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رؤية الكلية

كمية التربية بالغردقة مؤسسة رائدة محليا ودولياً فى مجالات التعليم ،والبحث العلمي ،وخدمة المجتمع ، بما يؤهلها للمنافسة على المستوى : المحلي ، و الإقليمي ، و العالمي

رسالة الكلية

تقديم تعميم مميز في مجالات العلوم الأساسية و إنتاج بحوث علمية تطبيقية للمساهمة فى التنمية المستدامة من خلال إعداد خريجين متميزين طبقا للمعايير الأكاديمية القومية، و تطوير مهارات و قدرات الموارد البشرية، و توفير خدمات مجتمعية وبيئية تلبي طموحات مجتمع جنوب الوادي، و بناء الشراكات المجتمعية الفاعلة.

What is Translation?

Translation is the interpreting of the meaning of a text and the subsequent production of an equivalent text, likewise called a "translation," that communicates the same message in another language. The text to be translated is called the source text, and the language that it is to be translated into is called the target language; the final product is sometimes called the target text.

Translation must take into account constraints that include context, the rules of grammar of the two languages, their writing conventions, and their idioms. A common misconception is that there exists a simple word-for-word correspondence between any two languages, and that translation is a straightforward mechanical process; such a word-for-word translation, however, cannot take into account context, grammar, conventions, and idioms.

Translation, when practiced by relatively bilingual individuals but especially when by persons with limited proficiency in one or both languages, involves a risk of spilling-over of idioms and usages from the source language into the target language. On the other hand, inter-linguistic spillages have also served the useful purpose of importing calques and loanwords from a source language into a target language that had previously lacked a concept or a convenient expression for the concept. Translators and interpreters, professional as well as amateur, have thus played an important role in the evolution of languages and cultures.

The art of translation is as old as written literature. Parts of the Sumerian *Epic of Gilgamesh*, among the oldest known literary works, have been found in translations into several Asiatic languages of the second millennium BCE. The *Epic of Gilgamesh* may have been read, in their own languages, by early authors of the *Bible* and of the *Iliad*.

With the advent of computers, attempts have been made to computerize or otherwise automate the translation of natural-language texts (machine translation) or to use computers as an *aid* to translation (computer-assisted translation).

The Term:

Etymologically, *translation* is a "carrying across" or "bringing across". The Latin *translatio* derives from the perfect passive participle, *translatum*, of *transferre* ("to transfer" – from *trans*, "across" + *ferre*, "to carry" or "to bring"). The modern Romance, Germanic and Slavic European languages have generally formed their own equivalent terms for this concept after the Latin model – after *transferre* or after the kindred *traducere* ("to bring across" or "to lead across").

Additionally, the Ancient Greek term for "translation", μετάφρασις (*metaphrasis*, "a speaking across"), has supplied English with *metaphrase* (a "literal translation", or "word-for-

word" translation)—as contrasted with *paraphrase* ("a saying in other words", from the Greek παράφρασις, *paraphrasis*"). *Metaphrase* corresponds, in one of the more recent terminologies, to "formal equivalence", and *paraphrase* to "dynamic equivalence."

A widely recognized icon for the practice and historic role of translation is the Rosetta Stone, which in the United States is incorporated into the crest of the Defense Language Institute.

Misconceptions:

Newcomers to translation sometimes proceed as if translation were an exact science – as if consistent, one-to-one correlations existed between the words and phrases of different languages, rendering translations fixed and identically reproducible, much as in cryptography. Such novices may assume that all that is needed to translate a text is to encode and

decode equivalents between the two languages, using a translation dictionary as the "codebook".

On the contrary, such a fixed relationship would only exist were a new language synthesized and simultaneously matched to a pre-existing language's scopes of meaning, etymologies, and lexical ecological niches. If the new language were subsequently to take on a life apart from such cryptographic use, each word would spontaneously begin to assume new shades of meaning and cast off previous associations, thereby vitiating any such artificial synchronization. Henceforth translation would require the disciplines described in this article.

Another common misconception is that *anyone* who can speak a second language will make a good translator. In the translation community, it is generally accepted that the best translations are produced by persons who are translating into their own native languages, as it is rare for someone who has learned a second language to have total fluency in that language.

A good translator understands the source language well, has specific experience in the subject matter of the text, and is a good writer in the target language. Moreover, he is not only bilingual but bicultural.

It has been debated whether translation is art or craft. Literary translators, such as Gregory Rabassa in *If This Be Treason*, argue that translation is an art – a teachable one. Other translators, mostly technical, commercial, and legal, regard their *métier* as a craft – again, a teachable one, subject to linguistic analysis, that benefits from academic study.

As with other human activities, the distinction between art and craft may be largely a matter of degree. Even a document which appears simple, e.g. a product brochure, requires a certain level of linguistic skill that goes beyond mere technical terminology. Any material used for marketing purposes reflects on the company that produces the product and the brochure. The

best translations are obtained through the combined application of good technical-terminology skills and good writing skills.

Translation has served as a writing school for many prominent writers. Translators, including monks who spread Buddhist texts in East Asia and the early modern European translators of the Bible, in the course of their work have shaped the very languages into which they have translated. They have acted as bridges for conveying knowledge and ideas between cultures and civilizations. Along with ideas, they have imported, into their own languages, loanwords and calques of grammatical structures, idioms and vocabulary from the source languages.

Fidelity vs. Transparency:

Fidelity (or *faithfulness*) and transparency are two qualities that, for millennia, have been regarded as ideals to be striven for in translation, particularly literary translation. These two ideals are often at odds. Thus a 17th-century French critic coined the

phrase *les belles infidèles* to suggest that translations, like women, could be *either* faithful *or* beautiful, but not both at the same time.

Fidelity pertains to the extent to which a translation accurately renders the meaning of the source text, without adding to or subtracting from it, without intensifying or weakening any part of the meaning, and otherwise without distorting it.

Transparency pertains to the extent to which a translation appears to a native speaker of the target language to have originally been written in that language, and conforms to the language's grammatical, syntactic and idiomatic conventions.

A translation that meets the first criterion is said to be a "faithful translation"; a translation that meets the second criterion, an "idiomatic translation". The two qualities are not necessarily mutually exclusive.

The criteria used to judge the faithfulness of a translation vary according to the subject, the precision of the original contents, the type, function and use of the text, its literary qualities, its social or historical context, and so forth.

The criteria for judging the transparency of a translation appear more straightforward: an unidiomatic translation "sounds wrong", and in the extreme case of word-for-word translations generated by many machine-translation systems, often results in patent nonsense with only a humorous value.

Nevertheless, in certain contexts a translator may consciously strive to produce a literal translation. Literary translators and translators of religious or historic texts often adhere as closely as possible to the source text. In doing so, they often deliberately stretch the boundaries of the target language to produce an unidiomatic text. Similarly, a literary translator may wish to adopt words or expressions from the source language in order to provide "local color" in the translation.

In recent decades, prominent advocates of such "non-transparent" translation have included the French scholar Antoine Berman, who identified twelve deforming tendencies inherent in most prose translations, and the American theorist Lawrence Venuti, who has called upon translators to apply "foreignizing" translation strategies instead of domesticating ones.

Many non-transparent-translation theories draw on concepts from German Romanticism, the most obvious influence on latter-day theories of "foreignization" being the German theologian and philosopher Friedrich Schleiermacher. In his seminal lecture "On the Different Methods of Translation" (1813) he distinguished between translation methods that move "the writer toward [the reader]", i.e., transparency, and those that move the "reader toward [the author]", i.e., an extreme fidelity to the foreignness of the source text. Schleiermacher clearly favored the latter approach. His preference was motivated, however, not so much by a desire to embrace the foreign, as by a nationalist

desire to oppose France's cultural domination and to promote German literature.

For the most part, current Western practices in translation are dominated by the concepts of "fidelity" and "transparency". This has not always been the case. There have been periods, especially in pre-Classical Rome and in the 18th century, when many translators stepped beyond the bounds of translation proper into the realm of "adaptation".

Adapted translation retains currency in some non-Western traditions. Thus the Indian epic, the *Ramayana*, appears in many versions in the various Indian languages, and the stories are different in each. Anyone considering the words used for translating into the Indian languages, whether those be Aryan or Dravidian languages, will be struck by the freedom that is granted to the translators. This may relate to a devotion to prophetic passages that strike a deep religious chord, or to a vocation to instruct unbelievers. Similar examples are to be

found in medieval Christian literature, which adjusted the text to the customs and values of the audience.

Equivalence:

The question of fidelity vs. transparency has also been formulated in terms of, respectively, "*formal* equivalence" and "*dynamic* equivalence". The latter two expressions are associated with the translator Eugene Nida and were originally coined to describe ways of translating the *Bible*, but the two approaches are applicable to any translation.

"Formal equivalence" corresponds to "metaphrase", and "dynamic equivalence" to "paraphrase". "Dynamic equivalence" (or "*functional* equivalence") conveys the essential *thought* expressed in a source text – if necessary, at the expense of literality, original sememe and word order, the source text's active vs. passive voice, etc.

By contrast, "formal equivalence" (sought via "literal" translation) attempts to render the text literally, or "word for word" (the latter expression being itself a word-for-word rendering of the classical Latin *verbum pro verbo*) – if necessary, at the expense of features natural to the target language.

There is, however, no sharp boundary between dynamic and formal equivalence. On the contrary, they represent a spectrum of translation approaches. Each is used at various times and in various contexts by the same translator, and at various points within the same text – sometimes simultaneously. Competent translation entails the judicious blending of dynamic and formal equivalents.

Back-translation:

A **back-translation** is a translation of a translated text back into the language of the original text, made without reference to the original text. In the context of machine

translation, this is also called a *round-trip translation*. It is analogous to reversing a mathematical operation; but even in mathematics such a reversal frequently does not produce a value that is precisely identical with the original.

Comparison of a back-translation to the original text is sometimes used as a quality check on the original translation. But while useful as an approximate check, it is far from infallible. Humorously telling evidence for this was provided by Mark Twain when he issued his own back-translation of a French version of his famous short story, "The Celebrated Jumping Frog of Calaveras County".

In cases when a historic document survives only in translation, the original having been lost, researchers sometimes undertake back-translation in an effort to reconstruct the original text. An example involves the novel *The Saragossa Manuscript* by the Polish aristocrat Jan Potocki (1761–1815). The polymath polyglot composed the book entirely in French and published

fragments anonymously in 1804 and 1813–14. Portions of the original French-language manuscripts were subsequently lost; the missing fragments survived, however, in a Polish translation that was made by Edmund Chojecki in 1847 from a complete French copy, now lost. French-language versions of the complete *Saragossa Manuscript* have since been produced, based on extant French-language fragments and on French-language versions that have been back-translated from Chojecki's Polish version.

Similarly, when historians suspect that a document is actually a translation from another language, back-translation into that hypothetical original language can provide supporting evidence by showing that such characteristics as idioms, puns, peculiar grammatical structures, etc., are in fact derived from the original language.

For example, the known text of the *Till Eulenspiegel* folk tales is in High German but contains many puns which only work if back-translated into Low German. This seems clear evidence

that these tales (or at least large portions of them) were originally composed in Low German and rendered into High German by an over-metaphrastic translator.

Similarly, supporters of Aramaic primacy – i.e., of the view that the Christian New Testament or its sources were originally written in the Aramaic language – seek to prove their case by showing that difficult passages in the existing Greek text of the New Testament make much better sense if back-translated into Aramaic – that, for example, some incomprehensible references are in fact Aramaic puns which do not work in Greek.

Literary Translation:

Translation of literary works (novels, short stories, plays, poems, etc.) is considered a literary pursuit in its own right. Notable in Canadian literature *specifically* as translators are figures such as Sheila Fischman, Robert Dickson and Linda Gaboriau, and the Governor General's Awards annually present

prizes for the best English-to-French and French-to-English literary translations.

Other writers, among many who have made a name for themselves as literary translators, include Vasily Zhukovsky, Tadeusz Boy-Żeleński, Vladimir Nabokov, Jorge Luis Borges, Robert Stiller and Haruki Murakami.

History:

The first important translation in the West was that of the Septuagint, a collection of Jewish Scriptures translated into Koine Greek in Alexandria between the 3rd and 1st centuries BCE. The dispersed Jews had forgotten their ancestral language and needed Greek versions (translations) of their Scriptures.

Throughout the Middle Ages, Latin was the *lingua franca* of the western learned world. The 9th -century Alfred the Great, king of Wessex in England, was far ahead of his time in commissioning vernacular Anglo-Saxon translations of Bede's

Ecclesiastical History and Boethius' *Consolation of Philosophy*. Meanwhile the Christian Church frowned on even partial adaptations of the standard Latin *Bible*, St. Jerome's *Vulgate* of ca. 384 CE.

In Asia, the spread of Buddhism led to large-scale ongoing translation efforts spanning well over a thousand years. The Tangut Empire was especially efficient in such efforts; exploiting the then newly-invented block printing, and with the full support of the government (contemporary sources describe the Emperor and his mother personally contributing to the translation effort, alongside sages of various nationalities), the Tanguts took mere decades to translate volumes that had taken the Chinese centuries to render.

Large-scale efforts at translation were undertaken by the Arabs. Having conquered the Greek world, they made Arabic versions of its philosophical and scientific works. During the Middle Ages, some translations of these Arabic versions were

made into Latin, chiefly at Córdoba in Spain. Such Latin translations of Greek and original Arab works of scholarship and science helped advance the development of European Scholasticism.

The broad historic trends in Western translation practice may be illustrated on the example of translation into the English language.

The first fine translations into English were made by England's first great poet, the 14th-century Geoffrey Chaucer, who adapted from the Italian of Giovanni Boccaccio in his own *Knight's Tale* and *Troilus and Criseyde*; began a translation of the French-language *Roman de la Rose*; and completed a translation of Boethius from the Latin. Chaucer founded an English poetic tradition on *adaptations* and translations from those earlier-established literary languages.

The first great English translation was the *Wycliffe Bible* (ca. 1382), which showed the weaknesses of an underdeveloped English prose. Only at the end of the 15th century did the great age of English prose translation begin with Thomas Malory's *Le Morte Darthur* – an adaptation of Arthurian romances so free that it can, in fact, hardly be called a true translation. The first great Tudor translations are, accordingly, the *Tyndale New Testament* (1525), which influenced the *Authorized Version* (1611), and Lord Berners' version of Jean Froissart's *Chronicles* (1523–25).

Meanwhile, in Renaissance Italy, a new period in the history of translation had opened in Florence with the arrival, at the court of Cosimo de' Medici, of the Byzantine scholar Georgius Gemistus Pletho shortly before the fall of Constantinople to the Turks (1453). A Latin translation of Plato's works was undertaken by Marsilio Ficino. This and Erasmus' Latin edition of the *New Testament* led to a new attitude to

translation. For the first time, readers demanded rigor of rendering, as philosophical and religious beliefs depended on the exact words of Plato, Aristotle and Jesus.

Non-scholarly literature, however, continued to rely on *adaptation*. France's *Pléiade*, England's Tudor poets, and the Elizabethan translators adapted themes by Horace, Ovid, Petrarch and modern Latin writers, forming a new poetic style on those models. The English poets and translators sought to supply a new public, created by the rise of a middle class and the development of printing, with works such as the original authors *would have written*, had they been writing in England in that day.

The Elizabethan period of translation saw considerable progress beyond mere paraphrase toward an ideal of stylistic equivalence, but even to the end of this period – which actually reached to the middle of the 17th century – there was no concern for verbal accuracy.

In the second half of the 17th century, the poet John Dryden sought to make Virgil speak "in words such as he would probably have written if he were living and an Englishman". Dryden, however, discerned no need to emulate the Roman poet's subtlety and concision. Similarly, Homer suffered from Alexander Pope's endeavor to reduce the Greek poet's "wild paradise" to order.

Throughout the 18th century, the watchword of translators was ease of reading. Whatever they did not understand in a text, or thought might bore readers, they omitted. They cheerfully assumed that their own style of expression was the best, and that texts should be made to conform to it in translation. For scholarship they cared no more than had their predecessors, and they did not shrink from making translations from translations in third languages, or from languages that they hardly knew, or – as in the case of James Macpherson's "translations" of Ossian –

from texts that were actually of the "translator's" own composition.

The 19th century brought new standards of accuracy and style. In regard to accuracy, observes J.M. Cohen, the policy became "the text, the whole text, and nothing but the text", except for any bawdy passages and the addition of copious explanatory footnotes. In regard to style, the Victorians' aim, achieved through far-reaching metaphrase (literality) or *pseudo*-metaphrase, was to constantly remind readers that they were reading a *foreign* classic. An exception was the outstanding translation in this period, Edward FitzGerald's *Rubaiyat* of Omar Khayyam (1859), which achieved its Oriental flavor largely by using Persian names and discreet Biblical echoes and actually drew little of its material from the Persian original.

In advance of the 20th century, a new pattern was set in 1871 by Benjamin Jowett, who translated Plato into simple, straightforward language. Jowett's example was not followed,

however, until well into the new century, when accuracy rather than style became the principal criterion.

Poetry:

Poetry presents special challenges to translators, given the importance of a text's formal aspects, in addition to its content. In his influential 1959 paper "On Linguistic Aspects of Translation", the Russian-born linguist and semiotician Roman Jakobson went so far as to declare that "poetry by definition [is] untranslatable".

In 1974 the American poet James Merrill wrote a poem, "Lost in Translation", which in part explores this idea. The question was also discussed in Douglas Hofstadter's 1997 book, *Le Ton beau de Marot*; he argues that a good translation of a poem must convey as much as possible not only of its literal meaning, but of its form and structure (meter, rhyme or alliteration scheme, etc.).

Sung Texts:

Translation of a text that is sung in vocal music for the purpose of singing in another language – sometimes called "singing translation" – is closely linked to translation of poetry because most vocal music, at least in the Western tradition, is set to verse, especially verse in regular patterns with rhyme. (Since the late 19th century, musical setting of prose and free verse has also been practiced in some art music, though popular music tends to remain conservative in its retention of stanzaic forms with or without refrains.) A rudimentary example of translating poetry for singing is church hymns, such as the German chorales translated into English by Catherine Winkworth.

Translation of sung texts is generally much more restrictive than translation of poetry, because in the former there is little or no freedom to choose between a versified translation and a translation that dispenses with verse structure. One might modify or omit rhyme in a singing translation, but the assignment

of syllables to specific notes in the original musical setting places great challenges on the translator. There is the option in prose sung texts, less so in verse, of adding or deleting a syllable here and there by subdividing or combining notes, respectively, but even with prose the process is almost like strict verse translation because of the need to stick as closely as possible to the original prosody of the sung melodic line.

Other considerations in writing a singing translation include repetition of words and phrases, the placement of rests and/or punctuation, the quality of vowels sung on high notes, and rhythmic features of the vocal line that may be more natural to the original language than to the target language. A sung translation may be considerably or completely different from the original, thus resulting in a contrafactum.

Translations of sung texts – whether of the above type meant to be sung or of a more or less literal type meant to be read – are also used as aids to audiences, singers and conductors,

when a work is being sung in a language not known to them. The most familiar types are translations presented as subtitles projected during opera performances, those inserted into concert programs, and those that accompany commercial audio CDs of vocal music. In addition, professional and amateur singers often sing works in languages they do not know (or do not know well), and translations are then used to enable them to understand the meaning of the words they are singing.

History of Theory:

Discussions of the theory and practice of translation reach back into antiquity and show remarkable continuities. The distinction that had been drawn by the ancient Greeks between *metaphrase* ("literal" translation) and *paraphrase* was adopted by the English poet and translator John Dryden (1631-1700), who represented translation as the judicious blending of these two modes of phrasing when selecting, in the target language,

"counterparts", or equivalents, for the expressions used in the source language:

When [words] appear ... literally graceful, it were an injury to the author that they should be changed. But since ... what is beautiful in one [language] is often barbarous, nay sometimes nonsense, in another, it would be unreasonable to limit a translator to the narrow compass of his author's words: 'tis enough if he chooses out some expression which does not vitiate the sense.

Dryden cautioned, however, against the license of "imitation", i.e. of adapted translation: "When a painter copies from the life... he has no privilege to alter features and lineaments..."

This general formulation of the central concept of translation – equivalence – is probably as adequate as any that has been proposed ever since Cicero and Horace, in first-century-

BCE Rome, famously and literally cautioned against translating "word for word" (*verbum pro verbo*).

Despite occasional theoretical diversities, the actual *practice* of translators has hardly changed since antiquity. Except for some extreme metaphrasers in the early Christian period and the Middle Ages, and adapters in various periods (especially pre-Classical Rome, and the 18th century), translators have generally shown prudent flexibility in seeking equivalents – "literal" where possible, paraphrastic where necessary – for the original meaning and other crucial "values" (e.g., style, verse form, concordance with musical accompaniment or, in films, with speech articulatory movements) as determined from context.

In general, translators have sought to preserve the context itself by reproducing the original order of sememes, and hence word order — when necessary, reinterpreting the actual grammatical structure. The grammatical differences between "fixed-word-order" languages (e.g., English, French, German)

and "free-word-order" languages (e.g., Greek, Latin, Polish, Russian) have been no impediment in this regard.

When a target language has lacked terms that are found in a source language, translators have borrowed them, thereby enriching the target language. Thanks in great measure to the exchange of calques and loanwords between languages, and to their importation from other languages, there are few concepts that are "untranslatable" among the modern European languages.

In general, the greater the contact and exchange that has existed between two languages, or between both and a third one, the greater is the ratio of metaphrase to paraphrase that may be used in translating between them. However, due to shifts in "ecological niches" of words, a common etymology is sometimes misleading as a guide to current meaning in one or the other language. The English *actual*, for example, should not be confused with the cognate French *actuel* (meaning "present",

"current"), the Polish *aktualny* ("present", "current") or the Russian *актуальный* ("urgent, topical").

The translator's role as a bridge for "carrying across" values between cultures has been discussed at least since Terence, Roman adapter of Greek comedies, in the second century BCE. The translator's role is, however, by no means a passive and mechanical one, and so has also been compared to that of an artist. The main ground seems to be the concept of parallel creation found in critics as early as Cicero. Dryden observed that "Translation is a type of drawing after life ..." Comparison of the translator with a musician or actor goes back at least to Samuel Johnson's remark about Alexander Pope playing Homer on a flageolet, while Homer himself used a bassoon.

If translation be an art, it is no easy one. In the 13th century, Roger Bacon wrote that if a translation is to be true, the translator must know both languages, as well as the science that

he is to translate; and finding that few translators did, he wanted to do away with translation and translators altogether.

The first European to assume that one translates satisfactorily only toward his own language may have been Martin Luther, translator of the Bible into German. According to L.G. Kelly, since Johann Gottfried Herder in the 18th century, "it has been axiomatic" that one works only toward his own language.

Compounding these demands upon the translator is the fact that not even the most complete dictionary or thesaurus can ever be a fully adequate guide in translation. Alexander Tytler, in his *Essay on the Principles of Translation* (1790), emphasized that assiduous reading is a more comprehensive guide to a language than are dictionaries. The same point, but also including listening to the spoken language, had earlier been made in 1783 by Onufry Andrzej Kopczyński, member of Poland's Society for Elementary Books, who was called "the last Latin poet".

The special role of the translator in society is aptly described in an essay that was published posthumously in 1803 and that had been written by Ignacy Krasicki – "Poland's La Fontaine", Primate of Poland, poet, encyclopedist, author of the first Polish novel, and translator from French and Greek:

> Translation... is in fact an art both estimable and very difficult, and therefore is not the labor and portion of common minds; [it] should be [practiced] by those who are themselves capable of being actors, when they see greater use in translating the works of others than in their own works, and hold higher than their own glory the service that they render to their country.

Religious Texts:

Translation of religious works has played an important role in history. Buddhist monks who translated the Indian sutras into Chinese often skewed their translations to better reflect China's very different culture, emphasizing notions such as filial piety.

A famous mistranslation of the *Bible* is the rendering of the Hebrew word קֶרֶן (*keren*), which has several meanings, as "horn" in a context where it actually means "beam of light". As a result, artists have for centuries depicted Moses the Lawgiver with horns growing out of his forehead. An example is Michelangelo's famous sculpture. Some Christians with anti-Semitic feelings used such depictions to spread hatred of the Jews, claiming that they were devils with horns.

One of the first recorded instances of translation in the West was the rendering of the Old Testament into Greek in the third century B.C.E. The resulting translation is known as the *Septuagint*, a name that alludes to the seventy translators (seventy-two in some versions) who were commissioned to translate the Bible in Alexandria. Each translator worked in solitary confinement in a separate cell, and legend has it that all seventy versions were identical. The *Septuagint* became the

source text for later translations into many languages, including Latin, Coptic, Armenian and Georgian.

Saint Jerome, the patron saint of translation, is still considered one of the greatest translators in history for rendering the *Bible* into Latin. The Roman Catholic Church used his translation (known as the Vulgate) for centuries, but even this translation at first stirred much controversy.

The period preceding and contemporary with the Protestant Reformation saw the translation of the *Bible* into local European languages, a development that greatly affected Western Christianity's split into Roman Catholicism and Protestantism, due to disparities between Catholic and Protestant versions of crucial words and passages.

Martin Luther's *Bible* in German, Jakub Wujek's in Polish, and the *King James Bible* in English had lasting effects on the religions, cultures and languages of those countries.

Machine Translation:

Machine translation (MT) is a procedure whereby a computer program analyzes a source text and produces a target text *without further human intervention*. In reality, however, machine translation typically *does* involve human intervention, in the form of **pre-editing** and **post-editing**. An exception to that rule might be, e.g., the translation of technical specifications (strings of technical terms and adjectives), using a dictionary-based machine-translation system.

To date, machine translation—a major goal of natural-language processing—has met with limited success. A November 6, 2007, example illustrates the hazards of uncritical reliance on machine translation.

Machine translation has been brought to a large public by tools available on the Internet, such as Yahoo!'s Babel Fish, Babylon, and StarDict. These tools produce a "gisting

translation" — a rough translation that, with luck, "gives the gist" of the source text.

With proper terminology work, with preparation of the source text for machine translation (pre-editing), and with re-working of the machine translation by a professional human translator (post-editing), commercial machine-translation tools can produce useful results, especially if the machine-translation system is integrated with a translation-memory or globalization-management system.

In regard to texts with limited ranges of vocabulary and simple sentence structure (e.g., weather reports), machine translation can deliver results that do not require much human intervention to be useful. Also, the use of a controlled language, combined with a machine-translation tool, will typically generate largely comprehensible translations.

Relying exclusively on unedited machine translation ignores the fact that communication in human language is context-embedded and that it takes a person to comprehend the context of the original text with a reasonable degree of probability. It is certainly true that even purely human-generated translations are prone to error. Therefore, to ensure that a machine-generated translation will be useful to a human being and that publishable-quality translation is achieved, such translations must be reviewed and edited by a human. The late Claude Piron wrote that machine translation, at its best, automates the easier part of a translator's job; the harder and more time-consuming part usually involves doing extensive research to resolve ambiguities in the source text, which the grammatical and lexical exigencies of the target language require to be resolved. Such research is a necessary prelude to the pre-editing necessary in order to provide input for machine-translation software such that the output will not be meaningless.

Computer-Assisted Translation (CAT):

Computer-assisted translation (CAT), also called "computer-*aided* translation", "machine-aided human translation (MAHT)" and "interactive translation", is a form of translation wherein a human translator creates a target text with the assistance of a computer program. The **machine** supports a human **translator**.

Computer-assisted translation can include standard dictionary and grammar software. The term, however, normally refers to a range of specialized programs available to the translator, including translation-memory, terminology-management, concordance, and alignment programs.

With the internet, translation software can help non-native-speaking individuals understand web pages published in other languages. Whole-page translation tools are of limited utility, however, since they offer only a limited potential understanding

of the original author's intent and context; translated pages tend to be more humorous and confusing than enlightening.

Interactive translations with pop-up windows are becoming more popular. These tools show several possible translations of each word or phrase. Human operators merely need to select the correct translation as the mouse glides over the foreign-language text. Possible definitions can be grouped by pronunciation.

References:

- Balcerzan, Edward, ed., *Pisarze polscy o sztuce przekładu, 1440-1974: Antologia* (Polish Writers on the Art of Translation, 1440-1974: an Anthology), Poznań, Wydawnictwo Poznańskie, 1977.

- Berman, Antoine (1984). "L'épreuve de l'étranger". Excerpted in English in: Venuti, Lawrence, editor (2002, 2nd edition 2004). *The Translation Studies Reader*.

- Cohen, J.M., "Translation", *Encyclopedia Americana*, 1986, vol. 27, pp. 12–15.

- Darwish, Ali (1999). "Towards a Theory of Constraints in Translation". (@turjuman Online).

- Galassi, Jonathan *et al.*, "*Como Conversazione*: On Translation", *The Paris Review*, 2000, no. 155, pp. 255–312, ISSN 0031-2037. Poets and critics Seamus Heaney, Charles Tomlinson, Tim Parks and others discuss the theory and practice of translation.

- John Barron, *MiG Pilot: The Final Escape of Lieutenant Belenko,* New York, McGraw-Hill, 1980, ISBN 0070038503.

- Kasparek, Christopher, "The Translator's Endless Toil", *The Polish Review*, vol. XXVIII, no. 2, 1983, pp. 83–87. Includes a discussion of European-language cognates of the term, "translation".

- Kelly, L.G. (1979). *The True Interpreter: a History of Translation Theory and Practice in the West*. New York, St. Martin's Press. ISBN 0-312-82057-7.

- Miłosz, Czesław, *The History of Polish Literature*, 2nd ed., Berkeley, University of California Press, 1983, ISBN 0-520-04477-0.

- Muegge, Uwe (2005). *Translation Contract: A Standards-Based Model Solution*. AuthorHouse. ISBN 1-4184-1636-3.

- Parks, Tim, *Translating Style: A Literary Approach to Translation—A Translation Approach to Literature*, Manchester, St. Jerome, 2007, ISBN 1-905763-04-2.

- Piron, Claude, *Le défi des langues — Du gâchis au bon sens* (The Language Challenge: From Chaos to Common Sense), Paris, L'Harmattan, 1994.

- Rose, Marilyn Gaddis, guest editor (1980). *Translation: agent of communication*. (A special issue of *Pacific Moana Quarterly*, 5:1)

- Schleiermacher, Friedrich, "Über die verschiedenen Methoden des Übersetzens" (1813), reprinted as "On the Different Methods of Translating" in Lawrence Venuti, editor (2002, 2nd edition 2004), *The Translation Studies Reader*.

- Simms, Norman, editor (1983). *Nimrod's Sin: Treason and Translation in a Multilingual World*.

- Tatarkiewicz, Władysław, *A History of Six Ideas: an Essay in Aesthetics*, translated from Polish by Christopher Kasparek, The Hague, Martinus Nijhoff, 1980, ISBN 83-01-00824-5.

- Venuti, Lawrence (1994). *The Translator's Invisibility*. Routledge. ISBN 0-415-11538-8.

What is Interpretation?

Interpretion vs. Translation:

Despite being used interchangeably, *interpretation* and *translation* are not synonymous, but refer, respectively, to the spoken and written transference of meaning between two languages. Interpreting, or *interpretation*, is the intellectual activity that consists of facilitating oral or sign-language communication, either simultaneously or consecutively, between two or among three or more speakers who are not speaking, or signing, the same language. Interpreting, or *interpretation*, occurs in real time, in the presence – physical, televised, or telephonic – of the parties for whom the interpreter renders an interpretation.

The words *interpreting* and *interpretation* both can be used to refer to this activity; the word *interpreting* is commonly used in the profession and in the translation-studies field to avoid confusion with other meanings of the word *interpretation*.

Translation is the transference of meaning from *text to text* (written or recorded), with the translator having time and access to resources (dictionaries, glossaries, etc.) to produce a faithful, true, and accurate document or verbal artifact.

A very common, layman's misconception of interpretation is that it is rendered *verbatim*, that is, as a word-for-word syntactic translation of an utterance. That is impractical, because a literal, verbatim interpretation of a source-language message would be unintelligible to the target-language recipient. For example, the Spanish phrase: *Está de viaje*, rendered verbatim to English translates as: *Is of voyage* (senseless in English), yet its faithful, true, and accurate denotational and connotational interpretations *in context* are: 'He/She/You is/are travelling' or 'He/She/You is/are out of town'. That is, the overall meaning, tone, and style *in the target language* are what matter, rather than the source-language syntax.

Interpretation is also held to a different standard of accuracy than translation. Translators have time to consider and revise each word and sentence before delivering their product to the client. While interpreters try to achieve total accuracy at all times, details of the original (source) speech can be omitted from the interpretation into the target language, without a pause. Conversely, in signed languages, when a word is used for which their is no sign, expansion may be necessary in order to accurately interpret the message and give the recipient the same message as those who are hearing it from the speaker.

The trained professional simultaneous interpreter, however, never omits original source language; rather, s/he learns to provide the same information in the target language. For example, when interpreting English to Spanish, s/he may shorten the interpretation rendered with gender specific usage and reflexive pronouns not used in English.

In court interpretation, it is not acceptable to omit anything from the source, no matter how fast the source speaks, since not only is accuracy a principal canon for interpreters, but mandatory. The most important factor for this level of accuracy is the use of a team of two or more interpreters during a lengthy process, with one actively interpreting and the second monitoring for greater accuracy. Speakers at interpreted meetings can ensure better communication of their message into other languages by slowing their delivery slightly and by adding a pause of one or two seconds at the end of each paragraph, although in practice, interpreters have to deal with difficulties such as the speaker speaking too fast, background noise, or other constraints.

Modes of Interpreting:

1. Simultaneous Interpreting:

In simultaneous interpretation (SI), the interpreter renders the message in the target-language as quickly as he or she can formulate it from the source language, while the source-language

speaker continuously speaks; a spoken language SI interpreter, sitting in a sound-proof booth, speaks into a microphone, while clearly seeing and hearing the source-language speaker via earphones. The simultaneous interpretation is rendered to the target-language listeners via their earphones. Moreover, SI is the common mode used by sign language interpreters, although the person using the source language, the interpreter and the target language recipient must necessarily be in close proximity.

2. Consecutive Interpreting:

In consecutive interpreting (CI), the interpreter speaks after the source-language speaker has finished speaking. The speech is divided into segments, and the interpreter sits or stands beside the source-language speaker, listening and taking notes as the speaker progresses through the message. When the speaker pauses or finishes speaking, the interpreter then renders a portion of the message or the entire message in the target language.

3. Whispered Interpreting:

In whispered interpreting, the interpreter sits or stands next to the small target-language audience whilst whispering a simultaneous interpretation of the matter to hand; this method requires no equipment, but may be done via a microphone and headphones if the participants prefer. Chuchotage is used in circumstances where the majority of a group speaks the source language, and a minority (ideally no more than three persons) do not speak it.

4. Relay Interpreting:

Relay interpreting occurs when several languages are the target-language. A source-language interpreter renders the message to a language common to every interpreter, who then renders the message to his or her specific target language. For example, a Japanese source message first is rendered to English to a group of interpreters, then it is rendered to Arabic, French, and Russian, the other target languages.

5. Liaison Interpreting:

Liaison interpreting is a form of consecutive interpreting, which is to some extent the most personal and informal type of interpreting. It is used principally for small groups or meetings (e.g. a business meeting between two executives. Aside from notes taken at the time, no equipment is used. Liaison interpreting is useful for small groups or meetings, one-on-one interviews, etc. It is also useful for when the interpreter is being used as a chaperone, perhaps for a visit to a foreign country.

Types of Interpreting:

1. Conference Interpreting:

Conference interpreting is the interpretation of a conference, either simultaneously or consecutively, although the advent of multi-lingual meetings has consequently reduced the consecutive interpretation in the last 20 years.

2. Legal and Court Interpreting:

Legal, court, or judicial interpreting, occurs in courts of justice, administrative tribunals, and wherever a legal proceeding is held (i.e. a police station for an interrogation, a conference room for a deposition or the locale for taking a sworn statement). Legal interpreting can be the consecutive interpretation of witnesses' testimony for example, or the simultaneous interpretation of entire proceedings, by electronic means, for one person, or all of the people attending.

2. Focus Group (Marketing) Interpreting:

In focus group interpreting, an interpreter sits in a sound proof booth or in an observer's room with the clients. There is usually a one-way mirror between the interpreter and the focus group participants, wherein the interpreter can observe the participants, but they only see their own reflection. The interpreter hears the conversation in the original language through headphones and simultaneously interprets into the target

language for the clients. Since there are usually anywhere between 2 to 12 (or more) participants in any given focus group, experienced interpreters will not only interpret the phrases and meanings but will also mimic intonation, speech patterns, tone, laughs, and emotions.

3. Escort Interpreting:

In escort interpreting, an interpreter accompanies a person or a delegation on a tour, on a visit, or to a meeting or interview. An interpreter in this role is called an *escort interpreter* or an *escorting interpreter*. This is liaison interpreting.

4. Public Sector Interpreting:

Public sector interpreting, also known as community interpreting, is the type of interpreting occurring in fields such as legal, health, and local government, social, housing, environmental health, education, and welfare services. In community interpreting, factors exist which determine and affect

language and communication production, such as speech's emotional content, hostile or polarized social surroundings, its created stress, the power relationships among participants, and the interpreter's degree of responsibility – in many cases more than extreme; in some cases, even the life of the other person depends upon the interpreter's work.

5. Medical Interpreting:

Medical interpreting is a subset of public service interpreting, consisting of communication, among medical personnel and the patient and his or her family, facilitated by an interpreter, usually formally certified and qualified to provide such interpretation services. In some situations medical employees who are multilingual may participate part-time as members of internal language banks. The medical interpreter must have a strong knowledge of medicine, common medical procedures, the patient interview, the medical examination processes, and the daily workings of the hospital or clinic where

he or she works, in order to effectively serve both the patient and the medical personnel. Moreover, and very important, medical interpreters often are cultural liaisons for people (regardless of language) who are unfamiliar with or uncomfortable in hospital, clinical, or medical settings.

6. Media Interpreting:

By its very nature, media interpreting has to be conducted in the simultaneous mode. It is provided particularly for live television coverages such as press conferences, live or taped interviews with political figures, musicians, artists, sportsmen or people from the business circle. In this type of interpreting, the interpreter has to sit in a sound-proof booth where ideally he/she can see the speakers on a monitor and the set. All equipment should be checked before recording begins. In particular, satellite connections have to be double-checked to ensure that the interpreter's voice is not sent back and the interpreter gets to hear only one channel at a time. In the case of interviews recorded

outside the studio and some current affairs programme, the interpreter interprets what he or she hears on a TV monitor. Background noise can be a serious problem. The interpreter working for the media has to sound as slick and confident as a television presenter.

Interpreting Modalities:

Interpreting services can be delivered in multiple modalities. The most common modality through which interpreting services are provided is on-site interpreting.

1. On-site Interpreting:

On-site interpreting, also called "in-person interpreting," this delivery method requires the interpreter to be physically present in order for the interpretation to take place. In on-site interpreting settings, all of the parties who wish to speak to one another are usually located in the same place. This is by far the

most common modality used for most public and social service settings.

2. Telephone Interpreting:

Telephone interpreting is referred to as "over-the-phone interpreting," "telephonic interpreting," and "tele-interpreting." It enables the interpreter to deliver interpretation via telephone. The interpreter is added to a conference call. Telephone interpreting may be used in place of on-site interpreting in some cases, especially when no on-site interpreter is readily available at the location where services are needed. However, telephone interpreting is more commonly used for situations in which all parties who wish to communicate are already speaking to one another via telephone (e.g. applications for insurance or credit cards that are taken over the phone, inquiries from consumers to businesses that take place via telephone, etc.)

2. Video Interpreting:

Interpretation services via Video Remote Interpreting (VRI) or a Video Relay Service (VRS) are useful where one of the parties is deaf, hard-of-hearing or speech-impaired (mute). In such cases the interpretation flow is normally within the same principal language, such as French Sign Language (FSL) to spoken French, Spanish Sign Language (SSL) to spoken Spanish, British Sign Language (BSL) to spoken English, and American Sign Language (ASL) also to spoken English (since BSL and ASL are completely distinct), etc.... Such activities involve considerable effort on the part of the translator, since sign languages are distinct natural languages with their own construction and syntax, different from the aural version of the same principal language.

With video interpreting, sign language interpreters work remotely with live video and audio feeds, so that the interpreter can see the deaf or mute party, converse with the hearing party

and vice versa. Much like telephone interpreting, video interpreting can be used for situations in which no on-site interpreters are available. However, video interpreting cannot be used for situations in which all parties are speaking via telephone alone. VRI and VRS interpretation requires all parties to have the necessary equipment. Some advanced equipment enables interpreters to control the video camera, in order to zoom in and out, and to point the camera toward the party that is signing.

References:

- Bertone, Laura (2006) *The Hidden Side of Babel: Unveiling Cognition, Intelligence and Sense*, ISBN 987-21049-1-3 Evolucion, Organización intercultural.
- Chuzhakin, Andrei (2007) "Applied Theory of Interpretation and Note-Taking", "Mir Perevoda 1 to 7", Ustny Perevod, Posledovatelny Perevod, Ace Perevoda Mir Perevoda.
- Gillies, Andrew (2005) *Note-taking for Consecutive Interpreting*, ISBN 1-900650-82-7.

- Jones, Roderick (1998) *Conference Interpreting Explained*, ISBN 1-900650-57-6.

- Rozan, Jean-François (1956) *La Prise de Notes en Interprétation Consécutive*, ISBN 2-8257-0053-3.

- Seleskovitch, Danica (1968) *L'interprète dans les conférences internationales*, Cahiers Champollion.

- Taylor-Bouladon, Valerie (2007) *Conference Interpreting — Principles and Practice*, 2nd Edition ISBN 1-4196-6069-1.

-1-

Islam

Islam is a major world religion, with over 1.3 billion followers worldwide (1/5 of the world's population). It is considered one of the Abrahamic, monotheistic faiths, along with Judaism and Christianity. Although usually associated with the Arabs of the Middle East, less than 10% of Muslims are in fact Arabs. Muslims are found all over the world, of every nation, color and race. The Muslim world extends from the Philippines in the East to Morocco in the west and from Central Asia in the north to sub-Saharan Africa in the south. Islam was first introduced by the Prophet Mohammad in Arabia in the 7th century.

The word "Islam" comes from an Arabic root word meaning *peace* and *submission*: submission to the will of God and the peace that is entailed in that submission. Islam teaches that one can only find peace in one's life by submitting to

Almighty God (Allah) in heart, soul and deed. The same Arabic root word gives us "Salaam alaykum," ("Peace be with you"), the universal Muslim greeting.

Allah is the proper name for Almighty God, and is often translated merely as "God." Allah has other names that are used to describe His characteristics: the Creator, the Sustainer, the Merciful, the Compassionate, etc. Muslims believe that since Allah alone is the Creator, it is He alone that deserves our devout love and worship. Islam holds to a strict monotheism. Any worship and prayers directed at saints, prophets, other human beings or nature is considered idolatry.

In Islam, faith and good works go hand-in-hand. A mere verbal declaration of faith is not enough, for belief in Allah makes obedience to Him a duty.

The Muslim concept of worship is very broad. Muslims consider everything they do in life to be an act of worship, if it is

done according to Allah's guidance. There are also five formal acts of worship which help strengthen a Muslim's faith and obedience. They are often called the "Five Pillars of Islam."

Muslims consider Islam to be the middle road. Muslims do not live life with complete disregard for God or religious matters, but nor do they neglect the world to devote themselves solely to worship and prayer. Muslims strike a balance by fulfilling the obligations of and enjoying this life, while always mindful of their duties to Allah and to others.

-2-

Thomas Edison

Thomas Alva Edison lit up the world with his invention of the electric light. Without him, the world might still be a dark place. However, the electric light was not his only invention. He also invented the phonograph, the motion picture camera, and over 1,200 other things. About every two weeks he created something new.

Thomas A. Edison was born in Milan, Ohio, on February 11, 1847. His family moved to Port Huron, Michigan, when he was seven years old. Surprisingly, he attended school for only two months. His mother, a former teacher, taught him a few things, but Thomas was mostly self-educated. His natural curiosity led him to start experimenting at a young age with electrical and mechanical things at home. When he was 12 years old, he got his first job. He became a newsboy on a train that ran between Port Huron and Detroit. He set up a laboratory in a

baggage care of the train so that he could continue his experiments in his spare time. Unfortunately, his first work experience did not end well. Thomas was fired when he accidentally set fire to the floor of the baggage car. Thomas then worked for five years as a telegraph operator, but he continued to spend much of his time on the job conducting experiments. He got his first patent in 1868 for a vote recorder run by electricity. However, the vote recorder was not a success. In 1870, he sold another invention, a stock-ticker, for $40,000. A stock-ticker is a machine that automatically prints stock prices on a tape. He was then able to build his first shop in Newark, New Jersey.

Thomas Edison was totally deaf in one ear and hard of hearing in the other, but thought of his deafness as a blessing in many ways. It kept conversations short, so that he could have more time for work. He called himself a "two-shift man" because he worked 16 out of every 24 hours. Sometimes he worked so intensely that his wife had to remind him to sleep and eat.

Thomas Edison died at the age of 84 on October 18, 1931, at his estate in West Orange, New Jersey. He left numerous inventions that improved the quality of life all over the world.

-3-

Tarzan of the Apes

Edgar Rice Burroughs wrote a very famous story called Tarzan of the Apes. This story involves a shipwreck on the West coast of Africa. The passengers on the ship include a certain Lord and Lady Greystoke from England. Lord and Lady Greystoke are the only survivors of the shipwreck.

Lord Greystoke builds a kind of shelter high up in the trees - a treehouse - for his pregnant wife and does his best to make them comfortable in their new jungle home. Lady Greystoke gives birth to a boy. They call the boy John. Unfortunately, she dies and leaves Lord Greystoke to take care of the baby on his own. Lord Greystoke is killed by an enormous ape that comes to investigate the strange house in the trees. The baby is left all alone. Fortunately, a female ape, whose baby has recently died, finds the human baby alone in the treehouse. Even though the baby is white and hairless, she feels a mother's love

for it and begins to feed and take care of it. She becomes John's mother. John - who later takes the name Tarzan, never having known his real identity - grows strong and powerful living among the apes. He has the advantage of human intelligence and eventually grows up to be leader of the apes and, eventually, lord of the jungle.

The books tell many stories of Tarzan's adventures in the jungles, his fights with savage animals, his encounters with other human beings (many of whom are as dangerous as the animals) and his re-discovery of his true identity.

Tarzan eventually teaches himself to read by returning to the treehouse where he was born and finding some children's books that his parents brought from England. He later finds out who he really is (an English Lord!) and travels to England to visit his home, where he falls in love with a young woman called Jane.

-4-

Learning English

Today, millions of people want to learn or improve their English but it is difficult to find the best method. Is it better to study in Britain or America or to study in your own country?

The advantages of going to Britain seem obvious. Firstly, you will be able to listen to the language all the time you are in the country. You will be surrounded completely by the language wherever you go. Another advantage is that you have to speak the language if you are with other people. In Italy, it is always possible, in the class, to speak Italian if you want to and the learning is slower. On the other hand, there are also advantages to staying at home to study. You don't have to make big changes to your life. As well as this, it is also a lot cheaper than going to Britain but it is never possible to achieve the results of living in the UK. If you have a good teacher in Italy, I think you can learn

in a more concentrated way than being in Britain without going to a school.

So, in conclusion, I think that if you have enough time and enough money, the best choice is to spend some time in the UK. This is simply not possible for most people, so being here in Italy is the only viable option. The most important thing to do in this situation is to maximise your opportunities: to speak only English in class and to try to use English whenever possible outside the class.

-5-

The Bermuda Triangle

At 2 pm on 5 December 1945, five US bombers took off from Fort Lauderlale in the USA for a training flight in perfect weather. Shortly afterwards, the pilots radioed that their flight instruments were all malfunctioning. Two hours after take-off, all contact with the planes was lost. A reconnaissance plane was immediately dispatched to search for the missing planes. Within 20 minutes, radio contact with it had also been lost. No trace of any of the planes was ever found. In all, six planes and 27 men had vanished into the air.

The disappearance of the six planes was far from being the first mysterious incident in the area: for years, navigational problems and strange magnetic forces had been reported. The disappearance was not even the greatest disaster within the triangle. The Cyclops, a 19,000-ton US ship was sailing from Barbados to Norfolk, Virginia. In March 1918, when it vanished

with its crew of 309 from the surface of he ocean without making a distress call and without the slightest wreckage ever being found.

The losses of boats and planes in that area defy explanation. The disasters are the origin of a new phrase in the English language – the Bermuda Triangle and this phrase has entered legend. The Bermuda Triangle has been called the Devils' Triangle, the Triangle of Death, the Graveyard of the Atlantic. It has swallowed up 140 ships and planes and more than 1,000 people. Today many airmen and sailors are still afraid of that area of the Atlantic Ocean.

-6-

Home Remedies

Everyone has his own special kind of home remedies for the common cold and other minor health discomforts. They are usually quick cures for minor ailments and often prove to be quite effective. The medical profession may not endorse their validity and discredit their healing power, but the wisdom of ages has worked on the side of the home remedy.

These home remedies usually emerge from that vast source of oral tradition passed on from generation to generation and one would be hard-pressed to find their exact formulas printed in a published book.

Folk wisdom tells us for example, to "starve a fever and feed a cold." This means that if someone has a cold, he should eat properly to provide the body with nutrition. On the other hand, if

her has a fever, the best remedy is to go to bed, get a full night's rest and drink only liquids.

One home remedy for getting rid of a fever is to drink a concoction of hot tea, lemon and sugar and spiced with a generous dose of rum to put one to sleep. Drink the solution quickly and then go to bed. During the evening, hopefully one will sweat off the fever. In the morning upon awakening the fever should be gone and the sick person up and about.

Camomile tea is said to soothe an upset stomach and an ice cube can stop a bleeding nose. A slice of raw meat can be applied to cure a black eye, and whiskey poured onto cotton can be used as a disinfectant to wash out a cut or wound.

To counteract fatigue experts recommend mixing a half teaspoon of apple cider and a tablespoon of honey in a cup of warm water. Some people believe that a combination of apple cider and honey is effective in treating a variety of ailments from

canker sores to indigestion and influenza. Some other remedies may seem bizarre but have proven effective. For an earache chew a wad of gum while holding a hair dryer set to a low, warm setting about 18 inches from the affected ear. Bad breath can be avoided by chewing on cloves, anise seeds or a twig of parsley. These help to freshen the breath naturally. For those suffering from body odor it is recommended to add two cup of tomato juice to the bath water and soak for 15 minutes. Afterwards scrub by using pine soap.

Behind these remedies is the belief that all the cures of one's ills can be found within nature. One need not resort to sophisticated chemicals and expensive prescribed drugs to find relief. The Chinese for centuries have made medicines from the herbs and elements of nature. These remedies have been around for hundreds of centuries and even the most cynical of skeptics have developed a respect for Chinese cures. In recent years even the average American has returned to the concept of a holistic

approach to health and the remedies found within nature to elicit a cure.

-7-

The Language of Music

A painter hangs his or her finished picture on a wall, and everyone can see it. A composer writes a work, but no one can hear it until it is performed. Professional singers and players have great responsibilities, for the composer is utterly dependent on them. A student of music needs as long and as arduous a training to become a performer as a medical student needs to become a doctor. Most training is concerned with technique, for musicians have to have the muscular proficiency of an athlete or a ballet dancer. Singers practice breathing every day, as their vocal chords would be inadequate without controlled muscular support. String players practice moving the fingers of the left hand up and down, while drawing the bow to and fro with the right arm --two entirely different movements.

Singers and instrumentalists have to be able to get every note perfectly in tune. Pianists are spared this particular anxiety, for the notes are already there, waiting for them, and it is the piano tuner's responsibility to tune the instrument for them. But they have their own difficulties: the hammers that hit the strings have to be coaxed not to sound like percussion, and each overlapping tone has to sound clear.

This problem of getting clear texture is one that confronts student conductors: they have to learn to know every note of the music and how it should sound, and they have to aim at controlling these sounds with fanatical but selfless authority.

Technique is of no use unless it is combined with musical knowledge and understanding. Great artists are those who are so thoroughly at home in the language of music that they can enjoy performing works written in any century.

-8-

Schooling and Education

It is commonly believed in the United States that school is where people go to get an education. Nevertheless, it has been said that today children interrupt their education to go to school. The distinction between schooling and education implied by this remark is important.

Education is much more open-ended and all-inclusive than schooling. Education knows no bounds. It can take place anywhere, whether in the shower or in the job, whether in a kitchen or on a tractor. It includes both the formal learning that takes place in schools and the whole universe of informal learning. The agents of education can range from a revered grandparent to the people debating politics on the radio, from a child to a distinguished scientist.

Whereas schooling has a certain predictability, education quite often produces surprises. A chance conversation with a stranger may lead a person to discover how little is known of other religions. People are engaged in education from infancy on. Education, then, is a very broad, inclusive term. It is a lifelong process, a process that starts long before the start of school, and one that should be an integral part of one's entire life.

Schooling, on the other hand, is a specific, formalized process, whose general pattern varies little from one setting to the next. Throughout a country, children arrive at school at approximately the same time, take assigned seats, are taught by an adult, use similar textbooks, do homework, take exams, and so on. The slices of reality that are to be learned, whether they are the alphabet or an understanding of the workings of government, have usually been limited by the boundaries of the subject being taught. For example, high school students know

that they are not likely to find out in their classes the truth about political problems in their communities or what the newest filmmakers are experimenting with. There are definite conditions surrounding the formalized process of schooling.

-9-

The Definition of "Price"

Prices determine how resources are to be used. They are also the means by which products and services that are in limited supply are rationed among buyers. The price system of the United States is a complex network composed of the prices of all the products bought and sold in the economy as well as those of a myriad of services, including labor, professional, transportation, and public-utility services. The interrelationships of all these prices make up the "system" of prices.

The price of any particular product or service is linked to a broad, complicated system of prices in which everything seems to depend more or less upon everything else. If one were to ask a group of randomly selected individuals to define "price", many would reply that price is an amount of money paid by the buyer to the seller of a product or service or, in

other words, that price is the money value of a product or service as agreed upon in a market transaction. This definition is, of course, valid as far as it goes. For a complete understanding of a price in any particular transaction, much more than the amount of money involved must be known. Both the buyer and the seller should be familiar with not only the money amount, but with the amount and quality of the product or service to be exchanged, the time and place at which the exchange will take place and payment will be made, the form of money to be used, the credit terms and discounts that apply to the transaction, guarantees on the product or service, delivery terms, return privileges, and other factors. In other words, both buyer and seller should be fully aware of all the factors that comprise the total "package" being exchanged for the asked-for amount of money in order that they may evaluate a given price.

-10-

Electricity

The modern age is an age of electricity. People are so used to electric lights, radio, televisions, and telephones that it is hard to imagine what life would be like without them. When there is a power failure, people grope about in flickering candlelight, cars hesitate in the streets because there are no traffic lights to guide them, and food spoils in silent refrigerators.

Yet, people began to understand how electricity works only a little more than two centuries ago. Nature has apparently been experimenting in this field for millions of years. Scientists are discovering more and more that the living world may hold many interesting secrets of electricity that could benefit humanity.

All living cells send out tiny pulses of electricity. As the heart beats, it sends out pulses of record; they form an electrocardiogram, which a doctor can study to determine how well the heart is working. The brain, too, sends out brain waves of electricity, which can be recorded in an electroencephalogram. The electric currents generated by most living cells are extremely small -- often so small that sensitive instruments are needed to record them. But in some animals, certain muscle cells have become so specialized as electrical generators that they do not work as muscle cells at all. When large numbers of these cells are linked together, the effects can be astonishing.

The electric eel is an amazing storage battery. It can send a jolt of as much as eight hundred volts of electricity through the water in which it lives. (An electric house current is only one hundred twenty volts.) As many as four-fifths of all the cells in the electric eel's body are specialized for

generating electricity, and the strength of the shock it can deliver corresponds roughly to the length of its body.

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The Beginning of Drama

There are many theories about the beginning of drama in ancient Greece. The one most widely accepted today is based on the assumption that drama evolved from ritual. The argument for this view goes as follows. In the beginning, human beings viewed the natural forces of the world - even the seasonal changes - as unpredictable, and they sought through various means to control these unknown and feared powers. Those measures which appeared to bring the desired results were then retained and repeated until they hardened into fixed rituals. Eventually stories arose which explained or veiled the mysteries of the rites. As time passed some rituals were abandoned, but the stories, later called myths, persisted and provided material for art and drama.

Those who believe that drama evolved out of ritual also argue that those rites contained the seed of theater because

music, dance, masks, and costumes were almost always used. Furthermore, a suitable site had to be provided for performances and when the entire community did not participate, a clear division was usually made between the "acting area" and the "auditorium." In addition, there were performers, and, since considerable importance was attached to avoiding mistakes in the enactment of rites, religious leaders usually assumed that task. Wearing masks and costumes, they often impersonated other people, animals, or supernatural beings, and mimed the desired effect -- success in hunt or battle, the coming rain, the revival of the Sun -- as an actor might. Eventually such dramatic representations were separated from religious activities.

Another theory traces the theater's origin from the human interest in storytelling. According to this view tales (about the hunt, war, or other feats) are gradually elaborated, at first through the use of impersonation, action, and dialogue by

a narrator and then through the assumption of each of the roles by a different person. A closely related theory traces theater to those dances that are primarily rhythmical and gymnastic or that are imitations of animal movements and sounds.

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Television

Television -- the most pervasive and persuasive of modern technologies, marked by rapid change and growth -- is moving into a new era, an era of extraordinary sophistication and versatility, which promises to reshape our lives and our world. It is an electronic revolution of sorts, made possible by the marriage of television and computer technologies.

The word "television", derived from its Greek (tele: distant) and Latin (visio: sight) roots, can literally be interpreted as sight from a distance. Very simply put, it works in this way: through a sophisticated system of electronics, television provides the capability of converting an image (focused on a special photoconductive plate within a camera) into electronic impulses, which can be sent through a wire or cable. These impulses, when fed into a receiver (television set), can then be electronically reconstituted into that same image.

Television is more than just an electronic system, however. It is a means of expression, as well as a vehicle for communication, and as such becomes a powerful tool for reaching other human beings.

The field of television can be divided into two categories determined by its means of transmission. First, there is broadcast television, which reaches the masses through broad-based airwave transmission of television signals. Second, there is nonbroadcast television, which provides for the needs of individuals or specific interest groups through controlled transmission techniques.

Traditionally, television has been a medium of the masses. We are most familiar with broadcast television because it has been with us for about thirty-seven years in a form similar to what exists today. During those years, it has been controlled, for the most part, by the broadcast networks, ABC, NBC, and CBS, who have been the major purveyors of news, information, and entertainment. These giants of broadcasting have actually shaped

not only television but our perception of it as well. We have come to look upon the picture tube as a source of entertainment, placing our role in this dynamic medium as the passive viewer

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Andrew Carnegie

Andrew Carnegie, known as the King of Steel, built the steel industry in the United States, and, in the process, became one of the wealthiest men in America. His success resulted in part from his ability to sell the product and in part from his policy of expanding during periods of economic decline, when most of his competitors were reducing their investments.

Carnegie believed that individuals should progress through hard work, but he also felt strongly that the wealthy should use their fortunes for the benefit of society. He opposed charity, preferring instead to provide educational opportunities that would allow others to help themselves. “He who dies rich, dies disgraced,” he often said.

Among his more noteworthy contributions to society are those that bear his name, including the Carnegie Institute of

Pittsburgh, which has a library, a museum of fine arts, and a museum of national history. He also founded a school of technology that is now part of Carnegie-Mellon University. Other philanthropic gifts are the Carnegie Endowment for International Peace to promote understanding between nations, the Carnegie Institute of Washington to fund scientific research, and Carnegie Hall to provide a center for the arts.

Few Americans have been left untouched by Andrew Carnegie's generosity. His contributions of more than five million dollars established 2,500 libraries in small communities throughout the country and formed the nucleus of the public library system that we all enjoy today.

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American Revolution

The American Revolution was not a revolution in the sense of a radical or total change. It was not a sudden and violent overturning of the political and social framework, such as later occurred in France and Russia, when both were already independent nations. Significant changes were ushered in, but they were not breathtaking. What happened was accelerated evolution rather than outright revolution. During the conflict itself people went on working and praying, marrying and playing. Most of them were not seriously disturbed by the actual fighting, and many of the more isolated communities scarcely knew that a war was on.

America's War of Independence heralded the birth of three modern nations. One was Canada, which received its first large influx of English-speaking population from the thousands of loyalists who fled there from the United States. Another was

Australia, which became a penal colony now that America was no longer available for prisoners and debtors. The third newcomer -- the United States --based itself squarely on republican principles.

Yet even the political overturn was not so revolutionary as one might suppose. In some states, notably Connecticut and Rhode Island, the war largely ratified a colonial self-rule already existing. British officials, everywhere ousted, were replaced by a home-grown governing class, which promptly sought a local substitute for king and Parliament.

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Suburbanization

If by "suburb" is meant an urban margin that grows more rapidly than its already developed interior, the process of suburbanization began during the emergence of the industrial city in the second quarter of the nineteenth century. Before that period the city was a small highly compact cluster in which people moved about on foot and goods were conveyed by horse and cart. But the early factories built in the 1830's and 1840’s were located along waterways and near railheads at the edges of cities, and housing was needed for the thousands of people drawn by the prospect of employment. In time, the factories were surrounded by proliferating mill towns of apartments and row houses that abutted the older, main cities. As a defense against this encroachment and to enlarge their tax bases, the cities appropriated their industrial neighbors. In 1854, for example, the city of Philadelphia annexed most of

Philadelphia County. Similar municipal maneuvers took place in Chicago and in New York. Indeed, most great cities of the United States achieved such status only by incorporating the communities along their borders.

With the acceleration of industrial growth came acute urban crowding and accompanying social stress -- conditions that began to approach disastrous proportions when, in 1888, the first commercially successful electric traction line was developed. Within a few years the horse-drawn trolleys were retired and electric streetcar networks crisscrossed and connected every major urban area, fostering a wave of suburbanization that transformed the compact industrial city into a dispersed metropolis. This first phase of mass-scale suburbanization was reinforced by the simultaneous emergence of the urban Middle Class, whose desires for homeownership in neighborhoods far from the aging inner city were satisfied by the developers of single-family housing tracts.

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Types of Speech

Standard usage includes those words and expressions understood, used, and accepted by a majority of the speakers of a language in any situation regardless of the level of formality. As such, these words and expressions are well defined and listed in standard dictionaries. Colloquialisms, on the other hand, are familiar words and idioms that are understood by almost all speakers of a language and used in informal speech or writing, but not considered appropriate for more formal situations.

Almost all idiomatic expressions are colloquial language. Slang, however, refers to words and expressions understood by a large number of speakers but not accepted as good, formal usage by the majority. Colloquial expressions and even slang may be found in standard dictionaries but will be so

identified. Both colloquial usage and slang are more common in speech than in writing.

Colloquial speech often passes into standard speech. Some slang also passes into standard speech, but other slang expressions enjoy momentary popularity followed by obscurity. In some cases, the majority never accepts certain slang phrases but nevertheless retains them in their collective memories. Every generation seems to require its own set of words to describe familiar objects and events.

It has been pointed out by a number of linguists that three cultural conditions are necessary for the creation of a large body of slang expressions. First, the introduction and acceptance of new objects and situations in the society; second, a diverse population with a large number of subgroups; third, association among the subgroups and the majority population.

Finally, it is worth noting that the terms "standard" "colloquial" and "slang" exist only as abstract labels for scholars who study language. Only a tiny number of the speakers of any language will be aware that they are using colloquial or slang expressions. Most speakers of English will, during appropriate situations, select and use all three types of expressions.

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Archaeology

Archaeology is a source of history, not just a humble auxiliary discipline. Archaeological data are historical documents in their own right, not mere illustrations to written texts. Just as much as any other historian, an archaeologist studies and tries to reconstitute the process that has created the human world in which we live -- and us ourselves in so far as we are each creatures of our age and social environment. Archaeological data are all changes in the material world resulting from human action or, more succinctly, the fossilized results of human behavior. The sum total of these constitutes what may be called the archaeological record. This record exhibits certain peculiarities and deficiencies, the consequences of which produce a rather superficial contrast between archaeological history and the more familiar kind based upon written records.

Not all human behavior fossilizes. The words I utter and you hear as vibrations in the air are certainly human changes in the material world and may be of great historical significance. Yet they leave no sort of trace in the archaeological records unless they are captured by a dictaphone or written down by a clerk. The movement of troops on the battlefield may "change the course of history," but this is equally ephemeral from the archaeologist's standpoint. What is perhaps worse is that most organic materials are perishable. Everything made of wood, hide, wool, linen, grass, hair, and similar materials will decay and vanish in dust in a few years or centuries, save under very exceptional conditions. In a relatively brief period the archaeological record is reduced to mere scraps of stone, bone, glass, metal, and earthenware. Still modern archaeology, by applying appropriate techniques and comparative methods, aided by a few lucky finds from peat-bogs, deserts, and frozen soils, is able to fill up a good deal of the gap.

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Museums

From Boston to Los Angeles, from New York City to Chicago to Dallas, museums are either planning, building, or wrapping up wholesale expansion programs. These programs already have radically altered facades and floor plans or are expected to do so in the not-too-distant future.

In New York City alone, six major institutions have spread up and out into the air space and neighborhoods around them or are preparing to do so.

The reasons for this confluence of activity are complex, but one factor is a consideration everywhere -- space. With collections expanding, with the needs and functions of museums changing, empty space has become a very precious commodity.

Probably nowhere in the country is this more true than at the Philadelphia Museum of Art, which has needed additional space for decades and which received its last significant facelift ten years ago. Because of the space crunch, the Art Museum has become increasingly cautious in considering acquisitions and donations of art, in some cases passing up opportunities to strengthen its collections.

Deaccession -- or selling off -- works of art has taken on new importance because of the museum's space problems. And increasingly, curators have been forced to juggle gallery space, rotating one masterpiece into public view while another is sent to storage.

Despite the clear need for additional gallery and storage space, however, "the museum has no plan, no plan to break out of its envelope in the next fifteen years," according to Philadelphia Museum of Art's president.

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Skyscrapers and Environment

In the late 1960's, many people in North America turned their attention to environmental problems, and new steel-and-glass skyscrapers were widely criticized. Ecologists pointed out that a cluster of tall buildings in a city often overburdens public transportation and parking lot capacities.

Skyscrapers are also lavish consumers, and wasters, of electric power. In one recent year, the addition of 17 million square feet of skyscraper office space in New York City raised the peak daily demand for electricity by 120, 000 kilowatts -- enough to supply the entire city of Albany, New York, for a day.

Glass-walled skyscrapers can be especially wasteful. The heat loss (or gain) through a wall of half-inch plate glass is more than ten times that through a typical masonry wall filled

with insulation board. To lessen the strain on heating and air-conditioning equipment, builders of skyscrapers have begun to use double-glazed panels of glass, and reflective glasses coated with silver or gold mirror films that reduce glare as well as heat gain. However, mirror-walled skyscrapers raise the temperature of the surrounding air and affect neighboring buildings.

Skyscrapers put a severe strain on a city's sanitation facilities, too. If fully occupied, the two World Trade Center towers in New York City would alone generate 2.25 million gallons of raw sewage each year -- as much as a city the size of Stanford, Connecticut, which has a population of more than 109, 000.

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Rare Fossil Record

The preservation of embryos and juveniles is a rate occurrence in the fossil record. The tiny, delicate skeletons are usually scattered by scavengers or destroyed by weathering before they can be fossilized. Ichthyosaurs had a higher chance of being preserved than did terrestrial creatures because, as marine animals, they tended to live in environments less subject to erosion. Still, their fossilization required a suite of factors: a slow rate of decay of soft tissues, little scavenging by other animals, a lack of swift currents and waves to jumble and carry away small bones, and fairly rapid burial. Given these factors, some areas have become a treasury of well-preserved ichthyosaur fossils.

The deposits at Holzmaden, Germany, present an interesting case for analysis. The ichthyosaur remains are found in black, bituminous marine shales deposited about 190

million years ago. Over the years, thousands of specimens of marine reptiles, fish and invertebrates have been recovered from these rocks. The quality of preservation is outstanding, but what is even more impressive is the number of ichthyosaur fossils containing preserved embryos.

Ichthyosaurs with embryos have been reported from 6 different levels of the shale in a small area around Holzmaden, suggesting that a specific site was used by large numbers of ichthyosaurs repeatedly over time. The embryos are quite advanced in their physical development; their paddles, for example, are already well formed. One specimen is even preserved in the birth canal. In addition, the shale contains the remains of many newborns that are between 20 and 30 inches long.

Why are there so many pregnant females and young at Holzmaden when they are so rare elsewhere? The quality of preservation is almost unmatched and quarry operations have

been carried out carefully with an awareness of the value of the fossils. But these factors do not account for the interesting question of how there came to be such a concentration of pregnant ichthyosaurs in a particular place very close to their time of giving birth.

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The Nobel Academy

For the last 82 years, Sweden's Nobel Academy has decided who will receive the Nobel Prize in Literature, thereby determining who will be elevated from the great and the near great to the immortal. But today the Academy is coming under heavy criticism both from without and from within.

Critics contend that the selection of the winners often has less to do with true writing ability than with the peculiar internal politics of the Academy and of Sweden itself. According to Ingmar Bjorksten, the cultural editor for one of the country's two major newspapers, the prize continues to represent "what people call a very Swedish exercise: reflecting Swedish tastes." The Academy has defended itself against such charges of provincialism in its selection by asserting that its physical distance from the great literary capitals of the world actually serves to protect the Academy from outside

influences. This may well be true, but critics respond that this very distance may also be responsible for the Academy's inability to perceive accurately authentic trends in the literary world.

Regardless of concerns over the selection process, however, it seems that the prize will continue to survive both as an indicator of the literature that we most highly praise, and as an elusive goal that writers seek. If for no other reason, the prize will continue to be desirable for the financial rewards that accompany it; not only is the cash prize itself considerable, but it also dramatically increases sales of an author's books.

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The War between Britain and France

In the late eighteenth century, battles raged in almost every corner of Europe, as well as in the Middle East, South Africa, the West Indies, and Latin America. In reality, however, there was only one major war during this time, the war between Britain and France. All other battles were ancillary to this larger conflict, and were often at least partially related to its antagonists' goals and strategies. France sought total domination of Europe. This goal was obstructed by British independence and Britain's efforts throughout the continent to thwart Napoleon; through treaties, Britain built coalitions (not dissimilar in concept to today's NATO) guaranteeing British participation in all major European conflicts. These two antagonists were poorly matched, insofar as they had very unequal strengths: France was predominant on land, Britain at sea. The French knew that, short of defeating

the British navy, their only hope of victory was to close all the ports of Europe to British ships. Accordingly, France set out to overcome Britain by extending its military domination from Moscow to Lisbon, from Jutland to Calabria. All of this entailed tremendous risk, because France did not have the military resources to control this much territory and still protect itself and maintain order at home.

French strategists calculated that a navy of 150 ships would provide the force necessary to defeat the British navy. Such a force would give France a three-to-two advantage over Britain. This advantage was deemed necessary because of Britain's superior sea skills and technology, and also because Britain would be fighting a defensive war, allowing it to win with fewer forces. Napoleon never lost sight of his goal, because Britain represented the last substantial impediment to his control of Europe. As his force neared that goal, Napoleon

grew increasingly impatient and began planning an immediate attack.

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Evolution of Sleep

Sleep is very ancient. In the electroencephalographic sense we share it with all the primates and almost all the other mammals and birds: it may extend back as far as the reptiles. There is some evidence that the two types of sleep, dreaming and dreamless, depend on the life-style of the animal, and that predators are statistically much more likely to dream than prey, which are in turn much more likely to experience dreamless sleep.

In dream sleep, the animal is powerfully immobilized and remarkably unresponsive to external stimuli. Dreamless sleep is much shallower, and we have all witnessed cats or dogs cocking their ears to a sound when apparently fast asleep. The fact that deep dream sleep is rare among prey today seems clearly to be a product of natural selection, and it makes sense that today, when sleep is highly evolved, the stupid animals are

less frequently immobilized by deep sleep than the smart ones. But why should they sleep deeply at all? Why should a state of such deep immobilization ever have evolved? Perhaps one useful hint about the original function of sleep is to be found in the fact that dolphins and whales and aquatic mammals in general seem to sleep very little. There is, by and large, no place to hide in the ocean. Could it be that, rather than increasing an animal's vulnerability, the function of sleep is to decrease it? Wilse Webb of the University of Florida and Ray Meddis of London University have suggested this to be the case. It is conceivable that animals that are too stupid to be quiet on their own initiative are, during periods of high risk, immobilized by the implacable arm of sleep. The point seems particularly clear for the young of predatory animals. This is an interesting notion and probably at least partly true.

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Modern American Universities

Before the 1850's, the United States had a number of small colleges, most of them dating from colonial days. They were small, church connected institutions whose primary concern was to shape the moral character of their students.

Throughout Europe, institutions of higher learning had developed, bearing the ancient name of university. In Germany a different kind of university had developed. The German university was concerned primarily with creating and spreading knowledge, not morals. Between mid-century and the end of the 1800's, more than nine thousand young Americans, dissatisfied with their training at home, went to Germany for advanced study. Some of them returned to become presidents of venerable colleges -- Harvard, Yale, and Columbia -- and transform them into modern universities. The new presidents broke all ties with the churches and brought in

a new kind of faculty. Professors were hired for their knowledge of a subject, not because they were of the proper faith and had a strong arm for disciplining students. The new principle was that a university was to create knowledge as well as pass it on, and this called for a faculty composed of teacher-scholars. Drilling and learning by rote were replaced by the German method of lecturing, in which the professor's own research was presented in class. Graduate training leading to the Ph.D., an ancient German degree signifying the highest level of advanced scholarly attainment, was introduced. With the establishment of the seminar system, graduate students learned to question, analyze, and conduct their own research.

At the same time, the new university greatly expanded in size and course offerings, breaking completely out of the old, constricted curriculum of mathematics, classics, rhetoric, and music. The president of Harvard pioneered the elective system, by which students were able to choose their own

courses of study. The notion of major fields of study emerged. The new goal was to make the university relevant to the real pursuits of the world. Paying close heed to the practical needs of society, the new universities trained men and women to work at its tasks, with engineering students being the most characteristic of the new regime. Students were also trained as economists, architects, agriculturalists, social welfare workers, and teachers.

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Children's Numerical Skills

People appear to be born to compute. The numerical skills of children develop so early and so inexorably that it is easy to imagine an internal clock of mathematical maturity guiding their growth. Not long after learning to walk and talk, they can set the table with impressive accuracy -- one knife, one spoon, one fork, for each of the five chairs. Soon they are capable of noting that they have placed five knives, spoons and forks on the table and, a bit later, that this amounts to fifteen pieces of silverware. Having thus mastered addition, they move on to subtraction. It seems almost reasonable to expect that if a child were secluded on a desert island at birth and retrieved seven years later, he or she could enter a second-grade mathematics class without any serious problems of intellectual adjustment.

Of course, the truth is not so simple. This century, the work of cognitive psychologists has illuminated the subtle forms of daily learning on which intellectual progress depends. Children were observed as they slowly grasped -- or, as the case might be, bumped into -- concepts that adults take for granted, as they refused, for instance, to concede that quantity is unchanged as water pours from a short stout glass into a tall thin one. Psychologists have since demonstrated that young children, asked to count the pencils in a pile, readily report the number of blue or red pencils, but must be coaxed into finding the total. Such studies have suggested that the rudiments of mathematics are mastered gradually, and with effort. They have also suggested that the very concept of abstract numbers - the idea of an oneness, a twoness, a threeness that applies to any class of objects and is a prerequisite for doing anything more mathematically demanding than setting a table - is itself far from innate.

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The Historical Significance of the American Revolution

The ways of history are so intricate and the motivations of human actions so complex that it is always hazardous to attempt to represent events covering a number of years, a multiplicity of persons, and distant localities as the expression of one intellectual or social movement; yet the historical process which culminated in the ascent of Thomas Jefferson to the presidency can be regarded as the outstanding example not only of the birth of a new way of life but of nationalism as a new way of life.

The American Revolution represents the link between the seventeenth century, in which modern England became conscious of itself, and the awakening of modern Europe at the end of the eighteenth century. It may seem strange that the march of history should have had to cross the Atlantic Ocean,

but only in the North American colonies could a struggle for civic liberty lead also to the foundation of a new nation.

Here, in the popular rising against a "tyrannical" government, the fruits were more than the securing of a freer constitution. They included the growth of a nation born in liberty by the will of the people, not from the roots of common descent, a geographic entity, or the ambitions of king or dynasty. With the American nation, for the first time, a nation was born, not in the dim past of history but before the eyes of the whole world.

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The Origin of Sports

When did sport begin? If sport is, in essence, play, the claim might be made that sport is much older than humankind, for, as we all have observed, the beasts play. Dogs and cats wrestle and play ball games. Fishes and birds dance. The apes have simple, pleasurable games. Frolicking infants, school children playing tag, and adult arm wrestlers are demonstrating strong, transgenerational and transspecies bonds with the universe of animals - past, present, and future. Young animals, particularly, tumble, chase, run, wrestle, mock, imitate, and laugh(or so it seems) to the point of delighted exhaustion. Their play, and ours, appears to serve no other purpose than to give pleasure to the players, and apparently, to remove us temporarily from the anguish of life in earnest.

Some philosophers have claimed that our playfulness is the most noble part of our basic nature. In their generous

conceptions, play harmlessly and experimentally permits us to put our creative forces, fantasy, and imagination into action. Play is release from the tedious battles against scarcity and decline which are the incessant, and inevitable, tragedies of life. This is a grand conception that excites and provokes. The holders of this view claim that the origins of our highest accomplishments - liturgy, literature, and law - can be traced to a play impulse which, paradoxically, we see most purely enjoyed by young beasts and children. Our sports, in this rather happy, nonfatalistic view of human nature, are more splendid creations of the nondatable, transspecies play impulse.

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Collectibles

Collectibles have been a part of almost every culture since ancient times. Whereas some objects have been collected for their usefulness, others have been selected for their aesthetic beauty alone. In the United States, the kinds of collectibles currently popular range from traditional objects such as stamps, coins, rare books, and art to more recent items of interest like dolls, bottles, baseball cards, and comic books.

Interest in collectibles has increased enormously during the past decade, in part because some collectibles have demonstrated their value as investments. Especially during cycles of high inflation, investors try to purchase tangibles that will at least retain their current market values. In general, the most traditional collectibles will be sought because they have preserved their value over the years, there is an organized auction market for them, and they are most easily sold in the

event that cash is needed. Some examples of the most stable collectibles are old masters, Chinese ceramics, stamps, coins, rare books, antique jewelry, silver, porcelain, art by well-known artists, autographs, and period furniture. Other items of more recent interest include old photograph records, old magazines, post cards, baseball cards, art glass, dolls, classic cars, old bottles, and comic books. These relatively new kinds of collectibles may actually appreciate faster as short-term investments, but may not hold their value as long-term investments. Once a collectible has had its initial play, it appreciates at a fairly steady rate, supported by an increasing number of enthusiastic collectors competing for the limited supply of collectibles that become increasingly more difficult to locate.

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Henry Ford

Although Henry Ford's name is closely associated with the concept of mass production, he should receive equal credit for introducing labor practices as early as 1913 that would be considered advanced even by today's standards. Safety measures were improved, and the work day was reduced to eight hours, compared with the ten-or twelve-hour day common at the time. In order to accommodate the shorter work day, the entire factory was converted from two to three shifts.

In addition, sick leaves as well as improved medical care for those injured on the job were instituted. The Ford Motor Company was one of the first factories to develop a technical school to train specialized skilled laborers and an English language school for immigrants. Some efforts were even made to hire the handicapped and provide jobs for former convicts.

The most widely acclaimed innovation was the five-dollar-a-day minimum wage that was offered in order to recruit and retain the best mechanics and to discourage the growth of labor unions. Ford explained the new wage policy in terms of efficiency and profit sharing. He also mentioned the fact that his employees would be able to purchase the automobiles that they produced -- in effect creating a market for the product. In order to qualify for the minimum wage, an employee had to establish a decent home and demonstrate good personal habits, including sobriety, thriftiness, industriousness, and dependability. Although some criticism was directed at Ford for involving himself too much in the personal lives of his employees, there can be no doubt that, at a time when immigrants were being taken advantage of in frightful ways, Henry Ford was helping many people to establish themselves in America.

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The Piano

The ancestry of the piano can be traced to the early keyboard instruments of the fifteenth and sixteenth centuries -- the spinet, the dulcimer, and the virginal. In the seventeenth century the organ, the clavichord, and the harpsichord became the chief instruments of the keyboard group, a supremacy they maintained until the piano supplanted them at the end of the eighteenth century. The clavichord's tone was metallic and never powerful; nevertheless, because of the variety of tone possible to it, many composers found the clavichord a sympathetic instrument for intimate chamber music. The harpsichord with its bright, vigorous tone was the favorite instrument for supporting the bass of the small orchestra of the period and for concert use, but the character of the tone could not be varied save by mechanical or structural devices.

The piano was perfected in the early eighteenth century by a harpsichord maker in Italy(though musicologists point out several previous instances of the instrument). This instrument was called a piano e forte (soft and loud), to indicate its dynamic versatility; its strings were struck by a recoiling hammer with a felt-padded head. The wires were much heavier in the earlier instruments. A series of mechanical improvements continuing well into the nineteenth century, including the introduction of pedals to sustain tone or to soften it, the perfection of a metal frame, and steel wire of the finest quality, finally produced an instrument capable of myriad tonal effects from the most delicate harmonies to an almost orchestral fullness of sound, from a liquid, singing tone to a sharp, percussive brilliance.

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Movie Music

Accustomed though we are to speaking of the films made before 1927 as "silent", the film has never been, in the full sense of the word, silent. From the very beginning, music was regarded as an indispensable accompaniment; when the Lumiere films were shown at the first public film exhibition in the United States in February 1896, they were accompanied by piano improvisations on popular tunes. At first, the music played bore no special relationship to the films; an accompaniment of any kind was sufficient. Within a very short time, however, the incongruity of playing lively music to a solemn film became apparent, and film pianists began to take some care in matching their pieces to the mood of the film.

As movie theaters grew in number and importance, a violinist, and perhaps a cellist would be added to the pianist in certain cases, and in the larger movie theaters small orchestras

were formed. For a number of years the selection of music for each film program rested entirely in the hands of the conductor or leader of the orchestra, and very often the principal qualification for holding such a position was not skill or taste so much as the ownership of a large personal library of musical pieces. Since the conductor seldom saw the films until the night before they were to be shown (if indeed, the conductor was lucky enough to see them then), the musical arrangement was normally improvised in the greatest hurry.

To help meet this difficulty, film distributing companies started the practice of publishing suggestions for musical accompaniments. In 1909, for example, the Edison Company began issuing with their films such indications of mood as "pleasant", "sad", "lively". The suggestions became more explicit, and so emerged the musical cue sheet containing indications of mood, the titles of suitable pieces of music, and precise directions to show where one piece led into the next.

Certain films had music especially composed for them. The most famous of these early special scores was that composed and arranged for D. W. Griffith's film Birth of a Nation, which was released in 1915.

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International Business and Cross-cultural Communication

The increase in international business and in foreign investment has created a need for executives with knowledge of foreign languages and skills in cross-cultural communication. Americans, however, have not been well trained in either area and, consequently, have not enjoyed the same level of success in negotiation in an international arena as have their foreign counterparts.

Negotiating is the process of communicating back and forth for the purpose of reaching an agreement. It involves persuasion and compromise, but in order to participate in either one, the negotiators must understand the ways in which people are persuaded and how compromise is reached within the culture of the negotiation.

In many international business negotiations abroad, Americans are perceived as wealthy and impersonal. It often appears to the foreign negotiator that the American represents a large multi-million-dollar corporation that can afford to pay the price without bargaining further. The American negotiator's role becomes that of an impersonal purveyor of information and cash.

In studies of American negotiators abroad, several traits have been identified that may serve to confirm this stereotypical perception, while undermining the negotiator's position. Two traits in particular that cause cross-cultural misunderstanding are directness and impatience on the part of the American negotiator. Furthermore, American negotiators often insist on realizing short-term goals. Foreign negotiators, on the other hand, may value the relationship established between negotiators and may be willing to invest time in it for long-term benefits. In order to solidify the relationship, they

may opt for indirect interactions without regard for the time involved in getting to know the other negotiator.

Clearly, perceptions and differences in values affect the outcomes of negotiations and the success of negotiators. For Americans to play a more effective role in international business negotiations, they must put forth more effort to improve cross-cultural understanding.

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Scientific Theories

In science, a theory is a reasonable explanation of observed events that are related. A theory often involves an imaginary model that helps scientists picture the way an observed event could be produced. A good example of this is found in the kinetic molecular theory, in which gases are pictured as being made up of many small particles that are in constant motion.

A useful theory, in addition to explaining past observations, helps to predict events that have not as yet been observed. After a theory has been publicized, scientists design experiments to test the theory. If observations confirm the scientists' predictions, the theory is supported. If observations do not confirm the predictions, the scientists must search further. There may be a fault in the experiment, or the theory may have to be revised or rejected.

Science involves imagination and creative thinking as well as collecting information and performing experiments. Facts by themselves are not science. As the mathematician Jules Henri Poincare said, "Science is built with facts just as a house is built with bricks, but a collection of facts cannot be called science any more than a pile of bricks can be called a house." Most scientists start an investigation by finding out what other scientists have learned about a particular problem. After known facts have been gathered, the scientist comes to the part of the investigation that requires considerable imagination. Possible solutions to the problem are formulated. These possible solutions are called hypotheses.

In a way, any hypothesis is a leap into the unknown. It extends the scientist's thinking beyond the known facts. The scientist plans experiments, performs calculations, and makes observations to test hypotheses. Without hypothesis, further

investigation lacks purpose and direction. When hypotheses are confirmed, they are incorporated into theories.

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Changing Roles of Public Education

One of the most important social developments that helped to make possible a shift in thinking about the role of public education was the effect of the baby boom of the 1950's and 1960's on the schools. In the 1920's, but especially in the Depression conditions of the 1930's, the United States experienced a declining birth rate -- every thousand women aged fifteen to forty-four gave birth to about 118 live children in 192089.2 in 193075.8 in 1936, and 80 in 1940. With the growing prosperity brought on by the Second World War and the economic boom that followed it young people married and established households earlier and began to raise larger families than had their predecessors during the Depression. Birth rates rose to 102 per thousand in 1946, 106.2 in 1950, and 118 in 1955. Although economics was probably the most important determinant, it is not the only explanation for the

baby boom. The increased value placed on the idea of the family also helps to explain this rise in birth rates. The baby boomers began streaming into the first grade by the mid 1940's and became a flood by 1950. The public school system suddenly found itself overtaxed. While the number of schoolchildren rose because of wartime and postwar conditions, these same conditions made the schools even less prepared to cope with the flood. The wartime economy meant that few new schools were built between 1940 and 1945. Moreover, during the war and in the boom times that followed, large numbers of teachers left their profession for better-paying jobs elsewhere in the economy.

Therefore in the 1950's and 1960's, the baby boom hit an antiquated and inadequate school system. Consequently, the "custodial rhetoric "of the 1930's and early 1940's no longer made sense that is, keeping youths aged sixteen and older out of the labor market by keeping them in school could

no longer be a high priority for an institution unable to find space and staff to teach younger children aged five to sixteen. With the baby boom, the focus of educators and of laymen interested in education inevitably turned toward the lower grades and back to basic academic skills and discipline. The system no longer had much interest in offering nontraditional, new, and extra services to older youths.

Telecommuting

Telecommuting -- substituting the computer for the trip to the job -- has been hailed as a solution to all kinds of problems related to office work.

For workers it promises freedom from the office, less time wasted in traffic, and help with child-care conflicts. For management, telecommuting helps keep high performers on board, minimizes tardiness and absenteeism by eliminating commutes, allows periods of solitude for high-concentration tasks, and provides scheduling flexibility.

In some areas, such as Southern California and Seattle, Washington, local governments are encouraging companies to start telecommuting programs in order to reduce rush-hour congestion and improve air quality.

But these benefits do not come easily. Making a telecommuting program work requires careful planning and an understanding of the differences between telecommuting realities and popular images.

Many workers are seduced by rosy illusions of life as a telecommuter. A computer programmer from New York City moves to the tranquil Adirondack Mountains and stays in contact with her office via computer. A manager comes in to his office three days a week and works at home the other two. An accountant stays home to care for her sick child; she hooks up her telephone modem connections and does office work between calls to the doctor.

These are powerful images, but they are a limited reflection of reality. Telecommuting workers soon learn that it is almost impossible to concentrate on work and care for a young child at the same time. Before a certain age, young children cannot recognize, much less respect, the necessary

boundaries between work and family. Additional child support is necessary if the parent is to get any work done.

Management too must separate the myth from the reality. Although the media has paid a great deal of attention to telecommuting in most cases it is the employee's situation, not the availability of technology that precipitates a telecommuting arrangement.

That is partly why, despite the widespread press coverage, the number of companies with work-at-home programs or policy guidelines remains small.

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The Origin of Refrigerators

By the mid-nineteenth century, the term "icebox" had entered the American language, but ice was still only beginning to affect the diet of ordinary citizens in the United States. The ice trade grew with the growth of cities. Ice was used in hotels, taverns, and hospitals, and by some forward-looking city dealers in fresh meat, fresh fish, and butter. After the Civil War (1861-1865), as ice was used to refrigerate freight cars, it also came into household use. Even before 1880, half the ice sold in New York, Philadelphia, and Baltimore, and one-third of that sold in Boston and Chicago, went to families for their own use. This had become possible because a new household convenience, the icebox, a precursor of the modern refrigerator, had been invented.

Making an efficient icebox was not as easy as we might now suppose. In the early nineteenth century, the knowledge of

the physics of heat, which was essential to a science of refrigeration, was rudimentary. The commonsense notion that the best icebox was one that prevented the ice from melting was of course mistaken, for it was the melting of the ice that performed the cooling. Nevertheless, early efforts to economize ice included wrapping the ice in blankets, which kept the ice from doing its job. Not until near the end of the nineteenth century did inventors achieve the delicate balance of insulation and circulation needed for an efficient icebox.

But as early as 1803, an ingenious Maryland farmer, Thomas Moore, had been on the right track. He owned a farm about twenty miles outside the city of Washington, for which the village of Georgetown was the market center. When he used an icebox of his own design to transport his butter to market, he found that customers would pass up the rapidly melting stuff in the tubs of his competitors to pay a premium price for his butter, still fresh and hard in neat, one-pound

bricks. One advantage of his icebox, more explained, was that farmers would no longer have to travel to market at night in order to keep their produce cool.

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British Columbia

British Columbia is the third largest Canadian province, both in area and population. It is nearly 1.5 times as large as Texas, and extends 800 miles (1,280km) north from the United States border. It includes Canada's entire west coast and the islands just off the coast.

Most of British Columbia is mountainous, with long rugged ranges running north and south. Even the coastal islands are the remains of a mountain range that existed thousands of years ago. During the last Ice Age, this range was scoured by glaciers until most of it was beneath the sea. Its peaks now show as islands scattered along the coast. The southwestern coastal region has a humid mild marine climate. Sea winds that blow inland from the west are warmed by a current of warm water that flows through the Pacific Ocean. As a result, winter temperatures average above freezing and

summers are mild. These warm western winds also carry moisture from the ocean.

Inland from the coast, the winds from the Pacific meet the mountain barriers of the coastal ranges and the Rocky Mountains. As they rise to cross the mountains, the winds are cooled, and their moisture begins to fall as rain. On some of the western slopes almost 200 inches (500cm) of rain fall each year.

More than half of British Columbia is heavily forested. On mountain slopes that receive plentiful rainfall, huge Douglas firs rise in towering columns. These forest giants often grow to be as much as 300 feet (90m) tall, with diameters up to 10 feet (3m). More lumber is produced from these trees than from any other kind of tree in North America. Hemlock, red cedar, and balsam fir are among the other trees found in British Columbia.

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Botany

Botany, the study of plants, occupies a peculiar position in the history of human knowledge. For many thousands of years it was the one field of awareness about which humans had anything more than the vaguest of insights. It is impossible to know today just what our Stone Age ancestors knew about plants, but from what we can observe of pre-industrial societies that still exist a detailed learning of plants and their properties must be extremely ancient. This is logical. Plants are the basis of the food pyramid for all living things even for other plants. They have always been enormously important to the welfare of people not only for food, but also for clothing, weapons, tools, dyes, medicines, shelter, and a great many other purposes. Tribes living today in the jungles of the Amazon recognize literally hundreds of plants and know many properties of each. To them, botany, as

such, has no name and is probably not even recognized as a special branch of "knowledge" at all.

Unfortunately, the more industrialized we become the farther away we move from direct contact with plants, and the less distinct our knowledge of botany grows. Yet everyone comes unconsciously on an amazing amount of botanical knowledge, and few people will fail to recognize a rose, an apple, or an orchid. When our Neolithic ancestors, living in the Middle East about 10, 000 years ago, discovered that certain grasses could be harvested and their seeds planted for richer yields the next season the first great step in a new association of plants and humans was taken. Grains were discovered and from them flowed the marvel of agriculture: cultivated crops. From then on, humans would increasingly take their living from the controlled production of a few plants, rather than getting a little here and a little there from many varieties that grew wild - and the accumulated knowledge of tens of

thousands of years of experience and intimacy with plants in the wild would begin to fade away.

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Plankton

Scattered through the seas of the world are billions of tons of small plants and animals called plankton. Most of these plants and animals are too small for the human eye to see. They drift about lazily with the currents, providing a basic food for many larger animals.

Plankton has been described as the equivalent of the grasses that grow on the dry land continents, and the comparison is an appropriate one. In potential food value, however, plankton far outweighs that of the land grasses. One scientist has estimated that while grasses of the world produce about 49 billion tons of valuable carbohydrates each year, the sea's plankton generates more than twice as much.

Despite its enormous food potential, little effect was made until recently to farm plankton as we farm grasses on

land. Now marine scientists have at last begun to study this possibility, especially as the sea's resources loom even more important as a means of feeding an expanding world population.

No one yet has seriously suggested that "plankton burgers" may soon become popular around the world. As a possible farmed supplementary food source, however, plankton is gaining considerable interest among marine scientists.

One type of plankton that seems to have great harvest possibilities is a tiny shrimp-like creature called krill. Growing to two or three inches long, krill provide the major food for the great blue whale, the largest animal ever inhabit the Earth. Realizing that this whale may grow to 100 feet and weigh 150 tons at maturity, it is not surprising that each one devours more than one ton of krill daily.

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Raising Oysters

In the past oysters were raised in much the same way as dirt farmers raised tomatoes - by transplanting them. First, farmers selected the oyster bed, cleared the bottom of old shells and other debris, then scattered clean shells about. Next, they "planted" fertilized oyster eggs, which within two or three weeks hatched into larvae. The larvae drifted until they attached themselves to the clean shells on the bottom. There they remained and in time grew into baby oysters called seed or spat. The spat grew larger by drawing in seawater from which they derived microscopic particles of food. Before long, farmers gathered the baby oysters, transplanted them in other waters to speed up their growth, then transplanted them once more into another body of water to fatten them up.

Until recently the supply of wild oysters and those crudely farmed were more than enough to satisfy people's

needs. But today the delectable seafood is no longer available in abundance. The problem has become so serious that some oyster beds have vanished entirely.

Fortunately, as far back as the early 1900's marine biologists realized that if new measures were not taken, oysters would become extinct or at best a luxury food. So they set up well-equipped hatcheries and went to work. But they did not have the proper equipment or the skill to handle the eggs. They did not know when, what, and how to feed the larvae. And they knew little about the predators that attack and eat baby oysters by the millions. They failed, but they doggedly kept at it. Finally, in the 1940's a significant breakthrough was made.

The marine biologists discovered that by raising the temperature of the water, they could induce oysters to spawn not only in the summer but also in the fall, winter, and spring. Later they developed a technique for feeding the larvae and rearing them to spat. Going still further, they succeeded in

breeding new strains that were resistant to diseases, grew faster and larger, and flourished in water of different salinities and temperatures. In addition, the cultivated oysters tasted better!

Oil Refining

An important new industry, oil refining, grew after the Civil War. Crude oil, or petroleum -- a dark, thick ooze from the earth -- had been known for hundreds of years, but little use had ever been made of it. In the 1850's Samuel M. Kier, a manufacturer in western Pennsylvania, began collecting the oil from local seepages and refining it into kerosene. Refining, like smelting, is a process of removing impurities from a raw material.

Kerosene was used to light lamps. It was a cheap substitute for whale oil, which was becoming harder to get. Soon there was a large demand for kerosene. People began to search for new supplies of petroleum.

The first oil well was drilled by E. L. Drake, a retired railroad conductor. In 1859 he began drilling in Titusville,

Pennsylvania. The whole venture seemed so impractical and foolish that onlookers called it "Drake's Folly". But when he had drilled down about 70 feet (21 meters), Drake struck oil. His well began to yield 20 barrels of crude oil a day.

News of Drake's success brought oil prospectors to the scene. By the early 1860's these wildcatters were drilling for "black gold" all over western Pennsylvania. The boom rivaled the California gold rush of 1848 in its excitement and Wild West atmosphere. And it brought far more wealth to the prospectors than any gold rush.

Crude oil could be refined into many products. For some years kerosene continued to be the principal one. It was sold in grocery stores and door-to-door. In the 1880's refiners learned how to make other petroleum products such as waxes and lubricating oils. Petroleum was not then used to make gasoline or heating oil.

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Plate Tectonics and Sea-floor Spreading

The theory of plate tectonics describes the motions of the lithosphere, the comparatively rigid outer layer of the Earth that includes all the crust and part of the underlying mantle. The lithosphere is divided into a few dozen plates of various sizes and shapes; in general the plates are in motion with respect to one another. A mid-ocean ridge is a boundary between plates where new lithospheric material is injected from below. As the plates diverge from a mid-ocean ridge they slide on a more yielding layer at the base of the lithosphere.

Since the size of the Earth is essentially constant, new lithosphere can be created at the mid-ocean ridges only if an equal amount of lithospheric material is consumed elsewhere. The site of this destruction is another kind of plate boundary: a subduction zone. There one plate dives

under the edge of another and is reincorporated into the mantle. Both kinds of plate boundary are associated with fault systems, earthquakes and volcanism, but the kinds of geologic activity observed at the two boundaries are quite different.

The idea of sea-floor spreading actually preceded the theory of plate tectonics. In its original version, in the early 1960's, it described the creation and destruction of the ocean floor, but it did not specify rigid lithospheric plates. The hypothesis was substantiated soon afterward by the discovery that periodic reversals of the Earth's magnetic field are recorded in the oceanic crust. As magma rises under the mid-ocean ridge, ferromagnetic minerals in the magma become magnetized in the direction of the geomagnetic field. When the magma cools and solidifies, the direction and the polarity of the field are preserved in the magnetized volcanic rock. Reversals of the field give

rise to a series of magnetic stripes running parallel to the axis of the rift. The oceanic crust thus serves as a magnetic tape recording of the history of the geomagnetic field that can be dated independently; the width of the stripes indicates the rate of the sea-floor spreading.

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Icebergs

Icebergs are among nature's most spectacular creations, and yet most people have never seen one. A vague air of mystery envelops them. They come into being -- somewhere -- in faraway, frigid waters, amid thunderous noise and splashing turbulence, which in most case no one hears or sees. They exist only a short time and then slowly waste away just as unnoticed.

Objects of sheerest beauty they have been called. Appearing in an endless variety of shapes, they may be dazzlingly white, or they may be glassy blue, green or purple, tinted faintly or in darker hues. They are graceful, stately, inspiring -- in calm, sunlight seas.

But they are also called frightening and dangerous, and that they are -- in the night, in the fog, and in storms. Even in

clear weather one is wise to stay a safe distance away from them. Most of their bulk is hidden below the water, so their underwater parts may extend out far beyond the visible top. Also, they may roll over unexpectedly, churning the waters around them.

Icebergs are parts of glaciers that break off, drift into the water, float about awhile, and finally melt. Icebergs afloat today are made of snowflakes that have fallen over long ages of time. They embody snows that drifted down hundreds, or many thousands, or in some cases maybe a million years ago. The snows fell in polar regions and on cold mountains, where they melted only a little or not at all, and so collected to great depths over the years and centuries.

As each year's snow accumulation lay on the surface, evaporation and melting caused the snowflakes slowly to lose their feathery points and become tiny grains of ice. When new snow fell on top of the old, it too turned to icy grains. So

blankets of snow and ice grains mounted layer upon layer and were of such great thickness that the weight of the upper layers compressed the lower ones. With time and pressure from above, the many small ice grains joined and changed to larger crystals, and eventually the deeper crystals merged into a solid mass of ice.

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Topaz

Topaz is a hard, transparent mineral. It is a compound of aluminum, silica, and fluorine. Gem topaz is valuable. Jewelers call this variety of the stone "precious topaz". The best-known precious topaz gems range in color from rich yellow to light brown or pinkish red. Topaz is one of the hardest gem minerals. In the mineral table of hardness, it has a rating of 8, which means that a knife cannot cut it, and that topaz will scratch quartz.

The golden variety of precious topaz is quite uncommon. Most of the world's topaz is white or blue. The white and blue crystals of topaz are large, often weighing thousands of carats. For this reason, the value of topaz does not depend so much on its size as it does with diamonds and many other precious stones, where the value increases about four times with each doubling of weight. The value of a topaz is largely determined

by its quality. But color is also important: blue topaz, for instance, is often irradiated to deepen and improve its color.

Blue topaz is often sold as aquamarine and a variety of brown quartz is widely sold as topaz. The quartz is much less brilliant and more plentiful than true topaz. Most of it is a variety of amethyst: that heat has turned brown.

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The Salinity of Ocean Waters

If the salinity of ocean waters is analyzed, it is found to vary only slightly from place to place. Nevertheless, some of these small changes are important. There are three basic processes that cause a change in oceanic salinity. One of these is the subtraction of water from the ocean by means of evaporation - conversion of liquid water to water vapor. In this manner the salinity is increased, since the salts stay behind. If this is carried to the extreme, of course, white crystals of salt would be left behind.

The opposite of evaporation is precipitation, such as rain, by which water is added to the ocean. Here the ocean is being diluted so that the salinity is decreased. This may occur in areas of high rainfall or in coastal regions where rivers flow into the ocean. Thus salinity may be increased by the

subtraction of water by evaporation, or decreased by the addition of fresh water by precipitation or runoff.

Normally, in tropical regions where the sun is very strong, the ocean salinity is somewhat higher than it is in other parts of the world where there is not as much evaporation. Similarly, in coastal regions where rivers dilute the sea, salinity is somewhat lower than in other oceanic areas.

A third process by which salinity may be altered is associated with the formation and melting of sea ice. When sea water is frozen, the dissolved materials are left behind. In this manner, sea water directly beneath freshly formed sea ice has a higher salinity than it did before the ice appeared. Of course, when this ice melts, it will tend to decrease the salinity of the surrounding water. In the Weddell Sea Antarctica, the densest water in the oceans is formed as a result of this freezing process, which increases the salinity of cold water. This heavy

water sinks and is found in the deeper portions of the oceans of the world.

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Cohesion-Tension Theory

Atmospheric pressure can support a column of water up to 10 meters high. But plants can move water much higher; the sequoia tree can pump water to its very top more than 100 meters above the ground. Until the end of the nineteenth century, the movement of water in trees and other tall plants was a mystery. Some botanists hypothesized that the living cells of plants acted as pumps. But many experiments demonstrated that the stems of plants in which all the cells are killed can still move water to appreciable heights. Other explanations for the movement of water in plants have been based on root pressure, a push on the water from the roots at the bottom of the plant. But root pressure is not nearly great enough to push water to the tops of tall trees. Furthermore, the conifers, which are among the tallest trees, have unusually low root pressures.

If water is not pumped to the top of a tall tree, and if it is not pushed to the top of a tall tree, then we may ask: how does it get there? According to the currently accepted cohesion-tension theory, water is pulled there. The pull on a rising column of water in a plant results from the evaporation of water at the top of the plant. As water is lost from the surface of the leaves, a negative pressure, or tension, is created. The evaporated water is replaced by water moving from inside the plant in unbroken columns that extend from the top of a plant to its roots. The same forces that create surface tension in any sample of water are responsible for the maintenance of these unbroken columns of water. When water is confined in tubes of very small bore, the forces of cohesion (the attraction between water molecules) are so great that the strength of a column of water compares with the strength of a steel wire of the same diameter. This cohesive strength permits columns of water to be pulled to great heights without being broken.

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American Black Bears

American black bears appear in a variety of colors despite their name. In the eastern part of their range, most of these bears have shiny black fur, but in the west they grow brown, red, or even yellow coats. To the north, the black bear is actually gray or white in color. Even in the same litter, both brown and black furred bears may be born.

Black bears are the smallest of all American bears, ranging in length from five to six feet, weighing from three hundred to five hundred pounds. Their eyes and ears are small and their eyesight and hearing are not as good as their sense of smell.

Like all bears, the black bear is timid, clumsy, and rarely dangerous, but if attacked, most can climb trees and cover

ground at great speeds. When angry or frightened, it is a formidable enemy.

Black bears feed on leaves, herbs, roots, fruit, berries, insects, fish, and even larger animals. One of the most interesting characteristics of bears, including the black bear, is their winter sleep. Unlike squirrels, woodchucks, and many other woodland animals, bears do not actually hibernate. Although the bear does not eat during the winter months, sustaining itself from body fat, its temperature remains almost normal, and it breathes regularly four or five times per minute.

Most black bears live alone, except during mating season. They prefer to live in caves, hollow logs, or dense thickets. A litter of one to four cubs is born in January or February after a gestation period of six to nine months, and they remain with their mother until they are fully grown or about one and a half years old. Black bears can live as long as

thirty years in the wild, and even longer in game preserves set aside for them.

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Coal-fired Power Plants

The invention of the incandescent light bulb by Thomas A. Edison in 1879 created a demand for a cheap, readily available fuel with which to generate large amounts of electric power. Coal seemed to fit the bill, and it fueled the earliest power stations (which were set up at the end of the nineteenth century by Edison himself).

As more power plants were constructed throughout the country, the reliance on coal increased. Since the First World War, coal-fired power plants have accounted for about half of the electricity produced in the United States each year. In 1986 such plants had a combined generating capacity of 289, 000 megawatts and consumed 83 percent of the nearly 900 million tons of coal mined in the country that year.

Given the uncertainty in the future growth of nuclear power and in the supply of oil and natural gas, coal-fired power plants could well provide up to 70 percent of the electric power in the United States by the end of the century.

Yet, in spite of the fact that coal has long been a source of electricity and may remain one for many years (coal represents about 80 percent of United States fossil-fuel reserves), it has actually never been the most desirable fossil fuel for power plants. Coal contains less energy per unit of weight than natural gas or oil; it is difficult to transport, and it is associated with a host of environmental issues, among them acid rain.

Since the late 1960's problems of emission control and waste disposal have sharply reduced the appeal of coal-fired power plants. The cost of ameliorating these environmental problems along with the rising cost of building a facility as large and complex as a coal-fired power plant,have also made

such plants less attractive from a purely economic perspective.

Changes in the technological base of coal-fired power plants could restore their attractiveness, however. Whereas some of these changes are evolutionary and are intended mainly to increase the productivity of existing plants, completely new technologies for burning coal cleanly are also being developed.

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Statistics

There were two widely divergent influences on the early development of statistical methods. Statistics had a mother who was dedicated to keeping orderly records of governmental units (state and statistics come from the same Latin root status) and a gentlemanly gambling father who relied on mathematics to increase his skill at playing the odds in games of chance. The influence of the mother on the offspring, statistics, is represented by counting, measuring, describing, tabulating, ordering, and the taking of censuses -- all of which led to modern descriptive statistics. From the influence of the father came modern inferential statistics, which is based squarely on theories of probability.

Descriptive statistics involves tabulating, depicting and describing collections of data. These data may be quantitative such as measures of height, intelligence or grade level --

variables that are characterized by an underlying continuum -- or the data may represent qualitative variables, such as sex, college major or personality type. Large masses of data must generally undergo a process of summarization or reduction before they are comprehensible. Descriptive statistics is a tool for describing or summarizing or reducing to comprehensible form the properties of an otherwise unwieldy mass of data.

Inferential statistics is a formalized body of methods for solving another class of problems that present great difficulties for the unaided human mind. This general class of problems characteristically involves attempts to make predictions using a sample of observations. For example, a school superintendent wishes to determine the proportion of children in a large school system that come to school without breakfast, have been vaccinated for flu, or whatever. Having a little knowledge of statistics, the superintendent would know that it is unnecessary and inefficient to question each child:

the proportion for the entire district could be estimated fairly accurately from a sample of as few as 100 children. Thus, the purpose of inferential statistics is to predict or estimate characteristics of a population from a knowledge of the characteristics of only a sample of the population.

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Obtaining Fresh Water from Icebergs

The concept of obtaining fresh water from icebergs that are towed to populated areas and arid regions of the world was once treated as a joke more appropriate to cartoons than real life. But now it is being considered quite seriously by many nations, especially since scientists have warned that the human race will outgrow its fresh water supply faster than it runs out of food.

Glaciers are a possible source of fresh water that has been overlooked until recently. Three-quarters of the Earth's fresh water supply is still tied up in glacial ice, a reservoir of untapped fresh water so immense that it could sustain all the rivers of the world for 1,000 years. Floating on the oceans every year are 7,659 trillion metric tons of ice encased in 10,000 icebergs that break away from the polar ice caps, more than ninety percent of them from Antarctica.

Huge glaciers that stretch over the shallow continental shelf give birth to icebergs throughout the year. Icebergs are not like sea ice, which is formed when the sea itself freezes, rather, they are formed entirely on land, breaking off when glaciers spread over the sea. As they drift away from the polar region, icebergs sometimes move mysteriously in a direction opposite to the wind, pulled by subsurface currents. Because they melt more slowly than smaller pieces of ice, icebergs have been known to drift as far north as 35 degrees south of the equator in the Atlantic Ocean. To corral them and steer them to parts of the world where they are needed would not be too difficult. The difficulty arises in other technical matters, such as the prevention of rapid melting in warmer climates and the funneling of fresh water to shore in great volume. But even if the icebergs lost half of their volume in towing, the water they could provide would be far cheaper than that produced by desalinization, or removing salt from water.

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The Source of Energy

A summary of the physical and chemical nature of life must begin, not on the Earth, but in the Sun; in fact, at the Sun's very center. It is here that is to be found the source of the energy that the Sun constantly pours out into space as light and heat. This energy is liberated at the center of the Sun as billions upon billions of nuclei of hydrogen atoms collide with each other and fuse together to form nuclei of helium, and in doing so, release some of the energy that is stored in the nuclei of atoms.

The output of light and heat of the Sun requires that some 600 million tons of hydrogen be converted into helium in the Sun every second. This the Sun has been doing for several thousands of millions of years.

The nuclear energy is released at the Sun's center as high-energy gamma radiation, a form of electromagnetic radiation like light and radio waves, only of very much shorter wavelength. This gamma radiation is absorbed by atoms inside the Sun to be reemitted at slightly longer wavelengths. This radiation, in its turn is absorbed and reemitted. As the energy filters through the layers of the solar interior, it passes through the X-ray part of the spectrum eventually becoming light. At this stage, it has reached what we call the solar surface, and can escape into space without being absorbed further by solar atoms. A very small fraction of the Sun's light and heat is emitted in such directions that after passing unhindered through interplanetary space, it hits the Earth.

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Vision

Human vision, like that of other primates, has evolved in an arboreal environment. In the dense complex world of a tropical forest, it is more important to see well than to develop an acute sense of smell. In the course of evolution members of the primate line have acquired large eyes while the snout has shrunk to give the eye an unimpeded view.

Of mammals only humans and some primates enjoy color vision. The red flag is black to the bull. Horses live in a monochrome world. Light visible to human eyes, however, occupies only a very narrow band in the whole electromagnetic spectrum. Ultraviolet rays are invisible to humans though ants and honeybees are sensitive to them. Humans have no direct perception of infrared rays unlike the rattlesnake which has receptors tuned into wavelengths longer than 0.7 micron. The world would look eerily different if human eyes were sensitive

to infrared radiation. Then instead of the darkness of night, we would be able to move easily in a strange shadowless world where objects glowed with varying degrees of intensity. But human eyes excel in other ways. They are in fact remarkably discerning in color gradation. The color sensitivity of normal human vision is rarely surpassed even by sophisticated technical devices.

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Folk Cultures

A folk culture is a small isolated, cohesive, conservative, nearly self-sufficient group that is homogeneous in custom and race with a strong family or clan structure and highly developed rituals. Order is maintained through sanctions based in the religion or family and interpersonal relationships are strong. Tradition is paramount, and change comes infrequently and slowly. There is relatively little division of labor into specialized duties. Rather, each person is expected to perform a great variety of tasks, though duties may differ between the sexes. Most goods are hand-made and subsistence economy prevails. Individualism is weakly developed in folk cultures as are social classes. Unaltered folk cultures no longer exist in industrialized countries such as the United States and Canada. Perhaps the nearest modern equivalent in Anglo America is the Amish, a German American farming sect that largely

renounces the products and labor saving devices of the industrial age. In Amish areas, horse drawn buggies still serve as a local transportation device and the faithful are not permitted to own automobiles. The Amish's central religious concept of Demut "humility" clearly reflects the weakness of individualism and social class so typical of folk cultures and there is a corresponding strength of Amish group identity. Rarely do the Amish marry outside their sect. The religion, a variety of the Mennonite faith, provides the principal mechanism for maintaining orders.

By contrast a popular culture is a large heterogeneous group often highly individualistic and constantly changing. Relationships tend to be impersonal and a pronounced division of labor exists, leading to the establishment of many specialized professions. Secular institutions of control such as the police and army take the place of religion and family in maintaining order, and a money-based economy prevails. Because of these

contrasts, "popular" may be viewed as clearly different from "folk". The popular is replacing the folk in industrialized countries and in many developing nations. Folk-made objects give way to their popular equivalent, usually because the popular item is more quickly or cheaply produced, is easier or time saving to use or leads more prestige to the owner.

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Bacteria

Bacteria are extremely small living things. While we measure our own sizes in inches or centimeters, bacterial size is measured in microns. One micron is a thousandth of a millimeter: a pinhead is about a millimeter across. Rod-shaped bacteria are usually from two to four microns long, while rounded ones are generally one micron in diameter. Thus if you enlarged a rounded bacterium a thousand times, it would be just about the size of a pinhead. An adult human magnified by the same amount would be over a mile (1.6 kilometers) tall.

Even with an ordinary microscope, you must look closely to see bacteria. Using a magnification of 100 times, one finds that bacteria are barely visible as tiny rods or dots. One cannot make out anything of their structure. Using special stains, one can see that some bacteria have attached to them wavy-looking "hairs" called flagella. Others have only one

flagellum. The flagella rotate, pushing the bacteria through the water. Many bacteria lack flagella and cannot move about by their own power, while others can glide along over surfaces by some little-understood mechanism.

From the bacterial point of view, the world is a very different place from what it is to humans. To a bacterium water is as thick as molasses is to us. Bacteria are so small that they are influenced by the movements of the chemical molecules around them. Bacteria under the microscope, even those with no flagella, often bounce about in the water. This is because they collide with the water molecules and are pushed this way and that. Molecules move so rapidly that within a tenth of a second the molecules around a bacterium have all been replaced by new ones; even bacteria without flagella are thus constantly exposed to a changing environment.

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Sleep

Sleep is part of a person's daily activity cycle. There are several different stages of sleep, and they too occur in cycles. If you are an average sleeper, your sleep cycle is as follows. When you first drift off into slumber, your eyes will roll about a bit, your temperature will drop slightly, your muscles will relax, and your breathing well slow and become quite regular. Your brain waves slow down a bit too, with the alpha rhythm of rather fast waves predominating for the first few minutes. This is called stage 1 sleep. For the next half hour or so, as you relax more and more, you will drift down through stage 2 and stage 3 sleep. The lower your stage of sleep, the slower your brain waves will be. Then about 40 to 60 minutes after you lose consciousness you will have reached the deepest sleep of all. Your brain waves will show the large slow waves that are known as the delta rhythm. This is stage 4 sleep.

You do not remain at this deep fourth stage all night long, but instead about 80 minutes after you fall into slumber, your brain activity level will increase again slightly. The delta rhythm will disappear, to be replaced by the activity pattern of brain waves. Your eyes will begin to dart around under your closed eyelids as if you were looking at something occurring in front of you. This period of rapid eye movement lasts for some 8 to 15 minutes and is called REM sleep. It is during REM sleep period, your body will soon relax again, your breathing will grow slow and regular once more, and you will slip gently back from stage 1 to stage 4 sleep - only to rise once again to the surface of near consciousness some 80 minutes later.

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Cells and Temperature

Cells cannot remain alive outside certain limits of temperature, and much narrower limits mark the boundaries of effective functioning. Enzyme systems of mammals and birds are most; efficient only within a narrow range around 37 a departure of a few degrees from this value seriously impairs their functioning. Even though cells can survive wider fluctuations, the integrated actions of bodily systems are impaired. Other animals have a wider tolerance for changes of bodily temperature.

For centuries it has been recognized that mammals and birds differ from other animals in the way they regulate body temperature. Ways of characterizing the difference have become more accurate and meaningful over time, but popular terminology still reflects the old division into "warm blooded" and "cold blooded" species; warm-blooded included mammals

and birds whereas all other creatures were considered cold-blooded. As more species were studied, it became evident that this classification was inadequate. A fence lizard or a desert iguana -- each cold-blooded -- usually has a body temperature only a degree or two below that of humans and so is not cold. Therefore the next distinction was made between animals that maintain a constant body temperature, called homeotherms, and those whose body temperature varies with their environment, called poikilotherms. But this classification also proved inadequate, because among mammals there are many that vary their body temperatures during hibernation. Furthermore, many invertebrates that live in the depths of the ocean never experience a change in the chill of the deep water, and their body temperatures remain constant.

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Marine Mammals

Since there is such an abundance of food in the sea, it is understandable that some of the efficient, highly adaptable, warm-blooded mammals that evolved on land should have returned to the sea. Those that did have flourished. Within about 50 million years -- no time at all, geologically speaking -- one of the four kinds of mammals that has returned to a marine environment has developed into the largest of all animal forms, the whale. A second kind, the seal, has produced what is probably the greatest population of large carnivorous mammals on Earth.

This suggests that these "top dogs" of the ocean are prospering and multiplying. However, such has not been the case, at least not for the last 150 years. Trouble has closed in on these mammals in the form of equally warm-blooded and even more efficient and adaptable predators, humans. At sea,

as on land, humans have now positioned themselves on the top of the whole great pyramid of life, and they have caused serious problems for the mammals of the sea. There is a simple reason for this. Marine mammals have the misfortune to be swimming aggregates of commodities that humans want: fur, oil and meat. Even so, they might not be so vulnerable to human depredation if they did not, like humans, reproduce so slowly. Every year humans take more than 50 million tons of fish from the oceans without critically depleting the population of any species. But the slow-breeding mammals of the sea have been all but wiped out by humans seeking to satisfy their wants and whims.

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Chimpanzees

The most striking single fact about chimpanzees is the flexibility of their social life, the lack of any rigid form of organization. It represents about as far a departure from the baboon type of organization as one can find among the higher primates, and serves to emphasize the great variety of primate adaptations.

Chimpanzees are more human than baboons, or rather they jibe better with the way we like to picture ourselves, as free-wheeling individuals who tend to be unpredictable, do not take readily to any form of regimentation, and are frequently charming. (Charm is relatively rare among baboons.)

Two researchers have described what they found during more than eight months spent among chimpanzees in their natural habitat the forest: "We were quite surprised to observe

that there is no single distinct social unit in chimpanzee society. Not only is there no 'family' or 'harem' organization; neither is there a 'troop' organization - that is to say, no particular chimpanzees keep permanently together. On the contrary, individuals move about at will, alone or in small groups best described as bands, which sometimes form into large aggregations. They leave their associates if they want to, and join up with new ones without conflict. “The general practice is best described as "easy come, easy go”, although there are certain group-forming tendencies.

As a rule, chimpanzees move about in one of four types of band: adult males only; mothers and offspring and occasionally a few other females; adults and adolescents of both sexes, but no mothers with young and representatives of all categories mixed together. The composition of bands may change a number of times during the course of a day as individuals wander off and groups split or combine with other

groups. On the other hand, certain individuals prefer one another's company. One of the researchers observed that four males often roamed together over a four-month period, and mothers often associated with their older offspring.

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Nitinol

Nitinol is one of the most extraordinary metals to be discovered this century: A simple alloy of nickel and titanium, nitinol has some perplexing properties. A metal with a memory, it can be made to remember any shape into which it is fashioned, returning to that shape whenever it is heated.

For example, a piece of nitinol wire bent to form a circle that is then heated and quenched will remember this shape. It may then be bent or crumpled, but on reheating, will violently untwist, reforming its original shape. This remarkable ability is called Shape Memory Effect (SME); other alloys, such as brasses, are known to possess it to a limited extent. No one fully understands SME, and nitinol remains particularly perplexing, for, whenever it performs this peculiar feat, it appears to be breaking the laws of thermodynamics by springing back into shape with greater force than was used to

deform it in the first place. But not only is nitinol capable of remembering, it also has the ability to "learn".

If the heating-cooling-crumpling-reheating process is carried out sufficiently often, and the metal is always crumpled in exactly the same way, the nitinol will not only remember its original shape, but gradually it learns to remember its crumpled form as well, and will begin to return to the same crumpled shape every time it is cooled. Eventually, the metal will crumple and uncrumple, totally unaided, in response to changes in temperature and without any sign of metal fatigue.

Engineers have produced prototype engines that are driven by the force of nitinol springing from one shape to another as it alternately encounters hot and cold water. The energy from these remarkable engines is, however, not entirely free: heat energy is required to produce the temperature differences needed to run the engine. But the optimum temperatures at which the metal reacts can be controlled by

altering the proportions of nickel to titanium; some alloys will even perform at room temperature. The necessary temperature range between the warm and the cold can be as little as twelve degrees centigrade.

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Treasure in Sunken Ships

Of the tens of thousands of ships on the ocean bottom, only a handful, less than 1 percent, contain negotiable treasure, such as gold and jewels. Most give us a different priceless treasure -- history. A sunken ship lies in trust, preserved in the airless environment of the sea and those in deep water are especially well protected. No dry land sites anywhere -- except perhaps Egyptian tombs -- are in a better state of preservation than a vessel deep in the ocean. A sunken ship, therefore, can be a rare window through which a moment in time is glimpsed.

This is not to imply that sunken ships are always found intact. Most ships break up on the way down, hit the bottom at about 100 miles per hour, and become a chaotic, confusing jumble. I recall the chagrin of a novice diver who, after surfacing from an underwater tour of a 400-foot ship, asked his diving buddy, "Where was the wreck?" It takes experience to

actually know a sunken ship when one sees it. But no matter what its condition on the way down, a ship deteriorates much more slowly as it sinks deeper into protective layers of sand and mud. Ancient vessels have been found in remarkably good condition. In 1977 a group of marine archaeologists excavating a 900-year-old wreck recovered engraved glassware. Greek coins, bronze kettles, and amazingly, Greek jars containing seeds, almonds, and lentils -- even a plate with chicken bones.

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Creating Colors

There are two ways to create colors in a photograph. One method, called additive, starts with three basic colors and adds them together to produce some other colors. The second method, called subtractive, starts with white light (a mixture of all colors in the spectrum) and by taking away some or all other colors leaves the one desired.

In the additive method separate colored lights are combined to produce various other colors. The three additive primary colors are green, red and blue (each proportion, about one third of the wavelengths in the total spectrum). Mixed in varying proportions, they can produce all colors. Green and red light mix to produce yellow, red and blue light mix to produce magenta, green and blue mix to produce cyan. When equal parts of all three of these primary colored beams of light overlap, the mixture appears white to the eye.

In the subtractive process, colors are produced when dye (as in paint or color photographic materials) absorbs some wavelengths and so passes on only part of the spectrum. The subtractive primaries are cyan (a bluish green), magenta (a purplish pink), and yellow; these are the pigments or dyes that absorb red, green and blue wavelengths, respectively, thus subtracting them from white light. These dye colors are the complementary colors to the three additive primaries of red, green and blue. Properly combined, the subtractive primaries can absorb all colors of light, producing black. But, mixed in varying proportions they too can produce any color in the spectrum.

Whether a particular color is obtained by adding colored lights together or by subtracting some light from the total spectrum, the result looks the same to the eye. The additive process was employed for early color photography. But the subtractive method, while requiring complex chemical

techniques, has turned out to be more practical and is the basis of all modern color films.

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Organic Foods

Are organically grown foods the best food choices? The advantages claimed for such foods over conventionally grown and marketed food products are now being debated. Advocates of organic foods -- a term whose meaning varies greatly -- frequently proclaim that such products are safer and more nutritious than others.

The growing interest of consumers in the safety and nutritional quality of the typical North American diet is a welcome development. However, much of this interest has been sparked by sweeping claims that the food supply is unsafe or inadequate in meeting nutritional needs. Although most of these claims are not supported by scientific evidence, the preponderance of written material advancing such claims makes it difficult for the general public to separate fact from fiction. As a result, claims that eating a diet consisting entirely

of organically grown foods prevents or cures disease or provides other benefits to health have become widely publicized and form the basis for folklore.

Almost daily the public is besieged by claims for "no-aging" diets, new vitamins and other wonder foods. There are numerous unsubstantiated reports that natural vitamins are superior to synthetic ones, that fertilized eggs are nutritionally superior to unfertilized eggs, that untreated grains are better than fumigated grains and the like.

One thing that most organically grown food products seem to have in common is that they cost more than conventionally grown foods. But in many cases consumers are misled if they believe organic foods can maintain health and provide better nutritional quality than conventionally grown foods. So there is real cause for concern if consumers particularly those with limited incomes, distrust the regular food supply and buy only expensive organic foods instead.

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Animals' Compasses

Researchers have found that migrating animals use a variety of inner compasses to help them navigate. Some steer by the position of the Sun. Others navigate by the stars. Some use the Sun as their guide during the day and then switch to star navigation by night. One study shows that the homing pigeon uses the Earth's magnetic fields as a guide in finding its way home and there are indications that various other animals from insects to mollusks, can also make use of magnetic compasses. It is of course very useful for a migrating bird to be able to switch to a magnetic compass when clouds cover the Sun; otherwise it would just have to land and wait for the Sun to come out again.

Even with the Sun or stars to steer by, the problems of navigation are more complicated than they might seem at first. For example, a worker honeybee that has found a rich source

of nectar and pollen flies rapidly home to the hive to report. A naturalist has discovered that the bee scout delivers her report through a complicated dance in the hive, in which she tells the other workers not only how far away the food is, but also what direction to fly in relation to the Sun. But the Sun does not stay in one place all day. As the workers start out to gather the food, the Sun may already have changed its position in the sky somewhat. In later trips during the day, the Sun will seem to move farther and farther toward the west. Yet the worker bees seem to have no trouble at all in finding the food source. Their inner clocks tell them just where the Sun will be and they change their course correspondingly.

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Muscles and Human Body

It is in the joints of the human body that movements of the bones take place. The movement itself is caused by the pull of sheets and cords of very tough tissue called muscle. Muscle tissue has the special ability to shorten itself so that the bone on which it pulls has to move. When muscle tissue shortens, it also bunches up. Muscle tissue covers the body in sheets and bands that lie between the skin and the skeleton. The bones are the framework of the body, but the muscles fill out the body shape.

Most muscles extend from one bone to another. When the muscle between the bones shortens, one bone has to move. The point where the muscle is fastened to the unmoving bone is called the origin of the muscle, whereas the point where the muscle is not fastened to the bone that is to be moved is called the insertion. Sometimes the muscle is not attached directly to

the bone but to a tough, nonstretchable cord, or tendon, that is attached to the bone.

Muscles do not push; they can only pull. To bend the arm at the elbow, the muscle at the front of the upper arm has to shorten and bunch up. To unbend the arm other muscles in the back of the arm have to shorten. These two sets of muscles - the front and the back - are said to act in opposition to each other. When one set is working, the other set is usually relaxed. But there are times when both of them work. Sometimes muscles are called upon to do more than simply pull in one direction. They may have to perform a turning motion. To be able to do this, the muscle must be attached to the bone at an angle. By pulling, the muscle can cause the bone to pivot. A few muscles have special functions. The diaphragm, for example, forces the lungs to take in air. This part of breathing is not primarily a bone moving operation.

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Colds and Age

A critical factor that plays a part in susceptibility to colds is age. A study done by the University of Michigan School of Public Health revealed particulars that seem to hold true for the general population. Infants are the most cold ridden group, averaging more than six colds in their first years. Boys have more colds than girls up to age three. After the age of three, girls are more susceptible than boys, and teenage girls average three colds a year to boys' two. The general incidence of colds continues to decline into maturity. Elderly people who are in good health have as few as one or two colds annually. One exception is found among people in their twenties, especially women, who show a rise in cold infections, because people in this age group are most likely to have young children.

Adults who delay having children until their thirties and forties experience the same sudden increase in cold infections. The study also found that economics plays an important role. As income increases, the frequency at which colds are reported in the family decreases.

Families with the lowest income suffer about a third more colds than families at the upper end. Lower income generally forces people to live in more cramped quarters than those typically occupied by wealthier people, and crowding increases the opportunities for the cold virus to travel from person to person. Low income may also adversely influence diet. The degree to which poor nutrition affects susceptibility to colds is not yet clearly established, but an inadequate diet is suspected of lowering resistance generally.

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Pottery

Ancient people made clay pottery because they needed it for their survival. They used the pots they made for cooking, storing food, and carrying things from place to place. Pottery was so important to early cultures that scientists now study it to learn more about ancient civilizations. The more advanced the pottery in terms of decoration, materials, glazes and manufacture, the more advanced the culture itself.

The artisan who makes pottery in North America today utilizes his or her skill and imagination to create items that are beautiful as well as functional, transforming something ordinary into something special and unique.

The potter uses one of the Earth's most basic materials, clay. Clay can be found almost anywhere. Good pottery clay must be free from all small stones and other hard materials that

would make the potting process difficult. Most North American artisan potters now purchase commercially processed clay, but some find the clay they need right in the earth close to where they work.

The most important tools potters use are their own hands; however, they also use wire loop tools, wooden modeling tools, plain wire, and sponges. Plain wire is used to cut away the finished pot from its base on the potter's wheel.

After a finished pot is dried of all its moisture in the open air, it is placed in a kiln and fired. The first firing hardens the pottery, and it is then ready to be glazed and fired again.

For areas where they do not want any glaze, such as the bottom of the pot, artisans paint on melted wax that will later burn off in the kiln. They then pour on the liquid glaze and let it run over the clay surface, making any kind of decorative pattern that they want.

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Mimicry in Plants

Plant adaptations can be remarkably complex. Certain species of orchids, for instance, imitate female bees, other plants look and smell like dead animals, and still others have the appearance of stones. These strange adaptations to life represent just a few of the sophisticated means by which plants enhance their chances of survival. Mimicry in plants or animals is a three part system. There is a model: the animal, plant or substrate being initiated. There is a mimic: the organism that imitates the model. And there is a signal receiver or dupe: the animal that cannot effectively distinguish between the model and the mimic.

Mimetic traits may include morphological structures, color patterns, behaviors or other attributes of the mimic that promote its resemblance to a model. That model may be either an unrelated species or an inanimate object, such as the

background against which an organism spends most of its time. Mimicry is not an active strategy on the part of an individual plant; flowers do not deliberately trick or deceive animals into visiting them.

Mimicry arises as the result of evolution through natural selection and the occurrence of random genetic mutations that lead over many generations to the appearance of favorable characteristics. If such traits help to camouflage a plant, for example, the plant is likely to have a survival advantage over other plants that are less well camouflaged. The plant will leave more descendants, thereby passing the advantage to the next generation. For natural selection to favor the evolution of mimicry, the mimicry must derive a reproductive advantage from modeling itself after another organism or object: its fitness, measured as the number of offspring produced that survive into the next generation, must be increased as the result of deception.

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Oil and Water

To understand the emulsifying process, we must first accept the scientific principle that oil and water do not naturally mix. Quite literally, they find each other's presence repulsive. A good illustration of this aversion is homemade oil and vinegar salad dressing. When you shake or beat your salad dressing, you do more than disperse the oil throughout the vinegar: you also break down the oil into droplets minute enough to remain temporarily suspended in the vinegar (which from now on we will call water, because that tart condiment is in effect mainly water). The second you stop agitating the dressing, the oil droplets start to combine into units too large to be suspended in the water, and thus slither their way upward, separating from the water in the process. The oil rises to the top and the water sinks because oil has a lower specific density than water. If you want a stable emulsion, you need an

emulsifying agent which prevents the oil droplets from combining into larger units.

Emulsifying agents occur naturally in many animal substances including egg yolks and milk. An emulsifying agent helps to keep the oil particles from combining in three basic ways. First, the agent coats the oil, serving as a physical barrier between the droplets. Second, it reduces the water's surface tension, which, in turn, reduces the water's ability to repulse oil. Third, the agent gives the surfaces of the oil droplets identical electrical charges; since like charges repel each other the droplets repel each other.

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Salt and Metabolism

Just how salt became so crucial to our metabolism is a mystery; one appealing theory traces our dependence on it to the chemistry of the late Cambrian seas. It was there, a half billion years ago, that tiny metazoan organisms first evolved systems for sequestering and circulating fluids. The water of the early oceans might thus have become the chemical prototype for the fluids of all animal life - the medium in which cellular operations could continue no matter how the external environment changed.

This speculation is based on the fact that, even today, the blood serums of radically divergent species are remarkably similar. Lizards, platypuses, sheep, and humans could hardly be more different in anatomy or eating habits, yet the salt content in the fluid surrounding their blood cells is virtually identical. As early marine species made their way to fresh

water and eventually to dry land, sodium remained a key ingredient of their interior, if not their exterior, milieu.

The most successful mammalian species would have been those that developed efficient hormonal systems for maintaining the needed sodium concentrations. The human body, for example, uses the hormones renin, angiotensin, and aldosterone to retain or release tissue fluids and blood plasma. The result, under favorable conditions, is a dynamic equilibrium in which neither fluid volume nor sodium concentration fluctuates too dramatically. But if the body is deprived of salt, the effects soon become dangerous, despite compensatory mechanisms.

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The Early Settlers in North America

The North American frontier changed some of the characteristics of the pioneers of the 1750's and intensified others. They were, as a group, semiliterate, proud, and stubborn, as dogged in their insistence on their own way of life as pine roots cracking granite to grow. Perhaps their greatest resource was their capacity to endure. They outlasted recurrent plagues of smallpox and malaria and a steady progression of natural accidents. They were incredibly prolific. Squire Boone's family of eight children was small by frontier standards. James Roberson, an eventual neighbor of Boone's and the founder of Nashville, had eleven children. Twice married John Sevier, the first governor of Tennessee, fathered eighteen; his longtime enemy, John Tipton, also twice married, produced seventeen. The entire assets of one of these huge families often amounted, in the beginning, to little more than an

axe, a hunting knife, an auger, a rifle, a horse or two, some cattle and a few pigs, a sack of corn seed and another of salt, perhaps a crosscut saw, and a loom. Those who moved first into a new region lived for months at a time on wild meat, Indian maize, and native fruits in season. Yet if they were poor at the beginning, they confidently expected that soon they would be rich. In a way almost impossible to define to urban dwellers, a slice of ground suitable for farming represented not just dollars and cents, but dignity. The obsession brought shiploads of yearners every week to Boston, New York, Philadelphia, Baltimore, Charles Towne, and Savannah. It sent them streaming westward into the wilderness after their predecessors to raise still more children who wanted still more land.

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Plants in the Deserts

Some cacti, like the saguaro, grow to tree size, but true trees need more moisture than most desert environments can supply, so they are scarce on deserts. Close to streambeds, cottonwoods can sometimes be found. Though these streams are dry most of the year, water flows there longest and is usually available fairly close to the surface. Elsewhere, trees must send taproots deep into the hard baked desert soil to draw on underground water. Perhaps the most widespread family of trees on the world's deserts is the acacia, whose taproots drill down as far as 25 feet (7. 5 meters). The mesquite common on North American deserts in both tree and shrub forms, does not begin to grow above ground until its root system is completely developed, ensuring the plant a supply of moisture. The roots of shrubs and trees help to hold the desert soil in place. Their stalks and branches also act as

screens to keep the wind from sweeping great drifts of sand along the surface. These services are vital if a desert is to support life. Scientists estimate that a desert needs year round plant cover over 20 to 40 percent of its surface. If shrubs are too far apart - separated by a distance greater than five times their height - soil around them is likely to blow away. Without the shelter of established shrubs, new seedlings will have difficulty in getting a start. On the other hand, plants that are too close together may compete for underground moisture. To protect themselves from this competition some shrubs give off a substance that kills young plants that sprout too close to them. In addition to a few varieties of trees and tough shrubs, most deserts have grasses, herbs, and other annual plants. These do not compete for moisture with the longer lived growth. They spring up quickly after rains, when the surface is moist. Then, for a brief time, the desert can be literally carpeted with color. Almost as quickly as they appeared, these small plants die away. But they have developed special ways

of ensuring the life of another generation when rains come again.

The American Civil War

The military aspect of the United States Civil War has always attracted the most attention from scholars. The roar of gunfire, the massed movements of uniformed men, the shrill of bugles, and the drama of hand to hand combat have fascinated students of warfare for a century.

Behind the lines, however, life was less spectacular. It was the story of back breaking labor to provide the fighting men with food and arms, of nerve tingling uncertainty about the course of national events, of heartbreak over sons or brothers or husbands lost in battle. If the men on the firing line won the victories, the means to those victories were forged on the home front.

Never in the nation's history had Americans worked harder for victory than in the Civil War. Northerners and

Southerners alike threw themselves into the task of supplying their respective armies. Both governments made tremendous demands upon civilians and, in general, received willing cooperation.

By 1863 the Northern war economy was rumbling along in high gear. Everything from steamboats to shovels was needed and produced. Denied Southern cotton, textile mills turned to wool for blankets and uniforms. Hides by the hundreds of thousands were turned into shoes and harness and saddles; ironworks manufactured locomotives, ordnance, and armor plate. Where private enterprise lagged, the government set up its own factories or arsenals.

Agriculture boomed, with machinery doing the job of farm workers drawn into the army. In short, everything that a nation needed to fight a modern war was produced in uncounted numbers. Inevitably there were profiteers with gold headed canes and flamboyant diamond stickpins, but for every

crooked tycoon there were thousands of ordinary citizens living on fixed incomes who did their best to cope with rising prices and still make a contribution to the war effort. Those who could buy war bonds: others knitted, sewed, nursed, or lent any other assistance in their power.

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Women in Colonial North America

The status of women in colonial North America has been well studied and described and can be briefly summarized. Throughout the colonial period there was a marked shortage of women, which varied with the regions and was always greatest in the frontier areas. This favorable ratio enhanced women's status and position and allowed them to pursue different careers.

The Puritans, the religious sect that dominated the early British colonies in North America, regarded idleness as a sin, and believed that life in an underdeveloped country made it absolutely necessary that each member of the community perform an economic function. Thus work for women, married or single, was not only approved, it was regarded as a civic duty. Puritan town councils expected widows and unattached

women to be self supporting and for a long time provided needy spinsters with parcels of land.

There was no social sanction against married women working; on the contrary, wives were expected to help their husbands in their trade and won social approval for doing extra work in or out of the home. Needy children, girls as well as boys, were indentured or apprenticed and were expected to work for their keep.

The vast majority of women worked within their homes, where their labor produced most articles needed for the family. The entire colonial production of cloth and clothing and partially that of shoes was in the hands of women.

In addition to these occupations, women were found in many different kinds of employment. They were butchers, silversmiths, gunsmiths and upholsterers. They ran mills, plantations, tanyards, shipyards, and every kind of shop, tavern,

and boardinghouse. They were gatekeepers, jail keepers, sextons, journalists, printers, apothecaries, midwives, nurses, and teachers.

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Satiric Literature

Perhaps the most striking quality of satiric literature is its freshness, its originality of perspective. Satire rarely offers original ideas. Instead, it presents the familiar in a new form. Satirists do not offer the world new philosophies. What they do is to look at familiar conditions from a perspective that makes these conditions seem foolish, harmful, or affected. Satire jars us out of complacence into a pleasantly shocked realization that many of the values we unquestioningly accept are false. Don Quixote derides the stupidity of knights Brave New World ridicules the pretensions of science; A Modest Proposal dramatizes starvation by advocating cannibalism. None of these ideas is original. Chivalry was suspect before Cervantes, humanists objected to the claims of pure science before Aldous Huxley, and people were aware of famine before Swift. It was not the originality of the idea that made these satires popular. It

was the manner of expression, the satiric method that made them interesting and entertaining. Satires are read because they are aesthetically satisfying works of art, not because they are morally wholesome or ethically instructive. They are stimulating and refreshing because with commonsense briskness they brush away illusions and secondhand opinions. With spontaneous irreverence, satire rearranges perspectives, scrambles familiar objects into incongruous juxtaposition, and speaks in a personal idiom instead of abstract platitude.

Satire exists because there is need for it. It has lived because readers appreciate a refreshing stimulus, an irreverent reminder that they live in a world of platitudinous thinking, cheap moralizing, and foolish philosophy. Satire serves to prod people into an awareness of truth, though rarely to any action on behalf of truth. Satire tends to remind people that much of what they see, hear, and read in popular media is sanctimonious, sentimental, and only partially true. Life

resembles in only a slight degree the popular image of it. Soldiers rarely hold the ideals that movies attribute to them, nor do ordinary citizens devote their lives to unselfish service of humanity. Intelligent people know these things but tend to forget them when they do not hear them expressed.

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The Microscopic Technique

Each advance in microscopic technique has provided scientists with new perspectives on the function of living organisms and the nature of matter itself. The invention of the visible light microscope late in the sixteenth century introduced a previously unknown realm of single celled plants and animals. In the twentieth century, electron microscopes have provided direct views of x-viruses and minuscule surface structures. Now another type of microscope, one that utilizes rays rather than light or electrons, offers a different way of examining tiny details; it should extend human perception still farther into the natural world.

The dream of building an x-ray microscope dates to back 1895; its development, however, was virtually halted in the 1940's because the development of the electron microscope was progressing rapidly. During the 1940's, electron

microscopes routinely achieved resolution better than that possible with a visible light microscope, while the performance of x ray microscopes resisted improvement. In recent years, however, interest in x ray microscopes has revived, largely because of advances such as the development of new sources of x-ray illumination. As a result, the brightness available today is millions of times that of x ray tubes, which, for most of the century, were the only available sources of soft x-rays. The new x-ray microscopes considerably improve on the resolution provided by optical microscopes. They can also be used to map the distribution of certain chemical elements. Some can form pictures in extremely short times; others hold the promise of special capabilities such as three dimensional imaging.

Unlike conventional electron microscope, x-ray microscope enables specimens to be kept in air and in water, which means that biological samples can be studied under

conditions similar to their natural state. The illumination used, so called soft x-rays in the wavelength range of twenty to forty angstroms (an angstrom is one ten billionth of a meter), is also sufficiently penetrating to image intact biological cells in many cases. Because of the wavelength of the x-rays used, soft x-ray microscopes will never match the highest resolution possible with electron microscopes. Rather, their special properties will make possible investigations that will complement those performed with light and electron based instruments.

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The History of Chemistry

Chemistry did not emerge as a science until after the scientific revolution in the seventeenth century and then only rather slowly and laboriously. But chemical knowledge is as old as history, being almost entirely concerned with the practical arts of living. Cooking is essentially a chemical process; so is the melting of metals and the administration of drugs and poisons. This basic chemical knowledge, which was applied in most cases as a rule of thumb, was nevertheless dependent on previous experiment. It also served to stimulate a fundamental curiosity about the processes themselves. New information was always being gained as artisans improved techniques to gain better results.

The development of a scientific approach to chemistry was, however, hampered by several factors. The most serious

problem was the vast range of material available and the consequent difficulty of organizing it into some system. In addition, there were social and intellectual difficulties, chemistry is nothing if not practical; those who practice it must use their hands, they must have a certain practical flair. Yet in many ancient civilizations, practical tasks were primarily the province of a slave population. The thinker or philosopher stood apart from this mundane world, where the practical arts appeared to lack any intellectual content or interest.

The final problem for early chemical science was the element of secrecy. Experts in specific trades had developed their own techniques and guarded their knowledge to prevent others from stealing their livelihood. Another factor that contributed to secrecy was the esoteric nature of the knowledge of a alchemists, who were trying to transform base metals into gold or were concerned with the hunt for the elixir that would bestow the blessing of eternal life. In one sense, the second of

these was the more serious impediment because the records of the chemical processes that early alchemists had discovered were often written down in symbolic language intelligible to very few or in symbols that were purposely obscure.

Food and Health

The food we eat seems to have profound effects on our health. Although science has made enormous steps in making food more fit to eat, it has, at the same time, made many foods unfit to eat. Some research has shown that perhaps eighty percent of all human illnesses are related to diet and forty percent of cancer is related to the diet as well, especially cancer of the colon. Different cultures are more prone to contract certain illnesses because of the food that is characteristic in these cultures. That food is related to illness is not a new discovery.

In 1945, government researchers realized that nitrates and nitrites, commonly used to preserve color in meats, and other food additives, caused cancer. Yet, these carcinogenic additives remain in our food, and it becomes more difficult all

the time to know which things in the packaging labels of processed food are helpful or harmful. The additives which we eat are not all so direct. Farmers often give penicillin to beef and poultry, and because of this, penicillin has been found in the milk of treated cows. Sometimes similar drugs are administered to animals not for medicinal purposes, but for financial reasons. The farmers are simply trying to fatten the animals in order to obtain a higher price on the market. Although the Food and Drug Administration (FDA) has tried repeatedly to control these procedures, the practices continue.

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Police and Communities

Few institutions are more important to an urban community than its police, yet there are few subjects historians know so little about. Most of the early academic interests developed among political scientists and sociologists, who usually examined their own contemporary problems with only a nod toward the past. Even the public seemed concerned only during crime waves, periods of blatant corruption, or after a particularly grisly episode. Party regulars and reformers generally viewed the institution from a political perspective; newspapers and magazines - the nineteenth century's media - emphasized the vivid and spectacular.

Yet urban society has always vested a wide, indeed awesome, responsibility in its police. Not only were they to maintain order, prevent crime, and protect life and property,

but historically they were also to fight fires, suppress vice, assist in health services, supervise elections, direct traffic, inspect buildings, and locate truants and runaways. In addition, it was assumed that the police were the special guardians of the citizens' liberties and the community's tranquility. Of course, the performance never matched expectations. The record contains some success, but mostly failure; some effective leadership, but largely official incompetence and betrayal. The notion of a professional police force in America is a creation of the twentieth century; not until our own times have cities begun to take the steps necessary to produce modern departments.

Population Growth

The growth of population during the past few centuries is no proof that population will continue to grow straight upward toward infinity and doom. On the contrary, demographic history offers evidence that population growth has not been at all constant. According to paleoecologist Edward Deevey, the past million years show three momentous changes. The first, a rapid increase in population around one million B. C., followed the innovations of tool making and tool using. But when the new power from the use of tools has been exploited, the rate of world population growth fell and became almost stable.

The next rapid jump in population started perhaps 10,000 years ago, when mankind began to keep herds, plow and plant the earth. Once again when initial productivity gains had been absorbed, the rate of population growth abated.

These two episodes suggest that the third great change, the present rapid growth, which began in the West between 250 and 350 years ago, may also slow down when, or if, technology begins to yield fewer innovations. Of course, the current knowledge revolution may continue without foreseeable end. Either way - contrary to popular belief in constant geometric growth - population can be expected in the long run to adjust to productivity. And when one takes this view, population growth is seen to represent economic progress and human triumph rather than social failure.

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Evolution and Wheels

In the past, evolutionary biologists contemplating the absence of wheels in nature agreed that the explanation was not undesirability: wheels would be good for animals, just as they are for us. Animals were prevented from evolving wheels, the biologists reasoned, by the following dilemma: living cells in an animal's body are connected to the heart by blood vessels and to the brain by nerves. Because a rotating joint is essential to a wheel, a wheel made of living cells would twist its artery vein and nerve connections at the first revolution, making living impracticable.

However, there is a flaw in the argument that the evolution of wheeled animals was thwarted by the insoluble joint problem. The theory fails to explain why animals have not evolved wheels of dead tissue with no need for arteries and nerves. Countless animals, including us, bear external

structures without blood supply or nerves - for example, our hair and fingernails, or the scales, claws, and horns of other animals. Why have rats not evolved bony wheels, similar to roller skates? Paws might be more useful than wheels in some situations, but cats' claws are retractable: why not retractable wheels? We thus arrive at the serious biological paradox flippantly termed the RRR dilemma: nature's failure to produce rats with retractable roller skates.

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Mother's Day

A special day for the celebration of mothers can be traced to the times of ancient Greece when tribute was paid to Rhea, the mother of many of the Greek gods. Early Christians also paid tribute to Mary, the mother of God, during Lent. This tribute evolved into “Mothering Sunday” in England. “Mothering Sunday” is a celebration of all mothers, and is observed on the fourth Sunday of Lent.

In 1872, in America, Julia Ward Howe, the author of "The Battle Hymn of the Republic", suggested the idea of Mother's Day. However, Anna Jarvis is credited with creating Mother's Day in 1905. Anna Jarvis campaigned for Mother’s Day as a tribute to her mother, who had tried to establish Mother's Friendship Day to help heal the scars of the Civil War in America.

In 1910, West Virginia became the first state to adopt a formal holiday to recognize mothers. A year later, nearly every state officially marked the day of celebration. In 1914, President Woodrow Wilson proclaimed Mother's Day as a national holiday, to be held on the second Sunday of May. Today, Mother's Day is celebrated in many countries throughout the world, although the celebrations do not fall on the same day in every country.

Mother’s Day is celebrated in various ways, depending on the country, the family, and the mother. Many families honor mothers by dining out, giving flowers, sending cards, giving gifts, and visits. Additionally, Mother’s Day is reported to be one of the busiest days of the year for telephone calls.

Mother's Day should be every day. Mothers nurture us, teach us, protect us, and make us feel special. Mothers are the people in our lives who are most responsible for the way we grow and mature.