, to complete), my thesis in a year.	17. Я надеюсь закончить свои исследования (диссертацию) через год.
18. I believe (hope) my work will be of practical interest for	18. Я надеюсь, что моя работа будет представлять практический интерес для...
19. The subject of your research work.	19. Предмет вашего исследования.
20. The current interest in the problem in general.	20. Интерес к проблеме в целом.
21. Have there been any attempts made to study the problem before?	21. Изучалась ли данная проблема раньше, кем и насколько?
22. Results already achieved and the aim of your own research.	22. Цель вашей работы.
23. Materials, equipment, methods to be used.	23. Материалы, оборудование, методы, которые вы используете в процессе исследований.
24. The current stages of the research.	24. На какой стадии находится ваше исследование в данное время?
25. The results of your current research work, if there are any.	25. Если уже получены какие-либо результаты, то какие именно?
26. The remaining part (portion) of the work.	26. Сколько времени вам необходимо для завершения работы, что еще необходимо сделать?
27. Significance of your research work in case it is completed successfully.	27. Каково практическое значение конкретно вашей работы?

9. Read the three texts, do the tasks, and answer the questions.

Data, Evidence and Facts

Data

Data is a set of values of qualitative or quantitative variables. Data is measured, collected and reported, and analyzed, whereupon it can be visualized using graphs or images. Data as a general concept refers to the fact that some existing information or knowledge is represented in some form suitable for better usage or processing.

Raw data, i.e. unprocessed data, is a collection of numbers, characters. Field data is raw data that is collected in an uncontrolled *in situ* environment. Experimental data is data that is generated within the context of a scientific investigation by observation and recording.

The word ‘data’ used to be considered the plural of ‘datum’, and still is by some English speakers. Nowadays, though, ‘data’ is most commonly used in the singular, as a mass noun (like ‘information’, ‘sand’ or ‘rain’).

10. Translate from English into Russian the words and word combinations in bold.

11. Answer the questions:

1. What is data? What type of data do you plan to collect and analyze for your research?
2. What is the difference between raw and field data?
3. Will you use experimental data in your research?

Evidence

Evidence, broadly construed, is anything presented in support of an assertion. This support may be strong or weak. The strongest type of evidence is that which provides direct proof of the truth of an assertion. At the other extreme is evidence that is merely consistent with an assertion but does not rule out other, contradictory assertions, as in circumstantial evidence.

Scientific evidence consists of observations and experimental results that serve to support, refute, or modify a scientific hypothesis or theory, when collected and interpreted in accordance with the scientific method.

In scientific research evidence is accumulated through observation of phenomena that occur in the natural world, or which are created as experiments in a laboratory or other controlled conditions. Scientific evidence usually towards supporting or rejecting a hypothesis.

One must always remember that the burden of proof is on the person making a contentious claim. Within science, this translates to the burden resting on presenters of a paper, in which the presenters argue for their specific findings. This paper is placed before a panel of judges where the presenter must defend the thesis against all challenges.

12. Translate from English into Russian the words and word combinations

13. Answer the questions:

1. What is the difference between evidence and scientific evidence
2. How is evidence accumulated in scientific research?
3. What is a claim? How to prove a claim?

Facts

A fact is something that has really occurred or is actually the case. The usual test for a statement of fact is verifiability - that is, whether it can be demonstrated to correspond to experience. Standard reference works are to check facts. Scientific facts are verified by repeatable careful observation or measurement (by experiments or other means).

14. Read the statements below and decide if they are facts or opinions:

1. The Russian Department of Agriculture recommends that adults consume three to four cups of vegetables per day.
2. Playing team sports is the better way to lose weight.
3. Research shows that a diet low in salt helps people to lower pressure.
4. Home-cooked meal tastes better than meal in restaurants.
5. Research indicates that young people who ate meals with tl did well academically.

14 Answer the questions:

List of questions

1. What institute did you graduate from and when?
2. What faculty did you study at?
3. What is your specialty?
4. Have you got a diploma with honors?
5. Are you a postgraduate or a research-student?
6. When did you decide to take a postgraduate course?
7. When did you enter (join) the postgraduate course?
8. Why are interested in research work?
9. What personal characteristics do you think are necessary for success in the chosen field?
10. Are you going to take a full time or a correspondence course?
11. Are there any scientists in your family or among you relatives?
12. What do you think will be more difficult for you – to write a theoretical or an experimental chapter? Why?
13. What is the subject of your research? What do you research? What do you study?
14. Do you work at your thesis already?

15. What is the subject of your thesis?
16. Is your research work individual or is it a group research?
17. Where do you take experimental material?
18. Do you know how many parts does a thesis consist of?
19. What candidate examinations have you already passed?
20. What scientific degree will you get?
21. Have you read your scientific supervisor's research papers? What are they about?
22. Do you think they will be useful for your dissertation?
23. Is your scientific supervisor helpful? How often do you get to see him?
24. How does your scientific supervisor help you in your research?
25. Have you got any publications? Tell us about the one that you think is the best.
26. Is your investigation (research work) an experimental or theoretical one?
27. Have you passed all the candidate examinations?
28. What candidate examinations have you passed?
29. When will you take you philosophy (specialty) examinations?
30. Has your investigation real practical value?
31. Where can the results of your investigations be applied at?
32. Do you use the Internet for your research? In what way?
33. What are the main problems in your area of research?

15. Read some sentences about the research work of a postgraduate student and give information about yourself

1. I am a postgraduate student of the department of microbiology and infectious diseases of OSAU. My specialty is Veterinary Microbiology, Virology, Epizootiology, Mycology and Immunology.
2. My supervisor is Candidate of Biological Sciences, assistant professor of microbiology and infectious diseases... .
3. The subject of my research is biological properties of antagonistically active enterococci isolates from animals.
4. The aim of my research is the study of the biological properties of enterococci isolated from the intestine of animals.
5. The main task is to identify the active antagonistic strains of enterococci.
6. The reasons for my choice are: first, probiotics are a good alternative to antibiotics, secondly, enterococci, showing antagonistic activity against a number of pathogens and non-virulence factors, can be used as a component of probiotic preparations.
7. My research work includes both theoretical and practical parts.
8. I plan to study the biological properties of bacteria of the genus Enterococcus.

9. I'm going to use the classical bacteriological and modern molecular genetics methods.

10. I want to collect a lot of material for my work.

11. I am currently involved in the selection of the theoretical data on my topic.

12. I have read articles, monographs, journals of our and foreign authors.

13. A major object of my work is to identify strains of enterococci with high antagonistic activity.

14. I'm going to analyze the presence of virulence factors in intestinal isolates of enterococci.

15. As a result of my research, I plan to develop practical recommendations for a new probiotic preparation based on strains of enterococci.

16. I am currently busy with the review of the literature.

17. I've already finished the experiments.

18. My immediate task is to arrange the data, analyze information, summarize results, make the necessary calculations.

19. I plan to finish my research (dissertation) in two years.

20. I hope that my work will be of particular interest for veterinarians and microbiologists.

16. Побеседуйте по-английски с коллегой о проводимых вами исследованиях. Используйте следующие вопросы и утверждения:

Use the following questions and statements:

1. What methods do you apply in your research? And why?
2. What are you going to prove in your research?
3. How can you formulate your hypothesis?
4. How do you plan your experiments?
5. How often do you record data during the experiment? (every hour, every two hours, etc).
6. What instruments and equipment do you use in your investigation? And why?
7. What views and data can your experiments (or research) prove or refute?
8. What illustrations are you preparing to demonstrate the results of your investigation?
9. What conclusions will you make if the results of your research are positive/negative?
10. What are the merits and demerits of the investigation that you have already carried out?
11. How will you continue your investigation? And why?
12. The hypothesis fits experimental data.
13. The research probes in the various aspects of the subject.

14. We experimented with the new materials.

15. We hope to find the answer to this problem.

16. The work was subjected to criticism.

17. Out of his work came a substantial knowledge.

18. The theory and the results are too extensive to be given here.

19. The experimental results were analyzed with the help of high-speed computing machines.

20. I am afraid I don't know for certain if there are any direct (adequate, reliable) data regarding ... I believe some information is available though I don't know what it is...

21. Yes, as far as we know there are some very interesting and, I dare say, very encouraging data about..., though at the moment I am not quite prepared to speak about them in detail.

22. Well, there must be rather adequate data at present since studies of the problem have been in progress for several years now (have long been under way)...

23. What is the problem you are investigating now (interested in)?

24. What does it deal with?

25. What is the core of the problem?

26. Is it sufficiently studied?

27. Does it involve certain difficulties?

28. What aspects does it include?

29. What kind of problem does it refer to?

30. Does the problem require a great deal of investigation?

31. Has it been discussed for a long time or is it a newly raised problem?

32. Is there a lot of information on this problem?

33. What foreign literature have you read on the problem?

34. Will it take much time to clear up all the aspects of the problem?

17. Read the following dialogues in parts

Dialogue 1

Peter: Hallo, Mike!

Mike: Oh, Peter! Haven‘t seen you for ages! What are you doing here in Orenburg? I know you live in Orsk.

Peter: You are quite right. But this year I have become a post-graduate student of the Orenburg State University. Do you remember that I was interested in research work when a student?

Mike: Oh, yes, I do. And, of course, you want to carry on research in applied statistics. Am I right?

Peter: Absolutely right you are. I have a particular interest in this field of knowledge.

Mike: That‘s fine! I congratulate you on a good beginning. They say: «Well begun is half done». I wish you success in your research.

Peter: Thanks a lot.

Dialogue 2

Post-graduate: What is your opinion of my last article?

Professor: There is a great deal in it that is new, and a great deal that is true …

Post-graduate: Do you really mean …?

Professor: … but it, unfortunately, happens that those portions which are new are not true, and those which are true are not new.

Dialogue 3

Post-graduate: I hear you said my new article was the worst I ever wrote.

Professor: No, I didn‘t. I said it was the worst article anybody ever wrote.

18. Read the text and compare your answers.

What is an Academic Career?

(Information about different routes into an academic career)

There are three main routes you could consider when following an academic career. These are:

• Research-only role, where the bulk of your time is spent conducting research with limited or no teaching commitment

• Teaching-only role, where majority of your time is for teaching with little or no time specifically allocated for research

• Research and teaching position, i.e. a lectureship, where you will be expected to both teach and conduct research.

In reality, most people will progress through a number of these roles when pursuing an academic career. The route you take will depend on your interests, the funding and opportunities in your subject area, and the job market at certain points in your career. It tends to be more common to have a long-term research-only career in the sciences as at present there is more funding available for research-only positions.

You should try to be clear about where your interests lie and what opportunities are available in your subject area. Many academic jobs will be a balance of research, teaching and administration but the percentage of time spent on each will vary greatly. Factors that will affect how you spend your time include:

• Your role, e.g., if you are employed as a research or teaching fellow

• Your level of experience, as junior lecturers will often have a greater teaching load than more senior lecturers

• The type of institution as lecturers at research-intensive universities may be expected to spend more time on research than those employed in teaching- focused institutions.

Some of the activities you may be expected to contribute to during an academic career are as follows:

Research

As a PhD student you will be familiar with the range of activities that come

- identifying suitable funding bodies and preparing proposals to apply for funding
- conducting research (reading, collection and interpretation of data, gathering of information from relevant sources, etc.)
- disseminating research findings through publishing
- speaking at conferences
- supervising postgraduate research students
- managing resources (research budget and possibly research staff).

Teaching

You may already have had some experience of teaching or tutoring. As an academic member of staff teaching responsibilities can include:

- design of courses and development of curricula
- preparing notes and material for lectures
- delivering lectures to undergraduates and postgraduates
- preparing for and facilitating discussion at small group tutorials
- marking / assessing students work
- supervising Honours students' dissertation research.

Administration

Some examples of the types of administrative roles academic staff may undertake include director of studies, admissions tutors, course organizer, or open-day coordinator / school liaisons officer.

Academics are also often members of several committees both within their department or school (e.g., staff-student liaison, health & safety), their college (e.g., library, equality and diversity, undergraduate studies) and/or across the university (e.g., quality, scholarships and student funding, recruitment and admissions strategy).

Administrative tasks associated with these roles include:

- writing the course handbook
- designing exam questions and answers (and getting these validated through the relevant committees)
- preparing a schedule of talks for visiting prospective students
- writing references for students seeking employment or further study
- screening applications for admission to postgraduate courses
- reading papers relevant to your committee membership and submitting your comments for discussion at meetings.

19. Before you read the Text "Jobs for Postgraduates", discuss these questions with your group mates or teacher.

1. What are the advantages for recruiting those with postgraduate qualifications?
2. What employers of postgraduates do you know?
3. What do academic and non-academic postgraduate jobs include?
4. What are lecturers responsible for?
5. Where can you find information on postgraduate jobs?

20. Read and translate

Jobs for postgraduates

More and more employers are recognizing the advantages of recruiting those with postgraduate qualifications. These range from multinational organizations to small and medium enterprises. The UK Graduate Program Study "What do PhDs do?" has found that a number of employers value PhD graduates for their maturity, independence, problem-solving skills, determination and innovative thinking. Although most employers do not have a specific postgraduate recruitment process, there are a number of opportunities requiring postgraduate qualifications. Higher education institutions are the largest employers of postgraduates in the region, offering a wide range of opportunities in a diverse range of subject areas. The universities within Yorkshire and Humber regularly recruit those with postgraduate qualifications. There are eight universities and three higher education colleges in the region.

Types of academic postgraduate jobs include a lecturer, a research associate, a research assistant, a research fellow, and a journal editor/ assistant.

Lecturers within higher education institutes are responsible for teaching academic courses at both undergraduate and postgraduate level, which, depending upon subject area, involves lectures, seminars, field work and practical demonstrations. Many lecturers pursue their own research outside of their teaching duties and contribute to other research activities in their department. Lecturers are often required to support other research projects and supervise PhD students and other post-doctorates. There is also a large amount of administration involved in lectureship posts.

A research associate is an. academic research post requiring postgraduate qualifications to PhD level. Research associates are required to work on projects funded by employers in industry or a research council; therefore they do not have the opportunity to pursue their own research. These posts are usually on a fixed-term basis, lasting between one and three years.

Universities often advertise research assistant posts which do not carry as much responsibility as research associates. These posts usually require candidates to have obtained at least a Master's level qualification.

Research fellowships allow post holders to engage in their own individual research project. These posts are usually full-time with no teaching duties although post holders may have responsibility for supervising students.

Many departments within Yorkshire Universities publish internationally recognized academic journals which require editors and assistants who are responsible for dealing with submissions, organizing publication and attending international conferences for promotional purposes.

Students who have just spent four years earning a Bachelor's degree plus two, three or more years earning a graduate degree might prefer a job that is not academically oriented. Working in a job that develops administrative, writing and organizational skills might benefit postgraduate students and help them gain experience needed to succeed in defending a dissertation or interviewing for a tenure-track position. Some postgraduates, especially those who do not intend to become university professors, might prefer to try something completely different from their field of study, such as retail, clerical, restaurants, the creative arts, publishing or even manual labour. This sort of a break from academics might help postgraduates hone in on abilities and skills they previously never realized they had.

Types of non-academic postgraduate jobs include: Arts and Humanities (journalist/broadcaster, journal/professional magazine editor, policy and research manager, policy adviser, project manager); Business and Finance (business adviser, marketing/market researcher, project manager, senior manager); Languages (project manager, translator); Science, Technology and Engineering (research associate, design engineer, development engineer, project manager, research and development scientist, scientific researcher, senior lab technician, senior scientist).

The UK Graduate and Research Council Program provides information and personal development programs to help PhD students gain the necessary skills for work outside of academia.

21. Complete the following sentences with details from the Text.

1. Multinational organizations and_____ are recognizing the advantages of recruiting postgraduates.

2. Lecturers_____PhD students and _____ research projects.

3. Research assistants do not carry as much responsibility as________.

4. Editors and assistants of internationally recognized academic journals are responsible for organizing publication, _____ and attending international conferences.

5. Students spend four years earning a Bachelor's degree and ____ years earning a graduate degree.

22. Locate the following details in the Text. Give the line numbers.

1. In which lines does the author explain the opportunities requiring postgraduate qualifications?
2. Where in the Text does the author first mention a research associate post?
3. Where in the Text does the author discuss research fellowships?
4. At what point in the Text does the author explain the functions of the UK Graduate and Research Council?

23. Underline the detail that is NOT mentioned in the Text in each of the sentences below.

1. Many employers are recognizing the advantages of recruiting those with undergraduate and postgraduate qualifications.
2. Research associates usually work on projects funded by employers in industry and education or a research council.
3. Some postgraduates prefer to try something different from their field of study, such as retail, clerical, business or manual labour.

24. Answer the following detail questions.

1. According to the Text, who do the universities often recruit?

a. those with undergraduate qualifications.

b. those with postgraduate qualifications.

c. those with a university diploma

2. According to the Text, what academic degree is a research associate required to have?

a. a Bachelor's degree

b. a Master's degree

c. a PhD degree

3. According to the Text, research associates hold their posts

a. permanently.

b. temporally.

c. for five years.

4. According to the Text, working in an administrative job may help postgraduate students

a. gain experience.

b. defend a dissertation.

c. have a successful job interview.

5. According to the Text, a break from academics may be

a. useless for postgraduates.

b. helpful for postgraduates.

c. unnecessary for postgraduates.

25. Underline or mark the main ideas of the Text and retell it in English.

UNIT 5

ACADEMIC CONFERENCES

1. Read the following polylogue:

2. Советы участнику научной конференции, работающему над письменным текстом своего доклада. Краткость, ясность, простота, конкретность – вот к чему, как считают, следует стремиться автору научного сообщения.

- ‘Keep sentences short. On the average, most sentences should be shorter than 25 words. But sentences should vary in length and structure.

- Prefer the simple to the complex sentences and phrases. Write “try to find out” rather than “endeavor to ascertain”.

- Prefer the familiar word but build your vocabulary. If a reader doesn’t understand your words, he can miss your meaning. But you may want to use long words in some cases – to clarify your point.

- Avoid words you don’t need. Extra words weaken writing. Make every word carry its own weight.

- Put action into your verbs. Passive verbs tire the reader. Write “we intend to write clearly” not “Clarity in composition is our intention”.

- Use terms your reader can picture. Choose short, concrete words your reader can visualize, not abstract terms. Don’t say “industrial community” when you’re describing a “factory town”.

- Tie in with your reader’s experience. The reader probably won’t get your new idea unless you link it with an old idea he already understands. If you’re describing how a new pump works, compare its operation with that of an old, standard pump.

- Write the way you talk, or at least try for a conversational tone. People rarely use business jargon when they talk.

- Make full use of variety. Vary the length of words and sentences and arrange them in different ways. Avoid monotonous patterns of writing.

- Write to Express, not to Impress. Don’t show off your vocabulary by using needlessly complex words.

3. Фрагмент статьи о выступлении на научной конференцию. Автор подчеркивает, что докладчик всегда должен помнить об аудитории и ее интересах и, исходя из этого, строить свое сообщение.

"Are you taking yourself too seriously? Sure, your world is great and you're fantastic, but what about the other guy? Don't forget, your purpose is to tell him what you know. To do that you need to get his attention and you need to keep it.

Where most of us have trouble is in orally presenting a published paper. It is easy to forget that you are dealing with two entirely different audiences.

Think about it. People reading your article have many devices and motions available to them. They can underline, put aside, reread, laugh out loud at, and (horrors!) cross out. Put those same people in an audience and all of those reactions (or all except the yawns) must be subordinated. They are in effect your captives – which also makes them your responsibility.

Avoid charts and graphs and prints of scopes (unless they are simple, simple, simple, and big, big, big). Most papers have a certain idea. Find it and make it the subject of your report. Paraphrase the paper. If lengthy explanations appear important, put them into a handout. After all if there is interest the paper has already been read or will be read in detail at a more leisurely pace later.

A ten-minute talk with detailed handouts (or the published article itself) will be remembered. A one-hour talk requiring close listening will primarily be remembered for its discomfort. Have you ever thought that an uncomfortable audience does? It criticizes the speaker, that's what the audience does. After all, somebody is at fault for making the audience uncomfortable, and that somebody is you!"

4. Use the following phrases in speech:

Руководитель (конференции, заседания, совещания)

1. I give the floor to...
2. I am afraid your time is up
3. Are there any questions or comments on... ?
4. I would like the speakers to be brief...
5. I would like to summarize...
6. Let me just interrupt you for a minute...
7. In order to open the discussion on this subject I would like to start with questions...
8. May I have your attention, please...
9. Speak from your place, please.
10. Take the floor, please...
11. Would you speak a little bit louder, please...
12. Speak to the point.
13. The answer is not full.

1. Я предоставляю слово ...
2. Боюсь, что Ваше время закончилось
3. Имеются ли вопросы или замечания по поводу...?
4. Мне бы хотелось, чтобы выступающие были кратки ...
5. Мне бы хотелось подвести итог...
6. Позвольте мне прервать Вас на минуту...
7. Чтобы открыть дискуссию по этой теме, я хотел начать с вопросов
8. Прошу вашего внимания ...
9. Пожалуйста, говорите с места ...
10. Пожалуйста, говорите
11. Вы не могли бы говорить чуть громче, пожалуйста
12. Говорите по существу
13.Ответ неполный.

Публичное выступление (доклад, лекция, сообщение)

5. Use the following phrases in speech:

Начало выступления

In my paper I want to highlight...

The subject of my lecture (talk) is ...

I'm going to be talking about...

Let me begin with ...

My introduction is going to be very little. I give you one or two sentences.

В своем докладе я хочу осветить ...

Тема моей лекции (моего выступления) ...

Я собираюсь рассказать (поговорить) о ...

Позвольте мне начать с ...

Мое выступление будет очень кратким. Я изложу его вам в одном-двух предложениях.

Выделение важного

It should be said that....

It is interesting (= of interest) to note that...

That's one thing I'd like to stress very heavily.

I want to reinforce the following.

The following is terribly informable (terribly well / badly needed)

I want to call (to draw / to invite) your attention to ...

It should be kept in mind that...

First (ly)... / Second (ly)... Third (ly).../ Fourth(ly)...

Следует сказать, что ...

Интересно отметить, что...

На одну вещь мне хотелось бы обратить особое внимание.

Я хочу подчеркнуть следующее

Следующее представляется необычайно важным (информативно полезным, необходимым)

Хочу привлечь (обратить / направить) ваше внимание к (на)...

Следует помнить, что (Не следует забывать, что)...

Во-первых,.../Во-вторых ...В-третьих, .../В-четвертых,...

Переход от данной мысли к другой

Now l come to ...

I'm coming on now to speak about...

Now we may pass to the next item (on the agenda)

Here we can say ...

We may pass these details.

Теперь я перехожу к ...

А теперь я перехожу к рассказу о ...

Теперь мы можем перейти к следующему пункту (в повестке дня)

Здесь можно сказать ...

Мы можем опустить эти детали.

Выражение личного мнения о высказываемом

I (don't) think...

I (don't) believe...

In my opinion...

In my view...

What I say (am saying) is that...

I dare say...

I am far from thinking (asserting) that...

It's no exaggeration to say that...

I'm sorry to say that...

Я (не) думаю ...

Я (не) считаю ..

По моему мнению ...

На мой взгляд...

Как я считаю (по-моему)...

Осмелюсь утверждать, что...

Я далек от того, чтобы думать (утверждать), что ...

Не будет преувеличением сказать, что ...

К сожалению, я должен сказать, что ...

Осуществление обратной связи с аудиторией

Any other points?

Is that clear?

Have I made my point clear?

If there's anything you don't understand, please ask me.

Будут другие мнения?

Это ясно (понятно)?

Я выразился (достаточно) ясно?

Если вам что-то не ясно, пожалуйста, спрашивайте.

Как избежать категоричности в своих высказываниях

As far as I know ...

If I am not mistaken ...

If my memory serves me well (doesn't fail me)

As far as I remember ..

Насколько мне известно... Если я не ошибаюсь ... Если мне не изменяет память... Насколько я помню ...

Пояснение и дополнение к сказанному

I mean_ to say that...

In other words ...

That is to say ...

To all this must be added that...

As I have already mentioned ...

I have forgotten to say that...

The following speaks for itself

Этим я хочу сказать, что ...

Другими (иными) словами...

Иначе говоря...

Ко всему этому следует добавить, что ...

Как я уже упомянул ...

Я забыл (а) сказать, что ...

Следующее говорит само за себя.

Завершение выступления и выводы из сказанного

I close with the words ...

The last part of my talk will be devoted to ...

Now I'm going to sum up what has been said

Summing up all that has been said ...

Hence, it follows that...

This brings us to the conclusion that...

I thank the audience for your kind attention.

Я заканчиваю словами...

Последняя часть моего выступления будет посвящена ...

А теперь я собираюсь резюмировать сказанное.

Суммируя все, что было сказано...

Из этого следует, что...

Это позволяет нам сделать вывод о том, что...

Благодарю присутствующих за внимание.

6. ***Побеседуйте с коллегой по-английски об участии в научных конференциях и о своих публикациях. Включите в свои высказывания следующие вопросы*** **(*Talk to a colleague in English about participating in scientific conferences and about your publications. Include the following questions in your comments*):**

1. At what scientific conferences (symposia, congresses) did you take part? ... and (are you going to participate)?
2. When and where were they held (will be held)?
3. What was the most noteworthy paper presented at that scientific meeting?
4. How long did/will that conference (congress, symposium) last?
5. How many simultaneous sessions were usually held on the same day?
6. What paper did/will you present at the scientific meeting?
7. How did your colleagues treat your report?
8. Were there any discussions of general interest held during that scientific forum?
9. What are the main ideas of your report?
10. What is your general impression of the scientific forum or assembly?
11. What articles have you already published?
12. What material are you going to publish?
13. Where and when were your articles, abstracts, etc, published?
14. What are the exact titles of your published papers?
15. What problems do you deal with in those papers?
16. Who are your published papers addressed to?
17. What do you give much (little; no) attention to in your published materials?
18. What is of particular interest in your papers?
19. What did you fail to describe or demonstrate adequately?
20. How many parts does your (longest) paper consist of?
21. What do you treat in your introductory part?
22. What do you say in conclusion?
23. What are the purposes of your publications?

7. Read the following dialogue:

A Spanish scientist, Dr.Alvarez Lopez, meets Professor Platonov and asks him about their mutual acquaintance:

Lopez: Dr. Platonov, I heard you say that Alexander Nalimov is working on his doctoral dissertation now. Did I get it all right?

Platonov: Quite. He was a Candidate of Science (Technology) and now, after submitting it to public hearing (защита), he will certainly be awarded Doctor's Degree *(Don't forget that the gradation of degrees in Russia is different, 'doctorate' is one degree higher than Ph.D (Doctor of Philosophy) in Britain, for example).*

L.: I see. Quite forgot it. And what roughly corresponds to Ph.D? Is it you degree of candidate?

P.: Yes, it is usually received after doing a post-graduate course of three years, passing special exams and submitting a thesis.

L.: You should have written two theses, then?

P.: Quite right, too. The subject of my first thesis was "Some Problems of Numerical Control". Then, for my doctorate, I submitted one more thesis.

L.: Dr. Platonov, who was your scientific adviser when you were working on your candidate dissertation?

P.: Professor, now Academician, Tomsky.

L.: Really? One of my colleagues worked under his guidance. He was a post-graduate student at the Russian Academy of Sciences.

P.: Then he must get a very thorough schooling.

8. You are accompanying Professor Platonov to the session. He introduces you to Professor Lopes. Tell him about your path in science:

What (institute, university, academy) did you graduate from?

I graduated from ...

What is your speciality? What are you specialized in?

My speciality is... I am specialized in ...

What scientific problems are you interested in?

I am interested in ...

When did you get interested in this problem?

I got interested in this problem two years ago.

You are taking a post-graduate course, aren't you?

Yes, I am, I am taking a post-graduate course now.

What kind of post-graduate are you: a full-time post graduate, a part-time post graduate, an applicant?

I am a full-time post graduate.

What is the subject (the theme) of your research?

The subject (the theme) of my research is...

What does the problem you are working on deal with?

The problem I am working on deals with ...

Has this problem been studied?

No, this problem hasn 't been studied yet.

What Master's degree examinations have you passed?

I have passed my Master's degree examination in Philosophy, in speciality

What mark did you get?

I got an excellent mark.

Who is your supervisor (scientific adviser)?

My supervisor is...

Did you participate in any conferences (in our country, abroad)?

I took part in ...

Have you published any abstracts and articles? Have you got published abstracts, articles ?

Two of my articles *are published in the academic periodical, and the abstracts will be published in the Proceedings of the Conference soon.*

Would you tell us about your research work?

When will you take your Master's degree examination in speciality?

I'll take my Master's degree examination in speciality next year.

When will you submit your theses to public hearing?

I'll submit my thesis to public hearing in a year...

What are you engaged in now? What is you task now?

My task now is to survey modern literature on the problem.

9. Read the following dialogues:

Dialogue 1

A: Let me introduce myself. I am Akatov, a full-time post-graduate from Moscow Physical Engineering Institute

B: Pleased to meet you. I'm D. Cooper, Master of Physics. How do you do? A: How do you do? I'm happy to see you here, in Moscow. I've read some of your articles. There is much interesting to discuss.

B: Certainly, there is. Would you like to meet tomorrow at five? A: Yes, that'd be nice. Thank you. Good-bye

Dialogue 2

A: As far as I know you are conducting experimental study, aren't you?

B: Quite so. I am testing the main installation (unit) new. But there is some problem with the most suitable technique. It is open to question.

A: As I know a usual routine is taking the reading (показания) of the apparatus, writing down the measurements, carrying out observations.

B: Right you are. But the data obtained didn't completely confirm (correlate with) our previous assumption (предсказания).

A: Then you'd better consult the adviser

B: I quite agree with you. I'll just meet him tomorrow, at 11 a.m.

Dialogue 3

A: How do you do, B.?

B: How do you do, A? I'd like to know what the main concern of your group is.

A: Microelectronics is our main concern. And what are you doing now?

B: We have a very interesting research programmer to fulfill. It's mainly concerned with introducing computer sciences achievements into production. We do it in collaboration with several research centers.

A: And, by the way, who is your scientific supervisor (adviser)?

B: Professor N. is

A: Oh, if I am not mistaken, he has got a large number of publications of late (за последнее время)

B: You are quite right. One of his papers was published in Japan

A: I wish you further success in your work

B: Thank you. The same to you. (I wish you the same)

Dialogue 4

A: What's the subject of your thesis?

B: Well, the problem I am working at is concerned with using electro physical fields. And what about you?

A: As for me, it is connected with membrane technology

B: Oh, there is much in common, I should say. And when are you going to complete your work and submit (present) your thesis to public hearing?

A: I hope, I'll do it in a year

B: But I haven't passed my Master's degree examination in speciality

A: You see. I'm busy with writing an essay now. I'll send it to one of the scientific periodicals

B: Good luck to you. Bye-bye

Dialogue 5

A: I've heard the Conference to be help on September 25-26 in Prague. Am I not mistaken?

B: Exactly so. I've got the first circular containing preliminary information on the conference. They ask to see the title and the abstracts of the paper to show your intention to participate in the conference

A: Oh, am I not late?

B: Not at all. After that you'll be informed of the acceptance of your paper. And you'll receive a registration form.

A: I'd like to know what official languages of the Conference are?

B: Well, they are English and Russian

A: I see. I'll try to deliver my paper in English, if it is accepted.

B: I believe you'll be a success.

<u>Название статьи, автор, стиль.</u>

The article I'm going to give a review of is taken from… - Статья, которую я сейчас хочу проанализировать из…

The headline of the article is - Заголовок статьи…

The author of the article is… - Автор статьи…

It is written by - Она написана …

The article under discussion is … - Статья, которую мне сейчас хочется обсудить, ….

The headline foreshadows… - Заголовок приоткрывает

<u>Тема. Логические части.</u>

The topic of the article is… - Тема статьи

The key issue of the article is… - Ключевым вопросом в статье является

The article under discussion is devoted to the problem… - Статью, которую мы обсуждаем, посвящена проблеме…

The author in the article touches upon the problem of… - В статье автор затрагивает проблему….

I'd like to make some remarks concerning… - Я бы хотел сделать несколько замечаний по поводу…

I'd like to mention briefly that… - Хотелось бы кратко отметить…

I'd like to comment on the problem of… - Я бы хотел прокомментировать проблему…

The article under discussion may be divided into several logically connected parts which are…- Статья может быть разделена на несколько логически взаимосвязанных частей, таких как…

<u>Краткое содержание.</u>

The author starts by telling the reader that - Автор начинает, рассказывая читателю, что

At the beginning of the story the author - В начале истории автор

describes - описывает

depicts - изображает

touches upon - затрагивает

explains - объясняет

introduces - знакомит

mentions - упоминает
recalls -вспоминает
makes a few critical remarks on - делает несколько критических замечаний
The story begins (opens) with a (the)
description of - описанием
statement - заявлением
introduction of - представлением
the mention of - упоминанием
the analysis of a summary of - кратким анализом
the characterization of - характеристикой
(author's) opinion of - мнением автора
author's recollections of - воспоминанием автора
the enumeration of - перечнем
The scene is laid in … - Действие происходит в …
The opening scene shows (reveals) .. - Первая сцена показывает (раскрывает) …
We first see (meet) … (the name of a character) as … - Впервые мы встречаемся с (имя главного героя или героев)
In conclusion the author
dwells on - останавливается на
points out - указывает на то
generalizes - обобщает
reveals - показывает
exposes - показывает
accuses/blames -обвиняет
mocks at - издевается над
gives a summary of -дает обзор

<u>Отношение автора к отдельным моментам.</u>

The author gives full coverage to… - Автор дает полностью охватывает…

The author outlines… - Автор описывает

The article contains the following facts…./ describes in details… - Статья содержит следующие факты …. / подробно описывает

The author starts with the statement of the problem and then logically passes over to its possible solutions. - Автор начинает с постановки задачи, а затем логически переходит к ее возможным решениям.

The author asserts that… - Автор утверждает, что …

The author resorts to … to underline… - Автор прибегает к …, чтобы подчеркнуть …

Let me give an example… - Позвольте мне привести пример …

Вывод автора.

In conclusion the author says / makes it clear that…/ gives a warning that… - В заключение автор говорит / проясняет, что … / дает предупреждение, что …

At the end of the story the author sums it all up by saying … - В конце рассказа автор подводит итог всего этого, говоря …

The author concludes by saying that../ draws a conclusion that / comes to the conclusion that - В заключение автор говорит, что .. / делает вывод, что / приходит к выводу, что

Выразительные средства, используемые в статье.

To emphasize … the author uses… - Чтобы акцентировать внимание … автор использует

To underline … the author uses… Чтобы подчеркнуть … автор использует

To stress… - Усиливая

Balancing… - Балансируя

Ваш вывод.

Taking into consideration the fact that - Принимая во внимание тот факт, что

The message of the article is that /The main idea of the article is - Основная идея статьи (послание автора)

In addition… / Furthermore… - Кроме того

On the one hand…, but on the other hand… - С одной стороны …, но с другой стороны …

Back to our main topic… - Вернемся к нашей основной теме

To come back to what I was saying… - Чтобы вернуться к тому, что я говорил

In conclusion I'd like to… - В заключение я хотел бы …

From my point of view… - С моей точки зрения …

As far as I am able to judge… - Насколько я могу судить .

My own attitude to this article is… - Мое личное отношение к

I fully agree with / I don't agree with - Я полностью согласен с/ Я не согласен
It is hard to predict the course of events in future, but there is some evidence of the improvement of this situation. - Трудно предсказать ход событий в будущем, но есть некоторые свидетельства улучшения.

I have found the article dull / important / interesting /of great value - Я нахожу статью скучной / важной/ интересной/ имеющую большое значение (ценность)

10. Text 1. Preparing research presentation

Presenting research results is a vital aspect of postgraduate work. It is an exciting time in a postgraduate student's degree program because it represents the culmination of many hours of hard work. The communication of research findings provides a valuable opportunity to inform others of a current investigation and it can lead to future speaking opportunities at conferences, grants for future research projects, school and business meetings and offer natural connections to new job opportunities.

Presenting academic material requires careful preparation and planning to effectively communicate to your audience. It is important to consider the diversity of expertise within a group of educators. Audiences will usually contain people who are experts in your subject area, others who have a general knowledge of the topic and the remainder who have basically little or no knowledge. How do you plan to effectively reach such a wide range of knowledge levels within one group? A popular communication strategy is to directly address the experts while integrating relevant and interesting illustrations and ideas into the presentation that make the results accessible to entire audience. It is a multidimensional speaking technique that demonstrates respect for those who attend your presentation. Some essential elements for research presentations are as follows.

Problem description and documentation. The problem statements should be presented in descriptive language that the audience can easily understand. The presentation should include several key studies from the literature review to provide solid support for the rationale for pursuing your research problem. There is a real temptation to share a host of studies but it tends to distract people who generally are more interested in understanding why an individual has undertaken a particular study.

Solution strategy. Presenting possible solutions to the problems under study is a vital part of the research process. It is important to present information in a concise manner. Therefore, stress three or four aspects that will help you keep your presentation focused and reduce potential resistance to your ideas.

Analysis of results (anticipated and otherwise). Interpretation of qualitative and quantitative data is always a very challenging task. Reviewing your results in light of the concepts of significance, generalizability, reliability and validity is recommended. The generalizability of a research project requires you to ask specific questions which examine the degree of broader applicability of your particular study.

Recommendations for change. As you prepare your presentation, take the time to consider the questions for those who might be skeptical of your findings, and share recommendations for changes. A research project may:

- address gaps in knowledge by investigating an area of research that fills a void in existing information;
- expand knowledge by extending research to new ideas and practices;
- replicate knowledge by testing old results with new participants or new research sites;

- add voices of individuals to knowledge, individuals whose perspectives have not been heard or whose views have been minimized in our society.

Solicitation of audience feedback. The audience can be a good resource for advice and feedback on your presentation and a forum to enhance professional knowledge and practices. Naturally, researchers are somewhat anxious about the personal risks involved having their project being scrutinized by others. Audience feedback can help individuals identify shortcomings or flaws in their research project which can be addressed in a future journal article or in future investigations. Dialogue over research results can provide the basis for a deeper understanding about current interpretations of educational practices and theories. Postgraduate students should be encouraged by the fact that their presentations will give others the opportunity to publicly affirm the positive elements and educational contributions of your work. The research project can be a good resource for sharing valuable knowledge with the academic community. It is wise to investigate potential speaking opportunities at your school, national and international conferences. Today's technology and educational conferences often provide websites with specific details about their expectations for papers. As you explore various speaking opportunities, it is a good time to examine publication of your research results in journals, magazines and newsletters (print and online).

Research presentations are excellent opportunities to demonstrate originality and inform others of valuable investigation findings. Contemporary educators appreciate quality work because it encourages improvement in educational practices and refinement of research skills [Muirhead, 2004].

1. Complete the following sentences with details from the Text.

1. Presenting research results provides valuable information for others, some speaking skills at conferences, and_____.

2. Audiences usually contain people who have a general knowledge of your subject area,______, and those who have little or no knowledge of the same.

3. It is recommended that you should review your research findings in terms of reliability, validity, and ______.

4. Audience feedback can help researchers identify ______shortcomings, and some risks to be involved.

5. It is important to study potential speaking opportunities at international and national conferences, and ______.

2. Underline the detail that is NOT mentioned in the Text in each of the sentences below.

1. The audience can be a good forum to enhance professional knowledge, practices, and experience.

2. Postgraduate students' presentations give others the opportunity to affirm the educational contributions, developments and positive elements of your research.

3. Research presentations are good opportunities to inform others of valuable investigation findings and demonstrate originality and novelty of your study.

3. Answer the following detail questions.

1. According to the Text, the presentation should include the literary review

a. to do your research.

b. to provide support for the audience.

c. to support your research problem.

2. According to the Text, the information should be presented

a. in full.

b. to the point.

c. in a wordy manner.

3. According to the Text, the generalizability of a research project requires you to ask specific questions which examine

a. the use of research results.

b. the significance of your research.

c. the qualitative and quantitative data of your research.

4. According to the Text, the research project can be a good resource for sharing valuable knowledge with

a. your school.

b. international conferences.

c. academy.

5. According to the Text, contemporary educators appreciate quality work because it improves

a. research skills

b. practices in education

c. investigation findings.

UNIT 6
ABSTRACT AND SUMMARY

An abstract is a condensed version of a longer piece of writing that highlights the major points covered, concisely describes the content and scope of the writing, and reviews the contents of the writing in abbreviated form. People write abstracts when submitting articles to journals, applying for research grants, writing a proposal for a conference paper, completing a Ph.D./Master's degree thesis or dissertation, etc.

1. Read the information about some specific features of writing an abstract for a research paper.

The key elements to be included in the abstract.

- Background: A simple opening sentence or two placing the work in context.
- Aims: One or two sentences giving the purpose of the work.
- Method (s): One or two sentences explaining what was (or will) be done.
- Results: One or two sentences indicating the mam findings (or what you hope to accomplish with the project).
- Conclusions: One sentence giving the most important consequence of the work - What do the results mean? How will they be used?

Words of advice:

1. For the first draft, don’t worry about length. Just try to cover all the important components that are required in the abstract. Use all the information that you highlighted and identified as you read through the article.
2. Take a word count before you begin to edit.
3. Begin editing by deleting words, phrases and sentences that are less important or provide more explanation than necessary.
4. Look for places where sentences can be combined to omit extra words or condense ideas.
5. Delete unnecessary background information.
6. Do not use jargon, abbreviations, direct quotes or citations.
7. Avoid writing in the first person (I). Rather than saying, “In this essay I discuss...”, try a more formal approach by starting your abstract with as opening similar to:

- This paper discusses the effects of... .
- This paper reports on ... .
- Specifically, this paper investigates ....
- This article examines how ....
- The present paper attempts to answer the question ...

7. Write to the required word count. Abstracts are typically 150 to 250 words. If a 200 word abstract is required, get as close to the required number of words as possible.
8.

2. Read some examples of abstracts.

a) Qualifying Urban Landscapes

Thomas Juel Clemmensen, Tom Nielsen

University of Oregon School of Architecture, USA

Abstract

The article presents an attempt to develop alternatives to the dominant planning

and design principles used in building and rebuilding the contemporary urban landscape. The basic idea is that the 'forces of modernization' driving current development might result in a broader and more interesting palette of places and spaces if supplementary principles of design and organization could be developed. The idea of formulating a normatively oriented theory for practice is based on an 'almost all right' approach but moves beyond the purely 'non-judgmental' attitude to contribute at a generic level to the task of constructing and improving things. With this goal, a set of objectives based in important insights from recent urban theory are formulated constituting the normative spine of the analysis of a number of found situations as basis for formulating eight generic concepts of qualification for contemporary urban landscape design practice.

b) Gothic Design

Michael Reeds University of London, UK

This paper discusses interior design during and after the Gothic revival of the late eighteenth century, noting that true Gothic architecture originally developed from the Romanesque style, emerging in the twelfth century. The paper examines some key pieces of architecture such as Notre Dame, the Abbey Church of St. Denis and the Cathedral of Sense and the paper contains images and pictures as illustrations. According to the paper, this style dominated until the beginning of the Renaissance in the fifteenth century. Gothic architecture is noted for its size and elaborate decoration. However, Gothic architecture is first defined in terms of a change in Romanesque church architecture when diagonal ribs were added to the groin-vault, as is first seen at the Abbey Church of St. Denis near Paris.

The Summary

The headline of the article I have read is "Kleinwort Wins Rosneft Price Tender". This article is written by Jeanne Whalen and it was published in "The Moscow Times" on the 3rd of March, 1998.

The aim of the article is to provide the reader some information on the tender for Rosneft which will take place in March. A tender is the privatization auction with many sellers and one buyer which can conduct the evaluation for the ware.

The author begins with telling the reader that German investment bank "Dresden Kleinwort Benson" has won the right to evaluate the worth of Rosneft before the company is sold in the privatization auction later this year. Sergei Perevizentsev, a spokesman for the Privatization Ministry said that Kleinwort Benson offered to conduct the evaluation for $ 650.000, underbidding its closest competitor by about $ 1.000.000 in a tender decided on Saturday. This bank has worked as an adviser for Gaspromand helped arrange $3 billion syndicated loan and a $ 1.2 billion bridging loan for Rosneft and the bank will bid on Rosneft in alliance with Royal Dutch/Shell and LUKoil.

Alexandr Agibalov, an oil analyst with Russian brokerage Aton said that this company had a good reputation and to ruin it by giving some information for Gasprom was not in its interest. Then the author writes that there were many other companies competed in the tender, for example: "Robert Fleming Securities", "Deutsche Morgan Grenfell", "Analyze", etc.

The author replies that Russia's federal government didn't want any auditor affiliated with a Rosneft bidder to conduct the valuation. In order to do it, the government chose to hire an independent auditor to value the worth of Rosneft and to recommend starting prices. The author reports that once the auditor determines Rosneft worth, it is up to the tender commission, consisting of seven people, to set up starting prices.

Then the author tells us that other bidders for Rosneft are an alliance between British Petroleum and Uneximbank's Sidako, Yuksi, the oil company soon to be created in merger between Yukos and Sibneft. Agibalov said that the commission will set the prices higher, if the government sells 75-percent-plus-one-share of Rosneft. The author further says that the format of this tender is more desirable for bidders. He added if the government chooses to sell only 50-percent-plus-one-share of Rosneft, Gasprom and Uneximbank groups will be less interested in bidding because this scheme will not allow the winner to exercise full control over the company.

In conclusion I can say that I found this article very interesting and very important not only for me, but for everybody in Russia. This situation tells us that Russia is in an economic crisis now and the government wants to earn some money by selling Russian companies to foreign firms in order to stabilize our economy. I think that this approach is erroneous, but what is done cannot be undone.

My opinion is that the Russia's government mustn't sell out our companies to foreign bidders even though it hasn't enough money. But the government must do something to make Russia's economy and industry function, if it wants Russia to become the greatest and the wealthiest country in the world the way it was.

Scientific Attitudes

The methods and skills used by scientists are intimately connected to a set of attitudes common in the practice of science. A scientific attitude is a disposition to act in a certain way or a demonstration of feelings and/or thoughts. Studies of the actions of scientists have led to lists of scientific attitudes such as displayed below. Some attitudes such as honesty would be expected in any human endeavor, but other attitudes such as tolerance of uncertainty are more characteristic of scientists. Note that scientific attitudes are different from attitudes about/towards science. Also note the exercises available in the top of the left frame on this webpage.

Scientific Attitude	Characteristics
critical-mindedness	· looks for inconsistencies · consults a number of authorities · challenges the validity of statements
suspended judgment (restraint)	· recognizes the restrictions in generalizations and theories · generalizes only to the degree justified by available evidence
respect for evidence	· looks for evidence (empirical approach) to support or contradict statements · demands interpretations that fit the evidence · collects as much evidence as possible
honesty	· reports all evidence even when it contradicts hypothesis or expectations · acknowledges the work of others
objectivity	· considers all pros and cons · considers all evidence available · considers and evaluates statements by others
willingness to change opinions	· recognizes all hypotheses, generalizations and theories as being tentative · evaluates evidence which contradicts prediction · alters hypotheses when necessary to accommodate empirical evidence
open-mindedness	· considers several possible options when investigating a problem · considers and evaluates ideas presented by others
questioning attitude	· looks for inconsistencies · challenges the validity of unsupported statements · asks many questions starting with who, where, when and how
tolerance of uncertainty	· accepts that there is always some uncertainty · strives for greater and greater certainty

NEWSPAPER ABSTRACT

1. The title of the article is «Banks turning to the real sector».

2. The article is written by ...

3. The article is published in the newspaper «Moscow News», number 12, 1998.

4. The article deals with changes in the banking sector of Russia over the recent year.

5. It is pointed out that the net assets have increased in absolute terms from $74 to $ 110 billion.

6. But it's noted that the share of banking system in the national economy it still small about 25 percent of GDP, that is Gross Domestic Product.

7. It is stressed that the foreigner's share in the Russian banking system's aggregate capital is from 5.3 to 5.8 percent.

8. By world standards these figures are insignificant, so, for example, in Hungary the figure exceeds 50 percent.

9. Low share of foreigners in our bank's capital is explained by shortage of cash, non-payments, use of bills, notes, bonds instead of real money.

10. It should be noted that 1997 was characterized by a slower growth of lending institutions, so in 1996 there were 26 new lending institutions while in 1997 only 12 lending institutions were registered Oust 5 banks).

11. The consider instability in a government and corporate securities markets over the last five months is forcing the banks to reorient their policy and work with the real sector of economy.

12. The authors pay attention to the fact that banks cannot hope to get fast and high profits in the real sector of economy.

13. Thus, banks develop their lending activity in the real sector very slowly, because Russia's industry is in depression and most of industrial enterprises are insolvent.

1) The title of the article is Adaptive genetic variation in Scots pine (Pinus sylvestris L.) in Scotland.

2) It is published by the University of Edinburgh in 2011.

3) The author of the article in Matti J. Salmela.

4) The article deals with the ability of plants to adapt to local growing conditions.

5) The article is devoted to the studies of patterns of local adaptation.

6) The article stresses that the main motivation for these experiments was to find the best-growing seed sources for different sites.

7) It should be noted that experiments in long-lived trees are laborious, time-consuming, expensive and thus, normally established only for species of commercial importance.

8) The author pays special attention to the fact that transfer trials established for

commercially important tree species such as Scots pine and lodge pole pine have indicated that populations often grow best in their home environments and that transfers along environmental gradients influence survival and growth.

9) The author sums up, that the acquisition by plants of various adaptive traits depends on factors such as soil, moisture and temperature of the environment, the presence of pests or herbivores.

10) In conclusion, studies of patterns of local adaptation in plants have a long history due to the importance of many species in agriculture or forestry.

1. The title of the article is «Enterococci in foods a conundrum for food safety».
2. It is published in «International Journal of Food Microbiology», number 88, 2003.
3. The authors of the article are Charles Franz, Michael E. Stiles, Karl Heinz Schleifer and Wilhelm H. Holzapfel.
4. The article deals with the problem of enterococci, which are considerable members of the community in the intestines of many animals and opportunistic pathogens that cause millions of infections each year.
5. The article suggests that Enterococci are important in the environment, food and clinical microbiology. These bacteria can play an important beneficial role in the production of various fermented food products and can be used as probiotics.
6. The authors stress that opportunistic enterococci cause a number of questions on their safety for use in foods or as probiotics.
7. It should be noted that the probiotic bacterial strains must meet certain requirements.
8. The authors pay special attention to two important criteria: ability to survive in the gastrointestinal tract and an antagonistic effect against pathogenic bacteria.
9. Thus, the needs of studying the biological properties of strains of enterococci have antagonistic activity against pathogenic microorganisms, including determination of the presence of potential virulence factors, to establish a new basis for their probiotic preparations.

CLICHÉ
for making a summary of a newspaper article

1. The title of the article is... The article is headlined	Название статьи ...
2. It is published in «Moscow New» number... dated ...	Она опубликована в газете «Москоу Ньюс» номер ... от...
3.The article is written by ...	Статья написана ...

The author of the article is ...	Автор статьи ...
4.The article deals with ... The article is devoted to the analyses of the situation in ... - to the question (problem) of... - to the discription of	В статье говорится о ... Статья посвящена анализу обстановки в ... вопросу о... описанию...
5.The article (author) discusses... - expresses the view that... - concentrates on, focuses the reader's attention on... - highlights... - points out... - stresses that... - suggests that... - sums up, summarizes ... - (strongly) criticises... - condemns - reveals - reviews - considers - comes out against... - comes out in support	В статье обсуждается ... (автор обсуждает) выражается точка зрения о .. концентрируется внимание на ... освещается... указывается на ... подчеркивается, что ... говорится, что ... подводится итог, суммируется... (остро) критикуется ... обсуждается ... вскрывается ... рассматривается ... дается обзор ... выступает против ... выступает в поддержку ...
6. It should be noted that	Следует отметить, что ...
7. The author pays special attention to the fact...	Автор обращает особое внимание на тот факт, что ...
8. To sum up ... In conclusion...	В заключение...

Texts and exercises

1. Read the text and find the answers to the following questions

a) What are invited and contributed papers?

b) What is the difference between an abstract and a summary of the presentation of the paper?

c) Do you have any papers published in a Diges?

Call for Contributed Papers

The conference will contain both invited and contributed papers. A number of contributed papers covering original unpublished work on the meeting subjects will be accepted for presentations. Each author will be expected to submit the following material on the paper supplied:

- A 50-word abstract of the paper for the meeting program;
- A summary of the presentation. This summary of up to four pages will be reproduced from the material submitted by the author.

Summaries of all accepted papers will be printed as submitted in a Digest of the meeting which will act in a lieu of a conference proceeding. The Digest is to be distributed at the Conference.

Completed abstracts and summaries must be received by the Organizing Committee by June 1, 2005.

Additional material for reading

Professional conference organizers see great hope in the use of computers to facilitate making contacts at conferences. This new technology can help both the young and the more established scientists find people with similar interests.

Conference participants reregister their specific areas of interest and indicate their preferences for meeting in small groups or on a one-to-one basis. Each participant can also indicate the times he or she is available. The computer then matches parties with the same interests and schedule contacts.

Conferences can be computerized by using a message processing system.

Groups of terminals could be set up at the conference site with assistance available to help participants use them. To retrieve your messages, you would simply type your name and registration number. All messages for you would either appear on the terminal's screen or be printed out. Simple messages like "You left your coat in my car" could be stored. But, more important, a graduate student could ask, for example, if anyone at the conference would like to discuss his or her thesis topic. Or you could ask a question on a particular speaker that you didn't have a chance to ask during the session. The speaker could answer the question some time later. You would find the answer when you interrogated the terminal the next day. This could help young scientists participate more fully since they are often reluctant to ask questions from the conference floor… In the meantime, young scientists should try to discard their assumptions that eminent people are unapproachable. In my experience, I have always found that leading scientists were willing to talk for at least a few minutes.

UNIT 7
RESEARCH METHODS

Text 1. Questions and hypotheses

Questions and hypotheses are testable explanations that are proposed before the methodology of a project is conducted, but after the researcher has had an opportunity to develop background knowledge (e.g., the literature review). Although research questions and hypotheses are different in their sentence structure and purpose, both seek to predict relationships. Deciding whether to use questions or hypothesis depends on facts such as the purpose of the study, the approach and design of the methodology, and the expected audience for the research proposal.

A research question proposes a relationship between two or more variables. Just as the title states, it is structured in form of a question. There are three types of research questions:

• A descriptive research question seeks to identify and describe some phenomenon.

For example: *What is the ethnic breakdown of patients seen in the emergency room for non-emergency conditions.*

• A differences research question asks if there are differences between groups on some phenomenon.

For example: *Do patients who receive massage experience more relief from sore muscle pain than patients who take a hot bath*?

• A relationship question asks if two or more phenomena are related in some systematic manner.

For example: *If one increases his level of physical exercise, does muscle mass also increase*?

A *hypothesis* represents a declarative statement, a sentence instead of a question, of the cause-effect relationship between two or more variables. Make a clear and careful distinction between the dependent and independent variables and be certain they are clear to the reader. *Be very consistent in your use of terms.* If appropriate, use the same pattern of wording and word order in all hypotheses.

While hypotheses come from the scientific method, to see how political scientists use hypotheses, imagine how you might use a hypothesis to develop a thesis for this paper: Suppose that we asked «How are presidential elections affected by economic conditions? » We could formulate this question into the following hypothesis: «When the national unemployment rate is greater than 7 percent at the time of the election, presidential incumbents are not reelected. »

Hypotheses can be created as four kinds of statements.

1. **Literary null -** a “no difference” form in terms of theoretical constructs.

*For example, "*There is no relationship between support services and academic persistence of nontraditional-aged college women" or "There is no difference in school achievement for high and low self-regulated students".

2. Operational null - a "no difference" form in terms of the operation required to test the hypothesis.

For example, "*There is no relationship between the number of hours nontraditional-aged college women use the student union and their persistence at college after their freshman year"* or *"There is no difference between the nr grade point averages achieved by students in the upper and lower quartiles of distribution of the Self-regulated Inventory".*

The operational null is the most used form for hypothesis-writing.

3. Literary alternative - a form that states the hypothesis you will accept the null hypothesis is rejected, stated in terms of theoretical constructs. In other words, this is usually what you hope the results will show.

For example, "*The more that nontraditional-aged women use support semi the more they will persist academically"* or *"High self-regulated students achieve more in their classes than low self-regulated students."*

4. Operational alternative - Similar to the literary alternative except I the operations are specified.

For example, *"The more that nontraditional-aged college women use the student union, the more they will persist at the college after their freshman ye* or *"Students in the upper quartile of the Self-regulated Inventory distribution achieve significantly higher grade point averages than do students in the lo quartile."*

Regardless of which is selected, questions or hypotheses, this element of research proposal needs to be as specific as possible in whatever field of study you are investigating. It should be realistic and feasible, and be formulated with time and resource constraints in mind.

1. Before you read the Text "The Practice of Science", discuss these questions with your group mates or teacher.

1. What is scientific research?
2. What scientific methods do you know?
3. What are they characteristic of?
4. What does the choice of research methods depend on?
5. Are research methods interconnected?
6. How can scientific theories be strengthened?

Text 2

1. Read and translate Text

The practice of science

When some people think of science, they think of formulas and facts to memorize. Many of us probably studied for a test in a science class by memorizing the names of the four nucleotides in DNA (adenine, cytosine, guanine, and thymine) or by practicing with one of Newton's laws of motion, like $\boldsymbol{f} = m\,a$ (force equals mass times acceleration). While this knowledge is an important part of science, it is not all of science. In addition to a body of knowledge that includes formulas and facts, science is a practice by which we pursue answers to questions that can be approached scientifically. This practice is referred to collectively as scientific research and while the techniques that scientists use to conduct research may differ between disciplines, the underlying principles and objectives are similar. Whether you are talking about biology, chemistry, geology, physics, or any other scientific field, the body of knowledge that is built through these disciplines is based on the collection of data that is then analyzed and interpreted in light of other research findings. How do we know about adenine, cytosine, guanine, and thymine? These were not revealed by chance, but through the work of many scientists collecting data, evaluating the results, and putting together a comprehensive theory that explained their observations.

Scientific research is a robust and dynamic practice that employs multiple methods towards investigating phenomena, including experimentation, description, comparison, and modeling. Though these methods are described separately here, many of these methods overlap or are used in combination. For example, when NASA scientists purposefully slammed a 370 kg spacecraft named ***Deep Impact*** into a passing comet in 2005, the study had some aspects of descriptive research and some aspects of experimental research. Many scientific investigations largely employ one method, but different methods may be combined in a single study, or a single study may have characteristics of more than one method. The choice of which research method to use is personal and depends on the experiences of the scientists conducting the research and the nature of the question they are seeking to address. Despite the overlap and interconnectedness of these research methods, it is useful to discuss them separately to understand their principal characteristics and the ways they can be used to investigate a question.

Experimentation. Experimental methods are used to investigate the relationship (s) between two or more variables when at least one of those variables can be intentionally controlled or manipulated. The resulting effect of that manipulation (often called a treatment) can then be measured on another variable or variables. The work of the French scientist Louis Pasteur is a classic example. Pasteur put soup broth in a series of flasks, some open to the atmosphere and others sealed. He then measured the effect that the flask type had on the appearance of microorganisms in the soup broth in an effort to study the source of those microorganisms.

Description. Description is used to gather data regarding natural phenomena and natural relationships and includes observations and measurements of behaviours. A classic example of a descriptive study is Copernicus's observations and sketches of the movement of planets in the sky in an effort to determine if the Earth or the Sun is the orbital center of those objects.

Comparison. Comparison is used to determine and quantify relationships between two or more variables by observing different groups that either by choice or circumstance is exposed to different treatments. Examples of comparative research are the studies that were initiated in the 1950s to investigate the relationship between cigarette smoking and lung cancer in which scientists compared individuals who had chosen to smoke of their own accord with non- smokers and correlated the decision to smoke (the treatment) with various health problems including lung cancer.

Modeling. Both physical and computer-based models are built to mimic natural systems and then used to conduct experiments or make observations. Weather forecasts are an example of scientific modeling that we see every day, where data collected on temperature, wind speed, and direction are used in combination with known physics of atmospheric circulation to predict the path of storms and other weather patterns.

These methods are interconnected and are often used in combination to folly understand complex phenomena. Modeling and experimentation are ways of simplifying systems towards understanding causality and future events. However, both rely on assumptions and knowledge of existing systems that can be provided by descriptive studies or other experiments. Description and comparison are used to understand existing systems and examine the application of experimental and modeling results in real-world systems. Results from descriptive and comparative studies are often used to confirm causal relationships identified by models and experiments. While some questions lend themselves to one or another strategy due to the scope or nature of the problem under investigation, most areas of scientific research employ all of these methods as a means of complementing one another towards clarifying a specific hypothesis, theory, or idea in science. Scientific theories are clarified and strengthened through the collection of data from more than one method that generate multiple lines of evidence. Take, for example, the various research methods used to investigate what came to be known as *the ozone hole* [Carpi, Egger, 2008].

1. Complete the following sentences with details from the Text.

1. Scientific knowledge includes facts, formulas, and ______.

2. The scientific methods are applied in______.

3.______is the resulting effect of the manipulation of some variables.

4. A classic example of using descriptive methods is ______.

5. An example of using modeling methods is ______.

6. Experimental and modeling methods rely on ___ and_____ of existing systems.

2. Locate the following details in the Text. Give the line numbers.

1. In which lines does the author explain the structure of scientific knowledge?

2. Where in the Text does the author first mention different types of research methods?

3. At what point in the Text does the author discuss the example of overlapping some scientific methods?

4. Where in the Text does the author explain the use of descriptive and comparative methods in combination?

UNIT 8
THE USE OF COMPUTERS IN RESEARCH

1. Before you read Text "The Role of Computers in Research" discuss these questions with your group mates or teacher.

1. How have computers changed the world?

2. What do you know about the first computers?

3. What are modem computers like?

4. What can you say about such uses of computers as data storage and analysis, scientific simulations, instrumentation control, and sharing knowledge through the Internet?

5. What other computer applications in scientific research do you know?

2. Read translate ad annotate the text.

The role of computers in research

Computers play a major role today in every field of scientific research from genetic engineering to astrophysics research. This text is a brief overview of the role that computers have played in research and the ways in which they are helping unravel several scientific mysteries. While they are still far away from that supreme ideal of being able to think for themselves as artificially intelligent machines the brute force of their ability to calculate and process information at phenomenal speeds powers research in every field of human endeavor. In fact, computers have changed the way in which information, or more precisely, knowledge is disseminated around the world.

The first computers developed were mere calculators, with the ability to carry out simple arithmetic operations. Advancement in electronics, the development of the vacuum tube-based transistors and the devising of digital logic gates led to the development of the first digital computer which could perform more advanced logical operations.

These early machines took up whole multistory buildings and were operated through punch cards. All this changed after the development of semiconductor-based transistors which led to the extreme miniaturization of integrated circuits, which made the development of the first personal computers possible.

Since then, computer technology has advanced by leaps and bounds to bring extreme computing power into the hands of the common man. Today computers are ubiquitous, with applications in every field of human endeavor. To no field have computers contributed as much as scientific research. From predicting weather to running astrophysical simulations, computers are the scientist's prime analytical tool in unraveling the mysteries of nature.

It is truly impossible to capture the whole range of computer applications in scientific research. Here is a bird's-eye view of the role of computers in scientific research, where four of their most important applications are discussed.

Data storage and analysis. Experimentation is the cornerstone of scientific research. Every experiment in any of the natural sciences generates a lot of data which need to be stored and analyzed to derive important conclusions, to validate or disprove hypotheses. Computers attached with experimental apparatuses directly record data as they are generated and subject them to analysis through specially designed software. Analyzing tons of statistical data is made possible using specially designed algorithms that are implemented by computers. This makes the extremely time-consuming job of data analysis to be a matter of a few minutes. In genetic engineering, computers have made the sequencing of the entire human genome possible. Data from different sources can be stored and accessed via computer networks set up in research labs, which makes collaboration simpler.

Scientific simulations. One of the prime uses of computers in pure science and engineering projects is the running of simulations. A simulation is a mathematical modeling of a problem and a virtual study of its possible solutions. Problems which do not yield themselves to experimentation can be studied through simulations carried out on computers. For example, astrophysicists carry out structure formation simulations, which are aimed at studying how large-scale structures like galaxies are formed. Space missions to the Moon, satellite launches and interplanetary missions are first simulated on computers to determine the best path that can be taken by the launch vehicle and spacecraft to reach its destination safely.

Instrumentation control. Most advanced scientific instruments come with their own on-board computer, which can be programmed to execute various functions. For example, the Hubble Space Craft has its own onboard computer system which is remotely programmed to probe the deep space. Instrumentation control is one of the most important applications of computers.

Knowledge sharing through the Internet. Lastly, in the form of the Internet, computers have provided an entirely new way to share knowledge. Today, anyone can access the latest research papers that are made available for free on websites like *ArXiv.org.* The sharing of knowledge and collaboration through the Internet has made international cooperation on scientific projects possible.

Through various kinds of analytical software programs, computers are contributing to scientific research in every discipline, ranging from biology to astrophysics, discovering new patterns and providing novel insights. When computers are granted with the ability to learn and think for themselves, future advances in technology and research will be even more rapid. If we survive human strife and manage not to self-destruct our civilization, future is going to be an exciting time [Phatak, 2011].

3. Complete the following sentences with details from the Text.

1. Computers play an important part in the dissemination of _____and knowledge.
2. The first computers were operated through______ .
3. The data obtained from experiments need ______ and ______ .
4. One of the main applications of computers is______.
5. Computers are contributing to ___________ in every discipline.

4. Locate the following details in the Text. Give the line numbers.

1. In which lines does the author discuss the subject of this text?
2. Where in the Text does the author first mention different computer applications?
3. At what points in the Text does the author explain the use of computers in genetic engineering and astrophysics?
4. Where in the Text does the author discuss the use of instruments in research?

5. Underline the detail that is NOT mentioned in the Text in each of the sentences below.

1. Advancement in electronics, logical operations, and the development of the vacuum tube based transistors led to the development of the first digital computer.

2. Data from different sources can be analyzed, accessed, stored and implemented by using computer networks.

3. The sharing of knowledge, collaboration, and new ideas via the Internet has made international cooperation possible.

6. Answer the following detail questions.

1. According to the Text, computers are the scientists’ main analytical tool in

a) using integrated circuits.

b) developing punch cards.

c) contributing to scientific research.

2. According to the Text, experiments are the cornerstone in scientific research because they

a) store a lot of information.

b) produce a lot of data.

c) validate or disapprove hypotheses.

3. According to the Text, how can the problems which do not yield themselves to experiments be solved?

a) through mathematical modelling

b) through engineering projects

c) through designing algorithms

4. According to the Text, what can websites like *ArXiv.org* provide?

a) a new way to share knowledge

b) an access to research articles

c) collaboration through the Internet

5. According to the Text, future progress in research will be more rapid due to

a) different types of analytical software programs.

b) technology development.

c) artificial intelligence advances.

How to use a computer for research

As technology continues to advance, increasing numbers of tasks will be done by computer. An example is in the area of research. Computer research has its flaws, but by learning how to do it properly, you will be able to get information efficiently.

Instructions.

1. Choose a computer with high-speed Internet service. A broadband connection will allow you to surf the web faster and get more research done. Go to a library if you do not have a high-speed connection at home.

2. Take notes right on the computer. Open a blank document, using Microsoft Word for instance, and type your notes rather than hand-write them, which can be

faster and more legible. You can also copy and paste text from a site right into your notes to save time and ensure accuracy.

3. Look at the Internet sources with a critical eye. Although the web offers a vast amount of useful knowledge, it also contains a lot of inaccurate, biased material. The majority of your research should be from credible sources and professional texts. The Internet sources that link back to a text are sometimes more credible.

4. Save your documents often. Press the "Ctrl" key and the "S" key simultaneously to save documents and prevent losing data due to a computer crash or error.

5. Do not get distracted. Close all social networking sites and instant messaging programs, as it is easy to lose focus while on the computer. By doing this, you may be able to research more efficiently-

As computers become more sophisticated, researchers have more tools at their disposal to conduct their research.

Solving Mathematical Equations. Scientific research often requires that complex mathematical equations be solved in order to determine if data is valid or if a certain structure of molecules will remain stable. Computers are integral to this calculation process since scientists can write software programs specifically to provide answers to such questions. This removes the element of human error, which can cost research institutions millions of dollars in fixing a product that was created with even the smallest amount of flawed data.

Database Technology. Computing has advanced the way researchers conduct literature searches, the initial process of finding existing research on the investigator's subject. Instead of thumbing through bound texts in a library, databases allow researchers to quickly locate articles about their research from multiple disciplines from anywhere they can access the Internet.

Library Research. Most sizable library systems now have their information online. Rather than using the card catalog to locate a specific book, library patrons can now find and reserve books via a computer account linked to their library card. Libraries also offer links to specific research sites that patrons may not otherwise be aware of. Access to dictionaries, encyclopedias and other research aids are also options via library websites that have reduced the need to travel to the library in search of a particular piece of information.

Climate Models. Climate scientists use computers to create complex models of the earth's environment, helping to predict both short term weather and long term climate trends. By inputting historical data and extrapolating future trends, scientists can predict the climate for both the short and long term.

Product Testing. Determining the toxicity of products can be difficult, but computers can make it easier. Scientists have built computer models that mimic the body's reaction to pharmaceutical drugs and environmental toxins, streamlining the approval of lifesaving drugs and helping to assess environmental damage.

Looking at the Stars. Astronomers have been using computer technology for many years to look at the heavens and explore the world around us. Astronomers feed raw data into large supercomputers and use those data to determine the position of stars and even check the atmospheric composition of faraway planets.

Modeling Human Behaviour. Social scientists also make use of computer technology. This computer technology is used to model the behaviour of large groups of people, helping scientists understand why people behave the way they do.

Computers are used for many different reasons and are very valuable in many aspects of research. Whether you are using CD ROM programs, the Internet or your own statistics, computers can be crucial when you want to start or finish a research program [Moore, 2010**].**

7. Complete the sentences choosing the best variant corresponding to the contents of the text.

1. You should use the Internet resources critically because they..

a) contain a vast amount of useful knowledge.

b) may have a lot of inaccurate information.

c) are credible.

2. Computers are used for solving mathematical equations as ...

a) they can do it very fast.

b) they remove some human mistakes.

c) some software programs are written by scientists.

3. Computer database allow researchers ...

a) to access the Internet.

b) to thumb through texts in a library.

c) to find any information they need.

4. Most big libraries have ...

a) their websites and information online.

b) a card catalog online.

c) no links to research sites.

5. Astronomers use computers ...

a) to create complex models of the earth's environment.

b) to model behaviour of large groups of people.

c) to explore stars and planets.

SUPPLEMENTARY READING

NEW TECHNOLOGY MAKES TISSUES, SOMEDAY MAYBE ORGANS

A new device for building large tissues from living components of three-dimensional microtissues borrows on ideas from electronics manufacturing. The Bio-Pick, Place and Perfuse is a step toward someday making whole organs.

A new instrument could someday build replacement human organs the way electronics are assembled today: with precise picking and placing of parts.

In this case, the parts are not resistors and capacitors, but 3-D microtissues containing thousands to millions of living cells that need a constant stream of fluid to bring them nutrients and to remove waste. The new device is called “BioP3” for pick, place, and perfuse. A team of researchers led by Jeffrey Morgan, a Brown University bioengineer, and Dr. Andrew Blakely, a surgery fellow at Rhode Island Hospital and the Warren Alpert Medical School, introduces BioP3 in a new paper in the journal Tissue Engineering Part C.

Because it allows assembly of larger structures from small living microtissue components, Morgan said, future versions of BioP3 may finally make possible the manufacture of whole organs such as livers, pancreases, or kidneys.

“For us it’s exciting because it’s a new approach to building tissues, potentially organs, layer by layer with large, complex living parts,” said Morgan, professor of molecular pharmacology, physiology and biotechnology. “In contrast to 3-D bioprinting that prints one small drop at a time, our approach is much faster because it uses pre-assembled living building parts with functional shapes and a thousand times more cells per part.”

Morgan’s research has long focused on making individual microtissues in various shapes such as spheres, long rods, donut rings and honeycomb slabs. He uses a novel micromolding technique to direct the cells to self-assemble and form these complex shapes. He is a founder of the Providence startup company Mi- croTissues Inc., which sells such culture-making technology.

Now, the new paper shows, there is a device to build even bigger tissues by combining those living components.

“This project was particularly interesting to me since it is a novel approach to large-scale tissue engineering that hasn't been previously described,” Blakely said.

The BioP3 prototype

The BioP3, made mostly from parts available at Home Depot for less than $ 200, seems at first glance to be a small, clear plastic box with two chambers: one side for storing the living building parts and one side where a larger structure can be built with them. It’s what rests just above the box that really matters: a nozzle connected to some tubes and a microscopelike stage that allows an operator using knobs to precisely move it up, down, left, right, out and in.

The plumbing in those tubes allows a peristaltic pump to create fluid suction through the nozzle’s finely perforated membrane. That suction allows the nozzle to pick up, carry and release the living microtissues without doing any damage to them, as shown in the paper.

Once a living component has been picked, the operator can then move the head from the picking side to the placing side to deposit it precisely. In the paper, the team shows several different structures Blakely made including a stack of 16 donut rings and a stack of four honeycombs. Because these are living components, the stacked microtissues naturally fuse with each other to form a cohesive whole after a short time.

Because each honeycomb slab had about 250 000 cells, the stack of four achieved a proof-of-concept, million-cell structure more than 2 mm thick. That’s not nearly enough cells to make an organ such as a liver (an adult s has about 100 billion cells), Morgan said, but the stack did have a density of cells consistent with that of human organs. In 2011, Morgan’s lab reported that it could make honeycomb slabs 2 centimeters wide, with 6 million cells each. Complex stacks with many more cells are certainly attainable, Morgan said.

If properly nurtured, stacks of these larger structures could hypothetically continue to grow, Morgan said. That’s why the BioP3 keeps a steady flow of nutrient fluid through the holes of the honeycomb slabs to perfuse nutrients and remove waste. So far, the researchers have shown that stacks survive for days.

In the paper the team made structures with a variety of cell types including H35 liver cells, KGN ovarian cells, and even MCF-7 breast cancer cells (building large tumors could have applications for testing of chemotherapeutic drugs or radiation treatments). Different cell types can also be combined in the microtissue building parts. In 2010, for example, Morgan collaborated on the creation of an artificial human ovary unifying three cell types into a single tissue.

Improvements underway

Because version 1.0 of the BioP3 is manually operated, it took Blakely about 60 minutes to stack the 16 donut rings around a thin post, but he and Morgan have no intention of keeping it that way.

In September, Morgan received a $ 1,4 million, three-year grant from the National Science Foundation in part to make major improvements, including automating the movement of the nozzle to speed up production.

“Since we now have the NSF grant, the Bio-P3 will be able to be automated and updated into a complete, independent system to precisely assemble large-scale, high-density tissues,” Blakely said.

In addition, the grant will fund more research into living building parts — how large they can be made and how they will behave in the device over longer periods of time. Those studies include how their shape will evolve and how they function as a stack.

"We are just at the beginning of understanding what kinds of living parts we can make and how they can be used to design vascular networks within the structures," Morgan said. "Building an organ is a grand challenge of biomedical engineering. This is a significant step in that direction."

Brown has sought a patent on the BioP3.

IN SEARCH OF THE ORIGIN OF OUR BRAIN

While searching for the origin of our brain, biologists have gained new insights into the evolution of the central nervous system and its highly developed biological structures. Nerve cell centralization does begin in multicellular animals, researchers have confirmed.

While searching for the origin of our brain, biologists at Heidelberg University have gained new insights into the evolution of the central nervous system (CNS) and its highly developed biological structures. The researchers analyzed neurogenesis at the molecular level in the model organism Nematostellavectensis. Using certain genes and signal factors, the team led by Prof. Dr. Thomas Holstein of the Centre for Organismal Studies demonstrated how the origin of nerve cell centralization can be traced back to the diffuse nerve net of simple and original lower animals like the sea anemone. The results of their research will be published in the journal "Nature Communications".

Like corals and jellyfish, the sea anemone — Nematostellavectensis — is a member of the Cnidaria family, which is over 700 million years old. It has a simple sack-like body, with no skeleton and just one body orifice. The nervous system of this original multicellular animal is organized in an elementary nerve net that is already capable of simple behaviour patterns. Researchers previously assumed that this net did not evidence centralization, that is, no local concentration of nerve cells. In the course of their research, however, the scientists discovered that the nerve net of the embryonic sea anemone is formed by a set of neuronal genes and signal factors that are also found in vertebrates.

According to Prof. Holstein, the origin of the first nerve cells depends on the Wnt signal pathway, named for its signal protein, Wnt. It plays a pivotal role in the orderly evolution of different types of animal cells. The Heidelberg researchers also uncovered an initial indication that another signal path is active in the neurogenesis of sea anemones — the BMP pathway, which is instrumental for the centralization of nerve cells in vertebrates.

Named after the BMP signal protein, this pathway controls the evolution of various cell types depending on the protein concentration, similar to the Wnt pathway, but in a different direction. The BMP pathway runs at a right angle to the Wnt pathway, thereby creating an asymmetrical pattern of neuronal cell types in the widely diffuse neuronal net of the sea anemone. “This can be considered as the birth of centralization of the neuronal network on the path to the complex brains of vertebrates,” underscores Prof. Holstein.

While the Wnt signal path triggers the formation of the primary body axis of all animals, from sponges to vertebrates, the BMP signal pathway is also involved in the formation of the secondary body axis (back and abdomen) in advanced vertebrates. “Our research results indicate that the origin of a central nervous system is closely linked to the evolution of the body axes,” explains Prof. Holstein.

PATTERNS OF RNA REGULATION IN NUCLEI OF PLANTS IDENTIFIED

In a new study done in plants, biologists give a global view of the patterns that can affect the various RNA regulatory processes that occur before these molecules move into the cytoplasm, where they are translated into the proteins that make up a living organism.

When the human genome was first sequenced, experts predicted they would find about 100 000 genes. The actual number has turned out to be closer to 20 000, just a few thousand more than fruit flies have. The question logically arose: how can a relatively small number of genes lay the blueprint for the complexities of the human body?

The explanation is that genes are subject to many and varied forms of regulation that can alter the form of that protein and can determine whether and how much of a gene product is made. Much of this regulation occurs during and just after DNA is transcribed into RNA.

In a new study done in plants, University of Pennsylvania biologists built on earlier work in which they cataloged all the interactions that occur between RNA and the proteins that bind to it. This time, they looked exclusively at these interactions in the nuclei, and simultaneously obtained data about the nuclear RNA molecules’ structure. By combining these datasets, their findings give a global view of the patterns that can affect the various RNA regulatory processes that occur before these molecules move into the cytoplasm, where they are translated into the proteins that make up a living organism.

In addition, the researchers have provided a vast, publically available set of data that other scientists can use to address questions about any genes and regulatory mechanisms that interest them, gaining a better understanding of the dynamics of the journey from DNA to protein.

Brian D. Gregory, an assistant professor in Penn’s School of Arts & Sciences’

Department of Biology, was senior author on the work, which will appear in the journal Molecular Cell. Sager J. Gosai, a research specialist, and Shawn W. Foley, a graduate student, both members of Gregory's lab, were co- first authors. Additional contributors from Penn included Ian M. Silverman, a graduate student in the Gregory lab, along with FevziDaldal, a professor in the Department of Biology and NurSelamoglu of the Daldal lab. The Penn researchers teamed with Emory University's Dongxue Wang and Roger B. Deal and University of Arizona's Andrew D. L. Nelson and Mark A. Beilstein to conduct the study.

Earlier this year in Genome Biology, Gregory's team reported on a method they developed to obtain a complete catalog of the interactions in live organisms between RNA and RNA- binding proteins, or RBPs, which interact with RNA transcripts to repress, enhance or otherwise alter gene expression in a cell-type specific manner. The technique is called PIP-seq, for protein interaction profile sequencing. Their initial demonstration of PIP-seq identified the full complement of RBP interaction sites in a human cell line.Their initial demonstration of PIP-seqidentified the full complement of RBP interaction sites in a human cell line.

In the current work, they used the commonly studied plant Arabidopsis thaliana to map out all of the RBP interaction sites as well as compile a full look at the secondary structure of the RNA transcripts. Unlike the first study, which looked at all the RNA in the cell, a set of material known as the transcriptome, this study looked only in the nucleus.

"By focusing specifically on the nucleus we can get away from all of the features on RNA molecules that are associated with the process of translation into proteins, which occurs in the cytoplasm," Gregory said.

The researchers extracted nuclei from 10-day-old Arabidopsis seedlings. They performed PIP-seq and also obtained information on the secondary structure of the RNA — how the strands of RNA fold, loop or bind together.

Focusing on sections of RNA that bind to RBPs, the team found that these sequences have been conserved over evolutionary time and are likely playing an important function in gene regulatory mechanisms.

The scientists also found a strong inverse relationship between patterns of RBP binding and secondary structure.

"When structure is low, proteins tend to bind those regions and when structure is high, RBPs tend to not bind those regions," Gregory said. "Time and time again, we've seen that the structural context, and not just the RNA sequence, is aselective force in RBP binding."

Another significant finding was unique patterns oi RBP binding and structure present around the start codon of each messenger RNA transcript, which is where a cell's proteinmaking machinery begins the process of making RNA in pro"This is suggesting that there is a regulatory event happening here even before the RNA comes out of the nucleus and engages with the translation machinery," Gosai said. "It's an exciting place for future studies to start with and figure out what regulation events are happening in the nucleus."

Two key forms of transcript regulation are alternative splicing, in which pieces of RNA undergo a cut-and-paste process to generate new sequences that can code for various proteins, and alternative polyadenylation, which alters where a transcript ends and an adenine "tail" is added, a process that can enhance either stabilization or degradation of the RNAmolecule.

In their analysis, the Penn biologists found that *RBP*-binding sites and certain patterns of secondary structure were much more common at sites where alternative splicing and alternative polyadenylation occur.

"In humans, almost 95 percent of genes are alternatively spliced, and the number is at least 60 percent in plants," said Foley. "To see high levels of RBP binding and interplay with secondary structure at sites of alternative splicing and polyadenylation in plants is good indication of where and how regulation is occurring to produce different proteins from one RNA sequence."

As in their previous study using PIP-seq, Gregory and his colleagues identified recurring patterns, known as "motifs', of RNA sequences at sites that tended to be bound by certain RBPs. It's possible, the researchers noted, that these groupsof RBPs could bind functionally-related genes to coordinate their regulation.

Finally, the team zoomed in on one RBP-bound sequence motif that was particularly abundant and found that it interacted with an RBP called CP29A.

"This protein was known to bind RNA in the chloroplast, but we wereable to identify it as a nuclear RBP for the first time, Foley said, suggesting CP29A may be an important regulatory factor in both organelles.

To follow up on this work, the Penn scientists will examine how RNA regulation differs in plant tissues at different developmental stages. They also plan to use PIP-seq and structural analyses to study other types of organisms.

"Now that we've found beautiful patterns that mark alternative splicing and other events that shape the protein-coding capacity of plants, we're going to go in and identify the proteins that lead to those," Gregory said. "And eventually we'd like to go into humans and other organisms and ask if we see similar patterns."

KILLING FOR DNA: A PREDATORY DEVICE IN THE CHOLERA BACTERIUM

Scientists have uncovered the unconventional way that the cholera bacterium stabs and kills other bacteria to steal their DNA, making it potentially more virulent.

Cholera is caused when the bacterium Vibrio cholerae infects the small intestine. The disease is characterized by acute watery diarrhea resulting in severe dehydration.

Cholera is caused when the bacterium Vibrio cholerae infects the small intestine. The disease is characterized byacute watery diarrhea resulting in severe dehydration. EPFL scientists have now demonstrated that V.cholerae uses a tiny spear to stab and kill neighboring bacteria — even of its own kind — and then steal their DNA. This mechanism, known as "horizontal gene transfer", allows the cholera bacterium to become more virulent by absorbing the traits of its prey. Thestudy is published in Science.

The lab of Melanie Blokesch at EPFL has uncovered how V. cholerae uses a predatory killing device to compete with surrounding bacteria and steal their DNA. This molecular killing device a spring-loaded spear that is constantly shooting out. This weapon is called the "type VI secretion system" (T6SS) and is known to exist in many types of bacteria. When V. choleraecomes close to other bacteria, the spear punches a hole into them, leaving them to die and release their genetic material, which the predator pulls into itself.

Killing neighbors and stealing genes

This spear-killing, predatory behaviour is triggered by the bacterium's environment. The cholera bacterium naturally lives in water, such as the sea, where it attaches onto small planktonic crustaceans. There, it feeds on the main component of their shells: a sugar polymer called chitin. When chitin is available, V.cholerae goes into an aggressive survival mode called "natural competence". When in this mode, V. cholerae- attacks neighboring bacteria with its spear even if they are of the same species.

Melanie Blokesch set out to explore how V. cholerae uses this behaviour to compete for survival in nature. Her lab tested different strains of the bacterium from all over the world, most of which have been implicated in the 7th cholera pandemic, which began in Indonesia in the 1960s, spread rapidly to Asia, Europe, and Latin America, and still affects populations today.

The researchers grew these bacteria on chitin surfaces that simulated their natural habitat on crustaceans. What they found was that the tiny spear is not only part of V. cholerae's natural survival system, but it also contributed to the transfer of genes that could make the bacterium more resistant to threats, even to antibiotics. The researchers then used genetic and bioimaging techniques to identify, in real time, whichmechanisms are involved in this event, which is called "horizontal gene transfer".

"Using this mode of DNA acquisition, a single V. cholerae cell can absorb fragments containing more than 40 genes from another bacterium," says Melanie Blokesch. "That's an enormous amount of new genetic information." This phenomenon is referred to as "horizontal" gene transfer, as opposedto the conventional "vertical" passage of genes from parent to offspring.

The importance of this study lies in the fact that horizontal gene transfer is a widespread phenomenon in bacteria, and it contributes to the dispersal of virulence factors and antibiotic resistances. In addition, the chitin-mediated activation of the spear-killing device most likely renders the bacterium more dangerous to patients when they ingest it, as this molecular spear might also kill protective bacteria in the human gut.

The researchers are now extending their investigation into the interplay between the chitin-induced production of the spear and horizontal gene transfer. "By studying this interplay, we can begin to better understand evolutionary forces that shape human pathogens and maybe also transmission of the disease cholera," says Blokesch.

NASA FINDS GOOD NEWS ON FORESTS AND CARBON DIOXIDE

A new NASA-led study shows that tropical forests may be absorbing far more carbon dioxide than many scientists thought, in response to rising atmospheric levels of the greenhouse gas. The study estimates that tropical forests absorb 1.4 billion metric tons of carbon dioxide out of a total global absorption of 2.5 billion — more than is absorbed by forestsin Canada, Siberia and other northern regions, called boreal forests.

A new NASA-led study shows that tropical forests may be absorbing far more carbon dioxide than many scientists thought, in response to rising atmospheric levels of the greenhouse gas. The study estimates that tropical forests absorb 14 billion metric tons of carbon dioxide out of a total global absorption of 2.5 billion — more than is absorbed by forests in Canada, Siberia and other northern regions, called boreal forests.

"This is good news, because uptake in boreal forests is already slowing, while tropical forests may continue to take up carbon for many years," said David Schimel of NASA s Jet Propulsion Laboratory, Pasadena, California. Schimel is lead author of a paper on the new research, appearing online in the Proceedings of National Academy of Sciences.

Forests and other land vegetation currently remove up to 30 percent of human carbon dioxide emissions from the atmosphere during photosynthesis. If the rate of absorption were to slow down, the rate of global warming would speed up in return.

The new study is the first to devise a way to make apples-to-apples comparisons of carbon dioxide estimates from many sources at different scales: computer models of ecosystem processes, atmospheric models run backward in time to deduce the sources of today's concentrations (called inverse models), satellite images, data from experimental forest plots and more. The researchers reconciled all types of analyses and assessed the accuracy of the results based on how well they reproduced independent, ground-based measurements. They obtained their new estimate of the tropical carbon absorption from the models they determined to be the most trusted and verified.

"Until our analysis, no one had successfully completed a global reconciliation of information about carbon dioxide effects from the atmospheric, forestry and modeling communities," said co-author Joshua Fisher of JPL. "It is incredible that all these different types of independent data sources start to converge on an answer."

The question of which type of forest is the bigger carbon absorber "is not just an accounting curiosity", said co-author Britton Stephens of the National Center for Atmospheric Research, Boulder, Colorado. "It has big implications for our understanding of whether global terrestrial ecosystems might continue to offset our carbon dioxide emissions or might begin to exacerbate climate change."

As human-caused emissions add more carbon dioxide to the atmosphere, forests worldwide are using it to grow faster, reducing the amount that stays airborne. This effect is called carbon fertilization. "All else being equal, the effect is stronger at higher temperatures, meaning it will be higher in the tropics than in the boreal forests," Schimel said.

But climate change also decreases water availability in some regions and makes Earth warmer, leading to more frequent and larger wildfires. In the tropics, humans compound the problem by burning wood during deforestation. Fires don't just stop carbon absorption by killing trees; they also spew huge amounts of carbon into the atmosphere as the wood burns.

For about 25 years, most computer climate models have been showing that mid-latitude forests in the Northern Hemisphere absorb more carbon than tropical forests. That result was initially based on the then-current understanding of global air flows and limited data suggesting that deforestation was causing tropical forests to release more carbon dioxide than they were absorbing.

In the mid-2000s, Stephens used measurements of carbon dioxide made from aircraft to show that many climate models were not correctly representing flows of carbon above ground level. Models that matched the aircraft measurements better showed more carbon absorption in the tropical forests. However, there were still not enough global data sets to validate the idea of large tropical-forest absorption. Schimel said that their new study took advantage of a great deal of work other scientists have done since Stephens' paper to pull together national and regional data of various kinds into robust, global data sets.

Schimel noted that their paper reconciles results at every scale from the pores of a single leaf, where photosynthesis takes place, to the whole Earth, as air moves carbon dioxide around the globe. "What we've had up till this paper was atheory of carbon dioxide fertilization based on phenomena at the microscopic scale and observations at the global scale that appeared to contradict those phenomena. Here, at least, is a hypothesis that provides a consistent explanation that includes both how we know photosynthesis works and what's happening at the planetary scale."

NASA monitors Earth's vital signs from land, air and space with a fleet of satellites and ambitious airborne and ground- based observation campaigns. NASA develops new ways to observe and study Earth's interconnected natural systems with long-term data records and computer analysis tools to better see how our planet is changing. The agency shares this unique knowledge with the global community and works with institutions in the United States and around the world that contribute to understanding and protecting our home planet.

EVOLUTION IS UNPREDICTABLE AND IRREVERSIBLE

Evolutionary theorist Stephen Jay Gould is famous for describing the evolution of humans and other conscious beings as a chance accident of history. If we could go back millions of years and "run the tape of life again", he mused, evolution would follow a different path.

A study by University of Pennsylvania biologists now provides evidence Gould was correct, at the molecular level: Evolution is both unpredictable and irreversible. Using simulations of an evolving protein, they show that the genetic mutations that are accepted by evolution are typically dependent on mutations that came before, and the mutations that are accepted become increasingly difficult to reverse as time goes on.

The research team consisted of postdoctoral researchers and co-lead authors Premal Shah and David M. McCandlish andprofessor Joshua B. Plotkin, all from Penn's Department of Biology in the School of Arts & Sciences. They reported their findings in the Proceedings of the National Academy of Sciences.

The study focuses exclusively on the type of evolution known as purifying selection, which favors mutations that have no or only a small effect in a fixed environment. This is in contrast to adaptation, in which mutationsare selected if they increase an organism's fitness in a new environment. Purifying selection is by far the more common type of selection.

"It's the simplest, most boring type of evolution you can imagine, Plotkinsaid. "Purifying selection is just asking an organism to do what it's doing and keep doing it well."

As an evolutionary model, the Penn team used the bacterial protein argT, for which the three-dimensional structure is known. Its small size means that the researchers could reliably predict how a given genetic mutation would affect the protein's stability.

Using a computational model, they simulated the protein evolving during the equivalent of roughly 10 million years by randomly introducing mutations, accepting them if they did not significantly affect the protein's stability and rejecting them if they did. They then examined pairs of mutations, asking whether the later mutation would have been accepted had the earlier mutation not have been made.

"The very same mutations that were accepted by evolution when they were proposed, had they been proposed at a much earlier in time, they would have been deleterious and would have been rejected," Plotkin said.

This result – that later mutations were dependent on the earlier ones demonstrates a feature known as contingency. In other words, mutations that are accepted by evolution are contingent upon previous mutations to ameliorate their effects.

The researchers then asked a distinct, converse question: whether it is possible to revert an earlier mutation and still maintain the protein s stability. They found that the answer was no. Mutations became "entrenched" and increasingly difficult to revert as time went on without having a destabilizing effect on the protein.

"At each point in time, if you make a substitution, you wouldn't see a large change in stabilization," Shah said. But, after a certain number of changes to the protein, if you go back and try to revert the earlier change, the protein structure begins to collapse."

The concepts of contingency and entrenchment were well known to be present in adaptive evolution, but it came as a surprise to the researchers to find them under purifying selection.

"We thought we would just try this with purifying selection and see what happened and were surprised to see how much contingency and entrenchment occurs," Plotkin said. "What this tells us is that, in a deep sense, evolution is unpredictable and in some sense irreversible because of interactions between mutations."

Such interactions, when the effect of a mutation is dependent on another, are known as epistasis. The researchers' investigation found that, unexpectedly, purifying selection enriches for epistatic mutations as opposed to mutations that are simply additive. Plotkin explained that this is because purifying selection favors mutations that have a small effect. Either the mutation can have a small effect on its own, or it can have a small effect because another, earlier mutation ameliorated the effects of the current mutation. Thus mutations that are dependent upon earlier mutations will be favored.

"Our study shows, and this has been known for a long time, that most of the substitutions that occur are substitutions that have small effects," McCandlish said. "But what's interesting is that we find that the substitutions that have small effects change over time."

An implication of these findings is that predicting the course of evolution, as one might wish to do, say, to make an educated guess as to what flu strain might arise in a given year, is not easy.

“The way these substitutions occur, since they’re highly contingent on what happened before, makes predictions of long-term evolution extremely difficult,” Plotkin said.

The researchers hope to partner with other groups in the future to conduct laboratory experiments with microbes to confirm that real-world evolution supports their findings. And while Gould’s comment about replaying the tape of life was mainly a nod to the large amount of randomness inherent in evolution’s path, this study suggests a more nuanced reason that the playback would appear different.

There is intrinsically a huge amount of contingency in evolution,” Plotkin said. “Whatever mutations happen to come first set the stage for what other later mutations are permissible. Indeed, history channels evolution down a certain path. Gould’s famous tape of life would be very different if replayed! even more different than Gould might have imagined.”

RESEARCH SOLVES MYSTERY

Researchers have identified two types of stem cells in the hippocampus, a region of the brain crucial for learning and memory.

Scientists are one step closer to understanding how the brain regulates memory and mood, thanks to the discovery of two distinct types of stem cells.

University of Queensland researchers have identified two types of stem cells in the hippocampus, a region of the brain crucial for learning and memory.

Dr. DhanishaJhaveri, the study’s lead author, said Queensland Brain Institute (QBI) researchers had isolated pure populations of these cells for the first time.

The discovery may have implications for the treatment of learning- and mood-related disorders.

The stem cells we have identified give rise to new neurons,” Dr. Jhaveri said.

The production of new neurons in the brain, a process that decreases as we age, is essential for learning and cognitive function.”

Professor Perry Bartlett, QBI director, said the discovery solved a longstanding mystery about the birth of new neurons in the hippocampus.

“Previously, these neurons were all thought to be identical, so it wasn’t understood how the region is able to regulate behaviours as divergent as learning and mood,” he said.

“The existence of distinct stem cell populations suggests that they give rise to different types of neurons, which explains the varied functions of thehippocampus.”

Dr. Jhaveri said the discovery was made using state-of-the-art cell-sorting and DNA technologies.

“The two cell groups are located in different regions of the hippocampus, which suggests that distinct areas within the hippocampus control spatial learning versus mood," she said.

"When we purified the cells we found that they are activated by different mechanisms, and generate new neurons that differ in their gene expression."

HOW BIRDS LEARN FOREIGN LANGUAGES

Biologists have succeeded in teaching wild birds to understand a new language. After only two days of training, fairy wrens learned to flee when they heard an alarm call that was foreign to them, showing that birds can learn to eavesdrop on the calls of other species.

After only two days of training, fairy wrens learnt to flee when they heard an alarm call that was foreign to them, showing that birds can learn to eavesdrop on the calls of other species.

The research, led by biologists at The Australian National University (ANU), could be used to help train captive animals to recognize signals of danger before they are released in to the wild.

The first bird we tested lived on the ANU campus near my office. There was general disbelief and excitement when the bird learned the task perfectly," said the leader of the study, Professor Robert Magrath, from the ANU Research School of Biology:"We had been doing experiments on learning using different methods, but until then with little success. So it was exciting to finally crack the practical problems of carrying out this experiment, and get clear results."

Many animals get information about danger by eavesdropping on each other, but how they do it has been an ongoing puzzle.

Recognizing other species' calls is a remarkable ability, because there are lots of species in a natural community, and lots of different types of calls. It's like understanding multiple foreign languages," Professor Magrath said.

The biologists trained the fairy-wrens by playing unfamiliar sounds to them, while throwing a model glider of a predatory bird, a currawong or a sparrow hawk, over them.

After only eight playbacks the birds had learned to flee, while they did not flee when played unfamiliar sounds that had not been paired with the gliders.

GERMINATION

Germination involves the imbibition of water, a rapid increase in respiratory activity, the mobilization of nutrient reserves and the initiation of growth in the embryo. It is an irreversible process; once germination has started the embryo is committed irrevocably to growth or death. Externally, germination is marked by the bursting of the testa and the extrusion of the plumule or radicle. In this chapter, we examine the influence that various environmental factors have on the process.

TEMPERATURE AND GERMINATION

Constant temperatures

Quite apart from its well-documented effects on the induction and breaking of dormancy, temperature has important effects on germination itself. These may be divided, conveniently but rather arbitrarily, into effects of constant and alternating temperatures. The latter are considered later. In seasonal climates, temperature is of course a good indicator of the time of year and is therefore implicated strongly in determining the timing of germination. Washitani and Masuda (1990) conducted a remarkably detailed study of germination in a Japanese grassland, in which germination of almost all species was confined to the spring-early summer period. They found that the temperature, at which seeds began to germinate, when subjected to gradually increasing temperatures in a standardized screening program, was linked closely to the observed timing of emergence in the field. Interestingly, emergence timing was not correlated at all with presence of dormancy or requirements for dormancy breaking, illustrating the important point that dormancy normally plays little part in determining germination timing. A number of species investigated by Washitani and Masuda began to germinate at 4°C, the lowest temperature employed. In the large-scale laboratory screening study, many species were able to germinate at 5°C, the lowest temperature employed in that study. Several other species, which required moist chilling to break dormancy, germinated in darkness at the chilling temperature (5°C) in the same study. These species were predominantly herbs of woodland or scrub *(Galium aparine, Mercurialis perennis, Hyacinthoides non-scripta)* or of fertile, tall-herb communities *(Aegopodium poda- graria, Anthriscus sylvestris, Heracleum sphondylium).* Presumably, in these communities there is an overwhelming advantage in germinating early, before the closing of the tree canopy or the growth of large competitors. The low-temperature limit for seed germination is unknown, but germination in many species may be prevented only by freezing. Several British species, including nearly all the grasses tested, were capable of germination at 2°C.

Because temperature requirements for germination are connected so intimately with germination timing, it is rarely possible to detect habitat-specific effects. One case where this is possible is in the genus *Carex.* Most of the large number of species in this genus are found in northern temperate climates, and they display a remarkable uniformity of germination biology; nearly all have dormancy broken by chilling, a light requirement for germination, persistent seed banks and an inability to germinate at low temperatures. Although this uniformity of seed biology is reflected in rather uniform ecology in general, sedges can be found in both woodlands and open habitats. All germinate best at high temperatures (25°C), but only the woodland sedges are also able to germinate at 10°C. When seeds of both groups were sown into woodland, only the woodland sedges emerged before the closure of the tree canopy, whereas the sedges from open habitats failed to germinate at all. Woodland sedges seem equipped to exploit a rather narrow window of opportunity from late April to mid-May in cool temperate woodland.

Strict dormancy, a persistent seed bank and a requirement for light and high temperatures define the sedge ‘regeneration niche’ as relatively unpredictable gaps in vegetation that occur during late spring or early summer. Nor is this niche restricted to seedlings; growth of adult sedges also begins later in the year than most of the species with which they coexist. This late germination and growth would be potentially fatal in competition with fast-growing species and is consistent with the restriction of almost all sedges to unproductive, semi-natural ecosystems

THE SOIL CHEMICAL ENVIRONMENT

With the exception of some epiphytes (which germinate in branches of trees) and some mangrove species (which germinate while attached to the parent), soil provides the physical medium in which most seed germination takes place. A key aspect of the soil environment is its chemical make-up. In this section, we consider the effects of a range of gaseous and liquid substances that surround the seed and that have a bearing on its germination.

Oxygen and carbon dioxide

The concentrations of oxygen and carbon dioxide in soils can differ considerably from those of the atmosphere. This is due largely to the biological activity in the soil, especially that of microorganisms and plant roots. In general, oxygen tends to be depleted and carbon dioxide increased relative to the above-ground levels. The divergence from ambient increases with depth. Movement of these gases through the soil is by diffusion. The rate of diffusion is much reduced if the air spaces are filled with water, when diffusion resistance will be increased by several orders of magnitude. In such situations, oxygen especially may become limiting. Extremes of concentration are also likely to occur at localized microsites on the scale of single seeds next to plant roots or decaying material.

Germination and early seedling growth normally require oxygen for respiration, though some species (notably aquatics) can at least germinate in anoxic conditions, e.g. *Typha latifolia*, *Scirpus juncoides* and *Echinochloa crusgalli*. These may all be tolerant of the ethanol produced by anaerobic respiration. Flooding imposes anaerobic conditions. Many species of aquatic habitats emerge from dormancy under water. Seeds of *Zostera marina,* a submerged marine angiosperm, are especially notable for germinating better under deoxygenated than in aerated conditions. This may ensure that this species establishes its seedlings in the submerged sediments favoured by the adult plants. However, the ability to germinate without oxygen is not confined to aquatics. *Veronica hederifolia* can be induced to germinate in 100% nitrogen. Even under well-aerated conditions, the oxygen concentration inside imbibed seeds at the site of embryonic meristems may be quite low because of the low rate of oxygen diffusion in water and because of the uptake of oxygen by the coat and endosperm tissues.

The ecological role of oxygen in regulating germination and dormancy is uncertain because of the wide range of responses seen in different species to reduced concentrations. Reduced levels of oxygen have been shown to induce dormancy in a number of species, e.g. *Veronica persica*, *Lobelia dortmanna* and *Tragopogon* spp. In some cases, the response to depleted oxygen is temperature-dependent, e.g. in *Echinochloa crusgalli* and *Avenafatua*.

Carbon dioxide levels vary with depth and with the environmental factors that influence microbial activity, i.e. moisture, temperature and amount of organic matter in the soil. Carbon dioxide levels of 2--5% have been shown to stimulate germination, though at levels above 5% a number of species are inhibited showed in a three-year study that at depths of 1.75-4.0 m, carbon dioxide levels varied between 1 and 4%. Ambient atmospheric concentration is currently about 0.036%. The response of seeds to the high levels found at comparatively great depths in soil may not be of great ecological significance because (1) the seeds could not emerge from such depths even if stimulated to germinate by the high carbon dioxide levels and (2) these concentrations are not usually found in the surface layers of the soil from which most seedlings emerge, where concentrations are more usually about 0.1%.

There is much current speculation about the potential effects of elevated global carbon dioxide in the future. While this may affect vegetative growth the specific effect on seed germination is unclear. Stomer & Horvath tested the germination of three native annual species in concentrations up to 0.21% (i.e. about six times ambient) and found no significant effect. As the anticipated increases in global concentrations are much less than this, their data suggest that there may be little effect on germination as such. However, other studies have found significant effects even at twice ambient levels. Ziska & Bunce tested six crop and four weed species and found an increase in germination rate and percentage final germination in one of the crops and two of the weeds. In a field experiment, elevated carbon dioxide (twice ambient) resulted in the emergence of more weed seedlings three weeks after tillage, compared with ambient controls. If elevated global carbon dioxide levels differentially favour the regeneration of certain species, they may thereby have profound long-term effects on vegetation composition.

Nitrate

Nitrate (NO^{-}) is one of the most ubiquitous and nutritionally important inorganic ions in soils. Along with the ammonium ion (NH+), it provides the main source of nitrogen to plants. It has also long been known to stimulate germination, especially in weed species. For example, out of 85 weeds tested by Steinbauer & Grigsby, half gave a positive response to nitrate. Laboratory tests show that the response occurs within the range of nitrate concentrations commonly found in soils. The response to nitrate can be interpreted as dormancy-breaking, but it is here regarded as a promotion of germination in non-dormant seeds; that is, the seeds are considered to respond to the nitrate only after their dormancy requirements (such as chilling or after-ripening) have been satisfied.

The internal nitrate content of seeds has been shown to have a clear correlation with germinability. Seeds from *Sisymbrium officinalis* plants that had been grown in various levels of KNO_3 showed a direct positive relationship between nitrate content per seed and percentage germination. However, nitrate readily leaches out of seeds in the soil, and the endogenous content may be of less ecological significance than the sensitivity of the seed to external nitrate ions. Sensitivity has been shown to change with time through the year in buried seeds.

The hypothesis that the response to nitrate could be used as a mechanism to detect gaps in vegetation has been put forward by Pons. He showed that nitrate levels in gaps in chalk grassland were greater than those under undisturbed vegetation. Disturbance in forest soils can also induce a flush of nitrification. The presence of vegetation is thought to reduce the level of nitrate in the soil because of uptake by the plants, so that an increase in nitrate might often therefore be an indicator of disturbance. Soil nitrate also varies seasonally. Germination peaks in some species have been shown to coincide with high nitrate levels in the soil. For example, on cleared soil plots, Popay & Roberts found that the emergence of Capsella bursa-pastoris and Senecio vulgaris seedlings was related closely to the levels of available nitrate over a nine-month period. However, there does not seem to be a well-defined general pattern of seasonal availability in different soil types, making it perhaps less likely that the nitrate response on its own could be used as a means of ‘season detection’.

In many cases, the germination response to nitrate is highly influenced by (or only occurs in combination with) other environmental factors, especially light and fluctuating temperatures.

Since these three factors (light, temperature fluctuations and nitrate) all change simultaneously when a gap is created in vegetation, a response to all three would form an effective gap-detecting mechanism. The optimum response may be one in which germination is induced only when the appropriate combination of factors occurs. The fact that many weed seeds require light to respond to nitrate has practical consequences for weed control. Nitrate fertilizer added to soils does not generally induce the weed seeds to germinate, probably because so many of the seeds are buried. It has been suggested that germination could be induced (and herbicide applied) if the fertilizer was added after repeated cultivation treatments, thus exposing the seeds to a light stimulus. The physiological mechanism of nitrate detection is unknown, but a neat model incorporating the action of light, temperature and nitrate on germination has been proposed by Hilhorst.

Salinity

Plants living on tidal salt marshes are subjected to a very harsh regime of changing salinities on a twice-daily basis. Sea water contains approximately 3.3% (or 0.56 M) dissolved salts, predominantly NaCl. When the tide recedes, evaporation (especially on sunny days) will result in the soil water near the surface becoming much more concentrated. On wet days, the salinity of the soil water may be diluted by rain. Combined with the mechanical action of the tides in scouring the soil surface, such conditions pose special difficulties for seed germination. Ungar reviews the salt tolerance of a range of species with respect to germination.

Given that the adult plants are well adapted to saline conditions; it is perhaps surprising that the germination of the seeds of the majority of halophyte species is inhibited by salt water. Most germinate to highest percentages in fresh water, with a rapid decline in germination with salinity. This applies both in marine salt marsh and in inland salt desert species. From a review of the literature, Baskin & Baskin list 65 halophytes in which germination has been found to be reduced by salinity. Salinity affects imbibition, germination and root elongation. However, there is a minority of species that show remarkable tolerance. *Zostera marina* will germinate even at full sea-water salinity (c.3.3%) given the appropriate conditions. *Salicornia pacifica* var. *utahensis* show some germination even at 5% salinity. In some species, low concentrations of NaCl (0.25-0.5%) actually enhance germination, e.g. *Salicornia brachiata*. Experiments comparing the response of *Atriplex* species to NaCl versus polyethylene glycol solutions indicate that the influence of NaCl is a combination of an osmotic effect and a specific ion effect.

Because of the inhibitory effects of salinity on seed germination in most halophytes, the timing of germination might be expected to coincide with periods when the soil water was diluted by rain, perhaps accompanied by cooler temperatures, which would reduce evaporation. *Atriplex griffithii* seeds germinate in response to monsoon rains and cool temperatures in the saline deserts in Pakistan. Many temperate salt-marsh species require chilling to overcome dormancy followed by cool temperatures for germination. This would target the timing of germination to early spring. Timing may be particularly important for marine salt-marsh species, as the 'windows of opportunity' for germination may be infrequent and brief, limited to periods of rain between tides at the right time of year. Shumway & Bertness showed that seedling recruitment is in fact relatively rare under natural conditions in a New England salt marsh. In artificially created bare gaps, seed germination was severely limited by high salinities. This was shown by the appearance of a large number of seedlings in gaps that were treated experimentally with fresh water after the tide receded.

Organic compounds

In addition to the inorganic substances that affect germination, seeds are surrounded in the soil by numerous organic compounds generated by decomposition of dead matter or secreted by living organisms. Some of these substances are known to influence seed germination. The agricultural literature records innumerable cases where crop residues have been shown to inhibit germination. In some cases, plants are suspected of actively inhibiting seed germination in their vicinity by producing allelopathic growth inhibitors. Most experimental tests on germination-inhibition by allelopathy involve bioassays of plant extracts on seeds of crop plants. Seeds themselves have been shown in some cases to exude compounds that inhibit neighbouring seeds, e.g. *Carduus nutans* and *Lotus tenuis*. Extracts of many plants inhibit germination in Petri dishes, but the effects tend to wear off in soil, where leaching, adsorption and degradation will reduce the effectiveness of the toxins. Although a number of experiments show allelopathic effects even in soil, it remains true that a convincing, ecologically relevant case of germination-inhibition by allelopathy in a natural ecosystem has yet to be demonstrated unequivocally.

Positive effects on germination by organic compounds are also possible. Seeds of parasitic plants are known to be stimulated by exudates from the roots of their hosts. As the seeds of many parasitic plants are very small, with little internal reserves, they have to germinate close to the root of the host. The relationship between parasite and host is usually highly specific, so the seed has to be able to recognize and respond to a highly specific chemical compound released by the plant. In *Striga hermintheca,* the chemical trigger (from the roots of one of several cereals) results in the production of endogenous ethylene by the seed that initiates germination.

Ethylene itself is a common constituent of the soil atmosphere. It is produced by many types of bacteria and tends to be most concentrated in the rhizosphere. Ethylene has been found to stimulate germination in a minority of species. For example, out of 43 weed species tested by Taylorson, 9 were stimulated, 2 were inhibited, and the rest were unaffected. The ecological significance (if any) of soil ethylene for seed germination in the field is unknown. A synergism between ethylene and nitrate is seen in some species. An ability to respond to both these compounds simultaneously might possibly provide a seed with the means of detecting a flush of microbial activity indicative of newly disturbed soil.

An important aspect of the chemical environment for seed germination in fire-prone habitats is the presence of smoke and other products of combustion. One of the earliest studies to identify the specific effect of smoke as a germination stimulant was the investigation by de Lange & Boucher (1990) on the germination of the South African shrub *Audouinia capitata.* In the following decade, numerous experiments were carried out to see whether a response to smoke was a general phenomenon in communities subject to frequent fires. Many of these studies have been community-based. Three Mediterranean vegetation types (Californian chaparral, South African fynbos and Western Australian bushland) have been found to have numerous species sensitive to smoke, with about half to two-thirds of the species tested showing a positive response. Keeley & Bond make an interesting comparison between the germination behaviour of a wide range of plants in South Africa and California, showing that the response to post-fire chemical cues has arisen independently in distantly related families on two continents. Other studies are taxonomically based, investigating the incidence of the smoke response in a single family or genus. For example, 25 out of 32 species of Restionaceae tested showed a positive response, as did 26 out of 40 species of *Erica* and 7 out of 7 species of *Grevillea*.

The species involved often have a high degree of dependence on smoke as a germination cue. The response is presumed to be a mechanism for controlling the timing of germination by limiting it to post-fire situations when conditions for establishment will be favourable, especially because of the reduction in competition. As the effect of a fire on vegetation is profound (modifying the light, moisture, temperature and chemical environments), it is likely that the presence of smoke is only one of a number of possible cues to which the seeds can respond. Charred wood itself appears to stimulate germination very effectively in many species. Gilmour *et al.* found that although smoke on its own stimulated germination in *Epacris tasmanica,* the most effective response was obtained with a combination of smoke, heat shock and darkness.

The physiological mechanism of the smoke response is unknown, partly because there is no clear indication as to which constituent of the smoke is the active ingredient. The smoke is effective even when cold, or as aqueous extracts or incorporated into fumigated filter paper. Although some smoke-sensitive species respond to nitrate, it is thought not to be the cue in the smoke itself. Keeley & Fotheringham dismiss nitrate as the key substance involved. Some claim that ethylene and fatty acids are responsible; others refute this on the grounds that aqueous smoke extracts can withstand autoclaving without losing activity. Acids generated by burning or oxidizing gases have been put forward. A strong candidate, at least in some species, seems to be nitrogen dioxide. It is entirely possible that different species have different mechanisms and are responding to different chemicals. A study of the anatomy of smoke-sensitive species found that the seed coats tend to have a suite of characteristics including a semi-permeable subdermal membrane that blocks the entry of large molecules. It is postulated that the permeability of this layer may be altered by the smoke.

The significance of smoke as a germination cue for plants is confounded by the finding that the response does not seem to be confined to species from habitats subject to frequent burning. For example, Pierce compared the response of five fire-prone species with five non-fire-prone species in the family Mesembryanthemaceae. They found that germination was stimulated in both groups. This general response of seeds to smoke (or a constituent of it) is confirmed by tests on a range of cool temperate arable weeds in which 12 out of 19 species showed a positive reaction to smoke-water solution. However, other non-fire-prone species are notable for their lack of response, e.g. grassy woodland and forest species in Australia. The most compelling evidence for the significance of the phenomenon in fire-prone communities is the magnitude of the response in some cases. Brown *et al.* report that the germination of *Erica clavisepala* and *Rhodocoma capensis* increased by factors of 81 and 253, respectively, when smoke-treated. *Emmenanthe penduliflora* (with highly dormant seeds) can increase its germination with smoke treatment from 0 to 100%. Brown *et al.* suggest that a ten-fold response would define a group of species for which smoke is likely to be a major factor controlling germination in the field. The indications are that high concentrations of these highly sensitive species are confined largely to fire-prone habitats.

Seedling establishment

Seedling establishment represents the final hurdle in the process of regeneration. The start of the seedling phase may be defined by the completion of germination. In most cases, this is marked by the extrusion of the radicle (root), which anchors the seedling in the soil, followed by the plumule (shoot), which grows towards the light. If the seed is buried, the plumule has to push its way through the soil to the surface, a process that expends energy from the seed’s reserves. In most field experiments, the appearance of the shoot at the soil surface (emergence) is the first sign that germination has taken place and is usually taken as the starting point in demographic studies. However, although it is seldom measured, mortality between germination and emergence is probably quite high, especially if the seeds are emerging from any depth. The emerging seedling faces a new set of hazards. Whereas a lack of light, water or nutrient has little or no effect on seed survival, these become major causes of death in seedlings. The predators and pathogens that menaced the seed are replaced by a different set at the seedling stage.

Early growth of seedlings

The term 'seedling' is used very loosely in the literature to cover young plants generally, and it is seldom defined strictly, even within the contexts of individual studies. The main problem is defining the end point: when does a seedling cease to be seedling? There are various possible answers, but all of them either are arbitrary or present practical difficulties:

- The point at which the cotyledons (or endosperm) cease to lose weight.
- The point at which independent survival is possible, even if the cotyledons (or endosperm) are removed.
- The point at which an agreed percentage (e.g. 90%) of the stored N (or P, K, Mg, etc.) has been translocated to the embryo.
- The point at which the seedling dry weight achieves a fixed multiple (e.g. 10 or 100) of the embryo dry weight.
- The point at which maximum daily relative growth rate (RGR_{max}) is attained following germination (see below).

It would be very useful to know whether there is a general relationship between any of these measures that applies to a wide range of species. For example, does attainment of RGRmax after germination generally occur at a time when the seedling has attained a particular multiple of the embryo weight? Is independent survival possible only when a given proportion of a particular stored element has been used up? If a wide range of different species were shown to behave in a similar way, then a reasonably objective definition could probably be arrived at. However, the different functions of photosynthetic and non-photosynthetic cotyledons would have to be considered. A provisional definition of a seedling might be 'a young plant that is still using (though not necessarily dependent on) its carbon or mineral seed reserves'.

One of the main difficulties in defining the transition point from seedling to juvenile is the fact that transference of dependence from internal to external resources is gradual, with no distinct cut-off point. The best method for defining the end point of the seedling phase may lie, therefore, in identifying a recognizable turning point in early seedling growth. Hunt *et al.* showed that the daily change in relative growth rate of newly germinated seedlings of *Holcus lanatus* follows a bell-shaped curve; similar curves have been obtained for peas and sunflowers by Hanley *et al.*. If this pattern of early growth is universal, then it suggests that the attainment of the peak in RGR provides an identifiable event in seedling growth that could be used to define the end of the seedling phase. In Hanley *et* al.'s experiments, the timing of the peak in the RGR curve broadly coincided with the termination of dependence on the cotyledons and the exhaustion of the seed reserves.

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по научным специальностям:

4.1.1. Общее земледелие и растениеводство

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