were then described. The larynx of the child, like its head, is large relatively to the rest of the body. At the age of fourteen or fifteen, rather earlier in girls than in boys, the vocal apparatus enlarges and strengthens. In boys the vocal chords about double in length; in girls they increase from five to seven. In the latter case the pitch of the voice is not materially altered; in the male it usually descends an octave or more.

Garcia adopted the division of Registers into three, namely, the chest, falsetto, and head voice, due originally to Müller. This remains the most practical mode of classification, though the word falsetto is misleading, being liable to confusion with the artificial male voice bearing the same name, and may well be replaced by the phrase Medium. The term register has been enveloped in much professional mystery, and has been far too much refined upon. There has also been a confusion of octaves, from which even Madame Seiler is not free, due mainly to the modern and objectionable method of scoring music for the tenor voice in the soprano clef, and an octave too high. Register evidently marks an alteration of mechanism in the voice-reed and resonator to enable it to obtain the very remarkable compass, amounting to nearly five octaves, of which the human voice is possessed. Single voices run to three octaves or more. Catalani had $3\frac{1}{2}$; Bastardella, heard by Mozart in 1770, had the same. Madame Carlotta Patti can reach G♯ in alt. Bennati, a tenor, had three full octaves, and Tamberlik reached the C♯ of 544 double vibrations.

The words Head and Chest obviously only represent subjective sensations which accompany the shifted mechanism. In many parts of the voice similar notes can be reached in two registers, but with different force and quality, on either side of the break.

In using chest-voice the vibration can be seen to involve the whole vocal chord and the arytœnoid cartilages. At about A in the male and C in the female the chords act alone, though the first mechanism can by an effort be continued. The second form of vibration takes the voice up to F, the usual limit of bass voices and of the chest register. Above the F the chords are stated to lengthen, giving by a second elongation the second series of the chest register, which forms the bulk of the tenor compass, the remainder being formed by a variable number of falsetto notes. These seem to be produced by a thinning of the edges of the chords. Czermak lighted the larynx of thin persons strongly from the outside, and found that sufficient light was transmitted to show a decided increase of transparency in the chords at this point. All observers agree in placing this change, both in males and females, between F and F♯. In this region, common to both males and females, an amusing experiment can be made by causing a tenor male and a contralto female singer to execute the same passage behind a screen, or in an adjoining room. It is difficult, and at times impossible, to discover the sex of the singer from the quality of the tone. There still remains among male voices the curious and only partially explained counter-tenor. Sometimes by arrest of development or by accident the boy's compass is retained in after-life. This accident may be quite independent of masculinity, as those who have heard lusty, rubicund Yorkshiremen, with their wives and children round them, trolling out a sweet treble in glees on the terraces of the Crystal Palace after the Handel Festival, can testify. But besides this rare accident, most basses and baritones can cultivate an artificial and peculiar voice which most properly bears the name falsetto. Its production appears to be in great measure a matter of education. It was seemingly commoner in the madrigalian epoch and in the time of Queen Elizabeth than it is now. Dr. Bristowe says truly that the mechanism of its production is still doubtful, though many attempts have been made to determtne it. Such voices are not only artificial, but complex and uneven, being a compound of high chest notes and others of special quality. There is a serious break between the two both in production and in quality, which practised singers disguise by running the one into the other at different places, according as the passage to be sung ascends or descends.

It will have been seen that female voices overlap the compass of the male voice by an octave or more. Many contraltos take the E on the bass stave, which is well in the middle of the bass voice, and a low note for a tenor singer. Hence we sometimes hear of female tenors, though the effect is usually more peculiar than pleasing. Our great English contralto, Madame Patey, however, drops to this note with fine effect in Handel's oratorio of Solomon, which was written for the exceptional and now fortunately obsolete voice of Farinelli.

In females the break is somewhat higher than in males, but the transition to the falsetto takes place at the same note G. The contralto does not use the head-register.

This, otherwise called the Small, begins as just stated. Its upper limit varies, the extremes having been already given. Mozart wrote the fine air *Gli Angui d'Inferno* in the "Magic Flute" for such an exceptional voice reaching to F in alt. A commoner and perhaps pleasanter limit is the C below this.

All authorities agree in describing a curious appearance of the glottis in singing these notes. This is a folding together of its posterior half with vigorous vibration of its anterior part. Such an appearance can only be produced either by some stopping of the chords at the middle by contact with structures lower down, or by overlapping from vigorous approximation of the arytœnoid cartilages. The former supposition lacks anatomical confirmation, and the latter, which is anatomically possible, has the implied, though not the expressed sanction, of Helmholtz. The drawing of this appearance is given by Madame Seiler, who alone of laryngoscopists, possesses a register peculiar to the female.

Dr. Stone was materially assisted in his first lecture not only by Mr. Behnke, but also by his colleague Dr. Felix Semon, who gave admirable demonstrations of the healthy larynx, as seen in Mr. Williams, and some other pupils of St. Thomas's Hospital.

ACCLIMATISATION OF EDIBLE MOLLUSKS

A RECENT and interesting notice by Mr. F. P. Marrat of Liverpool, who is an excellent conchologist, mentions the introduction into the Cheshire coast of what he calls the "wampum clam," or *Venus mercenaria* of Linné; and he concludes that there is "a fair prospect of the naturalisation, on the extensive shallow shores of Lancashire and Cheshire, of an extremely nutritious and highly esteemed food-product, new to Great Britain." The late Prof. Gould says that this mollusk is known in Massachusetts under the name of "Quahog," given to it by the Indians. According to him and other American writers on the subject, the true "clam" *par excellence* is *Mya arenaria* of Linné. I was present as a guest at one of the fashionable "clam-feasts"; but the muddy flavour derived from the habitat of that mollusk does not agreeably commend itself to my palatable recollection. However, *chacun à son goût!* *Mya arenaria* inhabits the western coasts of the North Pacific as well as both sides of the North Atlantic.

The American oyster (*Ostrea virginica* of Gmelin = *O. borealis* and *O. canadensis* of Lamarck) is peculiar to North America, and has now found its way into the London market. It differs from the common European oyster (*O. edulis*, L.), and is equally variable as regards size. *O. virginica* has been within the last few years introduced into the mouth of the Tagus, and is called the Portuguese oyster. Our own or "native" oyster was

highly esteemed by the Romans, as we know from Juvenal; but there are no grounds for imagining that it was in those times imported into Rome from Britain. The facility of transport was not then so great as it is at present; and a gamy flavour was probably not so much relished by the Romans as it is said to have been by our King George the First, who preferred oysters a week old at Hanover to those which he afterwards got in England.

Within the last few years the "periwinkle" (*Littorina litorea*, L.), which is a favourite delicacy of our poorer classes, has spread with unusual rapidity along the eastern shores of the North American continent. Mr. Arthur F. Gray, in *Science News* for April, 1879, attributed its origin to Europe. It certainly does not seem to have been observed in America by Gould or any other conchologist before 1870.

Preeminent among land shells, as a dainty article of food in France, is *Helix pomatia*, L. We are more fastidious or more conservative in our gastronomic notions. It is a mistake to suppose that the Romans, when they possessed and inhabited Great Britain, brought this snail with them to indulge their luxurious tastes. In all probability it was not even known to them, because another species (*H. lucorum*, Müller) takes its place in Central Italy. *H. pomatia* has not been found at Wroxeter or York, or in any other part of England or Wales where the Romans built cities or had important military stations. Among the debris of an extensive Roman villa discovered in Northamptonshire, in which the shells of cockles, oysters, mussels, and whelks abounded, not one of *H. pomatia* occurred, although at Woodford, a few miles distant, that species is plentiful in a living state.

J. GWYN JEFFREYS

THE ALFIANELLO METEORITE

SIGNOR DENZA, Director-General of the Italian Meteorological Association, sends us an account of the remarkable aerolite which fell in the province of Brescia on February 16, and to which we referred last week. On that date, at 2.43 p.m. local time, a strong detonation was heard in many places of the province of Brescia and even in the neighbouring provinces of Cremona, Verona, Mantua, Placenza, and Parma. The detonation was quite awful in the commune of Alfianello, in the district of Verolanuova, Brescia. This was found to be caused by a meteorite which exploded a few hundred yards above Alfianello. A peasant saw it fall in the direction of N.E. to S.W., or, more exactly, N.N.E. to S.S.W., at a distance of about 150 yards. When the meteoric mass fell to the earth, it produced on the ground, in consequence of the transmission of the shock, a movement similar to that of an earthquake, which was felt in the surrounding districts; the telegraph wires oscillated and window frames shook. Before the meteorite fell a confused commotion was seen in the sky, and immediately after a prolonged noise was heard similar to that of a tram moving rapidly along the rails. No light was seen; but the meteor must have been accompanied, as usual, by a light vapour, produced by the volatilisation of the substanee melted at the surface; for some of those who saw it fall compared it to a chimney falling from the sky, and surmounted by a wreath of smoke. The meteorite fell in a field about 300 yards south-west of Alfianello. It penetrated the ground obliquely, nearly in the same direction as it was seen moving in the air, from east to west, sinking to the depth of about a yard, deducting the height of the meteoric mass. The peasants who saw it fall and who were the first to touch it, found it somewhat hot. The meteorite fell entire, but unfortunately was soon broken to pieces and carried away by the crowd who gathered to see the strange sight. The form was ovoid, but a little flattened at the centre; the under part was broad and convex, presenting the form of a cauldron; the upper part was truncated. The surface was covered with the usual blackish crust, and studded with small concavities, partly separate, partly grouped together.

As to the dimensions and weight of the aerolite, the estimates differ. According to the evidence of some, its height was about 75 centimetres, greatest breadth 60 centimetres, and its volume about 25 cubic decimetres. Its weight has been variously estimated at 50, 100, 200, and 250 kilograms. Its real weight was probably not much under 200 kilograms. It is certain that Prof. Bombicci carried more than 25 kilograms to Bologna, to add to the rich collection of meteorites in the Mineralogical Museum of the University; that a specimen weighing 13½ kilograms was taken possession of by MM. Ferrari, the owners of the field in which the meteorite fell; that about 40 kilograms remained in possession of other persons; that the municipality of Alfianello sent a specimen of 5 kilograms to the Athenæum of Brescia; and that two pieces weighing 12 kilograms each were thrown into a stream and lost; without speaking of a considerable quantity of small fragments, distributed here and there, of which Signor Denza possesses four, of a total weight of 39 grammes.

By its structure the Alfianello meteorite belongs, according to Prof. Bombicci, to the sporasiderite-oligosiderite group, being almost identical with the New Concord (Ohio) meteorite. The substance is finely granulated, of an ashy grey; the bright glossy surface has elements showing varied gradations of colour. Metallic particles abound; they are found scattered like small nuclei, in which are iron and perhaps one of its alloys, in brilliant crystalline aggregations, of a yellowish or bronze white. Circles of rust of a yellowish brown rapidly form around the particles of iron In the places where there are no metalliferous nuclei, the grains of iron are attached to the stony portion in the proportion of 68 per 1000 of weight. The blackish crust is rough, and to some extent rugged in some parts of the surface, and rather smooth and uniform in others; in general it is somewhat lustrous. The total specific weight of the stone is from 3·47 to 3·50. The chemical analysis of the meteorite is being made in two different laboratories at Bologna. Signor Denza's information has been obtained from Prof. Bombicci of Bologna University, and from Professors Briosi, Ragazzoni, and Casali of Brescia.

THE SHAPES OF LEAVES[1]

IV.—*Special Types in Special Environments*

FROM the previous papers it will be clear that degree of subordination to the stem accounts in large measure for the extent to which leaves vary from the primitive ovate-lanceolate type. Where they are still so most subordinated, there will be a strong tendency towards the long pointed ribbon-like form, and also a marked inclination towards decurrence. This combination of peculiarities is well seen in several thistles, and in comfrey, as also to a less extent in many epilobes and stellarias. Compare *Verbascum thapsus*, and other mulleins. From these extreme cases, in which leaf and stem are not fully differentiated from one another, one can trace several gradations, through square stems with sessile leaves (as in certain St. John's worts) up to merely sessile stem-leaves, or leaves that clasp the stem with pointed or rounded auricles. Wherever lines exist along the stem, they may be observed in pairs up to the point where a leaf is given off, and they are undoubtedly surviving marks of the primitive unity of stem and leaf. The same may be said of rows of hairs, like those of *Stellaria media* and of *Veronica chamædrys*. There can be little doubt

[1] Concluded from p. 495.