in the starchy central core of the typha rhizome was shown by A. P. Claassen, who estimated that one acre would yield a total dry weight of 10,792 pounds of cat-tail rhizomes, or more than two tons of flour, made from the central core.

Typha may be used as a substitute for high-priced corn. It would seem that the best time for feeding would be in the fall and winter, as the starchy content is likely to be highest then.

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SOIL SHIFTING AND DEPOSITS

Mr. Peterson's article on deposition of soil in the Palouse area of eastern Washington and Idaho, which appeared in Science, January 27, 1922, should prove of interest and value to foresters as well as agriculturists in this region. The questions naturally arise: How far is this soil carried into the Bitterroot mountains, and how does it influence the character of the soil and vegetation within the forest areas? The writer's observations in this respect may be of interest in this connection.

Dust storms, commonly referred to as "Palousers," are of comparatively frequent occurrence throughout northern Idaho and northwestern Montana. They accompany high winds from the west and southwest; they are well known and despised by housekeepers in Kalispell, Missoula, Thompson Falls, Libby and all surrounding towns. The dust penetrates into every house and office. When accompanied by rain the window panes and buildings are besmirched with streaks of red soil. One of these storms in March, 1917, laid down on the snow within the timbered region of northern Idaho about 600 pounds of dust per acre. The dust from that storm hung on the trees, even at 6,000 feet elevation, along the Kootenai-Priest Divide throughout the summer of 1917. Settlers say that dust storms are common along the Cœur d'Alene, St. Joe and Clearwater rivers.

The writer has noted the billowy soil surface, unmistakably due to surface shifting of the soil, as far east as Pierce, Idaho, about eighty miles east of Moscow. The soil is unusually deep and fertile and the vegetation is more profuse, with better growth of timber, over the larger portion of the Clearwater Forest in Idaho than occurs on the forests farther north or on the forests of western Montana. It is of interest to note that the Clearwater forest lies directly in the path of the strong west winds from the arid parts along the Columbia River, and that Lewis and Clark, as early as 1806, called attention to the unusually deep and seemingly fertile soil in the Clearwater basin.

These observations lead to the supposition that the accumulation and shifting of soil on the Palouse area have been effective in preventing natural establishment of the forest here in the past, though climatic records indicate that the area should grow western yellow pine; and they strengthen the belief that the unusually good growth of timber, profuse vegetation, and deep soils on certain parts of the western slopes of the Bitterroot mountains in Idaho, are due partly to the fact that soil is carried in by the westerly winds from lava plateaus along the Snake and Columbia rivers.

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QUOTATIONS

AN INTERNATIONAL LANGUAGE

There is an increasing demand among scientific men for international agreement as to the choice of a universal auxiliary language. After a long struggle, many of the fundamental tools of thought have been unified. All nations now use the same system of numbers, Arabic numerals, measurements of latitude and longitude, mathematical symbols, chemical formulæ, and, at least in science, the metric system.

But language, the master-key to thought and the vehicle of communication, remains under the curse of Babel. Were it possible by acquiring a second language in addition to the natal language to convey ideas to fellow-workers in every part of the world and to receive their ideas, one of the greatest barriers to the progress of science would be broken down. Time and money would be saved, overlapping of effort prevented, and precision of ideas would be assisted.

For many years there have been efforts towards the establishment of an international language, but chiefly by private persons or by associations formed directly for that purpose. Since 1919, however, governmental, scientific, and international bodies have given serious attention to the practical possibilities. At the meeting of the International Research Council, held in Brussels in the first summer after the war, a committee was appointed to investigate and report on the general problem of an international auxiliary language, and to cooperate with similar bodies established or that might be established for the same purpose.

The Section for Education of the British Association at the Bournemouth meeting appointed a committee which reported to the Edinburgh meeting last autumn. The American Association soon afterwards took a similar step, and its report was presented to the meeting at Toronto last December. The French and Italian Associations have also appointed committees, but as yet these have not issued reports. The delegates representing 12 states presented a resolution in the Assembly of the League of Nations last September taking the definite step of recommending Esperanto, and hoping that the teaching of that language would be made more general in the whole world, so that children of all countries might know at least two languages.

In accordance with the procedure of the league, this motion was referred to a committee under the chairmanship of Lord Robert Cecil. The committee was of the opinion that the question, in which "an ever-increasing number of great states" was interested, should be studied attentively before being dealt with by the Assembly. Accordingly, it is being studied by the secretariat. The British Association committee went further, and definitely recommended the choice of an artificial language, but hesitated to decide between those which have been invented. The American Association recognized the "need and timeliness of fundamental research on the scientific principles which must underlie the formation, standardization, and introduction of an international auxiliary language," and recommended further study.

These various bodies are free from the suspicion of advocating serious study of what might be regarded as a "fad." It is fair to accept their action as witness to the urgency of the problem. There is also evidence of their agreement that an auxiliary language, if it is to serve its purpose, must receive almost universal adoption.

The only suggestions which have received sufficient support to be ranked as serious candidates are Latin, English, Esperanto, and Ido. Latin was at one time the common medium of many nations and has retained a wide currency, directly in religion, less directly in some branches of science, and as the basis of the Romance languages. It is elegant and concise, has a definite system of forming new compounds and derivatives, and, as a dead language, its roots have unchanging significance. But its grammar is difficult; it has many exceptions and irregularities. The revival of Latin would require the coining of a very large number of new words.

English is widely used and is spreading rapidly; its grammar is relatively simple and its vocabulary is rich. But the choice of one among many widespread living tongues would excite a just jealousy. Its spelling is chaotic, and its pronunciation difficult and various. Moreover, a living language reflects the changing activities and emotions of the people who use it in literature and in daily speech, and is therefore unsuited as a vehicle for the cold and precise exchange of international knowledge.

The invented language Esperanto has already made great progress as an international auxiliary tongue; it has held 12 international congresses in different countries; it is taught in schools in Geneva, Breslau, Milan, Czecho-Slovakia, and Bulgaria. Its grammar, pronunciation, and method of word-building are simple, scientific, and easy to acquire, and its root-words have been carefully selected. Ido claims to be a later and improved form of Esperanto; hitherto it has had a smaller vogue, but in appearance and sound it is more attractive.

The balance of advantages seems to lie with the selection of either Esperanto or Ido or some modification of them recommended by experts on language. The vital requirement is that the auxiliary language should be kept auxiliary, the vehicle of formal statement. If it should become a language of common speech, of emotion, or of literature it will at once fail of its purpose and be only an additional linguistic burden.—London *Times.*

SPECIAL ARTICLES

ATOMIC STRUCTURE

THERE has been considerable discussion in the literature, during the past few months, of the Lewis theory of atomic structure[1] and Langmuir's extension of it to the heavy elements.[2] In 1919 and 1920 the writer worked out a somewhat different extension of this theory. For various reasons its publication has been delayed, but in a few months a paper describing it in some detail is to appear. Because of this delay, a short outline of the theory may not be out of place here.

The *number* of electrons in each shell of the lighter atoms is the same as in the original Lewis theory. It is assumed, however, that the fifth, sixth, seventh and eighth electrons in the second and third shells pair off with the first four, the distance between the electrons in each of these pairs; and also in each pair formed by bonding between atoms, being much less than the distance between pairs. These shells are therefore tetrahedra of pairs instead of cubes of single electrons.[3] The electrons in each shell (after the second) tend to be placed opposite the centers of the faces of the imaginary polyhedron formed by the electron groups in the underlying shell. If a certain shell is a tetrahedron, the next shell out will also be a tetrahedron; if the inner shell is a cube, the outer shell will be an octahedron (six points, eight faces); and if the smaller shell is an octahedron, it will be surrounded by a tetrahedron—four of its eight faces then being occupied—or by a cube.

[1] *J. Am. Chem. Soc.*, 38: 762 (1916).
[2] *Ibid.*, 41: 868 (1919).
[3] *Cf.* Lewis, *loc. cit.*, p. 779.

When the nuclear charge becomes sufficiently great, the same forces which cause pairing of electrons in nitrogen result in the formation of triplets in the inner shells of the heavier atoms. The type of force between electrons necessary to account for these phenomena is discussed in my longer paper and will not be considered here. As one after another of the outer electrons are drawn into an inner shell to form triplets, the remaining pairs are pushed further and further from the nucleus. This may result in rearrangement of the kernel structure, as indicated in the examples of atomic structure given below. Often, in different environments, different kernel structures are stable, some having more valence electrons and fewer triplets than others, etc.

The structures resulting from the application of the foregoing ideas I shall represent by means of formulæ, in which the first parenthesis represents the nucleus and indicates its charge, the remaining parentheses each representing a shell of electrons, in order from the nucleus out. The number of electron-groups and the number of electrons in each group are indicated for every shell, except (in some cases) the valence shell. Formulæ for atoms and ions of some of the elements follow:

H	(+1)(1)
He	(+2)(2x1)
C	(+6)(2x1)(4)
Ne	(+10)(2x1)(4x2)
Cl^-	$[(+17)(2x1)(4x2)(4x2)]^-$ or
	$[(+17)(2x1)(8x2)]^-$
A	(+18)(2x1)(4x2)(4x2) or
	(+18)(2x1)(8x2)
Co^{+++}	$[(+27)(2x1)(6x3 + 2x2)]^{+++}$
Cu^{++}	$[(+29)(2x1)(5x3 + 1x2)(4x2)]^{++}$
Cu^+	$[(+29)(2x1)(6x3)(4x2)]^+$
Zn^{++}	$[(+30)(2x1)(6x3)(4x2)]^{++}$
Br^-	$[(+35)(2x1)(6x3)(8x2)]^-$
Kr	(+36)(2x1)(6x3)(8x2)
Ag^+	$[(+47)(2x1)(8x3)(6x2)(4x2)]^+$
Sn	(+50)(2x1)(8x3)(6x2)(4x2)(4) and
	(+50)(2x1)(6x3)(8x2)(6x2)(2)
I^-	$[(+53)(2x1)(8x3)(6x2)(8x2)]^-$
Xe	(+54)(2x1)(8x3)(6x2)(8x2)
Ce	(+58)(2x1)(8x3)(6x2)(8x2)(4) and
	(+58)(2x1)(8x3)(1x3 + 5x2)(8x2)(3)
Lu	(+71)(2x1)(8x3)(6x3)(8x3)(3)
Ta	(+73)(2x1)(8x3)(6x3)(8x3)(5)
Au^+	$[(+79)(2x1)(8x3)(6x3)(8x2)(6x3)]^+$