THE

ESSEX NATURALIST:

BEING THE

Journal of the Essex Field Club.

EDITED BY

PERCY THOMPSON, F.L.S., *Honorary Secretary.*

VOLUME XX.

APRIL 1921 *to OCTOBER* 1923.

"Men that undertake only one district are much more likely to advance Natural Knowledge than those that grasp at more than they can possibly be acquainted with. Every kingdom, every province, should have its own Monographer."—GILBERT WHITE, of Selborne.

"Things seen are mightier than things heard."—TENNYSON.

Stratford, Essex:
THE ESSEX FIELD CLUB, AT THE ESSEX MUSEUM OF NATURAL HISTORY.

1924.

"Ask now the beasts, and they shall teach thee; and the fowls of the air, and they shall tell thee:

Or speak to the earth, and it shall teach thee: and the fishes of the sea shall declare unto thee."

JOB xii., 7, 8.

"Denn niemals kehrt' er heim, er bracht' euch etwas,
War's eine schöne Alpenblume, war's
Ein seltner Vogel oder Ammonshorn,
Wie es der Wandrer findet auf den Bergen."

SCHILLER (*Wilhelm Tell*).

"Engelond is full enow of fruyt and of treen,
Of wodes and of parkes that joy it is to seen."

Old English poem.

"A good land, a land of brooks of water, of fountains and depths that spring out of valleys and hills; a land of wheat and barley."

DEUTERONOMY viii., 7, 8.

"I cannot start at the presence of a Serpent, Scorpion, Lizard or Salamander: at the sight of a Toad or Viper I find no desire to take up a stone to destroy them. I feel not in myself those common Antipathies that I can discover in others."

Sir THOMAS BROWNE (*Religio Medici*).

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[The Editor wishes to express his indebtedness to Mr. W. H. Dalton, F.G.S., for his kindness in preparing this Index.]

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The Essex Naturalist:

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EDITED BY PERCY THOMPSON, F.L.S., *Honorary Secretary,*
assisted by
HENRY WHITEHEAD, B.Sc.

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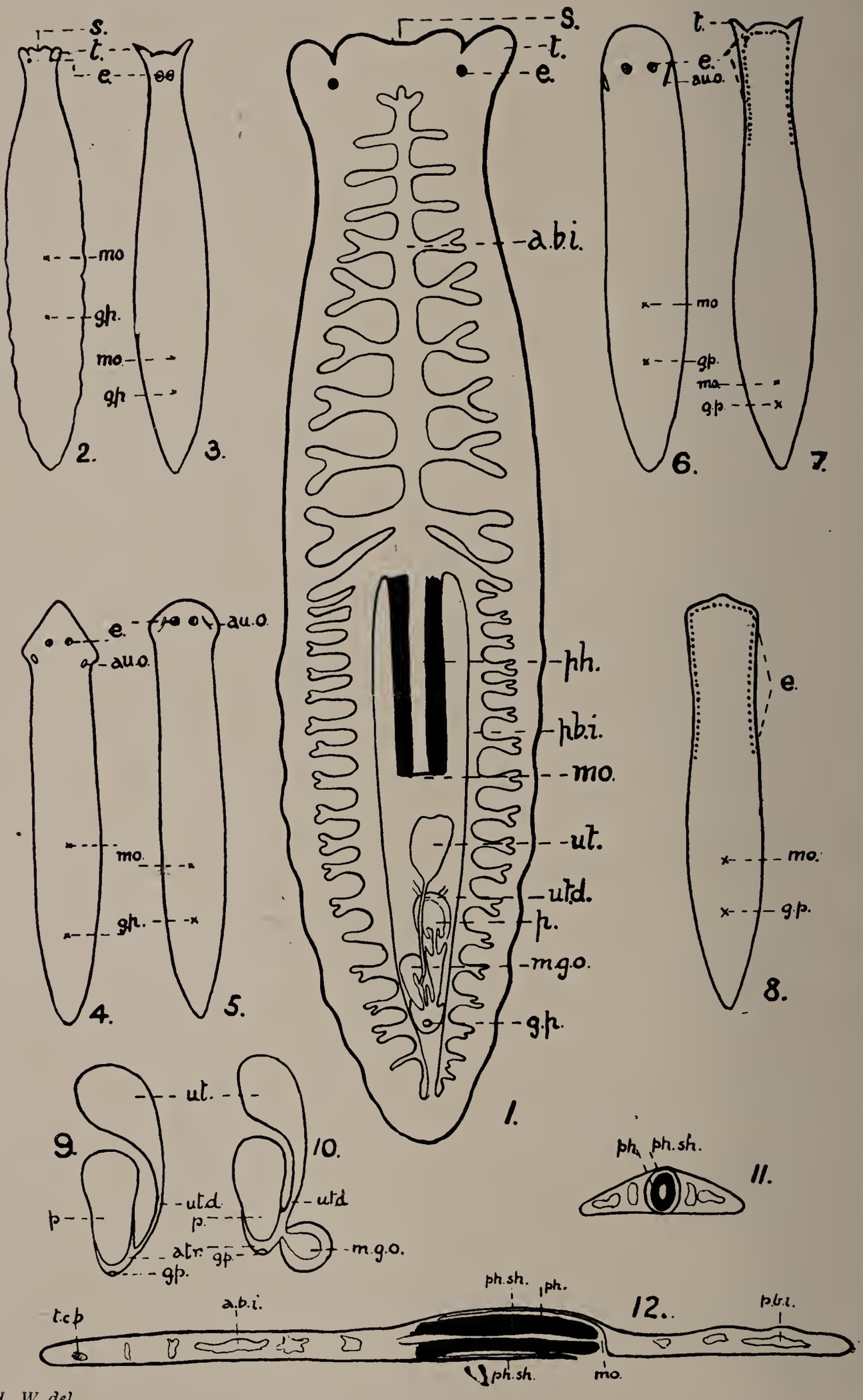

[*For explanation, see Text.*]

British Freshwater Planarians.

THE

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Journal of the Essex Field Club.

VOLUME XX.

THE BRITISH FRESH-WATER PLANARIANS (TRICLADIDA).

BY HENRY WHITEHEAD, B Sc.

(*With Plate* I.)

[*Read in abstract 25th February, 1922.*]

EVERY naturalist who has examined plants taken from a pond has noticed a black creature about half an inch in length, flat and unsegmented, which glides gracefully over the surface of leaf or stem. This is one of the commonest and smallest planarians of our ponds, and is known as *Polycelis nigra*. Ponds and streams in this country contain at least eight species of planarians, the largest attaining a length of two inches. The colours range from black through brown and grey to white, an example of the last being another common species—*Dendrocoelum lacteum*.

Often enough many people confound planarians with the smaller species of leeches; both occur in similar situations, viz., on the water plants and under the stones in ponds and running streams, and in mud. The gliding motion of planarians, however, is quite distinct from the looping movement of leeches. Planarians, again, are unable to swim; some leeches do so with vigorous eel-like movements.

The student who makes the acquaintance of this fascinating group finds the task of collecting information about planarians laborious and difficult; that must be the justification for this summary of literature on the subject, with hints on habitats, identification, rearing and observing.

The name of this little group of animals has been changed frequently, a fact which is at first confusing: a brief summary, therefore, recording the more important discoveries, may be of some use and interest.

LITERATURE. O. F. Müller (26), the Danish naturalist, in the year 1773, first recognized and described species of these worms. Later he gave them the general name of *Planaria*, a name which should now be restricted to a genus. *Paludicola* is another name for the fresh-water Tricladida. The name Planarian is now in common use by field naturalists and is used throughout this paper.

In 1814 Sir John Graham Dalyell (6), of Edinburgh, noticed that many of the specimens which he kept under observation were more or less mutilated. He tried the experiment of cutting off parts of a healthy specimen, and found that the missing parts grew again. This led him to suspect that the animals might reproduce themselves by spontaneous transverse fission, and his suspicions proved correct. He says: "It" (*Polycelis nigra*) "is privileged to multiply its species in proportion to the violence offered to its otherwise delicate frame. It may be almost called immortal under the edge of the knife." Dalyell also noted that sexual union took place; he observed the deposition of the cocoons and the periods of incubation of the various species. He also described how some species sometimes use the surface film when gliding, and how the animals frequently lower themselves from the surface by means of mucus threads.

Within the decade a Bristol physician, Dr. J. R. Johnson (19, 20), made similar observations. Michael Faraday (11) was fascinated to watch the regeneration of mutilated planarians.

Two important discoveries were published about 1826: the Dane, O. Fabricius (10) found that a large proportion of the surface of the creature's body was covered with cilia, and C. E. v. Baer (1) observed that planarians were hermaphrodite.

Five years afterwards Ehrenberg (9) applied the name "Turbellaria" (turbellae = disturbances) to all ciliated, unsegmented worms.

The order Turbellaria is now divided into four sub-orders according to the character of the gut. (1) Sub-order *Acoela* (without gut), marine; (2) Sub-order *Rhabdocoelida* (with a straight, unbranched gut), small forms, fresh-water and marine; (3) Sub-order *Tricladida* (gut with three main branches), fairly large, found in the sea, in fresh-water or on land. (This paper deals exclusively with the fresh-water Tricladida); (4) Sub-order *Polycladida* (gut with many branches), marine.

The literature published during the last half century on European Tricladida is chiefly in French and German. E. Ray Lankester (23) in an article, "On the Planaria of our Ponds and Streams," written in 1867, laments the sad neglect of this branch of zoology in this country. He complains that even the British Museum list of non-parasitical worms (21), published in 1865, is practically worthless so far as the Turbellarians are concerned. Houghton (16), in 1868, gives very little information. The most helpful recent contribution is that by Gamble, in the *Cambridge Natural History* (12), where figures are given which help to identify the commoner species, though there is little information as to habits.

GENERAL APPEARANCE AND STRUCTURE. The more obvious characters are observable by means of a pocket lens; allusion to microscopic details is made only when necessary to elucidate some special point.

The bodies of planarians are very soft and flexible. Being capable of rapid extension and contraction they present an ever-varying form. The shapes here described are those assumed when the animal is fully extended during gliding.

British planarians range in length from 12 mm. to 36 mm.; the body is usually from four to six times as long as broad, in *Polycelis nigra* about eight times. They are all flat; the thickness rarely exceeding half a millimetre. This film-like, flexible thinness permits the ventral surface of the animal to be closely applied to the stones under which it lies and to the water plants among which it crawls. The outline of the anterior region or "head" of the planarian, the number of the eyes and their position claim first the attention of the systematist. In many species the "head" is divided from the "body" by a slight constriction; its frontal margin may be simply rounded, as in *Planaria torva* (fig. 6), shaped like the head of an axe, *Pl. polychroa* (fig. 5), convex with a small median projection as in *Polycelis nigra* (fig. 8), or triangular as in *Pl. gonocephala* (fig. 4). *Planaria alpina* (fig. 3), and *Polycelis cornuta* (fig. 7), have a rounded frontal margin with two lateral projections (tentacles[1]) like the ears of a cat. The two remaining British species, *Bdellocephala*

1 In *Pl. gonocephala* and *Pl. polychroa* the head widens out behind the eyes into a pair of lateral lobes or "auricles" which are readily distinguishable from tentacles.

punctata (fig. 2), and *Dendrocoelum lacteum* (fig. 1), have tentacles, and also a sucker in a median position on the ventral surface.

The eyes (18) are numerous in the two species of *Polycelis* and appear as a row of black dots extending across the head and some distance along the sides of the body. Other British species of planarians have generally two eyes. In *Dendrocoelum lacteum* and *Bdellocephala punctata* they appear as small black dots, one near the base of each tentacle. In *Planaria alpina* the black dot is in the centre of a whitish oval. In the species, *Planaria gonocephala*, *Pl. torva* and *Pl. polychroa*, each eye is in a circular or oval white area and is not in the centre but on the circumference near the middle line; this disposition gives the animal a curious squint. Occasionally three or four eyes may be seen on one individual. The eyes are connected with the brain by means of short ganglia. To study the nervous system it is necessary to cut and stain sections for microscopical examination. The brain consists of two lobes connected by a transverse commissure. Two lateral nerves pass backwards from the brain and extend the full length of the body.

In addition to the organs described above, *Planaria torva*, *Pl. gonocephala* and *Pl. polychroa* each have on the dorsal surface, between the margin and the eyes, a pair of grooves, termed the auricular organs (*au.o.* figs. 4, 5 and 6); doubt still exists as to the function of these.

The pharynx (*ph.*, figs. 1, 11 and 12), or proboscis, lies on the ventral surface near the middle of the body, and consists of a straight muscular tube which lies in a sheath; (*ph.s.*, fig. 12). This tube, with the mouth (*mo.*) directed backward, is protruded when the animal feeds. The intestine consists of three portions (hence, *Tricladida*); a single tube, bearing pairs of branches, is directed forward, and a pair of tubes, with branches on the outer sides, passes backward alongside the proboscis towards the posterior extremity. (See fig. 1.) The whole system may be compared to a tuning fork in which the handle is pointed forward and the two prongs backward.

In the section dealing with classification, formulae are given to denote the number of lobes to each branch of the intestine, commencing at the left fork, then the handle where there are paired lobes, and finally the right fork. For example, the lobe-formula for *D. lacteum* is 16–19, 2 (10–15), 16–19. This means

that the intestinal branch on the left of the pharynx has from 16 to 19 lobes ; the branch anterior to the pharynx has 10 to 15 pairs of lobes, and the right branch, like the left, has from 16 to 19 lobes.

The ultimate branches of the intestine have blind ends, consequently undigested fragments of food are returned through the mouth. The soluble waste products pass through the renal excretory system, which is made up of thin elongated tubes, forming a series of complicated loops, which pass along the body. These tubes open to the surface of the body by a series of pores, whose number and position, as well as the number of tubes, vary in different species. The renal tubes end in tiny blind sacs, at the bottom of each of which is a cell provided with a long vibrating lash which projects into the sac. The rapid vibrations of their cilium resemble the flickering of a flame ; the whole organ is therefore termed a " flame cell."

There are no special organs of respiration, that process being apparently carried on by means of the skin.

Immediately behind the mouth, and between the posterior branches of the intestine, the outlines of the genital organs may be distinguished in mature individuals at certain seasons of the year. The animals are hermaphrodite and when sexually mature show, (a) male organs consisting of a penis (*p.*, figs. 1, 9 and 10), to which is attached the *vas deferens*,[2] and the testes ;[2] and (b) female organs—the uterus (*ut.*, figs. 1, 9 and 10), connected with the ovaries by a long oviduct,[2] and the vitelline glands,[2] which provide the yolk for the egg. Both male and female organs open into a common chamber, namely, the atrium, which opens externally by the genital pore (*g.p.*). Mutual copulation between two individuals takes place. The ova are fertilized by spermatozoa, which, in the case of *Planaria torva*, are enclosed in a spermatophore.

The greater part of the surface of the body of a planarian is covered with cilia by whose rhythmic movements the animal glides in a highly characteristic manner. These cilia are attached to epithelial cells, which contain a number of small rods, from 10μ to 16μ in length, called rhabdites, arranged in the cells with their long axes at right angles to the body surface. The rhabdites are formed, not in the epithelial cells, but in a deeper layer of

2. These organs are omitted from Fig 1 in order to avoid overcrowding the diagram.

tissue, and pass to the surface cells along definite tracks. No doubt the rhabdites give a considerable amount of support to the body and yet permit freedom of movement. They are analogous to an external skeleton, made up of small parts, which articulate freely—a variety of chain armour. Then, too, the rhabdites can be discharged, and on coming into contact with water, produce a slimy substance. In addition to this, planarians have special glands developed on the lateral margins, which produce mucus. This mucus serves as a protection and is used in the capture of prey. Sometimes threads of it are formed and are used by the animal to lower itself through the water. (See p. 2.)

COLLECTION AND PRESERVATION. Planarians should be searched for in fresh water, under stones and on the shaded parts of submerged plants. *Planaria alpina* may be found in cold springs and mountain streams. Flowing streams, rivers, lakes and ponds are all suitable hunting grounds. *Bdellocephala punctata* lives in mud, which it leaves only for the purpose of depositing cocoons. Böhmig (3) suggests wrapping up bait, such as a dead frog, in gauze and leaving it in a pond or stream for a few days.

When collecting planarians, care should be taken that no animals likely to die and set up decomposition remain in the tube containing them. The water must be prevented from becoming warm during transportation, as planarians soon die and disintegrate under sudden changes of temperature.

Identification of species should be made, when possible, on living animals ; it is often difficult to diagnose dead specimens, especially when they are not sexually mature.

Planarians do not make very satisfactory preparations, as they always contract, in spite of every care. Steinmann and Bresslau (36) recommend the following solution for killing :— Commercial nitric acid, 1 part : a saturated solution of mercuric chloride in a 5% solution of common salt, 1 part ; distilled water, 1 part. The animal is placed on a sheet of glass with the smallest quantity of water possible. As soon as the planarian extends itself, the solution is poured over it quickly and the creature is left in the fluid not longer than one minute. It is then placed

in absolute alcohol, which should be occasionally changed. At the end of an hour the animal is fixed. To get rid of the mercuric chloride it is necessary to place the planarian in a weak solution of iodine in 95% spirit, and afterwards in clean spirit to free the specimen from the iodine. Specimens prepared by this method may then be mounted in Canada balsam after dehydrating with absolute alcohol and clarifying in xylol or benzol. If a stained preparation is desired, either borax carmine or hæmatoxylin differentiated by acid alcohol give good results.

Sections may be cut from material killed and preserved in this way. Double staining with Delafield's hæmatoxylin and eosin or Orange-G. gives satisfactory results.

HABITS AND LIFE-HISTORY.

Locomotion. The gliding motion of planarians, which resembles that of snails, is due not (as in the case of the mollusc) to muscular contraction, but to the movement of the cilia covering the under surface of the body. It has been suggested that the slime glands render the movements of the cilia easier and that the secretion from the ventral surface prevents the coagulation of mucus from the lateral gland. Planarians sometimes creep along on the under side of the surface film of water. Dalyell (6) noted this in the case of *Polycelis cornuta*.

When planarians are irritated the gliding movement passes into one in which the body, with the head fixed to the substratum, is stretched fully and then contracted violently. This operation is repeated until the animal is out of reach of the irritating object. *Dendrocoelum lacteum* usually adopts these tactics when attempts are made to capture it.

Reactions to Light and to Running Water. All fresh-water planarians avoid light, seeking the shade of water plants, stones and submerged leaves. They recognize the direction from which light comes and move rapidly away into shade. Further interesting information on this branch of the subject is to be found in a paper by Prof. Raymond Pearl (30).

Some species show a tendency to arrange the long axis of their bodies parallel to the direction of the current, with the head facing up-stream. *Planaria alpina*, *Pl. gonocephala* and *Dendrocoelum lacteum* are examples of this, whilst *Pl. torva* and *Polyceli*

nigra appear indifferent to the direction of running water. *Polycelis cornuta* reacts only feebly.

Nutrition. The food of planarians consists of small crustaceans, insect larvæ, small worms, and sometimes dead animals or even plants. The planarians discharge quantities of rhabdites which, when in the water, produce mucus, wherein the prey becomes entangled and is then devoured. A planarian is able to penetrate the joints of fresh-water amphipods and isopods by means of its muscular proboscis, although no signs of teeth can be detected. It is probable that a special secretion assists in this difficult process. When once the skin has been penetrated, the proboscis is inserted and ingestion commences. A recently-fed planarian usually shows the ramification of the intestinal lobes, owing to the presence of partly digested food. The undigested portion is returned through the mouth. (See p. 5.)

Planarians have a marvellous power of withstanding hunger, and they are able to live for months, and even for a year, without food. Stoppenbrink (37) has studied this subject carefully and he found that the size of the animal diminished steadily during starvation. Specimens of *Planaria alpina*, kept for nine months without food, had diminished almost to one-fourth of their original length. The sexual organs degenerated in the inverse order of their development, while the nervous, alimentary and excretory systems underwent little change. This is a somewhat unusual occurrence in nature—the immediate sacrifice of the race for the welfare of the individual.

Reproduction and Regeneration. All fresh-water planarians are hermaphrodite, and under favourable conditions reproduce sexually by means of eggs, several of which are deposited in a cocoon.

The time for cocoon production depends upon the species, and upon the temperature rather than the season. Generally speaking, however, *Bdellocephala punctata*, *Planaria alpina* and *Polycelis cornuta* are sexually mature during the winter and early spring; *Planaria gonocephala* and *Pl. torva* in summer and autumn. Böhmig (3) states that *Dendrocoelum lacteum* is a winter, and *Polycelis nigra* a summer, layer. I have found

sexually mature specimens of the former species in March, April and August, and of *P. nigra* in April and June.

Some fresh-water planarians are able to reproduce asexually by transverse fission. A century ago Dalyell (6) observed that both *Planaria alpina* and *Polycelis cornuta* were able to divide in two, each part becoming a complete animal. As he had never found cocoons of these species, he thought that this was their normal method of reproduction. Spontaneous fission has been observed in *Bdellocephala punctata*, *Planaria alpina*, *Pl. gonocephala* and *Polycelis cornuta*. Details of this process vary in different species, but as a general rule, transverse division takes place in the neighbourhood of the pharynx, sometimes in front and sometimes behind. The conditions which lead to fission are sudden changes of temperature (see p. 10), in the case of *Planaria alpina* and *Polycelis cornuta*. *Pl. gonocephala* frequently divides when the temperature is raised but a deficiency in the supply of oxygen produces the same effect. In some cases death follows fission, but often the missing portions develop and a perfect creature results.

Planarians possess in a remarkable degree the power of repairing mutilations of their bodies, and consequently have been subjected to experiments even as early as 1778, when Pallas (28) wrote on this subject. In this connection, in Britain, Shaw (32) in 1791, Dalyell (6) in 1814, and Michael Faraday (11) in 1832, published results of their investigations. Numerous Continental and American workers have written since then on the subject. It has been demonstrated that some species of planarians may be divided either transversely, longitudinally or by cuts in other directions, and the separate parts have each succeeded in repairing the injury and in becoming what appeared to be an unmutilated animal. An important factor is a favourable temperature, when a quick recovery is made. It was found that a planarian divided into two longitudinally produced two symmetrical individuals in a period of 20 days. By making suitable incisions, it was found possible to produce monstrosities with two heads, or with two tails (35).

Reactions to Temperature. Freshwater planarians (*Tricladida*) are remarkably sensitive to changes of temperature and a small rise causes death in some forms. Species which are able to live

through a range of only a few degrees, are termed *stenothermous*, whilst those able to endure a wider range of temperature are said to be *eurythermous*. *Planaria alpina* is an example of a stenothermous planarian. If taken from water at 0°C and placed in water at 12°C., it dies immediately. On the other hand, if the temperature be raised *slowly*, 20°C. may be attained before death ensues. This short range of temperature restricts the distribution of the species to cool waters with but little variation of temperature—conditions which, in this country, obtain only in springs and streams in hilly districts. Dalyell (6) found *Planaria alpina* in a spring at Edinburgh Castle, and the writer found the species abundant in a spring near Bavelaw, Pentland Hills, N.B., where the temperature of the spring in August was 11°C.

No systematic work on the distribution of this species has been done in Britain, but on the Continent it has been found that *Pl. alpina* is confined to springs and mountain streams, except in the Alps and in Scandinavia, where the cold water from the melting glaciers descends low into the valleys, and in these districts the range of *Pl. alpina* is often extended to all the streams of an alpine valley.

Another stenothermous species, *Polycelis cornuta* has a wider range of temperature and is often found in the same streams as *Pl. alpina*, but at a lower altitude where the water is slightly warmer. Lower still, the eurythermous planarian, *Pl. gonocephala*, is found. This species can withstand a temperature of 34°C., though asexual reproduction by transverse fission takes place at temperatures higher than 12°C.

It has been possible in some districts on the Continent to divide a river system from source to mouth into five zones, each characterized by the presence of one or two species of planarians, thus :—

(1). Zone of *Pl. alpina*.
(2). ,, ,, *Pl. alpina* + *P. cornuta*.
(3). ,, ,, *P. cornuta*.
(4). ,, ,, *P. cornuta* + *Pl. gonocephala*.
(5). ,, ,, *Pl. gonocephala*.

The remarkably wide distribution of *Pl. alpina* in springs and streams at the sources of rivers geographically wide apart, has given rise to a good deal of conjecture. One view is that

Pl. alpina was ubiquitous at the end of the Glacial period, and that as the climate became warmer it survived only in the higher and cooler portions of the river systems. As it vacated a particular section of a stream, its place was taken by *P. cornuta*. This explanation is supported by the facts of the distribution of the species in regions where there are glaciers now.

Another theory seeks to explain the distribution of *Pl. alpina* by the fact that the animal shows a marked tendency to move upstream against the current.

Von Hofsten (15) has found the species abundant in the streams of N. Sweden. He does not consider the species to be a glacial relic. To give only one of his reasons, he found *Pl. alpina* in situations which it could not have reached by active migration.

Enemies. The slimy excretions render planarians unpalatable to many creatures, but it has been recorded that they are sometimes eaten by newts, sticklebacks, and certain carnivorous insect larvæ.

Mr. John Ritchie, junr. (31), found the parasitic infusorian, *Trichodina steinii* (C. and L.), plentiful on the bodies of *Planaria gonocephala*. I have found *T. steinii* moving freely over the surface of the body of the Rhabdocoel, *Mesostoma tetragonum*. Apparently the host suffers no inconvenience. An allied species of *Trichodina* is found on *Hydra viridis*.

CLASSIFICATION AND IDENTIFICATION.

British Species of Fresh-water Planarians.

It is difficult to draw up a list of British species from the very scattered and scanty records available. To the first list given below, containing British species already recorded, is added a second, of species which are widely distributed and which very probably exist in Britain but have not yet been recognized.

I. British Species already recorded.

Bdellocephala punctata (Pallas).
**Dendrocoelum lacteum* (Müller).
Planaria torva M. Schultze.
**Pl. polychroa* O. Schm.

**Pl. gonocephala* Dugès.
Pl. alpina (Dana).
**Polycelis nigra* Ehrenb.
Pol. cornuta (Johnson).

Those marked thus * indicate species that I have found in Essex.

II. Species not yet recorded from Britain, but which may occur.

Dendrocoelum infernale (Steinmann).
Planaria vitta Dugès.
Pl. cavatica Fries.
Pl. lugubris O. Schm.

Short descriptions of these species are given later, but they are not included in the following key.

KEY TO BRITISH SPECIES.

This key is slightly modified from that of Steinmann and Bresslau (36).

1. Eyes two (rarely three or four) .. .. .. (2)
   Eyes numerous, along margin of head and anterior of body .. .. (7)
2. With pointed tentacles, projecting like the ears of a cat. Brow convex. .. .. .. *Pl. alpina*
   Tentacles either absent or if present not pointed or well defined .. .. (3)
3. Lateral lobes of head (p. 3), movable .. .. (4)
   Lateral lobes of head not movable .. .. .. (6)
4. Head triangular, with one angle projecting forward and the other two forming the lateral lobes .. .. .. *Pl. gonocephala*
   Head blunt, brow outline straight or concave. Sides of body frilled .. .. (5)
5. Colour white .. .. *Dendrocoelum lacteum*
   Colour brown, often with dark spots .. .. *Bdellocephala punctata*
6. Head margin straight or slightly convex with blunt angles at side of head. (Fig. 6.) Colour brown to black. Eyes squinting, behind widest part of head .. .. *Pl. torva*

Head margin distinctly convex. Eyes squinting, and in front of widest part of head *Pl. polychroa*

7. With pointed tentacles .. .. *Polycelis cornuta*
Without tentacles. Front margin blunt, with slight convex portion in middle .. *Pol. nigra*

The specific characters given below are chiefly taken from Böhmig's (3) descriptions, to which some of my own observations are added :—

Bdellocephala punctata Pallas. Fig. 2.

SYNONYMS : *Fasciola punctata* Pallas.
Planaria bicornis Gmelin.
Bdellocephala bicornis de Man.
Dendrocoelum angarense Hallez.
Dendrocoelum punctatum Weltner.

DESCRIPTION. Length 32 to 40 m.m. ; width 6.0 to 6.5 m.m. in fully stretched specimens. Contracted specimens have a length of from 13 to 16 m.m and are from 10 to 12 m.m. wide. There is a constriction about the level of the eyes and a pair of blunt tentacles are present. A concave, unpigmented sucker (*s*) lies between the tentacles. The colour of the dorsal surface is brown with black spots or streaks ; when these are very numerous the body appears almost black. The under surface is lighter in colour. The mouth lies approximately half-way down the body. The posterior is not pointed. The sides of the body are frilled. The intestines are furnished with many lobes which anastomose. Lobe—formula 10–11 2 (9–10), 10–11.

HABITS. The animals live in the mud of slow streams or of stagnant water during the summer, and rise to the surface for the purpose of producing cocoons. The spherical, brown cocoons, 3 to 4 m.m. in diameter, are deposited during the winter or early spring. A cocoon contains from 9 to 24 young, which emerge in about 20 days.

Transverse fission has been observed in this species.

DISTRIBUTION :—

Britain. The writer has not found this species, but it is included on the authority of Prof. Gamble (12).

France, Germany, Switzerland, Sweden.

Dendrocoelum lacteum Müll. Fig. 1.

SYNONYMS : *Fasciola lactea* Müller.
Planaria lactea Müller.
Dendrocoelum lacteum Oer.

DESCRIPTION. Length about 26 m.m. ; width 6 m.m. Colour, milk-white, with branches of intestine often showing brown. Front margin

of head blunt with a pair of very blunt tentacles. The eyes are placed wide apart, and a slight constriction is to be seen behind them. The mouth lies about two-thirds of the body length from the front margin, and immediately behind the mouth, in the mature individual, a pale streak indicates the position of the sexual organs. The sides of the body are almost parallel over the greater part of its length. Posterior to the mouth the body margins are frilled. Lobe formula of intestine 16–19, 2 (10–15), 16–19.

Habits. Occurs in ponds and in running streams under stones and decayed leaves. It can withstand brackish water and has been found in the Baltic Sea.

Böhmig (3) regards the species as a winter layer but Steinmann and Bresslau (36) state that it may come to maturity at any time of the year. The writer has found sexually mature individuals in March, April and August. Probably cocoons are produced throughout the year in Britain. The cocoons are dark brown, 2 to 3 m.m. in diameter, and contain from 5 to 42 embryos. The incubation period ranges from two to six weeks. Transverse fission has not been observed in this species; its power of replacing lost parts is slight.

Distribution :—

Britain. Epping Forest, Chigwell Row, R. Stort; East London Waterworks, Tottenham; Regent's Park; Totteridge; Staines; Rickmansworth; Elstree Reservoirs. (H.W.)

Ireland, France, Germany, Switzerland, Italy, Sweden, Russia.

At present *D. lacteum* is the only milk-white species of planarian known in England. It is possible that some of the following milk-white planarians may be found, viz. :—*Planaria vitta*, with eyes, and *Dendrocoelum infernale* and *Planaria cavatica*, without eyes.

Dendrocoelum infernale Steinmann.

The species is very similar to *D. lacteum*, but it is about half the length and *has no eyes*. The uterine duct has an enlargement just before opening into the atrium. The uterine duct of *D. lacteum* (Fig. 1. *ut.d.*) is narrow throughout its course. Intestinal lobe-formula 15–18, 2 (12–15), 15–18.

It lives in streams both above and underground. It has not yet been found in Britain, but has been recorded from Germany and Switzerland.

Planaria cavatica Fries.

Synonym. *Dendrocoelum cavaticum* Enslin.

Milk-white, without eyes, and with two pointed tentacles. Frontal

margin distinctly concave, with a smaller concavity on the middle line. Intestinal lobe-formula 18–22, 2 (14–17), 18–22, occurs in springs and streams where they issue from the ground.

Not yet recorded from Britain, but found in France, Germany, and Switzerland.

Planaria vitta Dugès.

SYNONYMS *Dendrocoelum vittatum* Girard.
D. vitta Stimpson.

A milk-white planarian, similar in appearance to *D. lacteum*, but without tentacles, and with a slight projection on the frontal margin in the middle line. Eyes close together and well away from the margin. Lobe-formula 18–19, 2 (11), 18–19. Found in mud and in springs and hill streams Not recorded from Britain but found in Germany, Switzerland and Italy.

Planaria torva M. Schultze. Fig. 6.

SYNONYM. *Planaria Schultzei* Diesing.

DESCRIPTION. Length as much as 20 m.m. The anterior margin is rounded, the eyes are close together and have a squinting appearance. The auricular organs appear as short streaks near the margin and starting just about the level of the eyes. Dorsal surface, brown to black; the auricular organs and the areas near the eyes are free from pigment. Ventral surface lighter in colour than dorsal. Genital pore three-quarters of body length from head; mouth a little anterior to this. A musculo-glandular organ is present. (Fig. 9, *m.g.o.*) Intestinal lobe-formula 12–15, 2 (5–8), 12–15. The two posterior branches of the intestine often anastomose by 5 or 6 small lobes.

HABITS. Occurs in stagnant and slowly moving water. Cocoons elliptical in outline, measuring 1.5 m.m. x 1.0 m.m., 7–14 embryos in each cocoon. Cocoons occur throughout the year, but are reduced in number during the winter (Böhmig (3)). Transverse fission has not been recorded.

DISTRIBUTION :—

Britain (Gamble (12)) ; Syon House, Kew (H.W.).

France, Germany, Austria, Italy, Russia.

Planaria polychroa O. Schm. Fig. 5.

SYNONYM. *Planaria torva* Müller (*ex parte*).

DESCRIPTION. Length 16–20 m.m. ; width 3–4 m.m. Frontal margin variable, sometimes round as in *Pl. torva* (Fig. 6), but often with immovable lateral lobes. (Fig. 5.) Eyes squinting and a little posterior in position to those of *Pl. torva*. Auricular organ placed a little behind the eyes. Colour brown to black. Mouth in the middle of the third quarter of the body. Genital pore, three-quarters of the body length from the frontal margin. *There is no musculo-glandular organ* like that in *Pl. torva*. (Figs. 9 and 10.) Intestinal lobe-formula 13–15, 2 (7–8), 13–15.

HABITS. Lives in slowly running or stagnant water. The

dark brown cocoons, measuring 1.5 m.m. in diameter, are stalked. The writer cannot find any records of transverse fission in this species though it has been observed in the closely allied *Pl. lugubris*.

DISTRIBUTION :—

Britain. East London Waterworks, Tottenham ; R. Stort, Roydon ; Staines (H.W.).

France, Germany, Switzerland, Italy, Sweden (?)

Planaria lugubris. O. Schm.

SYNONYM. *Planaria torva* Müller (*ex parte*).

This species is very much like *Pl. polychroa* and is regarded by some authors as being identical with it. The eyes lie in front of the widest part of the head. The penis is blunter than that of *Pl. polychroa* and the bulbus is not so distinct.

Not recorded from Britain. Occurs in France, Germany, Switzerland and Italy.

Planaria gonocephala Dugès. Fig. 4.

SYNONYM. *Planaria subtentaculata* Drap.

DESCRIPTION. Length attains 25 m.m. ; width 5 m.m. The markedly triangular head with lateral lobes, which are constantly in motion, makes it impossible to confuse this planarian with any other. The squinting eyes are near the middle line and in front of the lateral lobes ; and the auricular organs are near the margin, immediately behind the widest part of the head. The colour is brown to brownish-grey. The mouth is a little more than half-way down the body, and the genital pore is about three-quarters of the body length from the frontal margin. Lobe-formula of intestine 13–15, 2 (10–12), 13-15.

HABITS. Occurs gregariously under stones and plants in clear water of ponds and slowly moving streams. The cocoons are brown, spherical, stalked, and are found under plants and stones in autumn. Full-sized specimens taken in June from the reservoirs of the East London Waterworks (water temperature 20°C.) showed no signs of sexual organs. Transverse fission is quite common in this species. (See p. 9).

DISTRIBUTION :—

Britain. This species is not included in Gamble's (12) list, but I found specimens in the East London Reservoirs at Tottenham in June, 1913. Mr. John Ritchie, junr. (31), records this species from Beith, N. Ayrshire.

France, Germany, Switzerland, Italy.

Planaria alpina Dana. Fig. 3.

SYNONYMS : *Planaria torva* Carena.
Planaria arethusa Dalyell.

Planaria abscissa Ijima.
Planaria montana Chichkoff.

DESCRIPTION. Length 16 m.m. ; width 5 m.m. Colour grey, greyish-brown, brown, or dark green. Sometimes almost colourless specimens are found, which show a reddish or greenish colour in the intestine. Ventral surface lighter than dorsal. Tentacles well developed and pointed. Eyes small, in the centre of small colourless oval areas close together, and some distance behind the base of the tentacles. Mouth three-quarters of body length from frontal margin. Genital pore just behind the mouth. Lobe-formula of intestine 16–20, 2 (8–10), 16–20.

HABITS. Found in cold springs and mountain streams. For an account of distribution and temperature see p. 10. The cocoons are spherical and about 1.6 m.m. in diameter, and contain from 15 to 30 embryos. They are produced in winter as a general rule, but in very cold situations they are deposited throughout the year. Transverse fission is common (p. 9).

DISTRIBUTION :—

Britain. Edinburgh Castle (Dalyell 6) ; Bavelaw, nr. Edinburgh (water temperature 11°C.) (H.W.). Isle of Man.

Ireland, France, Pyrenees, Belgium, Switzerland, Germany, Austria, Sweden.

Polycelis nigra Ehrenb. Fig. 8.

SYNONYMS : *Fasciola nigra* Müller.
Planaria nigra Müller.
Polycelis tenuis Ijima.

DESCRIPTION. Length may attain 12 m.m. ; width, about 1.5 m.m. The numerous eyes, represented by black dots running along the frontal margin and about one-third down the lateral margins of the body, together with the absence of tentacles, distinguish this species from all others. The frontal margin is slightly convex with a slight protrusion in the middle. The colour is black or dark brown. Light brown specimens, with dark stripes, have been regarded as a distinct species, but are now considered to be a variety ; var. *brunnea*. The mouth is a little less than two-thirds the body length from the frontal margin. Intestinal lobe-formula 12–16, 2 (4–6), 12–16.

HABITS. Found in ponds, ditches and streams and can withstand a wide range of temperature. The cocoons are deposited on the shaded parts of water plants from spring to autumn. They are brown, spherical or ellipsoid, and about 1 m.m. in diameter. Dalyell observed, in August, 1812, that sexual union took place and as he was not aware that planarians are hermaphrodite he regarded the smaller specimens as males. Each cocoon contains several embryos and incubation takes place in from 21

to 25 days. Multiplication by transverse fission has not been noted although the species easily recovers from injury (p. 2).

DISTRIBUTION :—

Britain. Very common, and occurs in almost every pond. France, Germany, Switzerland, Sweden, Russia.

Polycelis cornuta Johnson. Fig. 7.

SYNONYMS : *Planaria cornuta* Johns.
Planaria viganensis Dugès (?)
Planaria Felina Dalyell.

DESCRIPTION. Attains a length of 18 m.m. Readily recognized by the numerous eyes which pass across the frontal margin and along part of the body, and by the well-developed tentacles. General outline similar to that of *Pl. alpina*, but readily distinguished by the character of the eyes. Colour, grey to black or greenish. Pharynx very long, sometimes measuring one-third the animal's length. Mouth about three-quarters of the way down the body. Lobe-formula of intestine 13–15, 2 (4–6), 13–15.

HABITS. Occurs gregariously in cool streams. (See p. 10). The cocoons are spherical and are not attached to any object. Multiplication by transverse fission is very common. Dalyell (6) states that on the 10th of November, 1810, he detached a small fragment from the tail of each of two planarians of this species. Twelve days afterwards each fragment had produced a head !

DISTRIBUTION :—

Britain. Edinburgh (Dalyell) ; Seven Arches, Nr. Leeds ; Grassington, Yorks. (H.W.)

France, Pyrenees, Germany, Italy, Switzerland, Sweden, Russia.

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EXPLANATION OF PLATE I.

Fig. 1. *Dendrocoelum lacteum.* Diagrammatic representation of internal structure observable by a lens in transparent specimens.
,, 2. *Bdellocephala punctata.*
,, 3. *Planaria alpina.*
,, 4. *Pl. gonocephala.*
,, 5. *Pl. polychroa.*
,, 6. *Pl. torva.*
,, 7. *Polycelis cornuta.*
,, 8. *P. nigra.*
,, 9. Part of genitalia of *Planaria polychroa.*
,, 10. ,, ,, *Pl. torva.*
,, 11. Transverse section of *Pl. alpina* through the pharynx.
,, 12. Longitudinal section of *Pl. alpina.*

a.b.i. Anterior branch of intestine.
at. Atrium.
au.o. Auricular organ.
e. Eye.
g.p. Genital pore.
l.l. Lateral lobe.
m.g.o. Musculo-glandular organ.
mo. Mouth.
p. Penis.
p.b.i. Posterior branch of intestine.
ph. Pharynx or proboscis.
ph.s. Pharyngeal sheath.
s. Sucker.
t. Tentacle.
t.c.b. Transverse commissure of brain.
ut. Uterus.
ut.d. Uterine duct.

THE SPARROW-HAWK (*ACCIPITER NISUS*) AND THE GOSHAWK (*ASTUR GENTILIS*) IN LITIGATION IN THE 12th & 13th CENTURIES.

By WILLIAM E. GLEGG, F.Z.S., M.B.O.U.

A SEARCH of a very mild nature, undertaken by the writer with the object of discovering matter which might shed light on the status of certain birds, especially those at times described as vermin, in the County of Essex in bygone days, brought to notice the references which give rise to this article.

Although the references hardly fall within the category of what was sought, and do not permit of much deduction, yet they do create ideas of the position of these two species in the County over 700 years ago and of the hold that falconry had on the people of Essex, and perhaps, of its growth, and they illustrate what may be called a custom or fashion of the County, although not peculiarly so.

Feet of Fines for Essex[1] is the title of a volume published by the Essex Archæological Society, and it is to this book that I am indebted for the data on which these remarks are based. Those who wish to go more deeply into the meaning of this title are referred to the introduction of the volume.

A fine may be described as a document recording the amicable settlement of a dispute made with the consent of the judges in a Court. When a fine dealt with a conveyance " some service or rent was mostly reserved by the grantor, either a payment in money, or some nominal rent, such as a soar sparrow-hawk, a pair of gilt spurs, a pair of gloves, a pound of Cummin, a rose, a gillyflower, etc."

To convey to the reader the nature of the references to the birds of prey in question, an example of a fine (Henry III., 1218–1219) is given here :—

14. Mich. Roger Fitz Philip dem. The Lord William, Bishop of London ten. 1 virgate of land with appurts. in Reine. Assize of mort d'a. To hold to dem. of the Bishop by the free service of 11s. 6d. yearly for all service ; except 7 acres of the said land, which are called Pamplingwrth, which dem. granted to ten. and the Church of St. Paul, London, quit from him and his heirs. Dem. gave to ten. one soar sparrowhawk.

The volume, *Feet of Fines for Essex*, covers a period of 90 years, from 1182 to 1272, during which we find the sparrow-

1 *Feet of Fines for Essex*, vol. i., 1899-1910. A copy is in the Club's library.

hawk mentioned on at least 131 occasions, and the goshawk on nine occasions, as in the above example. Nearly all these references are worded in the same manner, but occasionally the word " soar," or " sore," as it was spelt without exception from the year 1231–2 onwards, was omitted. We also read of " 1 mewed (i.e. moulted) goshawk," and on another occasion of " 1 falcon gentle," which probably refers to the goshawk.

A soar or sore hawk is any hawk of the first year.

To some extent we can trace the rise of this interesting old usage. During the reigns of Richard I. and John, from 1182 to 1215, a period of 33 years and over one-third of the total, there is to be found only one such reference and that to a sparrow-hawk, in 333 fines. In the next 17 years, bringing us to the fiftieth year, there are six in 309 fines. Considering the remaining 40 years in four periods of ten years each, we find in the first, 28 in 460 fines ; in the second, 37 in 345 ; in the third, 44 in 438 ; and in the fourth and last, 24 in 130 fines. The relation of the number of references to the number of fines, expressed on a percentage basis, shows the rise of the custom more clearly : Periods, 1, 0.3% ; 2, 1.9% ; 3, 6.0% ; 4, 10.7% ; 5, 10.0% ; 6, 18.4%.

In these figures it may be safe to say that we may see a reflection of the progress of falconry in the County.

If and when further fines are abstracted, it will be of decided interest to follow the progress of the custom, to see if it increases its vogue and when it wanes.

Although any estimate of the position of the sparrow-hawk and goshawk in the County must be based on assumption, because we do not know that the birds referred to were taken in Essex, yet it is highly probable that they were, and therefore such an estimate is not without value.

In considering this side of the subject it must be borne in mind that when a hawk was exacted as a payment, it was nominal, instead of a sparrow-hawk it might have been a rose or a gilly-flower. This suggests that the sparrow-hawk must have been very easily obtained and accordingly a common breeder. Remarkable as it may seem, it is not easy to say definitely what is the position of this hawk in the County to-day, but effecting a comparison with my own experiences, which are confined mostly to the south and east, I should say that it must have been much

more plentiful in the 13th century. With regard to the goshawk, if we consider the small number of times it is mentioned as compared with the sparrow-hawk, we might say that it may have bred sparingly in the County.

On two occasions, 1224–5 and 1239–40, we find the sum of 2/– fixed as an alternative payment to a sparrow-hawk, which gives us a clue to its value. Unfortunately this does not occur in connection with the goshawk.

A section of the fines refers to "Divers Counties," but I have dealt only with those which apply purely to the County of Essex.

NOTES ON THE OCCURRENCE OF THE BRITISH TRAP-DOOR SPIDER, *ATYPUS AFFINIS*, IN EPPING FOREST.

By HUGH MAIN, B.Sc., F.E.S.

(*With Plate II.*)

[*Read 29th October*, 1921.]

MOGGRIDGE, in his interesting book, *Harvesting Ants and Trap-door Spiders* (published in 1873), says :—

"The great group of trap-door spiders comprises spiders which differ widely in respect of their dwelling places. Some construct no nest at all or only an irregular web; others make a simple cylindrical tunnel or a tube having a prolonged uncovered funnel-shaped mouth; others again, belonging to the genus *Atypus*, form curious nests with a silken tubular lining, part of which hangs down outside, while on the higher rung of the architectural ladder stand the builders of the veritable trap-door nests."

All these trap-door spiders have structural characters separating them from the other groups. One of these points, easily noticeable, is the arrangement of the falces or mandibles, which have the fangs directed downwards, and move *vertically* parallel to one another, while in the other groups the fangs are directed towards one another in a *horizontal* plane.

The first discoverer of *Atypus* in England was Joshua Brown. In 1856 he found several nests in the neighbourhood of Hastings. An exhaustive account of the life and habits of this spider was published by the late F. Enock in *Trans. Ent. Soc.* for 1885 (pp. 389–420). Enock discovered it on Hampstead Heath in

March 1876, and subsequently at Woking, where he found several large colonies. I have also records of it from Eastbourne, Oxshott and the New Forest ; whether all these are to be referred to the same species I am unable to say.

I made the acquaintance of *Atypus* in Epping Forest a few years ago through the introduction of a friend, and have since observed it in a number of places in the higher parts of the Forest.

The favoured localities are gravelly banks covered with tufts of heather. The spider lives in a silken tube, which in the case of a mature female may extend three or four inches above ground, passing down into the earth for as much as eight or nine inches. The aerial portion of the tube may be found running either up or down hill. Probably in the first instance it is carried uphill among the roots and along the ground, but the supporting threads may be accidentally disturbed and broken and the tube then lies down the bank. (Plate II, fig. 1.) In captivity, I find the tubes are always carried up any adjacent objects whenever possible. In very hard ground the tube is generally shorter than when in loose earth. The tube is started by the young spider and becomes enlarged in diameter and length as the inmate grows. Enock considered that individual spiders might live as long as ten years.

By carefully removing the earth from around a tube its whole length may be laid bare. In large tubes there is frequently a swollen portion near the lower end which may contain eggs or young. (Plate II, fig. 2.) At the lower extremity there is often a solid plug consisting of earthy material.

I have never found both sexes in any of the tubes that I have examined ; generally only the female is present, but occasionally she is accompanied by young. In a tube, however, which I dug out and gave to Mr. Thompson, on the occasion of our Cryptogamic Foray on 15th November, 1919, he found a pair which were preserved, and are exhibited in the Club's museum. Enock found several tubes containing both a male and a female *Atypus*.

I have endeavoured to keep the spiders under observation in captivity, but they only appear to work at night. Earth is carried up from below the bottom of the tube and thrown out through an orifice at the upper end and extensions of the tube are occasionally made at both extremities. One finds the elytra

FIG. 1.

Hugh Main, Photo

FIG. 2.

FIG. 1. ATYPUS AFFINIS, showing aerial portion of tube *in situ*.

FIG. 2. ATYPUS AFFINIS, showing whole tube exposed by removal of earth. ($\frac{1}{2}$ nat. size.)

and other hard parts of beetles in the neighbourhood of the nests. The spider rests inside the aerial portion of the tube, back downwards, and insects are struck at when they walk over it. I have seen earwigs dragged through the wall of the tube in captivity and the rent afterwards repaired.

I would earnestly ask any who are interested in these creatures to avoid doing anything to risk their extermination. They are long lived and have numerous off-spring, but probably their enemies are abundant enough without the addition of human foes. Enock reported that on revisiting his old Hampstead colony in 1885 he found very few of the nests left.

The colonies I have found in the Forest are distributed over a large area, the nests are not easily seen unless specially looked for, and as the ground is left in its natural wild condition, the spiders should have a good chance of remaining permanent representatives of their special group.

THE BIRDS OF THE CROUCH VALLEY IN 1921.

By WILLIAM E. GLEGG, F.Z.S., M.B.O.U.

THE records included in this note have all been obtained during a series of visits made to the Valley in 1921. This little survey includes the traversing of the course of the Crouch from Wickford to the sea, and of both banks of the tidal water from Battlesbridge to the sea, a circuit of Wallasea Island, a visit to Foulness Island by the Broom Way, 24 hours being spent on this still remote corner, and a visit, illicit it must be confessed, to the Grange Decoy Pond.

From Battlesbridge eastwards the nature of the country, from the bird point of view, suggests considerable possibilities, and here that solitude which appeals to many naturalists may be obtained easily. The northern bank of the river, broken up by Fen, Clementsgreen, Stow and Bridgemarsh Creeks, and accordingly very hard to work, is much more attractive than the southern side, especially in the vicinity of North Fambridge, where there is much more or less fresh water behind the sea-wall. At two points, one on the north bank to the west of Fambridge, and the other on the south, midway between Hull Bridge and Fambridge, the sea has broken through the wall and reclaimed its own. At both these places many acres, which were at one

time farmed, now bear a luxuriant growth of *Aster tripolium* and are the haunt of many Redshank, Curlew, etc.

Very little of interest was noted on Foulness, and I was informed that very few duck appeared there and those that did come did not stay long. It was suggested that the absence of fresh water is the reason, which is probably correct. However, a certain amount of shooting is obtained on New England Island. In this area I have identified 75 species of birds, but as my observations were carried out during March, July (end), August, September, October and December it will be obvious that many more might be added. I give a complete list of all species identified, and the position of those upon which no remark is made may be taken as normal. Records of 28th August were obtained at a meeting of the London Nat. Hist. Society.

Carrion Crow, *Corvus corone*. Common. Identified on all visits.

Hooded Crow, *Corvus cornix*. One in a flock of rooks near Don's Farm, 9th October.

Rook, *Corvus frugilegus*. Especially abundant. The following rookeries were noted, Wickford, Runwell, Runwell Hall, S.E. of Rettendon Place (70 nests), Woodham Ferris, N. Fambridge, S. Fambridge, Creeksea (25 nests), Paglesham (60 nests), Southminster, and Dengie.

Magpie, *Pica pica*. 6th March, at Battlesbridge; 27th March, five birds and several nests, either old or new, seen in a small area near Althorne; 28th August, 2 seen at Battlesbridge, and a young bird in captivity at N. Fambridge, said to have been taken in the district; 9th October, at Battlesbridge and Fen Creek.

British Goldfinch, *Carduelis c. britannica*. Seen 31st July.

Corn-Bunting, *Emberiza calandra*. 26th March, singing near Southminster.

Yellow Wagtail, *Motacilla raii*. 31st July, feeding young. 28th August numerous, especially at N. Fambridge, where they appeared to be flocking.

Redstart, *Phœnicurus phœnicurus*. 28th August, one near Battlesbridge.

Whinchat, *Saxicola rubetra*. 28th August, at Battlesbridge and N. Fambridge.

Wheatear, *Œnanthe œnanthe*. 25th March, Wallasea Island;

28th August, S. Fambridge; 17th September, many on Foulness Island and Wakering marshes.

SWALLOW, *Hirundo rustica*. 31st July, numerous; 28th August, numerous at Hull Bridge; 17th September, a few.

MARTIN, *Delichon urbica*. 31st July, numerous; 28th August, numerous at Battlesbridge; 17th September, a few.

SAND-MARTIN, *Riparia riparia*. 31st July.

LESSER SPOTTED WOODPECKER, *Dryobates minor*. 9th October, Runwell.

KINGFISHER, *Alcedo ispida*. 28th March and 9th October, on the tidal water.

SHORT-EARED OWL, *Asio flammeus*. 28th August, one at N. Fambridge; 17th September, one on Foulness Island; 9th October, one at Clementsgreen Creek. On all three occasions the owl was flushed from long grass either on or near the sea-wall. It may be pointed out that this species has been recorded as nesting near Burnham-on-Crouch in 1921. (See *British Birds*, vol. xv., p. 69.)

LITTLE OWL, *Carine noctua*. 6th March, Hull Bridge; 25th March, Burnham and Woodham Ferris; 9th October, N. Fambridge; 11th December, Creeksea and Hockley.

COMMON SHELD-DUCK, *Tadorna tadorna*. 26th March, two, Grange Decoy Pond. On the Crouch, 27th March, six, 28th March five, 31st July, five.

COMMON TEAL, *Querquedula crecca*. 26th March, Grange Decoy Pond; 28th March, N. Fambridge.

SHOVELER, *Spatula clypeata*. 28th March, 31st July, 28th August at N. Fambridge. This duck was numerous here and this is a probable breeding place.

POCHARD, *Nyroca ferina*. 28th March, N. Fambridge.

TUFTED DUCK, *Nyroca fuligula*. 28th March, N. Fambridge.

HERON, *Ardea cinerea*. Found on all visits. Parties from nine to twenty seen.

COMMON SNIPE, *Gallinago gallinago*. 25th March, Wallasea Island; 18th September, Wakering Marshes; 9th October, Clementsgreen Creek.

JACK SNIPE, *Limnocryptes gallinula*. 25th March, Wallasea Island.

DUNLIN, *Erolia alpina*. 6th March, small flock near Battles-

bridge; 11th December, several large flocks between Creeksea and S. Fambridge.

Redshank, *Tringa totanus*. Abundant. Seen on all visits.

Common Sandpiper, *Tringa hypoleucus*. 28th August, about a dozen between Battlesbridge and Fambridge.

Green Sandpiper, *Tringa ochropus*. 31st July, two near Battlesbridge; 28th August, fully a dozen between Battlesbridge and Bridgemarsh Island; 18th September, one or more, Wakering Marshes.

Curlew, *Numenius arquata*. Fairly common. Identified on all visits, but not west of Hull Bridge.

Whimbrel, *Numenius phæopus*. 31st July and 28th August, on the flooded area, already alluded to, on the south of the river; 18th September, Wakering Marshes.

Golden Plover, *Pluvialis apricarius*. 9th October, Clementsgreen Creek.

Ringed Plover, *Charadrius hiaticula*. Not very common, 6th March, 28th August, flock of twelve; 17th September flock on ploughed land on Foulness Island; 9th October, 11th December.

Common Gull, *Larus canus*. 9th October, one; 11th Dec., one.

Herring-Gull, *Larus argentatus*. Not common. 6th March; 31st July; 28th August.

Lesser Black-backed Gull, *Larus fuscus*. 18th September, four near Barling. On the Crouch, 9th October, one, 11th December, one.

Common Tern, *Sterna hirundo*. 31st July, one near Hull Bridge.

Great Crested Grebe, *Podiceps cristatus*. 6th March, I watched one swimming down the river, diving in characteristic fashion; it returned in the same manner and then flew over the sea-wall. On 28th March I found one dead (apparently it had been shot), behind the sea-wall near Burnham.

Little Grebe, *Podiceps ruficollis*. 28th March; 31st July; 28th August, near N. Fambridge; only at this one place.

Coot, *Fulica atra*. As Little Grebe.

Stock Dove, *Columba œnas*. 25th March, two, Wallasea Island; 26th March, at Southminster, a probable nesting

place ; at Don's Farm ; 28th August, one ; 9th October, fourteen.

TURTLE-DOVE, *Streptopelia turtur*. 31st July ; 28th August, common.

Other species identified are as follow :—Jackdaw, Jay, Starling, Greenfinch, House Sparrow, Chaffinch, Linnet, British Bullfinch, Yellow Hammer, Reed-Bunting, Sky-Lark, Pied Wagtail, Meadow Pipit, British Great Titmouse, British Blue Titmouse, Whitethroat, Willow-Warbler, Missel-Thrush, Song-Thrush, Fieldfare, Blackbird, Redbreast, Hedge Sparrow, Wren, Green Woodpecker, Swift, Kestrel, Mallard, Lapwing, Black-headed Gull, Moor-Hen, Wood Pigeon, Partridge.

THE ROSY-MARBLED MOTH (*LITHACODIA [ERASTRIA] VENUSTULA, HUB.*) IN BRITAIN.

By CHARLES NICHOLSON, F.E.S.

[*Read 28th January*, 1922.]

ALTHOUGH the beautiful little moth which is the subject of these notes has been found in Britain only in the counties of Essex and Sussex, there is apparently no reference to it in the *Proceedings and Transactions of the Essex Field Club* or the ESSEX NATURALIST. It seems desirable therefore to summarise the knowledge we possess concerning it with a view to preserving, in a convenient form, as complete a record as possible of its habits and occurrence in Britain. Apart from Britain it is found in Europe (France, Spain, Germany, Austria, Hungary, Switzerland, Bulgaria and South Russia), and Asia (Transcaucasia, Armenia, Persia and Siberia), so that it has a very extensive range in the northern hemisphere of the Old World.

In Britain the outstanding feature in connection with this moth is its extremely limited range and the local character of its occurrence in (some, at least, of) its known localities. In Sussex it is to be found only in that stretch of woodland near Horsham, separate parts of which are known as Worth, Tilgate and St. Leonard's Forests respectively. In the last named area it was apparently discovered in 1874 (see Table), flying in June in dozens along the paths, and the late Mrs. Bazett, of Reading, was perhaps the first to take it (some 25 to 30 years

ago), in Worth Forest, where it is still "widely distributed and common." (W. G. Sheldon, *in litt.*) In Tilgate Forest—a well-known locality for it—it was seen swarming in 1917 and fairly abundant in 1921, by the Rev. J. W. Metcalfe (*in litt.*)

Coming to our own county of Essex, we find that J. F. Stephens in his *Illustrations of British Entomology* (1830) says: "An extremely rare species, of which I have hitherto seen four examples only—a pair in my own cabinet; one of the latter taken, I believe, in Epping Forest by the late Mr. Honey, the other by the late Mr. Bentley." The next reference appears to be that in the *Zoologist* for 1845 (p. 1085), where Henry Doubleday records that "On the 29th June, whilst walking in a heathy part of Epping Forest, I observed several specimens of this pretty little species flying over and alighting on the common fern; not having any entomological apparatus with me, except a couple of pill boxes, I only secured two specimens. The next day I again visited the spot, but could not see a single individual." H. T. Stainton, quoting these two extracts in his *Manual of British Butterflies and Moths* (1857), p. 297, says:—"The insect has not been seen in Britain since." But curiously enough in the next two years (1858–9) it was captured at Loughton and recorded in the *Zoologist* with a note that it appeared then to be generally distributed in the Forest (see Table). From that time to 1868 it seems to have been hunted by many collectors in its Forest haunts with more or less success, according to the nature of the seasons; the only subsequent records I can find are those shown in the appended Table, for 1882 and 1885, unless H. Jobson (who lived at Walthamstow) obtained eggs or larvæ from Epping Forest from which he reared the moths referred to in the Table under 1886, which is not unlikely. I have not been able to find any record of its discovery near Brentwood, its only other well-known Essex locality, nor do I know whether it still occurs there, but I understand the spot in which it is found is of exceedingly limited area.

The earliest description of the Rosy-marbled moth appears to be that in Haworth's *Lepidoptera Britannica* (1803), p. 261, and it was made from specimens in the collection of (presumably) the Mr. Honey mentioned by Stephens. C. G. Barrett, in his *Lepidoptera of the British Islands*, says that it was first taken in Epping Forest by J. F. Stephens in 1792, but as Stephens was

not born until that year (!) Barrett was evidently confusing dates.

In 1859–60 it was first bred in England by Henry Nicholls, a friend of the late W. H. Tugwell, of Greenwich, who records (*Entomologist* 1883, p. 164), that the larvæ were first tried with a variety of plants growing where the moths were caught in Epping Forest. The larvæ took most readily to the flowers of the common tormentil (*Potentilla erecta* = *P. tormentilla*) and the first specimens of the moth bred in this country duly appeared. Tugwell himself, some 17 years later, also reared the larvæ on the same plant until they were nearly full-fed, and then, having to go to Deal on holiday, where the plant was difficult to get, he tried silverweed (*P. anserina*) and flowers of bramble, which the larvæ obligingly accepted and they duly became moths. Attempts by other collectors to feed their larvæ on the common trailing tormentil (*P. reptans*) had not been productive of good results, as the larvæ, after beginning well, generally ended by devouring each other, from which it was assumed that *P. reptans*, although so closely allied to *P. erecta*, was not the proper food. It was thus established that the natural food of the species was *P. erecta*, but there *may* be others, seeing that Mr. Edelsten (see Table), brought his brood through on strawberry and bramble flowers and *lettuce* ! !

Judging from the published descriptions and figures of the larva it appears to vary somewhat in colour and pattern, but is generally some shade of velvety reddish or purplish brown with a paler medio-dorsal stripe, sometimes passing through a series of reddish diamond-shaped spots, and there is also a pale roundish spot sub-dorsally placed on each side of the fifth segment. This last character, and the decidedly swollen appearance of the 4th and 5th segments, caused Mr. Edelsten to liken it to a small edition of the larva of the Large Elephant Hawkmoth (*Chœrocampa elpenor*). The larva is apparently of an extremely nervous disposition, as it is described by several writers as falling from its food-plant and rolling itself into a ring on the least noise or disturbance in its vicinity. When full fed it descends to the surface of the earth and spins a tough little cocoon with fragments of moss and rubbish and therein becomes a light brown chrysalis.

C. G. Barrett in his *Lepidoptera of the British Isles* (vol. vi.,

pp. 179–80) says that the "moth hides in the daytime in the masses of tangled fern and bramble, or amongst heather, and in warm and very favourable weather it may occasionally be disturbed and induced to fly a short distance, but quickly darts down and hides close to the earth. It flies normally for a short time at early dusk, or even at sunset, on very calm evenings, but is hardly to be seen at any time on the wing if the weather is the least wet or chilly. Its flight is only for a short distance over the heather, or along glades or paths in woods, and it quickly settles, to fly again a short distance. It does not seem to be attracted to flowers" or the usual artificial baits provided by collectors for Noctuæ. To these remarks may be added the following notes. The flight in this species is low and jerky, resembling that of some "Tortrices" and lasting from about a quarter to half an hour, between 8.15 and 8.45, or thereabouts, when the common Pyrale, *Scoparia ambigualis*, is also flying. Emergence from the pupa takes place during the last week in May and first week in June in an average season, but the insect may be found as late as the first week in July (probably in backward seasons) as may be seen in the Table.

Mr. A. W. Mera tells me that he used to take it flying before sunset at Brentwood during the later years of last century, i.e., from 1888 onwards, but in more recent years to 1913 the insect was greatly reduced in numbers, and he had not seen that early flight, the moth not commencing to show itself until nearly 9 p.m. This seems to suggest a change of habit not common amongst lepidoptera.

I append a table giving all the records met with in some 200 volumes of entomological and other magazines and systematic works, from which it will be seen that the only places in Epping Forest specified as localities are "Loughton" and "Epping." I am inclined to think, however, that the latter is only a vague reference designed to mask the exact station for the moth. It must be admitted that "Loughton" itself is also somewhat vague and the entry in the Table giving the station as "half-way between Loughton and Epping" is little better. This reticence, in the case of such a local species, as our little moth undoubtedly is, is, of course, eminently praiseworthy, but one cannot help wondering whether, in spite of the reticence, the insect was exterminated from our Forest by too

persistent collecting in a district so easily reached from London. Its survival near Brentwood is not so remarkable, and much less so its frequent abundance in its Sussex haunts, up to the present time.

Year.	Month.	Collector.	Locality.	Remarks.	Reference.
1858–9	June	H. W. Killingback	Loughton		*Zool.*, 1860, p.6641
1859	May 27	W. E. Pallender ..	,,	In fine condition	*E.W.I.*, vi., p. 123
	June 7	,, ..	,,		,,
	,, 12	C. Healey ..	Ep. Forest	Three	,,
	,, 13	J. Baker ..	,,	Two during a shower	,, vi., p. 99
1860	,, 14	J. Bryant ..	,,	Several. Eggs obtained	,, viii., 107
	,, 16	C. Miller ..	Loughton	,, Drops when alarmed	,, ,, 99
	,,	J. Scott ..	,,	,, Flying from 8.30	,, ix., 143
	,, 24	E. Newman ..	Ep. Forest	Hundreds	*Zool.*, 1860, p.7108
	—	T. Eedle ..	Loughton	Several	*E.W.I.*, viii., 99
	June	C. S. Biggs ..	Ep. Forest	Eggs obtained	*Ent.*, 1883, p. 163
1861	—	T. Eedle ..	,,	Not so abundant as in 1860	*E.W.I.*, x., 107
1863	—	R. W. Wright ..	Loughton	One	*E.A.*, 1864
1864	July 4	,, ..	Ep. Forest	,,	,, 1865
	,,	Dr. B. Gill ..	,,	Three	,, ,,
1865	June 5	S. A. Davis ..	Loughton	Several	,, 1866
1866	June	Dr. B. Gill ..	Epping	Scarce	,, 1867
	,,	E. G. Meek ..	Loughton	,,	,, ,,
1867	June	T. Eedle ..	?		,, 1868
1868	May 27	A. Woodage ..	Epping	A few fine specimens	,, 1869
	June	Dr. B. Gill ..	,,	Scarce	,, ,,
	,, 13	H. Vaughan ..	Loughton	One	,, ,,
1874	June 2	D. Price ..	Roost Hole	Abundant, flying	*Ent.*, 1874, p. 206
	,, 6	,, ..	St. Leonard's Forest	by dozens.	,,
	,, 9	,, ..		Faded	,,
1877	—	W. H. Tugwell ..	St. Leonard's Forest	Eggs obtained and moths bred	,, 1883, p. 164
1882	June	W. H. Wright ..	Ep. Forest	Commoner than usual	,, 1883, p. 82
1885	June	G. V. Elstowe ..	Between Loughton and Theydon Bois	Good series, end of month	,, 1885, p. 203.
1886	—	H. Jobson ..	?	Successfully reared	,, 1886, p. 209
	—	G. H. Rayner ..	Brentwood		In. Coll. Brit. Mus.
1887	—	,, ..	,,		,,
1888		A. W. Mera ..	,,	Abundant	*In litt*
1910	June	H. M. Edelsten	Brentwood	Eggs obtained and moths bred	*In litt.*
1913	,, 7	London N.H. Society	,,	A few	*Transactions L.N.H.S.*
1914	,, 1	A. W. Mera ..	Three Bridges	One in daytime	*In litt.*
1917	June	Rev. J. W. Metcalfe	Tilgate For.	Flying in hundreds	,,
1921	,,	,,	,,	Fairly abundant	,,

Ent,. The Entomologist; E.A., Entomologists Annual; E.W.I., Entomologist's Weekly Intelligencer; Zool. Zoologist; L.N.H.S., London Nat. Hist. Society.

It is interesting to note that Hübner's specific name *venustula* (pretty, graceful), which fits this species so well, appears never to have had an alternative, but the generic names have been various: *Noctua*, Hüb. (1790) *Hapalotis* Hüb.; *Eustrotia*, Hüb.; *Erastria* Ochs.; and *Monodes*, Guenée.

I should like to acknowledge gratefully the kindness of Messrs.

H. M. Edelsten and A. W. Mera and Rev. J. W. Metcalfe, for useful information and the specimens exhibited; Mr. W. G. Sheldon for valuable notes; and Messrs. J. H. Durrant and W. H. T. Tams for help in research in the library and collections at the Brit. Mus. (Nat. Hist.).

THE ESSEX FIELD CLUB—REPORTS OF MEETINGS.

RAMBLE IN THE SEWARDSTONE DISTRICT (530th MEETING).

SATURDAY, 23RD APRIL, 1921.

The object of this ramble was a two-fold one—to study the returning summer bird-migrants, and also the spring flowers of this beautiful corner of the Forest district.

A dismally wet morning, sufficient to discourage all but the most ardent field-naturalists, was suddenly broken at 2 o'clock by a sunny interval; and thence forward the weather presented typical April alternations of smiles and showers, which produced magnificent effects of light and shadow on the landscape and yielded splendid blue distances.

Twenty members and friends assembled at the appointed time at Chingford station, a goodly muster considering the very unfavourable weather conditions of the earlier day. A start was made just before 3 o'clock, the route traversed being across Chingford Plain, through Bury Wood, and by field path and green lane to Gillwell Park, frequent pauses being made for the purpose of listening to the spring songs of the birds which abounded on all sides, and for culling the wild plants met with. Our conductors, Miss A. Hibbert-Ware, F.L.S., and Mr. William Glegg, F.Z.S., identified the calls of the birds heard, and gave impromptu lecturettes on the means of distinguishing one bird from another by its note; whilst our President, Mr. Robert Paulson, F.L.S., named the flowering plants for the benefit of the botanical students of the party.

At Gillwell Park, by permission of our members, Captain F. Gidney and Dr. Robert Patterson, the grounds of Gillwell House (now used as a training centre and camp for boy scouts) were visited, and scout "Donald" was detailed to climb two oak trees to seek for pellets of the Little Owl (*Athene noctua*), which uses hollows in these trees as feeding places. A small collection of pellets was speedily secured for the Club's Museum; these were seen to consist mainly of beetle-elytra, with skulls, bones, and fur of both vole and mouse; no bird-remains were detected in the pellets. On leaving the grounds the President expressed the thanks of the party to Captain Gidney and Dr. Patterson (the latter of whom was present) for their kindly assistance; and, it being now nearly 5 o'clock, a quick return was made along Gillwell Lane, over the flank of Yardley Hill, to Hawks mouth Farm, where tea had been arranged for in a picturesque timber barn-adjoining the farmhouse.

After tea a formal meeting of the Club (the 530th) was held, with the President, Mr. Robert Paulson, in the chair, when :—

Mr. George Eustace Brunwin, of *Haverings, Rayne, Braintree*, and

Mr. Arthur Brown, of 44, *Ravensdale Road, Stamford Hill, N.*16,

were elected members, and two candidates were nominated for membership.

The President then called upon Miss Hibbert Ware, who remarked upon the birds seen or heard during the afternoon, spoke of their habits, and described their songs, dwelling lovingly and at particular length upon her special *protégé*, the Little Owl.

Mr. Glegg, who followed, reported that 26 species of birds had been noted during the ramble, viz., Missel Thrush, Song Thrush, Blackbird, Robin, Whitethroat, Blackcap, Willow Warbler, Hedge Sparrow, Great Tit, Blue Tit, Marsh Tit, Wren, Tree-Pipit, Swallow, Chaffinch, House Sparrow, Linnet, Yellow Ammer, Starling, Carrion Crow, Skylark, Green Woodpecker, Cuckoo, Little Owl, Kestrel, and Heron ; and referred to notable absentees from the list, such as chiffchaff, redstart and greenfinch, none of which had been observed, although common enough at the time in neighbouring districts.

The President reported that he had noted 22 plants in flower, all of them common species ; but he remarked that even the commonest plants have some points of special interest and afford food for thought ; he instanced among those met with during the afternoon, Herb Robert (*Geranium robertianum*), the leaves of which are never eaten by insects or slugs ; the Lesser Celandine (*Ranunculus ficaria*), which reproduces itself by means of bulbils instead of seeds ; and the Wood Violet (*Viola sylvestris*), whose showy flowers are barren but which produces inconspicuous, green, cleistogamous flowers yielding fertile seeds.

The return to Chingford station was made through Hawk Wood and across Chingford Plain. Much interest was evinced in the apparent variation exhibited by the leaves of White Beam (*Pyrus aria*), in one of the plantations on the Plain, those on the suckers at the base of the trees being typical Mountain Ash leaves, while those on the branches had white downy undersides and were imperfectly pinnate ; and it was surmised in explanation of this anomaly that these nursery-raised trees were grafted on stocks of Mountain Ash, as is frequently done by nurserymen on account of the slow growth of trees of this species when raised from seed.

VISIT TO THE ROYAL HORTICULTURAL SOCIETY'S GARDENS, WISLEY, SURREY (531st MEETING).

SATURDAY, 21ST MAY, 1921.

In response to a kind invitation from the Director, Mr. F. J. Chittenden, F.L.S., V.M.H., a visit was arranged to the R.H.S. Gardens at Wisley for the above date. Just over thirty members availed themselves of the opportunity of seeing these famous horticultural grounds ; and a gloriously bright sunny day (" Club's weather ") favoured the party and added to its enjoyment.

Curtailment of the ordinary train service, an outcome of the prevalent

attack of "strikitis" from which the coal-mining industry was suffering, necessitated a slight alteration of plans almost at the last moment, but the entire party was successfully marshalled at Waterloo in time for the 10.45 train to Effingham Junction, which was reached an hour later.

Here our associate member, Mr. E. E. Turner (formerly of Coggeshall), was awaiting us, and under his leadership a leisurely walk of three miles to the Gardens was entered upon, botanical and other observations and collections being made by the way, and lunch being partaken of in a pine-wood *en route*.

At Elm Corner the fungus *Mitrula paludosa* was gathered, growing in a swamp amongst *Sphagnum*, and attracted much attention from its bright-orange receptacle. *Drosera rotundifolia* was also noted, and masses of *Hypericum elodes*, not yet in flower. An abundant growth of the exotic aroid *Calla palustris*, in a small pool (believed to be its only station in England) was pointed out by Mr. Chittenden, who joined the party at the spot.

The Gardens were reached at 2.30 o'clock, and the visitors were personally conducted through them by Mr. Chittenden, inspecting in turn the experimental plots of vegetables and of fruit trees, the extensive and picturesque rock-garden (a dream of floral beauty, which it was difficult to believe had only been commenced in 1911), and some of the hot-houses.

In the Vinery our conductor pointed out one vine which had been raised from a cutting from a Palestine parent. This was the celebrated vine of Eshcol, which, it will be remembered, was in Biblical times so profuse a bearer that it is recorded that the spies, sent by Moses into Canaan, "cut down a branch with one cluster of grapes, and they bare it between two upon a staff"[1]; its old-time fertility is still maintained, as Mr. Chittenden informed us that his plant has yielded a bunch of grapes weighing 14lbs., while a 28lb. bunch has been recorded by others from the same variety.

At 4.45 o'clock tea was kindly provided by Mr. Chittenden in the Entrance Hall of the beautiful Laboratory Building, our indefatigable host meanwhile giving us a chatty account of the history of the Royal Horticultural Society since its foundation in 1804, and of the Gardens under his charge. The latter, 65 acres in extent, and which we were informed necessitate an expenditure to-day of something like £10,000 per annum for upkeep (of which sum a munificent Government contributes by way of grant, £200 per annum !) were bought for £5,000 by the late Sir Thomas Hanbury and were presented by him to the Society, three Trustees being appointed by the donor to ensure the permanence of the scheme of management laid down by him; of these Trustees, our member, Miss E. Willmott, F.L.S., V.M.H., who first suggested to Sir Thomas Hanbury the desirability of making the purchase, is one.

After tea a short meeting of the Club was held, when

Mr. Alderman W. Gurney Benham, F.S.A., of 9, *Lexden Road, Colchester*, and

Miss Edith Gemmell, of 10, *Hampton Road, Forest Gate, E.7*,

were elected members; and three certificates of nomination were read.

The President moved that the hearty thanks of the Club be accorded to our host for his invitation and hospitality, and for the many services

1 Numbers xiii., 23, 24.

rendered by him during the day ; in so doing, he referred to other kindly offices fulfilled by Mr. Chittenden to the Club in past years, especially to the careful overhauling of the Club's moss-herbarium, carried out by him nearly 20 years ago. The Hon. Secretary warmly endorsed the President's enconiums from personal acquaintance with the moss-herbarium.

Mr. Chittenden thanked the speakers for their complimentary utterances ; and the vote of thanks was carried by acclamation.

Mr. Paulson also thanked Mr. Turner for his services to the party as guide during the day, and Mr. Turner briefly acknowledged the vote of thanks.

Before leaving, the party was conducted by Mr. Chittenden through the Laboratory Building, a triumph of picturesque architectural design adapted to its special purpose, inspecting the various Botanical, Chemical and Entomological Laboratories, the Director's Office, the Library and Herbarium, etc., all of which provoked much interest and admiration.

The final stage of a most enjoyable day's visit was a three-mile walk (somewhat hurried in its later portion), by road, canal-bank, and field-path to Byfleet, where the 6.41 train to Waterloo (fortunately somewhat late !) was safely caught.

VISIT TO THE GRAYS CHALK QUARRIES (532nd MEETING).

SATURDAY, 18TH JUNE, 1921.

A wish having been expressed by several members to repeat the visit to these quarries, paid last summer,[2] when many interesting records were made, both of plants and insects, the present expedition was arranged (by kind permission of the Grays Chalk Quarries Co. Ltd.), with the President and the Hon. Secretary as conductors of the party, which numbered about thirty.

Most of the party travelled down by the train leaving Fenchurch Street at 10.17, due to arrive at Grays at 11.5 o'clock ; but some members came down by later trains.

The same profusion of plants of Chalk *facies* was noticed as last year, and, to avoid recapitulation, members may be referred to the report of the earlier visit for full lists of the wild-flowers observed.

The beautifully mammillated specimens of Greywethers, which lie on the floor of the upper pit, attracted considerable interest, and Mr. Percy Thompson gave an account of their composition and history and their probable beds of origin.

Tea was taken in the town at 4.30 o'clock, and a formal meeting of the Club was held afterwards, at which

Miss Caroline A. Benn, of 68, *South Esk Road, Forest Gate, E.7*,

Miss Agnes Veitch, of 3, *Sherrard Road, Forest Gate, E. 7*, and

Mr. William Pollitt, *Borough Librarian and Curator, Southend-on-Sea*, were elected members, and one candidate was nominated for election.

The President (Mr. R. Paulson) gave a short account of the more characteristic plants met with during the day, and pointed out their rarity in our County, taken as a whole.

The return train to London was caught at 5.32 o'clock, after a very interesting expedition.

2 See ESSEX NATURALIST, xix., p. 256.

VISIT TO SHENFIELD AND HUTTON (533rd MEETING).

SATURDAY, 9TH JULY, 1921.

This Meeting was arranged in response to a kind invitation from our member, Mr. James Keeves, to visit him at "Haslemere," Hutton Mount. Our host and Mr. H. W. Weston acted as conductors throughout the day.

A five-mile cross-country walk, with nearly five hours in which to do it, would not seem to demand very strenuous exertion, but under the conditions of this summer of drought, with the shaded thermometer high in the 80's, and with a blazing sun overhead, a real effort was required to keep going, and the party was glad to seek casual opportunities for rest on the roadside greensward. Longfellow's lines :—

"Where Autumn, like a faint old man, sits down
"By the wayside a-weary,"

were quoted, not too inappropriately, on one of these occasions.

But, notwithstanding the intense heat, the day's programme was fully accomplished, and all present voted the excursion a most enjoyable one.

The party of some 25 members assembled at Shenfield station at 11.37 o'clock, and at once proceeded to Shenfield Church. Here, the Rector, the Rev. J. W. Lewis, welcomed the visitors and explained the various points of interest in the fabric and exhibited the registers.

Samuel Harsnett was rector here from 1604 on.

The north porch and door of mellow-red Tudor brickwork, which was only unmasked some three years ago upon the removal of an old mantling plant of ivy, makes a fine feature, covered as it is with patches of the yellow thallus of the lichen *Lecanora sulphurea* ; and the almost unique oak or chestnut arcading between the nave and north aisle attracted especial interest.

An inspection of the exterior of the late 15th century Shenfield Hall, and the adjacent Rectory, followed, and Mr. Lewis very kindly presented each member of the party with a charming reproduction of an old print of the Church.

On leaving, the President voiced the thanks of the party to Mr. Lewis for his kindly services.

The visitors next made their way to Thrift Wood, where an *al fresco* lunch was enjoyed in the grateful shade of large oak-trees. Proceeding through the wood some extensive patches of *Erythræa centaurium*, intermixed with several species of St. John's Wort, presented a charming and unusual spectacle in a recent clearing. *Carex pseudocyperus* was noted in a pond in the wood, and fine specimens of Skullcap (*Scutellaria galericulata*) were growing on its banks, while just outside the wood *Carex sylvatica* and, on a roadside, *Hypericum hirsutum* were recorded.

Several of our rarer moths are said to be still discoverable in this wood, but our entomologists present on this occasion, although energetically hunting for "flies," had to report very poor results, doubtless by reason of the abnormal drought. Beetles were, however, more in evidence.

A very picturesque "bit" for the camera was afforded by an exhibition of hurdle-making, which old-time industry was being carried on in wood from the felled Sweet Chestnut trees.

From Thrift Wood, the route passed over upland fields, and through

other woodlands of smaller extent to Hutton Church, where the party was received by the Reverend P. L. Claughton, who pointed out that the ancient fabric had been drastically restored in 1873 by C. E. Street (the celebrated Gothic architect, who designed the new Law Courts in the Strand), in the Early English style with which he was so familiar.

The carved oak rood, with figures of Christ on the Cross and the Virgin and St. John, attracted much interest, as did the handsome alabaster War Memorial on the south wall, which was executed by one of our members, Mr. Daymond.

Leaving this interesting church and thanking Mr. Claughton for his learned exposition, a fine avenue of elms, just opposite the church, was pointed out as being, together with other local landmarks, referred to in the opening chapter of Anthony Hope's *Sophie of Kravonia*. That well-known novelist visited relatives of his who live in the immediate neighbourhood, and drew upon local topography for his descriptions.

Mr. Arthur C. Guppy's garden at "The Coppice" was next visited, and its especial feature, an old marl-pit of several acres in extent, which has become filled with water and surrounded by trees and bushes, inspected.

The final stage to "Haslemere" was then undertaken, and here a most cordial welcome awaited the tired wayfarers from Mrs. Keeves and her daughters, and tea was administered in large doses.

After tea, a short meeting of the Club was held, when Miss Edith F. French, of 46, *Church Hill Road, Walthamstow, E.*17, was elected a member, and three nominations for membership were made.

The President expressed the thanks of those present to Mr. Keeves for the trouble he had taken in arranging the day's excursion and to him and Mrs. Keeves for the hospitality extended, and also to Messrs. Weston and Guppy for their respective shares in the day's enjoyment. Mr. Keeves replied, expressing the hope that a second visit of the Club might be made at no distant date.

The members then made their way to Shenfield Station, in separate detachments, to catch different trains. Before saying farewell Mr. Weston very kindly distributed to the visitors copies of some manuscript notes on the history of Hutton.

RAMBLE IN THE THEYDON GARNON AND ABRIDGE DISTRICT (534th MEETING).

SATURDAY, 17TH SEPTEMBER, 1921.

A cross-country nature-ramble in the above district was organized on this date, the principal object of the expedition being to study the autumn botany and to collect insects and pond-life specimens; the conductors were the president (Mr. R. Paulson, F.L.S., F.R.M.S.), Mr. D. J. Scourfield, F.Z.S., F.R.M.S., and Mr. Percy Thompson, F.L.S.

A cold morning, with a stiff nor'-easter blowing, coming unexpectedly as it did after a prolonged period of heat and drought, yet did not deter members from turning out in force, and a goodly muster of 50 persons attended.

Most of the party assembled at Theydon Bois Station at 10.50 a.m.

Others, who were unable to leave town earlier, travelled down by early afternoon trains and joined the main party in the meadows near Abridge.

The route taken, some six miles long in all, was designedly by field-paths and bridle-paths and by the river banks, roads being avoided as far as possible. During the ramble, several portions of the narrow mediaeval highway from London to Harlow, now long since disused by travellers, and in places overgrown, were explored.

At the picturesque old church of All Saints, at Theydon Garnon, the visitors were received and welcomed by the rector, the Rev. W. P. Rowley, and here a brief account of the architectural history of the fabric and of the interesting Priest's House in the churchyard was given by Mr. Percy Thompson. The wish was voiced that steps might be taken in the County to raise a fund to restore the old Priest's House, now in a deplorable state of dilapidation, before it fell into actual ruin.

The registers and the contents of the fine iron-bound oak church chest, where inspected with much interest.

Leaving the church, after thanks had been tendered to Mr. Rowley for his kindly welcome, the Party picnicked in the mediaeval roadway before mentioned, and later made its way across country to the Roding meadows, where a number of riverside plants were noted and gathered.

Notwithstanding the exceptional drought, which had persisted from early spring until only a week before the excursion, no less than seventy-seven wild plants, actually in flower, were recorded during the day's ramble. None of these were noteworthy rarities, however.

On arrival at Abridge the preparation of tea was expedited in deference to the feelings of some of the weaker members of the party, who were chilled by the persistent wind.

After tea a short formal meeting of the Club was held, with the President in the chair, when

Mr. H. S. Cousens, M.A., of 60, *Croftdown Road, Highgate Road, N.W.*5;
Mr. Arthur C. Guppy, of *The Coppice, Hutton*, and
Mr. C. Rix Jeyes, of *The Lindens, Hutton*,

were elected to membership, and three additional candidates were nominated. The President alluded to the presence with the party of a distinguished visitor, Dr. R. Lloyd Praeger, of Dublin, and of our honorary member, Dr. A. Smith Woodward, President of the Linnean Society.

The homeward journey from Abridge, by field-path and bridle-path to Chigwell Lane Station, was undertaken in a drizzle of rain which had now set in ; a few more plants were collected, and the ponds and swamps *en route* were tried for microscopic life, but failed to yield any noteworthy " takes " ; a small pit in the Roding Valley gravel was visited by a few of the party, and specimens of Hertfordshire conglomerate, Bunter quartzites, and Carboniferous sandstone were noted.

The up-train was caught at Chigwell Lane at 7.5 o'clock, and so concluded a pleasant day's excursion in spite of somewhat bleak climatal conditions.

FUNGUS FORAY IN EPPING FOREST (535th MEETING).

SATURDAY, 15TH OCTOBER, 1921.

The abnormal drought of the past spring and summer, which, with but few showers, had been prolonged into the autumn, did not promise big results from our fungus-foray this year; nevertheless, although no profusion of fungi met the casual eye of the wanderer through the woods, a quite respectable yield of interesting forms rewarded the determined seekers, and the subsequent display at the headquarters (the Roserville Retreat at Highbeach) compared not unfavourably with that of previous forays.

The referees were as under:—

For the Basidiomycetes and Ascomycetes	Miss A. LORRAIN SMITH, F.L.S. Miss ELSIE WAKEFIELD, F.L.S. Mr. F. G. GOULD. Mr. J. RAMSBOTTOM, F.L.S.
For the Myxomycetes ..	Miss G. LISTER, F.L.S.

The route followed by the morning party, which assembled at Chingford railway station at 11.4 o'clock, was by way of Fairmead to Highbeach, while the afternoon party, starting from Loughton station at 2.54 o'clock, proceeded by the shorter way of Staples Hill and Loughton Camp to the same rallying point. As in former years, various members of other Societies joined the Foray by invitation, some 120 persons in all being present.

Tea was served at the Roserville Retreat at 5 o'clock, following which a meeting of the Club (the 535th Ordinary Meeting) was held, with the President, Mr. Robert Paulson, F.L.S., F.R.M.S., in the chair.

The following were elected members of the Club:—

Mr. L. W. Godward, of 136, *Kensington Avenue, East Ham, E.*6.

Mr. George A. Hardy, of the *Essex Museum, Romford Road, Stratford, E.*15, and

Mr. Ernest Meech, of 119, *Kimpton Road, East Ham, E.*6.

Four candidates for membership were nominated.

The President then called upon the several conductors for reports upon the day's finds.

Miss A. Lorrain Smith expressed satisfaction at the number of specimens found, notwithstanding the long drought.

Mr. J. Ramsbottom referred to the occurrence of *Pyronema confluens*, a discomycete growing characteristically on burnt patches throughout the higher grounds of the Forest as a result of the numerous fires of the past dry summer.

He also remarked on the enormous production of spores by fungi, and on their long fertility; mentioning that spores from a specimen of the mould *Fumago vagans* Lk., a black fungus growing on living leaves of lime and other trees, had germinated after 67 years' preservation in the herbarium of a museum in an atmosphere saturated with camphor-fumes.

Mr. F. G. Gould referred to some noteworthy effects of the unusually dry season upon the records of the day. He pointed out that contrary to usual experience, very few specimens had been found on the clayey ground. Species of *Russula*, *Tricholoma*, *Lactarius*, *Clitocybe* and *Cortinarius*, so abundant in normal years, were almost entirely absent. On

the other hand, old stumps, and living trees, had yielded a fair harvest of *Hypholomas*, *Pholiotas*, and various kinds of *Polyporus* ; while in ditches and marshy places,usually too full of water to enable fungi to grow, had been found comparatively rare species, such as *Bolbitius flavidus* and, *Psilocybe ericæa*. The fungi found on dung namely, *Coprinus niveus*, *Anellaria separata*, *Panæolus campanulatus* and *Stropharia semi-globata* had been much in evidence. The gravelly soil at High Beach had yielded quite a good crop of *Amanita muscaria*, *Amanita rubescens*, and several kinds of *Boletus*, particularly *edulis*. A remarkable feature of the foray was the large quantity of the False Chanterelle (*Cantharellus aurantiacus*) which had turned up. This beautiful fungus has been comparatively rare in the Forest for many years, but on the present occasion numerous specimens had been gathered among long grass in open situations, where the full effect of recent showers of rain and heavy dews would be felt.

Miss G. Lister reported that seventeen species of myxomycetes had been recorded during the foray, most of them forms which grow on tree-stumps ; forms which grow on dead leaves on the ground were this year of rare occurrence.

After the extremely dry season a few showers had done something to moisten old logs and stumps in sheltered places, and sticks lying amongst grass, and conditions were favourable for the plasmodium of some Mycetozoa to emerge and form sporangia, but the beds of dead leaves, which in wet seasons often abound with some species of *Didymium*, were almost dry, and yielded little to diligent search. The following is a list of the seventeen species found :—

Physarum nutans Pers., var. *robustum* ; a form with short white stalks and rather rigid capillitium.

Fuligo septica Gmel. ; a weathered æthalium.

Didymium squamulosum (Alb. & Schw.) Fr. On old horse dung and dead holly leaves.

Stemonitis fusca Roth. Conspicuous masses of white plasmodium were seen emerging in cauliflower-like cushions from decayed wood (and these matured into sporangia twenty-four hours later.)

Stemonitis ferruginea Ehrenb. A handsome tuft of reddish-brown sporangia, on dead wood.

Comatricha nigra Pers. Seen emerging as translucent white beads and also as mature stalked sporangia, on sticks.

C. typhoides (Bull.) Rost. On dead wood.

Lamproderma scintillans (Berk. & Br.) Morg. On dead holly leaves.

Reticularia lycoperdon D.C. Two young cream-white æthalia were found on a dead stick (and matured the following day.)

Lycogala epidendrum (L.) Fr. On a hornbeam log.

Trichia affinis De Bary and *T. scabra* Rost. on stumps.

T. varia Pers. A large growth was found within a hollow tree ; the sporangia were bristling with the parasitic *Stilbum tomentosum*.

T. Botrytis Pers. On a stick.

Arcyria pomiformis (Leers) Rost—and *A. nutans* (Bull.) Grev. on decaying oak.

A. denudata (L.) Wettst. On stumps.

The President welcomed, in the name of the Club, those members of

JABEZ LEGG.
(*From an Oil Painting*).

other societies who were present, and proposed the thanks of the meeting to the conductors and referees; these were accorded by acclamation.

Mr. Farrell expressed the thanks of the School Nature Study Union for the invitation extended to its members, Mrs. Boyd Watt similarly replied for the Gilbert White Fellowship, Mr. Fagg for the Croydon Natural History Society, and a member of the South London Botanical Institute for his Society, and the meeting then terminated.

The walk through the moonlit Forest to the railway stations *en route* for home constituted not the least enjoyable experience of a delightful day.

JABEZ LEGG.

A FORGOTTEN LOCAL WORTHY.

By JOHN AVERY, F.C.A., F.S.S.

(With Plate III.)

[*Read 27th November* 1920.]

ONE hundred years ago the site of the West Ham Technical Institute was known as Stratford Common, and the nearest property on the east side along the main road consisted of two houses known as Carnarvon Villas. These houses are still standing just west of Carnarvon Road, behind what is known as Salisbury Hall, and the property was known in recent years as Salisbury House. No. 1 Carnarvon Villas was at that time occupied by a gentleman named Jabez Legg. He was in business with his father, Mr. Samuel Legg, at No. 2 Knightrider Street, in the City of London, as Undertakers. Both father and son were prominent members of the Congregational Denomination, and they were deacons of the old Poultry Chapel, which was sold and the proceeds used in part payment of the building of the City Temple. At the period mentioned, when Wanstead House was in its glory and the whole district was considered to be in the country, one of the principal attractions was the tea gardens attached to the Eagle and Child Public House, opposite the Forest Gate House in the Woodford Road leading from Upton to Wanstead Flats, and in consequence of the spiritual destitution of the district, Jabez Legg in the year 1830 conceived the idea of erecting a small Mission Hall or Chapel at a cost of £220 and conducted services therein, also providing day-school accommodation for the children of the residents in the district of the Broadway, a district which commenced to be developed as a building estate about 1820. In 1856, Mr. Legg, with assistance from several members of the Society of Friends,

including Samuel Gurney, Lady Buxton and others, was instrumental in erecting the Congregational Church in Forest Lane at a cost of £1,530, the building being opened free of debt.

Jabez Legg was possessed of the Carnarvon Hall Estate, which he inherited from his father, Mr. Samuel Legg, who died on the 7th August 1846, at Stratford Green, aged 93 years, and was buried on 14th August in Bunhill Fields Burial Ground, City Road. His sister, Mary Westbrook, was buried the same day, aged 87 years, and is described in the Burial Register as residing at Stratford Green. Jabez Legg continued to reside at Stratford Green until his death in 1867. He married Catherine, a daughter of Robert Waylen, Esq., Mayor of Devizes. She died on the 22nd April 1824, aged 39 years, and her remains were deposited in a vault within the Congregational Church at Devizes. Jabez Legg appears to have been buried in a grave outside the Church, but adjoining the Church walls. The inscription on the tablet in the church records as follows :—

> In affectionate remembrance of Jabez Legg, Esq., of Stratford Green, Essex, who died October 23rd, 1867, aged 81 years.

Very little is known regarding his history, and few of the inhabitants in the Borough have any information as to the buildings in Forest Lane, Forest Gate, known as the Forest Gate Retreat. They consist of a block of six cottages. Mr. Legg originally built (in 1858) the first three, Nos. 1 to 3, for the accommodation of his father's old servants, and added three more in 1863, the whole being intended to provide free living accommodation for six women having sufficient income to live upon. The gift of presentation is in the hands of private trustees. Under Mr. Jabez Legg's Will he left each inmate ten pounds, but provided no fund for the maintenance of the buildings. Since his death his niece has invested, in the names of trustees, funds for the maintenance of the property and upkeep of the garden, and any surplus income is divided between the inmates at Christmas.

The portrait is from an oil painting hanging in the room of the senior inmate of the Retreat, and is reproduced by permission of the trustees.

ORIGINAL NOTES

A MS. Essex Florula.—There are two slight emendations to be made in my account of the MS. "Flora of Dedham," which was printed in the ESSEX NATURALIST, vol. xix., pp. 303–307. The name of the finder, which appears as the Rev. E. Foord-Kelsey should have been the Rev. E. Foord-Kelcey ; and, secondly, the suggestion (p. 306) of the explanation of the pencilled alteration of "Mr. Hurlock's" to "the Lecturer's" is almost certainly wrong. There is, I find, an endowed Lectureship at Dedham, with an official residence, so that the alteration—probably Coleman's—is merely from the name of the occupant of the post at the time to a more general reference.—G. S. BOULGER.

Paludestrina Jenkinsi at Grays Thurrock.—In the enormous chalk-pit, belonging to the Grays Chalk Quarries Company Ltd., recently visited by the Club (18 June 1921), Mr. Charles Nicholson and I found this small mollusc, in great abundance, in an aqueduct which conveys the water of a spring coming direct from the base of the perpendicular cliff-like side of the pit, near its western side, through an artificial cutting, to the town of Grays. At the head of this aqueduct, within a few yards of its source, we found large numbers of the mollusc, practically all immature, crawling over the weeds and on the lumps of chalk lying in the bottom of the water-way

I have submitted the specimens to Mr. G. C. Robson, of the British Museum (N.H.), who definitely identifies them as above, and who points out that they are thickly coated with a deposit of some kind. This is probably carbonate of lime, with which the water they live in is, doubtless, highly impregnated, as it comes straight out of the solid chalk.

Paludestrina jenkinsi is not, I believe, a new record for Grays, where it inhabits (as is its usual wont) the brackish marsh ditches on the flats beside the Thames. The particular habitat in which we found the species in such abundance is, however, unusual.—MILLER CHRISTY, F.L.S.

Waxwing at Rochford.—A Waxwing (*Bombycilla garrulus*) was killed by a catapult at Rochford on 19th December 1921. This beautiful winter-visitant to our shores has been unusually frequent this year, being reported from many localities.—PERCY THOMPSON.

The "Levantine" Shearwater.—A specimen in the Club's Museum at Stratford, which was shot in September 1912, off the Yorkshire coast, has been recently examined by Mr. H. F. Witherby and determined by him as being an example of the newly-recognized West Mediterranean form of the "Levantine" Shearwater (*Puffinus puffinus mauretanicus* of Dr. P. R. Lowe), which is as yet only known from the coasts of S.E. Spain, Algeria, and the British Isles ; the breeding-place is still unknown. (cf. *British Birds*, xv., Dec. 1921, p. 151.)—PERCY THOMPSON.

Pied Blackbird at Romford.—A very handsome Pied Blackbird was brought in to me a few days ago from Raphael's Park, Romford.

Head almost entirely white, transverse line of black on crown, nape and breast uniformly speckled with black. Mantle black-edged with white, flight feathers and rectrices black. Greater wing coverts on right wing white, forming a broad band. Under tail coverts white, a few white feathers on rump. The bird had been noticed for some time in the Park.

Cause of death unknown to me. No trace of any wound, but half of the rectrices and a few of the rump feathers were missing.

The Bird was an adult male of at least two years, in healthy condition. Stomach empty.—PERCY W. HORN.

Yellowshank at West Mersea.—An adult male Yellowshank (*Totanus flavipes*) was captured at West Mersea on August 8th 1921, by

Photo, A. G. Wright.

YELLOWSHANK (TOTANUS FLAVIPES).
WEST MERSEA, Aug. 8, 1921.

Mr. John Pettitt, the dealer-naturalist of Colchester. The specimen is in full breeding plumage and in good condition, and has been set up for and purchased by the Southend Public Museum. The accompanying photograph of this extremely rare visitant from North America was taken by Mr. A. G. Wright, of Colchester, who kindly permits us to reproduce it in these pages.—PERCY THOMPSON.

Ring-Ousel at Bocking.—In 1913, while walking before breakfast on a foggy morning, I picked up a young Ring-ousel, dead, under some telegraph wires. I have had it set up.—ALFRED HILLS.

Bird Notes for 1921 from Walthamstow Reservoirs —

CARRION-CROW, *Corvus Corone*. This species is usually seen in pairs, but at these reservoirs it may be observed in parties as the following records show:—Feb. 5th, twenty; Oct. 8th, twenty-five; Nov. 19th, thirty-two; Dec. 3rd, thirty. The question arises, What food does the Crow find here during the winter?

YELLOW WAGTAIL, *Motacilla raii*. First date, May 1st; numerous during August, but decreasing at the beginning of September; last date, Sept. 11th.

FIELDFARE, *Turdus pilaris*. Dec. 3rd, party flying over.

WHINCHAT, *Saxicola rubetra*. Aug. 27th, one.

SAND-MARTIN, *Riparia riparia*. Aug. 6th, very numerous, also over Lea and marshes, numbers running into hundreds (probably flocking for migration as only a few birds were seen on Aug. 13th).

KINGFISHER, *Alcedo ispida*. On Aug. 20th one was seen diving from the shore of the island of No. 5 reservoir, the angle of the dive thus being very acute. Usually the water comes under the trees on the islands but the lack of rain has compelled the Kingfisher to modify its habits.

CORMORANT, *Phalacrocorax carbo*. Aug. 6th, two immature birds on the western island of No. 5 reservoir; Aug. 20th, one on Racecourse; Aug. 27th, two on the Racecourse and two perched on a tree on an island on the High Maynard Reservoir. Subsequently on the Racecourse as follows:—Sept. 3rd, two; Sept. 10th, one; Sept. 24th, two; Oct. 1st, one; Oct. 8th, two. There are points of interest in these occurrences. On all the visits the birds were resting on an island, on no occasion did I see them feeding but the visits were all made between the hours of 1 to 4 p.m.

Records of the Cormorant occurring inland in Essex are scarce; only one instance is quoted in *The Birds of Essex*. The fact that the birds made a stay of nine weeks is also worth mentioning. (See *British Birds*, vol. xv., p. 213.)

SHOVELER, *Spatula clypeata*. Aug. 27th, three, at least, on Racecourse.

POCHARD, *Nyroca ferina*. This species is making a longer annual stay on the reservoirs and it may be that its status is altering, like that of the Tufted Duck and Great Crested Grebe, and that it will eventually breed here.

COMMON SANDPIPER. *Tringa hypoleucus*. Aug. 6th, one on Racecourse; Aug. 20th, seen on Racecourse, No. 5 and West Warwick Reservoirs; Aug. 27th, two on Lockwood and two on East Warwick Reservoirs.

GREEN SANDPIPER, *Tringa ochropus*. Aug. 20th, one on Racecourse; Aug. 27th, one on the Lockwood.

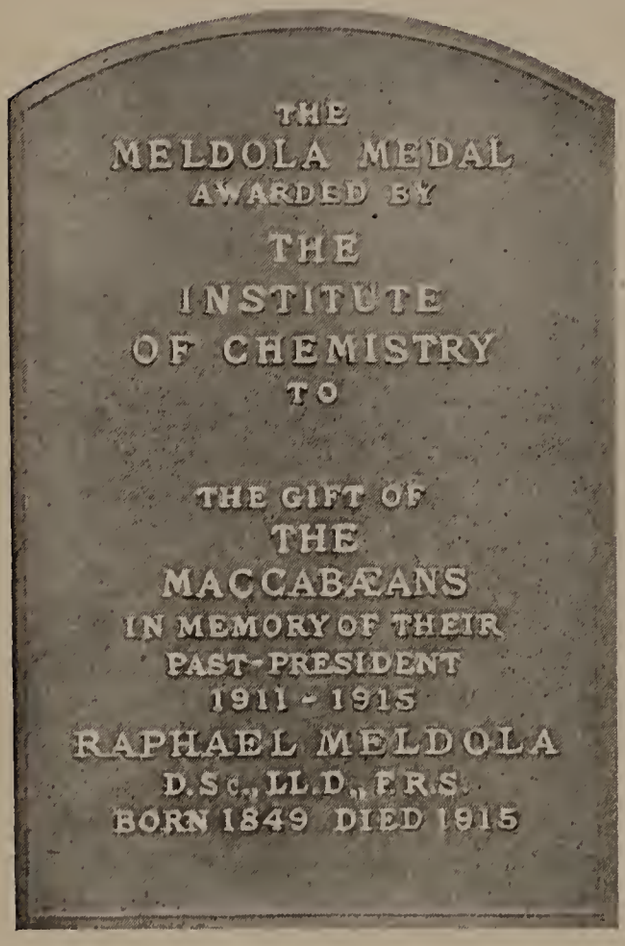
LESSER BLACK-BACKED GULL, *Larus fuscus*. Sept. 24th, two.

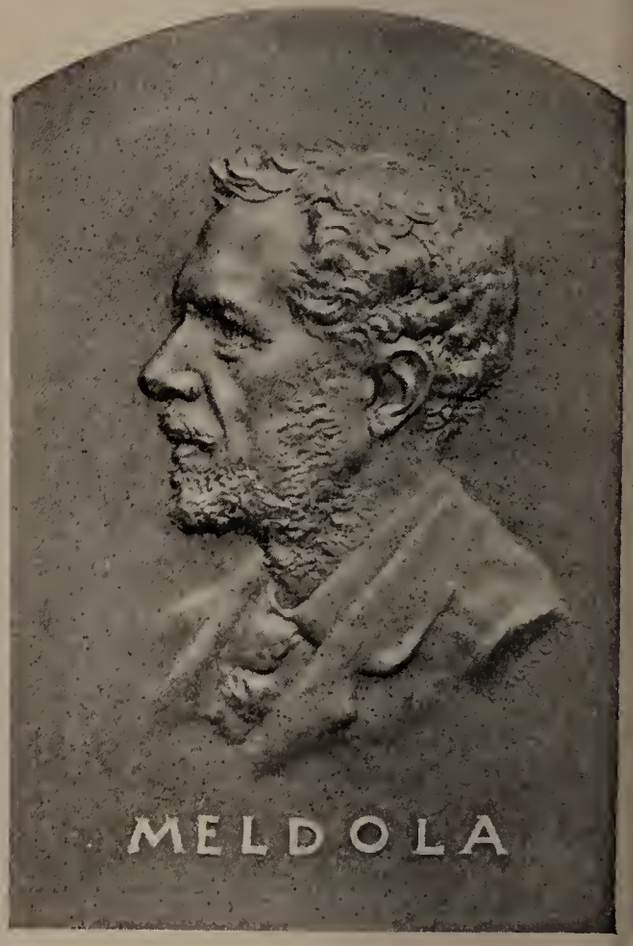
An immature TERN, either COMMON or ARCTIC, was seen on Sept. 24th.

The above note only deals with more outstanding features. The regular species, such as Mallard, Tufted Duck, Teal, Coot, Great Crested Grebe, etc., have been as usual. The autumnal migrational movement was

especially interesting, birds being very numerous.—William E. Glegg, F.Z.S., M.B.O.U.

The Meldola Medal for Chemical Research.—Our lamented vice-president and original member, the late Professor Raphael Meldola, D.Sc., LL.D., F.R.S., who died on 16th November, 1915, whilst actively engaged on special advisory work for the Government, in connection with the War, has had his name perpetuated by the institution of a medal, to be presented annually by the Institute of Chemistry, for the most meritorious chemical work of the year. The medal has been instituted by the Maccabæans, a Jewish society, of which Meldola was president,





and its award will be made by the Council of the Institute in conjunction with a nominated member of the Maccabæans; the award will be restricted to British subjects not over 30 years of age and will have primary regard to analytical research.

The medal, of which we are enabled to give an illustration by courtesy of the Registrar of the Institute of Chemistry, is in bronze, and has been designed and executed by Mr. Frank Bowcher. As our contemporary "Nature" justly comments, "this medal affords an additional fitting tribute to the memory of one of the most notable men of science of our time."—Editor.

PUBLICATIONS of the ESSEX FIELD CLUB.

The specially-valuable feature of the Publications of the Club is that they are almost wholly local in character. The volumes (comprising over 6,000 pages) contain hundreds of papers on the Natural History, Geology, and Pre-historic Archæology of Essex. The articles are of the greatest interest to all persons having any regard for the County, and the scientific accuracy and detail of a large proportion of them make them of value also to students of the subjects named living elsewhere.

The publications are all of demy octavo size. Nearly all contain numerous illustrations, in addition to plates. All are still in print, but some are becoming *very rare*.

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,, XIV	1905–7	xii + 280	32	0 15 0	
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,, XVII	1912–14	x + 292	19	0 15 0	
,, XVIII	1915–18	viii + 321	9	0 15 0	
,, XIX	1918–21	ix + 328	28	1 12 6	

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For continuation see over.

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The Essex Naturalist:

BEING THE JOURNAL OF THE ESSEX FIELD CLUB.

EDITED BY PERCY THOMPSON, F.L.S., *Honorary Secretary*
assisted by
HENRY WHITEHEAD, B.Sc.

Contents.

The Authors alone are responsible for the Statements and Opinions contained in their respective Papers.

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SOME NEOLITHIC SITES IN THE UPPER VALLEY OF THE ESSEX CAM.

By GEORGE MORRIS, B.Sc., F.R.A.I.

With 2 Plates and 1 Text Map.

[*Read 28th January, 1922.*]

INTRODUCTION.

FOR the past ten years the writer, in conjunction with Mr. Guy Maynard (late of the Saffron Walden Museum), has been engaged in collecting flint implements of the Neolithic period in the area surrounding the town of Saffron Walden.

As the investigation progressed many interesting problems in relation to the settlements, dispersal and origin of the Neolithic peoples arose, and had to be set aside for lack of sufficient data. The question as to what route these people followed to reach the area often occupied our attention; did they arrive from the N.E. or S.W. by way of the Chalk escarpment of the Chilterns or were they coastal tribes of the Thames estuary who penetrated inland up the valleys of the Lea, Pant, Blackwater, etc., and so over the forested water partings to the valley of the Cam and the surrounding Chalk lands?

A year ago it occurred to the writer to compile a list of the Neolithic sites recorded in the County, and to plot them on a fairly large scale map with a view to obtaining information as to the distribution of the Neolithic population, and also to find out whether the forests of the clay areas had proved a serious obstacle to travel and settlement.

With this end in view, a list of sites, recorded in the ESSEX NATURALIST, *The Victoria County History*, and other publications, was compiled, visits were paid to the county museums at Stratford and Colchester, and a careful examination was made of the material available there. A few words as to the net result of this enquiry up to the present time may be of interest.

The data were classified under the following headings :—

a. Flakes, scrapers and miscellaneous implements.
b. Polished celts and adzes.
c. Chipped celts and adzes.
d. Arrow heads.

e. Pottery.

f. Pierced hammers, axes and maces.

g. Burials, earthworks, hearths, etc.

A total of about 120 localities has been recorded, of which 32 yielded flakes and miscellaneous implements, 26 polished celts, 25 chipped celts, 7 arrow heads, 8 pottery, 15 pierced implements, 3 skeletons or parts of skeletons, 2 hearths and other unclassified remains. This list is still in course of compilation and is by no means complete. It does not include the specimens in the museums at Chingford and Chelmsford, and there are still a number of serial publications to be examined.

When examined in detail it was found that the records of sites were extremely unsatisfactory. In seventy cases the names of the parish or town only is given, with no data whatever relating to the site. In many other cases the data are entirely inadequate ; for example, " under the roots of a tree on the Bycullah Park Estate," or " on a heap of stones picked off a field at Gills Farm," does not help much. Even where the site is described in satisfactory detail there is a certain coyness in indicating its exact position which is, perhaps, understandable, but hardly scientific. In few cases only was a map of the site given and the exact position of the site indicated.

In the past, the attention of the Archæologist has been devoted mainly to the consideration of the implements, etc., found, and with certain notable exceptions the study of the site itself has been considered of little importance. In many cases the find has consisted of a single striking object, a celt, a pierced hammer, or an arrow head, picked from the furrow by the farmer and its exact locality forgotten by the time it reached the hands of the specialist. The paucity of records of sites where a quantity of worked flints can be obtained is also significant and points to the fact that considerable areas of the County are still unsurveyed.

One may regard the study of surface implements of the Neolithic type as the Cinderella of Pre-history. The wonderful story of the Palæolithic hunters, as revealed in the caverns and rock shelters of the continent, and the striking controversies centering round the pre-palæolithic remains of East Anglia and elsewhere, have diverted the attention of the savants from Neolithic man, and in this country at least but little attention

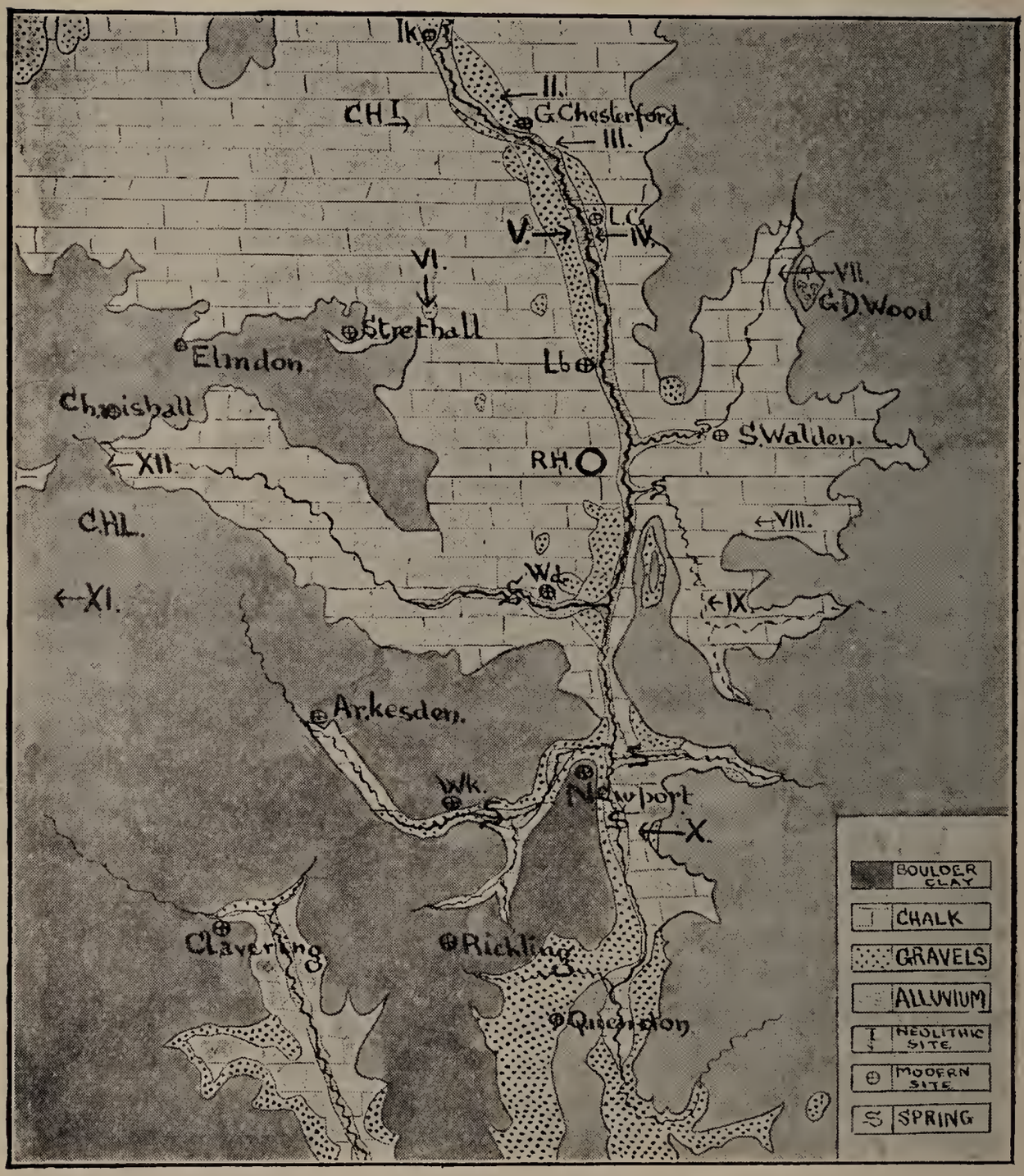
has been paid to surface material of this period during the past three decades.

In Scandinavia, however, the critical study of the remains of Neolithic man has continued, and much original work has been published which, when applied to the material available in this country, will be of the greatest value. The writer has little doubt that sooner or later the attention of pre-historians will again be focussed on Neolithic man, and he would suggest that, as a preparation for critical study, the recording of Neolithic sites in an efficient and scientific manner is a work that can profitably employ the attention of individual workers in this County.

In recording the Neolithic sites of the Cam Valley the writer has endeavoured to obtain the following necessary data :—

1. Position in latitude and longitude to the nearest second.
   Name of the parish and nearest hamlet or house marked on the ordnance map.
   Means of approach and salient features.
2. Height above sea-level O.D. and approximate height above the " thalweg " of the nearest valley.
3. Details of aspect and exposure.
4. Underlying geological structure.
5. Nature of the surface soil.
6. Position of the site in relation to available water.
7. Records of finds on the site :—
   a. Abundance.
   b. Type.
   c. Patination.
   d. Short description of any outstanding specimens.
8. Relation of the site to any neighbouring earthworks, tumuli or other pre-historic monuments.
9. Any indications that material of Neolithic type may be of pre- or post-Neolithic age.

Much of the data for such a record can be obtained from the inch to the mile ordnance and geological maps, but it is always advisable to check and supplement such information by actual survey. The data for latitude and longitude may be obtained from the $\frac{1}{4}$-sheet of the 6″ to the mile ordnance survey maps. With a little practice a point can be located with a possible error of 12 feet in each direction.



Sketch Map of the Upper Valley of the Cam, showing the Neolithic Sites in relation to the Geology, Water Supply and Recent Settlements.

Ik. : Ickleton. Lb. : Littlebury. L.C. : Little Chesterford. Wd. : Wenden. Wk. : Wicken. C.HL. : Chiswick Hall. C.H. : Coploe Hill. R.H. : Ring Hill Camp. G.D.W. : Grimms Dyke Wood.

THE VALLEY OF THE ESSEX CAM.

The sites to be described are all situated in the drainage area of the Cam, and they are, with the single exception of Coploe Hill, within the County boundary.

The Cam takes its origin in a series of field ditches around the villages of Elsenham and Henham. Elsenham is situated on the water parting of the Cam and the Stort. The stream therefore cuts back into the Chalk escarpment for a distance of about ten miles before it debouches upon the flat alluvial valley north of the Cambridge village of Ickleton. It has therefore the character of an obsequent stream and there is evidence that in glacial or pre-glacial times a gorge, now filled with glacial debris, existed through the Chalk Downs and may have drained much of the fenland area south into the Thames estuary. (1.) The head of the highest stream course is situated at a height of 390 ft. O.D. and its level at the county boundary at Ickleton is approximately 100ft. O.D. The real source is situated at Newport, about seven miles from this spot, and is at approximately 200ft. O.D. From the highest point on the stream course running water only occurs in times of rain, but just south of the village of Newport permanent springs exist which maintain a constant supply of water throughout the year. Above the 300ft. contour line water occurs in ponds and undrained hollows. On the east, secondary valleys enter the main valley at Newport from Debden, and north and south of Audley End Mansion where the Fulfen and Walden Slades enter the main stream. On the west, the Cam receives the drainage of the Arkesden Valley at Newport, of the Elmdon Valley at Wenden, of a small valley from Strethall, and of two long valleys at Ickleton. All these secondary valleys are characterized by the fact that their drainage originates in field ditches on the clay-capped hill-tops and their channels are dry during the greater part of the year. Near their mouths permanent springs are found at approximately 200ft. O.D.

The general elevation of the escarpment and its subsidiary ridges is between 300 and 400ft. O.D., but a height of about 490ft. is reached near High Wood on the extreme west of the area. The slopes are gentle and rounded, decreasing in steepness towards the north. Below the spring heads a narrow

alluvial plain is formed in the bottom of the valleys, which increases in width until, north of Ickleton, it merges into the flat lands of Cambridgeshire.

The general geological structure may be summarized as Boulder Clay above the 300ft. contour line, Chalk on the hill slopes, and Alluvium in the valley bottoms below the spring heads. The valley bottoms are fringed at intervals by gravel terraces of varying width, and exposures of gravel occur here and there on the valley slopes where the mid-glacial Gravels outcrop between the Chalk and the Boulder Clay. Small exposures of gravel and loam also occasionally occur on the tops of the ridges. The Chalk slopes are usually covered with a rainwash which is often of a clay-like consistency, but in steep places the soil may consist almost entirely of finely powdered chalk.

It seems probable that in Neolithic times the clay hill-tops were covered with damp oak-ash woodland (14), the hollows in its recesses being occupied by a swamp flora with numerous ponds and small lakes. The Chalk slopes were clad with grass or scrub land with a flora corresponding to that of the Newmarket and Royston Heaths (14), but it should be noted that the sporadic occurrence of typical beech-wood plants, such as the White Helleborine (*Cephalanthera grandiflora*), points to a possible northern extension of the primitive beech wood of the Chilterns. The valley bottoms were choked with a swamp or wet alder wood flora and there are indications that at Newport, Wenden and Saffron Walden the side valleys below the spring heads were occupied by either incipient fens or shallow lakes.

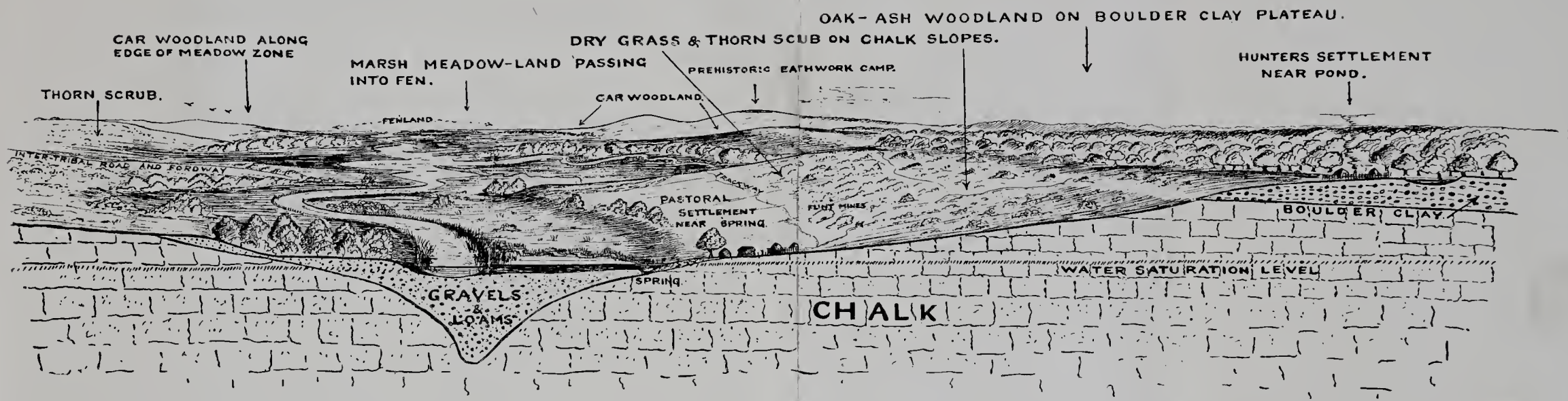
THE REMAINS OF NEOLITHIC MAN IN THE CAM VALLEY.

Neolithic earthworks in the area are restricted to a few doubtful examples only.

In Grimsditch Wood (2), about 1½ mile N.N.E. of Saffron Walden Church, there is a rampart and ditch with a cigar-shaped mound enclosed in the north corner. It is associated with an implementiferous area and is possibly a Neolithic camp.

The lynchetts or cultivation terraces at Ickleton (3) are associated with worked flints, which occur on the flats of

[To face p. 54.



SYNTHETIC DIAGRAMS OF THE CAM VALLEY, showing the relationship of the principal factors, Geology, Water and Vegetation, that affected Human Settlement in this region.

(1) in Neolithic Times (2) in Modern Times.

(Diagrams by Guy Maynard, Esq., F.R.A.I.)

the terraces ; failing other evidence, it appears not unlikely that these structures may also be of Neolithic origin.

In the excavation of the Saxon cemetery in the grounds of Hill House, Saffron Walden (4), several pits associated with calcined flint and flakes were found below the level of the graves and it has been suggested that these may be of Neolithic age.

The discovery of a Beaker burial at Berden (5), near the border of the area, is finally a link between the Neolithic and the Bronze period in this part of the country.

A Neolithic skull was found at Wenden, 16ft. from the surface, in a bed of peat, when making a culvert for the Audley End to Bartlow Railway in 1864. Dr. Keith describes it as that of a woman and " a good specimen of what Huxley named the River-bed type." He also mentions that " the specimen evidently belongs to the same race as the woman found at Walton-on-Naze, by Mr. Hazzledine Warren." This skull is in the Saffron Walden Museum (15).

Isolated examples of polished celts have been found at Saffron Walden and Henham and a perforated basalt axe at Great Chesterford. These specimens also are in the Saffron Walden Museum.

In the same museum are six specimens of arrow-heads of local origin, but with two exceptions the specimens are doubtful, and in the writer's opinion are quite probably merely triangular or leaf-shaped flakes with an accidental resemblance to arrow-heads. There are two definite tanged and barbed specimens, one without definite locality, the other from Newport. It should be noted, however, that the appearance and patina of this last specimen are entirely different from that of any of the hundreds of specimens of worked flint that the writer has obtained from this locality.

Generally speaking, flakes, implements and calcined flints are found scattered more or less abundantly over the Chalk outcrop of the valley slopes and the edge of the Boulder Clay. They are more abundant in the hollows than on the ridges, but this may be attributed to the natural downward movement of the soil, produced by the action of the weather and agricultural operations rather than by distribution by Neolithic man. In certain spots these artifacts occur in such quantities that the area may be considered as a site, either of habitation or manu-

facture, and such places are described as Neolithic sites in this paper. Such sites occur frequently in connection with the gravel terraces or outcrops, but are by no means confined to such localities. Human artifacts become fewer on the margin of the Boulder Clay and are usually absent at any considerable distance from the Chalk outcrop. The Chiswick Hall site is, however, well within the Boulder Clay and isolated examples of worked flint may occur on any part of the area.

THE TYPE OF ARTIFACTS FOUND IN THE CAM VALLEY.

The implements found in this area are mainly referable to one culture type, the same forms recurring again and again on the different sites, with occasional exceptions which will be mentioned later. Among the numerous records of the remains of Neolithic man in Britain there are several well-marked series, e.g., the Pebble Industry of the shores, the Microlithic or Pigmy Industry, the Cissbury and Grimes Graves type, and so forth, but their chronological sequence is still doubtful. It may, however, be possible to make some comparison of the material from the Cam Valley with that obtained from other sources.

Mr. Hazzledine Warren, in a paper on "The Classification of Pre-historic Remains in Eastern Essex" (6), has recognized two series of Neolithic remains in that area, an earlier series possibly extending from Pre-Robenhausian to Robenhausian times and a later series from Robenhausian well into the early Bronze period. In the scheme of sequence-dates that accompanies this article, he gives the place of (9)40 ? to (9)50 to the earlier series and (9)50 to (9)58 to the later series.

Mr. Warren's earlier series appears in many ways to present affinities with the culture exhibited by the Cam Valley artifacts, thus the presence of implements allied in form to the grattoir tarté, the rudeness of the axe forms, the presence of re-worked polished specimens, and the character of the flakes are points in common. On the other hand the rarity of arrow heads, and the presence of abundant examples of prismatic cores in the Cam Valley, seem to point to a difference in culture which may, however, be of local significance only. From the examples illustrated in this article and in the Essex Naturalist (6-7), and a few specimens from the East of Essex that the writer has

been able to examine, it would seem possible that the Cam Valley specimens are of an earlier and ruder culture than Mr. Warren's earlier series and may be provisionally classified as from, say (9)38 to (9)45 of his sequence-dates.

Mr. W. G. Clarke, in a paper delivered at Norwich in 1906 (8), makes a preliminary classification of Norfolk Neolithic Implements, which may serve in making a comparison with those of Essex. He recognizes the following divisions :—

1. Early Neolithic or Cissbury Type.
2. Intermediate Neolithic, or those typical of the heavier lands of the county where Boulder Clay is the sub-soil.
3. Late Neolithic, or those from the lighter lands and sandy sites.
4. Those of flint and other stones that have been polished or are of igneous rock.

This classification is rather artificial, especially in placing polished implements in a separate class, though probably the number and technique of polished specimens increase in chronological sequence. In a subsequent paper, read to the Pre-historic Society of East Anglia (9), Mr. Clarke merges his Intermediate and Late Neolithic into one series, but the present writer feels that the conception of an intermediate series may well be retained provisionally, especially as the description of this series corresponds very well with the type of artifacts found in the Cam Valley.

Mr. Clarke says :—" As may be expected, the implements are, as a rule, poor in design, and their variety is limited. From Norfolk specimens in various collections the chief varieties appear to be axes of the rudest type but with well-worked cutting edges ; hollow scrapers somewhat irregularly worked and occasionally right-angled instead of concave ; pointed implements probably used as borers, awls or drills ; rough fabricators ; single-edge flake knives ; square-ended, oval and thumb-nail scrapers ; discoidal implements ; implements of irregular shape, with one end chipped and a working edge, and a number of nondescript implements worked all round for which no definite use can be assigned. A typical form of implement is a nodule broken in halves, with a crust left on except at one end, where the chipping, although covering only a small portion of the implement, is often very delicate."

This description applies exceedingly well to the specimens from the Cam Valley, but to these implements we may add an abundance of prismatic cores of from one to three inches long, and a form of implement allied to the grattoir tarté. These may have originated from the use of the prismatic core, but in many cases the flakes struck from them would be useless and the signs of wear and retouching on their edge points to their use as a small plane for smoothing wood or bone. As in Norfolk, a large percentage of specimens are formed from nodules, and are thicker than those of the later industry and have often a portion of the original crust remaining. A large number of them have the mottled blue patina, but many of them are unpatinated and with a high polish upon the worked surfaces. It should be noted that on certain sites worked flakes are abundant, but that they are usually of small size and often of imperfect workmanship.

Although found upon Boulder Clay sub-soil in Norfolk this type usually occurs upon the lighter soil of the Chalk slopes and gravel terraces in N.W. Essex.

The crudity of the specimens and the rarity of polished implements and arrow heads point to the culture of a primitive folk, perhaps not antecedent in time to the more cultured peoples of the Brecklands and East Essex, but of a lower grade of civilisation.

As a provisional hypothesis the writer would suggest that Neolithic man in the Cam Valley and on the Norfolk uplands was a primitive race linking up the early Neolithic culture of the Cissbury type with the later Neolithic culture of the early series of East Essex and the Brecklands.

RECORD OF SITES.

I. Ickleton. Coploe Hill. Essex Sheet II., S.E.

Longitude 0° 10′ 39″, latitude 52° 3′ 33″. Elevation 230 ft. O.D., 115 ft. above valley bottom. On the west of the road from Ickleton to Strethall, about ¾ mile south of the church. Situated on a spur of the escarpment, running north from Strethall, and dividing a dry valley on the west from the main Cam Valley on the east. The site is on the brow and steep west slope of the ridge ; it is bare of trees and exposed to wind from all quarters.

The rock is Middle Chalk and the nearest exposure of Boulder Clay is two miles to the south at Strethall. The surface soil on the brow of the hill is composed entirely of comminuted chalk, with very little humus, which passes into a clayey rain-wash on the lower slopes and valley bottom. The nearest water is the River Cam, about a half-mile distant at the nearest point.

Abundant flakes, but traces of secondary working rare. Flakes of the chalk soil have a white patina, which is often glazed or scratched ; on the lower slopes there is a change towards the mottled blue patina with iron staining on the arêtes. Specimens from this site were examined by Dr. Allen Sturge and described by him as being probably of Cissbury culture (3).

The site is situated above and extending over the north end of the cultivation terraces (lynchetts) on the west of Coploe Hill. The exposed position of the site, the distance from water and the nature of the flakes, indicate that it is probably a site of manufacture only and not a site of habitation. The extension of flakes over the terraces of the lynchetts is significant and points to a possible Neolithic origin for these earthworks.

II. Great Chesterford, Site A. Essex. Sheet II., N.E.

Longitude 0° 11′ 36″ E., latitude 52° 4′ 4″ N. Elevation 129 ft. O.D., about 20 feet above the level of the river. Field on the west of the main Cambridge road, about 700 yards N.N.W. of the church and about 160 yards from the last house, north of the village.

The surface is level and is on a terrace of the main river valley, about $\frac{1}{4}$ of a mile from the stream course. The terrace consists of post-glacial gravels of the Barnwellian Series. These are chalky gravels with interstratified sands and loam and contain remains of *Elephas primigenius* and *Rhinoceros tichorhinus*, etc. (10). The surface soil is a dark loam with much organic matter and contains many pot sherds and other remains of the Roman occupation. It varies in depth from about nine inches to three feet, and in pits to five feet or more.

The Neolithic material consists of flakes, cores, scrapers, hammer stones, etc. The bulk of the material is unpatinated, black and lustrous, though occasionally blue mottled and ochreous flakes occur. The flakes are often very sharp and unworn, and occur at a considerable depth in the soil.

The N.E. corner of the walled Roman Station is about 200 yards from the centre of the site, and numerous rubbish pits of this period occur on the area. Up to the present no worked flint has been recorded in the pits, but the writer has taken worked implements from a depth of three feet in the soil, and it may be a line of enquiry as to a possible Roman date for this flint. Again the lustrous unpatinated condition of the flint and the organic content of the soil is significant.

III. Great Chesterford, Site B. Essex. Sheet II. S.E.

Longitude 0° 12′ 27″ E., latitude 52° 3′ 39″ N. Elevation 140 feet O.D., and about 10 feet above the river level. The site is on a gentle slope up from the water to the valley top. The underlying rock is marked as Middle Chalk on the Geological Survey Map (11), but there is a trace of gravel and probably a thin terrace of post-glacial gravel overlies the Chalk here. The soil is a chalky rain-wash with a fair amount of humus.

Flakes, a rough axe, scrapers of various types and hammer stones have been found. A fair percentage of these implements are black and they tend to be rather larger than usual. This is possibly an extension of Site A., which is separated from it by the area occupied by the houses and gardens of the village.

IV. Little Chesterford. Essex. Sheet II. S.E.

Longitude 0° 12′ 44″ E., latitude 52° 2′ 59″ N. Elevation 133 feet O.D., about 5 feet above water level. East of the footpath from Little Chesterford to Springwell and about 370 yards south of the church.

The site is at the foot of a bluff composed of post-glacial gravel, here terraced against a low spur of Middle Chalk from the main ridge bordering the valley. It is about 30 yards from the present river course and 3 feet above the level of the present alluvial flat. The soil is a light coloured sandy loam, from 9 inches to a foot in thickness, and it bears a distinctly calciphilous flora.

Spale flakes, cores, many of them of large size, and anvil stones form the bulk of the material found. Implements rare, the only records being a rough hand axe or chopper, and an unfinished axe of doubtful authenticity. The prevailing patina is a creamy white, passing into the blue mottle. The flakes and cores are often encrusted with a deposit of calcium

carbonate and the arêtes are very sharp and unweathered. The assemblage of flakes and cores bears a strong resemblance to the debris of a working floor at Grimes Graves and is in striking contrast to other worked flints in the Walden area.

This site, when first discovered, was of great interest. Three large battered flints (anvil stones) were exposed by a wash-out of the over-lying soil and formed a rough table, surrounding which were quantities of spales and cores. These were lying on the gravel and were exposed in layers of sharp edges in the overlying bank. Subsequently the turf and loam of the bank was removed and a trench dug into the gravel. It was found that the worked flint was limited to a circle about ten feet in diameter and did not extend into the gravel. Many of the flakes and cores had small portions of the original crust, which showed water erosion. The type of flaking is very distinct from that on other areas in this district and may indicate a different stratum of culture. The position of the site in relation to the present water level is significant as indicating the small amount of valley erosion that has taken place since Neolithic times.

V. Littlebury. Bordeaux Site. Essex. Sheet II. S.E.

Longitude 0° 12′ 2″ E., latitude 52° 2′ 58″ N. Elevation between 130 and 180 feet O.D., and about 6ft. above water level at the nearest point to the river. The site is extensive and lies upon the fields between the London and Cambridge main road and the G.E. Railway from the Bordeaux farms to Littlebury village. It lies upon a gravel terrace of the Barnwellian Series (10), the general structure of which is described in the Geological Survey Memoir (12). The gravel is covered with a sandy decalcified loam which in places reaches a depth of more than five feet. The soil is decalcified, brown and very sandy.

The artifacts are small and a variety of flakes, cores, scrapers, points and other implements are found. The bulk of the worked flint is unpatinated and has a greyish, lustrous appearance, which is highly characteristic of flint from sandy sites in this area. The remainder is mainly of the blue mottled type of patination. A finely worked circular scraper was taken from a depth of 2ft. 6in. in the loam.

The general character of the worked flint from this site has a

strong resemblance to that obtained at Newport, but the fine flakes are scarcer and generally specimens are less abundant than on that site. Flakes and implements that have been used as pot boilers are not uncommon on the area.

VI. Littlebury. Howe Wood, Essex. Sheet II. S.E.

Longitude 0° 10′ 50″ E., latitude 52° 2′ 19″ N. Elevation 365 feet O.D., 225 feet above the level of the Cam. Situated in a field on the north side of Howe Wood, north of the Strethall to Littlebury Road. This site is on a spur of the escarpment close to the junction of the Chalk and Boulder Clay. It is situated on a small patch of gravel which is coloured as an ancient river gravel on the maps of the Geological Survey (11), but is probably an out-crop of the Mid-glacial Gravel from beneath the Boulder Clay. The soil is a tenacious clayey rainwash.

The worked flint consists of flakes, scrapers and nodules, mostly unpatinated, black with the greenish glaze characteristic of clay sites ; a few specimens show the " toad belly " patina.

There are earthworks of uncertain age in Howe Wood.

This site was discovered by Mr. L. V. Nash and has not yet been thoroughly surveyed.

VII. Saffron Walden. Grimsditch Wood. Essex. Sheet III. S.W.

Longitude 0° 15′ 4″ E., latitude 52° 2′ 31″ N. Elevation 216 to 316 feet O.D., the highest point is 175 feet above the level of the Cam in the main valley. Fields on the slope between Grimsditch Wood and the road to Little Walden, 1¼ mile N.N.E. of the church.

The site lies upon the west slope of a spur of the heights that divides the drainage of the Cam from that of the Lin. Grimsditch Wood occupies the end of the spur which slopes down to Little Walden. The spring-heads of the Slade, west of Walden church, yield the nearest running water, but there is a pond in the wood and water can easily be retained in any hollow of the clay hill-top.

A certain amount of gravel and alluvium occurs in the valley bottom of the Slade. The slope is Upper Chalk succeeded by Boulder Clay. The soil on the lower part of the slope is a rainwash containing much Chalk and it becomes gradually more tenacious until upon the hill top it is entirely clay. The worked

flint does not extend over the alluvium in the valley but occurs upon the chalk slope and well on to the clay of the hill top.

The implements are of the usual character—flakes, cores, scrapers, hammer stones, &c. The patina tends to be white on flakes and implements of the lower slopes, mottled blue higher up as the percentage of clay increases, and ochreous on the clay. Here also a greenish glaze on unpatinated black flint is not uncommon.

It seems probable that the earthworks in Grimsditch Wood (2) which adjoins the site, may be the remains of a Neolithic fortification or camp. Mr. Guy Maynard has made a survey of this site, and it is highly desirable that at some future time excavations should be undertaken to determine the period of these earthworks. On the slope west of the wood there are three basin-shaped hollows, of which Mr. Maynard, in an unpublished paper, says :—"On the north west slopes there are a series of irregular hollows which can be nothing else than old chalk or flint pits, but the period at which these were worked is uncertain. The soil around these pits is full of definitely worked flint flakes of a mottled blue and white glossy surface and a number with the older white patination. More significant still is the presence of large flints bearing ancient patinated chippings on their surface. They cluster thickly round one of the pits and the whole evidence strongly suggests a group of flint mines of the Cissbury type."

VIII. Saffron Walden. Pleasant Valley. Essex. Sheet IX. N.W.

Longitude 0° 14′ 49″ E., latitude 52° 0′ 45″ N. Elevation 300 feet O.D., about 150 feet above the level of the Cam. Situated on the fields between the Friends' School and the fever hospital, on the edge of the plateau, about $\frac{3}{4}$ mile south of the church.

Although shown as Chalk on the survey map (12) this area has a thin covering of Boulder Clay with beds of loam and gravel, probably Mid-glacial. The soil is a clayey loam.

Flakes, calcined flints and rough scrapers are common, the bulk have the blue mottled patina but unpatinated black and grey specimens are not uncommon.

This site was first noted in 1880 when the Friends' School *Natural History Journal* records the finding of flakes and cal-

cined flint on the play field which was then being laid down to grass.

IX. Saffron Walden. Fulfen Slade. Essex. Sheet IX. S.W.

Longitude 0° 14′ 3″ E., latitude 52° 0′ 2″ N. Elevation 219 feet O.D., and about 50 feet above the level of the Cam.

Situated in a small triangular plantation of elder bushes on the west of the footpath through Beechy Rye and about 120 yards south of the rifle butts. It is in the bottom of the valley of the Fulfen Slade near the intermittent stream course, a little more than a mile from the spring heads at Abbey Farm. It is very near the Boulder Clay and several small ponds exist within a few hundred yards of the site. The material is upon the Upper Chalk and the flakes are turned up in powdered chalk by the rabbits. There is little or no surface soil on the site.

Flakes only, with the pure white patina, are found on the site. Occasionally traces of secondary dressing are observed.

The relation of the white patina to the chalk is again observed here. The site is probably a working one only.

X. Newport. Essex. Sheet XIV., N.W.

Longitude 0° 13′ 25″ E., latitude 51° 58′ 29″ N. Elevation 300 O.D., about 100 feet above the spring-heads on Newport Pond.

On the field south of the chalk pit a half mile S.E. of Newport Station, the site is on a steep bluff above the level ground, south of the village, which occupies the position of the Newport Pond, that was drained in the 16th or 17th century. At this point the Upper Chalk, Mid-glacial Gravel and Boulder Clay are in close proximity and worked flint occurs over all. The centre of distribution appears to be a small patch of Mid-glacial, or perhaps Tertiary, gravel, which out-crops between the Chalk and the Boulder Clay. At the lower part of the site the Chalk outcrops and a very chalky soil is present, but the bulk is a sandy loam which passes into clay on its eastern edge.

The implements and worked flakes on this area are very numerous and consist of many types of scrapers, borers, hammer stones, knife flakes, cores, &c. Small, well formed, long flakes are numerous. Most of the flint is derived either from the

Chalk or Boulder Clay ; worked pebbles from the gravel are uncommon. Two implements that show polish have been obtained, these are apparently made from polished axes that have been reworked to form scrapers ; no polished axes have been recorded from this site. A barbed and tanged arrow-head in the Saffron Walden Museum is labelled as being found at Newport, possibly from this site. The patination of the flint on this site is varied. The bulk of the specimens are either blue mottled, or unpatinated with a greyish appearance, in about equal proportions ; the remainder are black, cherty, or with an ochreous patina. Very occasionally the basket-work patina is observed. Bones and calcined flint are not uncommon on the site. So far no pottery has been found.

The position of this site in relation to that of the ancient Newport pond which marked the position of the spring heads of the Cam is particularly interesting as indicating the extreme antiquity of the settlements and the importance of the spring-heads in determining their position in this locality. Saffron Walden, Wenden and Newport are settlements of this type. The surroundings of the springs at Walden are unfavourable for flint hunting, as grass land or buildings surround the area, but there is no doubt that the antiquity of the town is great, and the discovery of pits under the Saxon cemetery at Hill House points to a primitive Neolithic settlement. No definite site has so far been recorded at Wenden, but there are indications that further search in this locality may be fruitful ; two possible sites near the springs have been noted, but further survey is needed before a definite record can be established. Bronze Age, Keltic, Roman and Saxon remains have been recorded from the immediate vicinity of this village.

XI. Chrishall. Chiswick Hall Farm, A. Essex. Sheet VIII. N.W.

Longitude 0° 6′ 14″ E., latitude 52° 0′ 35″ N. Elevation 466 feet O.D., and about 266 feet above the level of the spring-heads at Wenden.

The site is about 1¼ mile S.S.W. of the church, and is situated on a field west of the bridle road that runs S.W. from Chiswick Hall and west of High Wood. It is on the crest of the water-parting between the drainage of the Stort and Elmdon Water

and at head of a subsidiary valley draining into the Elmdon water course just east of the upper farm at Bilden End. This area was derelict for many years and has only again been brought under cultivation since 1912 (13).

The site is well within the Boulder Clay area and is surrounded by typical oak-ash woods. A small inlier of the Chalk occurs at Bilden End, and the chalk of the valley slope outcrops north of Chiswick Hall at a distance of about ¾ mile away. The soil is a tenacious clay, difficult to work and drying and cracking in summer. There is not a great number of stones present.

The nearest spring-heads are at least a couple of miles away but there would be ample water in ponds and hollows of the clay.

The implements from this site are very striking, and consist of polished axes, rough chipped adzes and picks, scrapers of the racloir type, nodule scrapers, hollow scrapers, points, flake knives, hammer stones, etc. With the exception of the axes and adzes the implements are of the same type as those from the Newport and other sites, but as a whole they are larger. The nodule implements often bear glacial striae on their crust, and the various qualities of the flint from which they are made points to the fact that the material was obtained from Boulder Clay erratics, though occasionally the material or the finished implements themselves may have been brought from sites on the chalk or gravel. Some implements show a yellow patination varying from cream to an ochreous brown, and a few show the blue mottled patina common to the edge of the clay lands. The bulk of the material is unpatinated, and exhibits a peculiar greenish glaze highly characteristic of worked flint found in Boulder Clay soil. This glaze often passes into a yellow mottle or " toad belly " patina and through that to the ochreous patination already mentioned.

This site was discovered by Mr. L. V. Nash, of Elmdon, and is of exceptional interest in that it is probably a site of habitation established well within the forest of the clay area. No trace of earthworks has so far been noted and it is difficult to suggest why such a spot should have been chosen. Apparently the site remained inhabited, for late Keltic or Roman pot-sherds are common, and some years ago the writer noticed a large fragment of a quern of Hertfordshire pudding-stone on a heap of stones by the field road that crosses the area.

XII. Chrishall. Chiswick Hall, B.

Longitude 0° 7′ 0″ E., latitude 52° 1′ 3″ N. Elevation 390 feet O.D., about 190 feet above the level of the spring-heads at Wenden.

Situated on a field on the slope of the valley between Upper Pond Street and Chiswick Hall, about ¾ mile due south of Chrishall Church, and on the junction of the Chalk and Boulder Clay. The soil is a clayey loam.

The implements are of the usual type, cores, scrapers, flakes, etc., and usually have the blue mottled patination.

The material from this site exhibits the relation of the blue mottled patina with the soil at the junction of the Clay and Chalk in a remarkable degree.

CONCLUSIONS.

From these records it may be allowable to make certain tentative suggestions and deductions, as follow:—

1. That a primitive race manufacturing a rather crude type of implement of the so-called Neolithic type inhabited the Cam Valley.

2. That the area of population was the zone of the Chalk outcrop on the valley slopes, and although isolated settlements occur within the Boulder Clay of the plateau top they are exceptional.

3. The inhabited sites were determined by the available water supply, and are therefore scattered along the gravel terraces by the river, by the spring heads, or on the edge of the Boulder Clay where pond water is abundant.

4. These sites correspond generally with the present distribution of human habitation in the area. In certain cases the modern village may actually have originated as a Neolithic settlement, e.g. Newport and Wenden.

5. The distribution of the sites indicates that the hydrography of the Cam Valley was practically the same in Neolithic times as it is to-day.

6. The close relation of the implementiferous sites with the earthworks in Grimsditch Wood and with the lynchetts at Ickleton suggests a Neolithic origin for these structures.

7. The crudeness of the implements, the practical absence of arrow and spear points, and the rarity of the celts indicates

the primitive culture of an unwarlike and non-hunting people, probably pastoral in occupation, and with the dawn of agricultural practice.

8. The occurrence of worked flints along with Roman remains at Great Chesterford and with Iron Age or Early Roman pottery at Chiswick Hall suggests an enquiry as to a Post-Neolithic date for these sites, but until further chronological evidence is forthcoming, it is convenient to regard them as belonging to a culture intermediate to the Cissbury and late Neolithic type.

9. The correlation of patination to the character of the soil is suggestive and may be summarised as :—

Soil with much humus, black and unpatinated.
Chalk soil, white patina.
Sandy loam, greyish glaze to blue mottle.
Clay loam, blue mottle.
Clay, greenish glaze to " toad-belly " and ochreous type.

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NEOLITHIC IMPLEMENTS FROM THE VALLEY OF THE ESSEX CAM.

I. Adze, unpolished, semilunar in section. Chiswick Hall, Site XI.
II. Polished Celt. Chiswick Hall, Site XI.
III. Worked Flake, showing white patination. Chiswick Hall, Site XI.
IV. Celt-like Scraper waisted for attachment to a haft or handle. Bordeaux Pit, Site V.
V. Prismatic Core. Newport, Site X.
VI. Spathulate Implement, rechipped from a polished Celt. Newport, Site X.
VII. Scraper. Newport, Site X.

BIRCH GROVES OF EPPING FOREST.

Being a Presidential Address delivered to the Club at the Annual Meeting on 25th March, 1922.

By ROBERT PAULSON, F.L.S., F.R.M.S.

(*With 3 Plates and 1 Text Diagram.*)

THE naturalist who has, through a period of several years, taken a keen interest in Epping Forest, or in other woodland of considerable area, especially if it be on gravel or sandy soil, will have become more and more conscious of a change gradually manifesting itself in certain features of the locality on which he was particularly concentrating his observation. Probably he will have become aware of an increase, or decrease, in numbers of some mammal, bird, insect, tree or ground plant.

The vegetation of woodland may be rendered unstable by occurrences such as (1) fires, (2) extensive felling (especially when it is not followed by subsequent replanting of the same species of tree as that cut down), (3) by a lowering of the water table on the introduction of artificial drainage, or (4) unstability may be the natural result of the leaching (washing out) of mineral matter that is rendered soluble in the soil by rain-water charged with carbon di-oxide, which is given off in large quantities from the acid humus that frequently covers the surface of the ground.

The subject of variation in the vegetation unit of woodlands was suggested to me by a striking example that has recently declared itself in an unmistakeable manner in certain parts of Epping Forest, especially on the lighter soil of the more elevated situations. There has, within the past fifty years, been a great increase in the number of birch trees; where there were tens there are now thousands. No detailed suggestions as to the probable cause or causes for the remarkable increase in this locality have yet, so far as I am aware, been made. A similar increase is taking place elsewhere in the south-eastern counties, as at Chiselhurst (Kent), Wimbledon Common and Oxshott Common (Surrey), Oxhey Wood (Hertfordshire), and Ruislip Woods (Middlesex), but as to the extent to which this is happening, there are not sufficient data to enable one to compare these localities with Epping Forest. At Oxshott it is quite evident to the casual observer that the invasion of birch and pine is very

rapid. One of the oldest inhabitants states that he can remember when there was not a pine on the heath between the great plantation of *Pinus sylvestris* and the railway line.

As this increase is the combined result of a number of causes, it is necessary to survey briefly the salient points of the topography, physical features, rainfall, and soil analysis relating to that part of the Forest area which we propose to consider, viz., that part which is enclosed by a line drawn from Loughton to High Beach and the converging lines from these places that meet at Epping.

As one looks eastward over the valley of the River Lea from favourable ground in Middlesex and in Hertfordshire, or westward across the Roding, the higher ground of Epping Forest is seen as a prominent feature of the landscape dominating the surrounding low country. Its elevation suggests a fresher, purer atmosphere and a greater rainfall than that of the alluvial country below. The high ground slopes much more steeply towards the west than it does in the opposite direction. A diagrammatic section east to west through High Beach exhibits a slope of approximately 1.5 mile to the River Lea, and of 2.5 miles to the Roding. From the western side one sees, in the spring, tier upon tier of leafy hornbeam and beech, and in the autumn sunsets, the russet red glow of the latter mingled here and there with the golden yellow of the birch and hornbeam.

The surface of the high ground includes a large portion, not less than two-fifths, of the actual woodland of the Forest. It attains at its greatest elevation a height slightly under 400 feet O.D., and forms a narrow irregular plateau with an average width approximating to three-quarters of a mile. It extends from High Beach (362 feet) to Jack's Hill (372 feet) onwards to the highest point (385 feet), a few yards north of Ambresbury Banks, the ancient camp, and thence to Bell Common (366 feet).

The plateau is not an unbroken level, as might be inferred from the figures just quoted ; it has been cut back by several small streams that burst out at the junction of the London Clay, approximately at the 300 feet contour, with either overlying Bagshot beds, as at High Beach, or with the Pebble Gravels. Where the uppermost layer of the London Clay is sandy, the springs break out at a slightly lower level. A former President, S. Hazzledine Warren, wrote in 1910, " Passing

under Staples Hill, evidences of a series of springs, thrown out on both sides of the valley, were observed. The level at which these springs appear is about, or rather below, the 200 feet contour and they probably indicate the presence of some permeable bed included in the London Clay."[1] Quite a number of springs, marked "rises" on the 6″ Ordnance Survey Map, 1921, issue from points at very short distances from either side of the Epping Road, which runs roughly parallel to, and within a quarter of a mile from, the watershed between the Lea and the Roding. The greater number, practically all, of these streams, follow a south-eastward course and form part of the drainage system of the latter river. They greatly enhance the picturesque beauty of the Forest, for several of the more secluded glades, or "slades," due to their action, afford a delightful variety of scene that can be enjoyed only by those who wander from the more frequented routes through the upper woodlands.

The rainfall, in the near neighbourhood of Epping town, based on an average of thirty-five years, 1876 to 1910, is the highest for Essex.

"The higher ridges between the Lea and Roding valleys, south of Harlow, extending from north-east to south-west for 15 miles, and narrowing from 9 miles in width on the north to a mere point in the south, includes the highest rainfall of Essex. The 25″ isohyetal surrounds this area running at an elevation of about 150 feet in the south to something over 250 feet in the north, while the highest ridge, on which Epping Forest stands, appears to have a rainfall exceeding 27.5 ins. at elevations about 350 feet."[2] The following table shows rainfall for the years 1916–20 at stations on the forest area at different levels, but at only a few miles distance from each other.

RAINFALL AT FIVE STATIONS ON OR NEAR THE FOREST FOR THE YEARS 1916—1920 :—

	O.D.	1916	1917	1918	1919	1920
Leytonstone High Road	100	32.91	29.57	33.13	26.81	24.31
Buckhurst Hill ..	275	32.06	25.02	29.18	25.46	24.68
Loughton, High Beach ..	376	34.29	27.23	29.84	29.12	26.60
Waltham Abbey..	66	34.38	26.94	28.78	28.16	24.18
Epping Hemnalls	345	38.88	29.54	34.94	31.54	28.54

1 *Proc. Geol. Assoc.*, 1910, vol. xxi., pt. 8, p. 452.
2 Whitaker and Thresh, *Water Supply of Essex*, 1916, p. 41.

It has been estimated that London Clay forms four-fifths of the whole surface of Epping Forest, the remaining fifth consisting of patches of sand and gravel that cap the clay. Within the limits of the plateau the ratio between similar surface layers is as 3 : 2.

Sand and gravel surfaces throughout the Forest are remarkably well indicated by the presence of birch grove, birch oakwood, and of small colonies of this tree. These very distinctive features did not exist 50 years ago.

On entering the Forest from Loughton, by way of Earl's Path, a few birches stand as sentinels around the gravel pit, now a pond. Beyond this point they increase rapidly in number on both sides of the road, but more especially on the western side; they disappear again by the time the Epping road is reached. The appearance and disappearance coincide with a patch of gravel overlying the London Clay. This gravel occurs just above the 200 feet contour line. It has been described by our Secretary[3] as forming part of a high level terrace of the Roding.

The birch grove around the church at High Beach is upon pebble gravel (362 feet) that has been broken up by the comparatively recent digging of numerous small, shallow, now overgrown pits, while the attractive belt of birch that sweeps round the church and reservoir on the western side, at a slightly lower level, is for the most part on Bagshot beds. Important birch groves occur around the Wake Arms and in close proximity to it, notably one at Jack's Hill. Here again are numerous overgrown gravel pits with a depth of 3 to 4 feet. The honeycombed nature of this pit area arises from the fact that the gravel is deposited in pockets. During a visit to this locality in October last, I was able to observe a small excavation that was being made by workmen on the side of the Epping road. Measurements made at the time gave the following results :— Surface soil 9″, gravel 30″, and a depth of clay removed 4″.

Birch groves occur also at Genesis Slade, Epping Thicks, Oak Hill, Piercing Hill, Sand Pit Plain, and on the western side of Loughton Camp. These are not confined to the Pebble Gravel, but the soil is at least sandy.

The gravels at Jack's Hill and its vicinity have a wide

3 Thompson, Percy G., "On the Occurrence of Rhaxella Chert in Epping Forest Gravels." Essex Naturalist, 1913, pt. x.-xii., vol. xvii. p. 256.

distribution. They were described by the late Sir Joseph Prestwich in 1890 as Westleton shingle, and more recently by a late President, W. Whitaker. They are composed approximately of :—

1.	Flint pebbles	50%
2.	White quartz pebbles	15%
3.	Sub-angular fragments of flint	20%
4.	Sub-angular fragments of chert	10%
5.	Pebbles of Lydian stone and ragstone	5%[4]

There are few or no birches where there is a considerable crater-like pocket in the clay filled with sandy gravel, for there water stagnates, as (1) in part at least of Rushey Plain, 300 yards north of the King's Oak Hotel, (2) in the portion of ground that is about 200 yards west of the Wake Arms, along the Waltham Road, and south of the keeper's cottage, and (3) in part of the Forest between the converging roads east and west of Great Monk Wood. On one of these patches *Sphagnum* sp., *Drosera rotundifolia*, *Erica tetralix* and *Lycopodium inundatum* were until recently present, though not frequent.

The sand and gravel areas, when not in such hollows, are well drained naturally, although considerable obstruction is caused by luxuriant vegetation at the issue of springs and for some distance below them. A scheme for draining such swampy places was commenced in the late seventies of the 19th century. It consisted in digging deep straight ditches through the boggy land, but owing to the strenuous efforts of the Club, aided by the sympathetic help of influential Conservators, the artificial drainage was allowed to become obsolete and no permanent lowering of the water-table of the plateau took place. The water is known to have maintained an almost constant level, six feet from the surface, for a long series of years in wells near the 300 feet contour line.

There is an interesting paragraph in *Water Supply of Essex*. "At the High Beach outlier, there are many springs on the northern side of the Common, sometimes with a rich growth of bog-moss (*Sphagnum*), and of other marsh plants. On the east, in the nursery southward of the King's Oak Inn, I saw, more lately, a spring with a bog garden." This delightful miniature graphically illustrates one of the beauties that forest

4 *Quart. Journ. Geol. Soc.*, 1890, pp. 81, 181.

lovers would lose should an artificial system of drainage ever be developed.

During the great drought of 1921, it was evident that these gravels had considerable capacity for retaining large quantities of water. In the report of the excursion secretary to the Quekett Microscopical Club, 1921, the statement occurs that, on that Club's visit to Chingford and Strawberry Hill on 25th June, the pond on Chingford Plain was dry, but that by the Earl's path contained water, as did the pond at Goldings Hill. These examples were characteristic of the ponds throughout the Forest: those on clay were dried up, those on the plateau gravel below the 300 contour contained water at the end of the long drought.

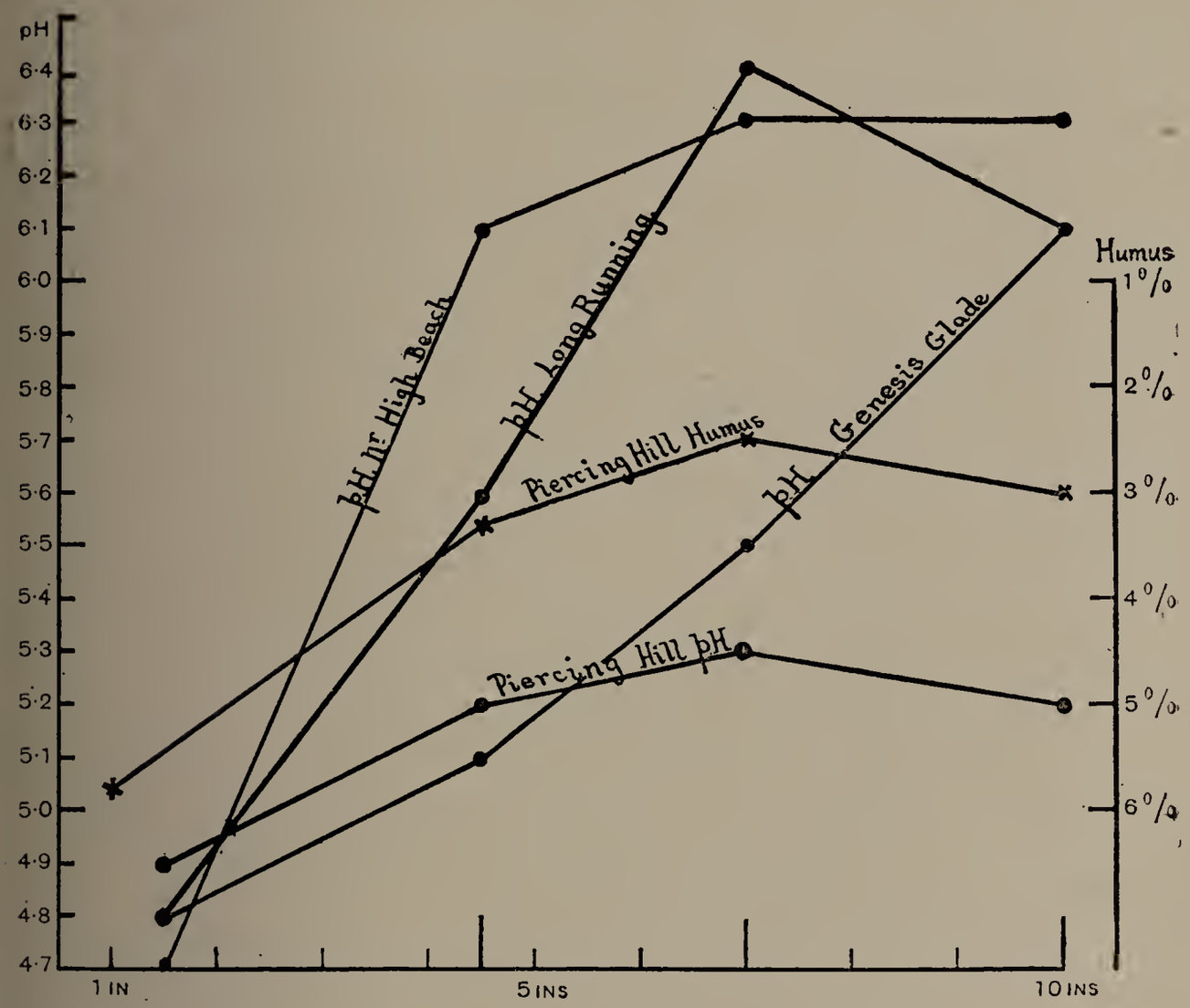
The prevalence of birch on light soils and its absence from the clay, indicated above, refer here solely to the Forest, for birches are known to grow on nearly every kind of soil. Warming gives a whole series of Danish birch types, from that on peat with Calluna and Vaccinium, to birch with meadow grass underneath. In a communication from Dr. W. G. Smith he writes, " I know it (the birch) from the surface of 15 feet of peat on the Humber to the stony slopes of our Scottish hills." There are a few birches on boggy ground at the head of streams that run through Hangboy and other Slades, but the water in these bogs is never quite stagnant.

Samples of soil taken at depths of 1.5", 4.5", 6.0" and 10.0" were forwarded to Dr. E. J. Salisbury, who has published the accompanying graphs illustrating hydrogen-ion concentration and the percentage of humus. They show that the organic content decreases rapidly with increasing depth, and that the hydrogen-ion concentration attains its maximum at the surface. The sample from Piercing Hill is not quite normal; there man has interfered by planting *Pinus sylvestris*.

The fruit of the birch *Betula alba* is small and light in weight. It consists of a narrow nutlet with an average length of 2.5 mm., while its width, including the membranous wings, approximates 4 mm. The average weight of a fruit is 0.00023 grams. From the size of the nutlet and the breadth of the wings one realizes that a fruit, once lifted by the wind above the height of the surrounding trees, may be carried for a great distance during a heavy gale of wind, yet it is a common sight to see the ground

of a birch grove completely carpeted during the winter months with birch fruits and scales; they are by no means all blown away. A gentle breeze passing through the ripe catkins is sufficient to bring down the fruits. In January of the present year they were seen on the ground at High Beach equalling at least 5 to the square inch, which means 20,072,448,000 to the square mile.

From what has already been stated it is quite obvious that



the number of seeds that successfully germinate is a very small percentage of the number shed. A large proportion of the seeds are not set and others are attacked by an insect that deposits an egg within the young seed.[5]

A bed of moss is a suitable nidus for birch seeds to ger-

5 A dipterous fly, *Oligotropus Betulae*, attacks the catkins and seeds of the birch, and is in its turn parasitised by a minute hymenopteron belonging to the Chalcididæ: specimens of both these were bred in the Club's Museum from birch seeds from Epping Forest. According to Mr. Blair, of the British Museum (Natural History), the Oligotropus has apparently not been recorded hitherto from Britain.—Ed.

minate upon. The examples exhibited this afternoon were taken from a moss-cushion 5″ square. There were 28 germinating birch seeds, in various stages of development, upon it. The cotyledons are epigeal. Counting from the left (Plate VI. fig. 1.)

No. 1 has hypocotyl 8 mm., cotyledon 2.5 mm., stalk of cotyledon 1 mm.

No. 5 has hypocotyl 12 mm., cotyledon 4.0 mm., stalk of cotyledon 1 mm.

No. 6 has hypocotyl 11 mm., cotyledon absent (fallen).

No. 1 cotyledon glabrous, 1st foliage leaf trilobed, shaggy, hairy.

No. 5 cotyledon glabrous, 1st foliage leaf narrowly trilobed, shaggy, hairy.

No. 6 cotyledon fallen, 1st foliage leaf broadly trilobed, shaggy, hairy.

No. 11 cotyledon fallen, 3rd foliage leaf broadly 5 lobed, shaggy, hairy.

No. 13 cotyledon fallen, 5th foliage leaf broadly 7 lobed, shaggy, hairy.

The younger of the roots exhibit signs of mycorrhiza, both epitropic and endotropic, but the detail respecting them is left for description at a later date. It would be interesting to discover whether the seed of the birch, like that of Calluna, is unable to germinate without the presence of mycorrhiza.

The stem of the birch elongates rapidly for the first ten years, lengthening as much as 2 to 2.5 feet the first year. Large numbers of young birches are now covering the land, especially on the eastern side, that, until recently, was enclosed as Paul's Nursery at High Beach.

The birch grows to a height of 65 to 80 feet, and lives for approximately 50 years.

The measurement of the circumference, at 3 feet above the ground, of a large number of forest birches has been taken during the last two years. Those with a circumference of less than 15″ have been neglected; they however form a large proportion, as shown in the photographs of birch groves now exhibited (Plate VII. figs. 1 and 2.)

Some of the largest on the Forest plateau are :—

(1) at High Beach, south of the churchyard, circumference 95″ (Plate VI. fig. 2.)

FIG. 1.

FIG. 2.

FIG. 1

FIG. 2.

(2) at High Beach, within the churchyard, circumference 83″
(3) ,, Long Running ,, 56″
(4) ,, Genesis Slade ,, 46″
(5) Epping Thicks ,, 47″

Number (5) was blown down during a storm of the early spring (1922). Mr. Gerald Buxton, Verderer of the Forest, kindly provided a transverse section of the trunk for the Club's Museum, from which the following measurements were taken :

Greatest diameter 15.5″
Width of widest annual ring, .3″
Radius from centre to :—

Outside of	5th	annual	ring	1.125″
,,	10th	,,	,,	2.5
,,	15th	,,	,,	3.0
,,	20th	,,	,,	4.0
,,	25th	,,	,,	5·375
,,	35th	,,	,,	5·75

This tree was 38 to 40 years old when blown down.

There appears to be a tendency for birches to grow in definite groups of two or three trees. At High Beach the following occur :—

(1) A group of 3. Circumferences 24″, 19″, 18″ respectively.
(2) ,, ,, 3 ,, 16″, 14″, 13.5″ ,,
(3) ,, ,, 2 ,, 20.5″, 16″ ,,
(4) ,, ,, 2 ,, 24″, 20″ ,,
(5) ,, ,, 2 ,, 10.5″, 11″ ,,

Some apparent groups are due to injury to the young tree when two to three stems arise just above the ground.

It may be that the small group represents the survivors of a larger number of seeds that germinated. It has already been pointed out how large a number of these fall in the autumn upon one square inch of soil.

To discuss the lack of agreement among the standard floras respecting the nomenclature of the genus Betula, is beyond the scope of this paper. Suffice it to say that, for the purpose of avoiding confusion, the system followed is that of the Cambridge Flora, which divided British birches into two series (1) the *Albae*, (2) The *Nanae*. The first series includes two species, *Betula alba*, L., commonly known as the white birch, and *B. pubescens*, the common birch ; both of which, with varieties and probably hybrids, occur in the Forest.

The salient features of *B. alba* are:—Height 75 to 80 feet, the thin branches, as they fray out, pendulous, young branches with resinous peltate glands, hairs absent, leaf lamina acuminate, doubly serrate, veins raised on upper surface, lateral lobes of the bracts more or less falcate (Plate VIII. fig. 2), wing of fruit twice or three times the diameter of the nutlets.

The chief points respecting *B. pubescens* are:—Rather less in height than *B. alba*, young branches with hairs, often densely pubescent, not infrequently with small rudimentary verrucosities, leaf lamina not acuminate, irregularly serrate, veins raised on the under surface, more or less hairy when young, often glabrous or sub-glabrous later, wing of fruit as broad as or a little broader than the nutlets.

The white birch has a deeply furrowed bark, but the depth of the furrows, and the extension from the base of the trunk upwards, vary considerably.

The birch is shallow rooted. Great numbers of slender roots are found at very little depth below the surface of the soil and should there be an accumulation of decaying leaves, at or near the foot of the tree, numerous, thread-like rootlets, each infected with mycorrhiza will be found ramifying throughout the decaying mass.

Birches, owing to their shallow root-system, are considerably damaged by heavy storms. At the present time there still remain evidences of the damage done to these trees by the great snowstorm of Sunday, 27 April 1919. It fell upon the birches when they were in full spring foliage. Being heavily weighted with snow, the shallow root-system proved quite inadequate to withstand the severe strain. Some trees are now growing out of the perpendicular, others that were brought to the ground were soon afterwards stripped of their branches (Plate VIII. fig. 1). The trunks of some still remain upon the ground forming an excellent nidus for saprophytic fungi.

The groves of the High Beach—Epping plateau are, in some localities, as close around the church of the former place, and at Long Running, almost pure birch, while in others the wood is of the type, oak-birch-heath association, with a large proportion of birch. The association has not been invaded by *Pinus sylvestris* although this tree was planted some forty years ago at Piercing Hill.

FIG. 1.

FIG. 2.

The ground flora varies slightly, but most of the following plants occur except where the bracken is abundant.

PHANEROGAMS.

Agrostis canina
Calluna vulgaris with var. *incana*
Carex pilulifera
Cytisus scoparius
Deschampsia flexuosa
Galium saxatile
Lonicera Periclymenum
Melampyrum pratense
Molinia coerulea
Nardus stricta
Prunus spinosa
Potentilla erecta
Rumex Acetosella
Solidago virgaurea
Salix repens
Teucrium Scorodonia
Ulex europaeus
Ulex minor

MOSSES.

Aulacomnion palustre
Ceratodon purpureum
Dicranella heteromalla
Funaria hygrometrica
Hypnum Schreberi
Polytrichum commune
Polytrichum juniperinum
Webera nutans

LICHENS.

On the ground :—

Cladonia digitata var. *denticulata*
C. fimbriata
C. Floerkeana
C. macilenta
C. pyxidata
C. squamosa
C. furcata
C. coccifera
Peltigera spuria
Lecidea uliginosa

On trees :—

Parmelia physodes
P. fuliginosa var. *laetevirens*
Lecanora varia

FUNGI.

On the ground :—

Agaricus muscarius
Boletus scaber

On trees :—

Exoascus betulae
Hypoxylon concentricum
Lenzites betulina
Melaneonis stilbostoma
Melamspora betulina
Polyporus betulinus
Polysticum hirsutum
Pholiota squarrosa
Valsa betulina

There is evidence in local and county floras that the birch was not a common tree in the Forest during the seventeenth, eighteenth, and for at least three-quarters of the nineteenth centuries, although it grew in the sixteenth century in sufficient quantity to make it profitable for felling with other trees. The late W. C. Waller, in "Monk Wood in Loughton; a Fragment of Forest History,"[6] quotes the following verdict given in relation to Forest woodland in 1582. "We say that there is a wood uppon the waste soyle of the said mannor called Muncke Wood, containing as it is measured fifty-three acres, sixty five poles at twenty-one foote to the pole: whereof there is waste ground in the same that beareth no wood by estimacion fifteen acres; which said wood hath been sold to Mr. Wroth, who felled the same. The nature and kind of the woodd so felled was most oke, beach, hornebeame, and birch."

The waste acreage still exists, the ground is swampy and covered with the grass *Molinia caerulea*. There is evidence of pan in this area as there is in that treeless portion south of the keeper's cottage already mentioned.

Warner, in his *Plantae Woodfordienses*, 1771, writes respecting the genus Betula, "Found on the Forest between High Beach and Golden Hill in the parish of Loughton, in general not very common." Specimens of birch in the Edward Forster herbarium, now incorporated in that of the British Museum, were collected, not in open spaces within the Forest, but on the edge of the woodland. The specimens are labelled, one Hale End 1794, and another Theydon Mount. The former station is on the southern boundary, the latter is to the north-east, quite outside the limits of the Forest as determined by the Perambulation of the 17th Charles 1st (1641). Birch was recorded on the same authority from Coopersale and Park Hall, on the north-eastern boundary. At Theydon it was growing plentifully. Gibson's *Flora of Essex* (1862), gives *Betula*, white birch, recorded from Stratford, in botanical district IV., fide J. Freeman, and near Epping, H. Doubleday, in addition to Edward Forster's localities.

On the western side of the Forest, in the counties of Middlesex and Hertfordshire, the birch was not plentiful. Trimen, *Flora of Middlesex* (1869), states "*Betula alba* rather rare"; no records

6 Essex Naturalist, v. 1891, p. 174.

are given in it for the botanical districts VI. and VII., which adjoin the Essex border. The nearest recorded localities to Essex are: Hampstead Heath and Bishop's Wood, which are approximately eight and a half miles south-west of Chingford. As regards Hertfordshire, Pryor, in the *County Flora*, writes, "*Betula alba*, locally abundant, but by no means generally plentiful." Both species grew in Northaw woods which are eleven miles west of Epping town ; they are too far north for the autumn equinoctial gales to carry seed into the Forest area.

Mr. William Cole, the founder of this Club, has stated in conversation, and in a recent letter, that in 1870, when living on the borders of the Forest, he frequently had to walk long distances to obtain young birch leaves for feeding the larvæ which he was then breeding. A more than ordinary depletion of birches may have been brought about by using birch branches for binding the faggots made of lopped portions of the hornbeam and other trees.

With reference to the historical evidence that a *small* number of birches existed in the Forest through all the period of which we have any knowledge, two names seem to need special mention. They are (1) Birch Hall, (2) Birching Coppice, west of Coopersale. The name Birch Hall is that of the estate just east of Oak Hill, but outside the present Forest boundary. The name dates back at least to the time of Henry VIII. Birching Coppice suggests that birches were grown there for a long period.

The result of experiments within animal proof enclosures made by the Conservators after the Forest was reserved for the public, was that all kinds of forest trees came up on the cleared spaces, but birch seedlings were so especially numerous that it was necessary to pluck up large numbers of them. It would, for our purpose, have been of more scientific value to have left some of the enclosures absolutely untouched by man. This would have shown whether the great number of birches could exist for many years.

A rough estimate of the present number of birches in the Forest, made a few months ago, worked out at not less than 20,000, but the figures are of little importance except for comparison with the very small number growing on the same area fifty years ago. The estimated number was arrived at by the following method, which was carried out at, (1) High Beach,

(2) Wake Arms, and (3) Long Running; a square, with a side of twenty yards, was corded off and the number of birch trees of over ten years growth, within the boundary, was counted. At the first station the average number per square was twenty-three, at the second thirty-eight, and at Long Running the number rose to forty. The number of trees per acre calculated in this manner is for the High Beach station 278.

With the knowledge that we possess of the Forest vegetation during the four centuries preceding the year 1870 there appears sufficient warrant for assuming that it represented a high form, possibly the "climax" of progressive successions, and that such form has, within quite recent times, undergone a "set-back," which may have been the result of one or more of the following causes:—Leaching of the soil, excessive felling, great fires, permanent lowering of the water-table, or injury caused by deer and rabbits.

Leaching of the Soil. The analysis necessary to enable one to judge of the extent to which leaching of the soil has taken place in this locality has not been completely carried out. The process of leaching is gradual and continuous, but at length there comes a time when a scarcity of lime in the surface soil shows its effect on the vegetation. Here again the change is in favour of the spread of the birch.

Felling. This has gone on through the centuries; it can scarcely be claimed to have been much more excessive during the last 50 years. The timber-right was originally under the control of the officers of the Crown, but subsequently, having been vested in many hands, there was little restraint upon those who appropriated to themselves the most valuable trees that the Forest supplied.

Fires. These have been periodical at all times. Devastating fires have taken place within quite recent date, notably the one in St. Thomas's Quarters (1894), one in the Theydon Quarters, and the destructive fire north of Great Monk Wood of a few years ago. The cumulative results of felling and fires have lessened the rejuvenating power of the Forest, and made it possible for the birch to increase rapidly.

Water-table. There is historical evidence from ancient wells that the height of the water-table has varied very little; data have already been given.

DEER. The number of deer in the Forest has fluctuated considerably within the last century. The following extract from *Epping Forest*, by E. North Buxton, verderer, makes the fact perfectly clear :—He remarks " An old inhabitant writes : —' When a boy, my father took me for a treat to London, 1829. I well remember the open plains bordering the Forest swarmed with deer. I am sure there must have been hundreds in sight at one time.' The number grew less and less until about the year 1860, when there were said to be under ten left alive." After this the herd increased slowly, but only small groups are met with at the present time, as there was a considerable loss of numbers during the war. Unless hard pressed, deer do not browse on birch ; it appears to be distasteful to them, and to other animals also.

When the number of deer was at its greatest (1829), they acted as a considerable factor in preventing the rejuvenescence of the Forest, as they browse on almost every tree *except* birch, and thus helped to prepare the way for the great invasion with which we are now dealing.

RABBITS. Towards the close of the last century there was a general complaint by the owners of woodlands in Essex that it was useless to plant, after felling, owing to the depredations of the enormous numbers of rabbits.

The following is one of the answers given to a questionnaire addressed to the owners of extensive woodlands in Essex :— " In some of the oldest oak woods, about 250 years of age, or more, the coppice has been eaten away till nothing but bramble forms the unprofitable undergrowth, and so hopeless does the prospect seem, that no planting has been done to replace stubs killed by rabbits." Another reply was " No replanting is being done now as the expense would be out of proportion to any return that could be expected."

Rabbits at this time, 1870–1914, were greatly hindering the normal rejuvenescence of the Forest. The numbers were, however, greatly depleted everywhere by the demand for animal food during our time of stress. That the number of rabbits now in the Forest falls far short of that of pre-war times is the general opinion of those who have very intimate associations with this area.

The analyses published by Dr. J. E. Salisbury are of import-

ance as they are the first that deal with the hydrogen-ion concentration of Forest soils.

The factors that have tended to bring about the great birch invasion may be summarized as :—

1. Leaching of the soil, a factor of primary importance.
2. Extensive felling for many successive years.
3. A long series of fires, especially those of recent date.
4. Browsing of large herds of deer, 1800–1850.
5. Injury done to germinating acorns and beechmast by rabbits (1870–1914), and even earlier. The young birch appears to be distasteful, even to rabbits ; it was thus able to increase while the oak and beech were checked.

During the autumn of 1899, and throughout the following year, birch trees in Essex, Kent, Surrey and elsewhere were killed in great numbers by a microscopical fungus, *Melaneonis stilbostoma*, but its virulence was soon exhausted. Although the disease is always present, it has not appeared in epidemic form since 1902. Trees of twenty to twenty-five years' growth were killed within a month.[7]

In parts of the upper Forest, where the birch has made rapid progress within living memory, conditions exist that correspond very closely with those described by Graebner and others as a result of their researches respecting the fundamental cause of the degeneration of woodland into heath. Graebner noted that, "when there is a rainfall of 70 cm. (28 inches) or more" (the record for High Beach and Epping is considerably above this, see page 71), "the surface layers are being continually impoverished in mineral salts by washing out or leaching, and the typical plants of the forest floor are thus starved and give way to the invasion of mosses and shade-bearing heath plants. The matting together of the surface layers of soil by the rhizoids and rootlets of the invaders prevents the access of oxygen to the soil and leads to the accumulation of 'acid humus' or 'dry peat' in place of the original mild humus of the woodlands."

The specimens, two inches thick, of dry peat, on exhibition this afternoon, are from the Forest. They are typical of that which occurs at various stations on the plateau having an annual rainfall of 28 inches or more.

7 R. Paulson "An Enquiry into the causes of the death of Birch Trees in Epping Forest and elsewhere." Essex Naturalist xi., 1900, pp. 273-284.

The result of the presence of humous compounds in the soil is the formation of pan, a hard layer of sand, at about the level of the normal water-table. The roots of trees cannot penetrate this. Leaching of the soil and the formation of moor-pan effectively prevent the rejuvenation of woodland.

Those who have known intimately, for at least thirty years, the woodland of the Forest plateau have had the unique opportunity of witnessing there a period of transformation similar to that which all woodland upon sand or sandy gravel undergoes, sooner or later, in the course of its history.

It is generally conceded that birches have added greatly to the sylvan beauty of the Forest, but should the great increase in the number of these trees go on unchecked, the pleasure derived from variety may in time be lost. Leaching of the soil must inevitably continue while the present climatic conditions persist. With this fact before us, in spite of the complete cessation of indiscriminate felling under the present management, and of the great reduction in the number of rabbits on the land, we can hardly look forward in the distant future to a new birth in the regeneration of the woodland upon the pebble gravel and sand of the Forest plateau.

I take the opportunity to thank the following correspondents: Mr. Gerald Buxton, Verderer of the Forest; Mr. F. F. McKenzie, Dr. Edward J. Russell, Dr. W. G. Smith and Mr. J. M. Wood, for valuable suggestions made during the preparation of this address. Mr. Gerald Buxton also kindly invited me to inspect the water-level of some wells on his estate.

"Fire-Brats" at West Ham.—Specimens of the little-known Thysanurid, *Thermobia furnorum*, were found in June 1920, about a baker's oven at West Ham, and are preserved in the Essex Museum at Stratford. Bakers call these insects "fire-brats," because of their apparent fondness for heat.

This species and *Lepisma saccharina* (the Silver Fish) are the only British representatives of the family Lepismidæ of the Thysanura. *Thermobi* has not, hitherto, been recorded in Essex.—PERCY THOMPSON.

THE ESSEX FIELD CLUB.—REPORTS OF MEETINGS.

ORDINARY MEETING (536th MEETING).

SATURDAY, 29TH OCTOBER, 1921.

This meeting was held in the Physical Lecture Theatre of the Municipal College, Romford Road, Stratford, with the President, Mr. Robert Paulson, F.L.S., F.R.M.S., in the chair. 66 members were present.

The following were elected members of the Club:—

Mr. Charles H. Butcher, of 17, *St. Mary's Road, Ilford.*

Mr. J. Varley Roberts,
Mrs. M. Varley Roberts, } *Vale Grove, Loughton.*

Miss Janet B. Littlejohn, of 5, *Fairfax Road, Bedford Park, W.*4.

The Curator exhibited various recent acquisitions to the Club's Museum, including:—

(a.) A mounted specimen of the Roller (*Coracias garrulus*), which had been captured alive at Ramsey, near Harwich, in July, 1921, and presented by our member, Mr. Walter B. Nichols (see ESSEX NATURALIST, xix., p. 327).

Mr. Miller Christy confirmed the exhibitor's statement as to the rare occurrence of this bird in Essex. Mr. Glegg spoke of his acquaintance with the species in Macedonia, and Miss G. Lister exhibited skins of the species and of an allied form (*Coracias Lorti*) from Somaliland, the latter having elongated outer tail feathers with long black tips.

(b.) A mounted specimen (immature) of the Red-throated Diver (*Colymbus septentrionalis*) from the Walthamstow Reservoirs.

(c.) An oak tea-caddy, believed on good authority to have been made from the wood of the celebrated Fairlop Oak.

(d.) Living Plaice (*Pleuronectes platessa*), juvenile specimens, showing their markedly protective resemblance to the sandy bottom on which they lived.

Mr. Whitaker exhibited, and presented to the Club's Museum, a length of core from the trial-boring for coal at Weeley, Essex, from depth 1,163 feet, showing bedding at a high angle of 60° or over.

Mr. Walter Fox exhibited, and presented to the Museum, a Wheat Dib, from Aveley, which he thought might be 120 years old or more. Mr. Miller Christy, commenting on this exhibit, mentioned that the Dib was one of a pair, and that such implements were in use until the invention of the drill, some 80 years ago.

Mr. Avery exhibited numerous specimens of timber of the White Willow (*Salix alba*), showing damage caused by the larva of the Goat Moth (*Cossus ligniperda*), also a living caterpillar of this moth.

Mr. Avery also exhibited some abnormally large fruits of Horse Chestnut, from Woodford, these being doubtless a result of the long and hot summer.

Professor Boulger exhibited a copy of the book, a MS. Flora of Dedham, by William Coleman, with MS. additions in Coleman's handwriting

referred to in his article on this botanist (see ESSEX NATURALIST, xix., p. 303).

Mr. Powers exhibited two chrysalids of the Convolvulus Hawk Moth, from Leytonstone.

Mr. Hugh Main exhibited a living Scorpion from the south of France, showing some two dozen living young clustered on the mother's back.

The thanks of the meeting were accorded to the various exhibitors and donors.

The Hon. Secretary read Mr. Oke's Report as Delegate of the Club to the Annual Conference of Delegates of Corresponding Societies at the British Association Meeting at Edinburgh, in September, and to the South Eastern Union's Congress at Reading in July.

The thanks of the meeting were voted to Mr. Oke for his report.

Mr. Hugh Main read a paper on "*Atypus affinis*, the British representative of the Trap-door Spiders," (printed *ante*, p. 23), with notes on its occurrence in Epping Forest, illustrating his subject with lantern photographs and by specimens of the spider and its tube.

Thanks were voted to Mr. Main for his communication.

The President then called upon Mr. John Seabrook, who gave an interesting lecture on "The Nile in the Service of Egypt," accompanying his account with a series of lantern photographs of the Nile, its barrages and dams, and exhibiting also a fine series of entomological specimens taken in Egypt by himself whilst on active service.

The President proposed the thanks of the meeting to the lecturer, which were heartily accorded.

CRYPTOGAMIC FORAY IN EPPING FOREST (537th MEETING).

SATURDAY, 12TH NOVEMBER, 1921.

The rigours of a bitterly cold day, with a northerly wind, were faced by a small, but determined, party, numbering some 28 to 30 persons, on the occasion of the annual cryptogamic foray. Fortunately the thick hoar frost which had whitened the ground for a week past disappeared on the morning of the foray, and so enabled the ground-forms of mosses and lichens to be again recognized.

The party assembled at Loughton Railway Station at 10.41 o'clock. Entering the Forest at York Hill, after traversing the village of Loughton, and inspecting the War Memorial on King's Green, the route (a somewhat zig-zag one) was roughly via Blackweir Hill, the Green Ride as far as nearly to Broadstrood, Great Monk Wood, the Wake Valley, and thence across to the Verderer's Path and Highbeach.

Collecting was actively carried on throughout the day, this being eminently a working party, under the energetic conductorship of Mr. L. B. Hall, F.L.S. and Mr. W. R. Sherrin, A.L.S. (for the mosses and hepatics), Miss A. Lorrain Smith, F.L.S. and our President, Mr. R. Paulson, F.L.S. (for the lichens), and Miss G. Lister, F.L.S. (for the fungi and myxomycetes).

Some of the rarities of the Forest were sought (and found) in their known stations.

The rare moss, *Zygodon Forsteri*, was seen in two spots, and *Webera albicans* was noted, as also were the ferns, *Osmunda regalis* and *Blechnum spicant.*

Several lichens of more than ordinary interest were met with, including *Cladonia papillaria, C. digitata, C. uncialis, Cetraria glauca, Bæomyces roseus* in abundant fruit, and quite a carpet of *Cetraria aculeata.* Another noteworthy find was *Chaenotheca melanophaea*, which, with its variety *flavocitrina*, was found growing on tree trunks in the Wake Valley district.

The headquarters were, as usual, the Roserville Retreat at Highbeach, and tea was served here at 4.30 o'clock; following which a meeting of the Club was held, with the President (Mr. R. Paulson, F.L.S.) in the chair.

Miss Constance V. Frampton, of 84, *Cambridge Road, Seven Kings*, was elected a member, and nominations of three candidates for membership were read.

The President referred to the death yesterday, at the age of 88, of an original member of the Club, Mr. John Spiller, F.C.S., F.I.C., which was announced in to-day's newspapers, and spoke of the deceased's activities in the earlier years of the Club's history; and Mr. T. C. Dymond made warm reference to Mr. Spiller's active educational work as a co-opted member of the Education Committee of the Essex County Council.

The Hon. Secretary thought it would be the wish of those present that a letter of condolence should be sent, in the name of the Club, to the surviving relatives of the deceased, and this was cordially agreed.

The President then called upon the several conductors for their reports on the finds of the day.

Mr. Hall reported that 43 mosses and 2 forms of sphagnum had been recorded during the foray; and compared the mosses and the myxomycetes in some detail, both as regards their structure, their food and their life histories.

Mr. Sherrin said he could add to Mr. Hall's record a list of 12 liverworts, found to-day. He added that it should be recorded that, at the foray of last year, he had found a new moss to Essex, *Webera proligera*, which was therefore a new record for Epping Forest.

Miss Lorrain Smith said that, not having been with the collecting party, she had nothing to say on the lichens found during the day, but she made the interesting statement that, whilst recently examining a lichen sent from Jamaica, she had seen the algal-cells in that lichen in the act of sporulating, and so was able to add her testimony to the accuracy of our President's recently-published observations.

The President reported that he had noted 25 to 27 lichen-forms during to-day's foray. He was agreeably surprised, in view of the long drought of the past summer and autumn, to notice how soon the ground forms had recovered their activity of growth and how healthy they appeared; he instanced *Bæomyces roseus*, which we had seen to-day in copious fruit, *Cetraria aculeata*, which was completely carpeting the ground in one spot, and *Lecidea uliginosa*, which also had been seen freely fruiting. Mr. Paulson referred to Dr. Church's recent theory of the origin of lichens from decorticated marine algæ ("skinned seaweeds"), which he was,

however, unable to accept, and to the publication during the past summer of Miss Lorrain Smith's two indispensable works on lichens.[1]

Miss Lister said that the weather conditions of frost following a long drought were inimical to the active growth of myxomycetes, and consequently it was not surprising that but one specimen had been seen throughout the day ; *Trichia varia* alone had defied the frost. Turning to the fungi, she remarked on the sporadic growth of particular fungi on burnt patches of ground, the result of the many forest fires of the past summer. Thus, two months ago numerous patches of the discomycete, *Pyronema confluens*, had been in evidence ; to-day these had entirely disappeared, but we had noticed, at Blackweir Hill, large patches of another discomycete, *Humaria* (*Peziza*) *macrocystis*, which also specially affects burnt soil.

Thanks were expressed to the conductors and the meeting then terminated.

A brisk walk through the Forest, illumined by the pale rays of a nearly full, but misty, moon, brought the party back to Loughton in time to catch the 6.31 train for town.

ORDINARY MEETING (538th MEETING).

SATURDAY, 26TH NOVEMBER, 1921.

This meeting was held at 3 o'clock on the above afternoon, in the Municipal College, Romford Road, Stratford, the President, Mr. Robert Paulson, F.L.S., F.R.M.S., in the chair. 50 members attended.

The following persons were elected members of the Club :—

Miss E. R. Barty, of *Woodford County High School.*

Miss Elizabeth Childs, of 10, *Speldhurst Road, E.*9.

Mr. Geoffrey Dent, of "*Ashlings,*" *Ongar.*

The Curator exhibited a specimen of the Yellow-necked Wood Mouse (*Apodemus flavicollis wintoni*) which had been caught in a house ("Ashlings") at Ongar a week earlier, and presented to the Club's Museum by Mr. Geoffrey Dent. The donor reported that in the same cupboard in which this specimen had been caught he had also caught three Bank Voles, as well as House Mice. The occurrence of Bank Voles in an inhabited dwelling house is unusual in this country, although common in Norway in winter.

Mr. Thompson also exhibited the specimen of *Atypus affinis* shown by Mr. Hugh Main at a previous meeting ; during the last four days some twenty or more baby spiders had made their appearance in the jar containing the adult's tube, and a tiny new silken tube had been constructed by one of them.

The Curator also produced the Club's Album containing the photographs taken by Mr. Daymond during the Club's visit to Colchester at Easter, 1921. On the President's motion, the thanks of the meeting were voted to Mr. Daymond for his gift.

Mr. Hazzledine Warren gave a demonstration on "Flint-Knapping in

1 Intending students of the lichens are reminded that the Club's Museum now contains a very fine collection of these plants, which are available for study, while the Library includes practically all the important works on the subject that have been published in England during the last eighty years, including Miss Smith's recent books.—Ed.

Norfolk," illustrating his remarks by a series of lantern slides and by actual specimens which showed the methods of flaking adopted for the preparation of flints for the facing of church and other walls in mediaeval and later times. Mr. Warren remarked on the resemblance of some of the flint-debris to prehistoric implements.

After a discussion, the thanks of the meeting were accorded to Mr. Warren for his lecture.

Mr. Avery gave a description of the twenty-three prints of Castle Hedingham, Tilbury Fort, Upminster, etc., exhibited by him, and was voted the thanks of the meeting for his exhibit.

The President called attention to some important recent researches on the algæ of the soil, particularly alluding to a paper which had been read before the Linnean Society in March, 1918, which gave an account of an investigation carried on by Miss Muriel Bristol, M.Sc. By culture-methods the soil alga, *Chlorococcum humicola*, was made to grow abundantly, and biciliate zoogonidia were produced in large numbers. At the reception by the President of the Linnean Society in October, 1921, Miss Bristol exhibited cultures of soil-algæ in agar + mineral salts + glucose, which, even in the dark, had developed an intense, vivid green colour. The President remarked that the results of such cultures opened up questions as to the nutrition required by soil-algæ, and asked :—Is the alga a saprophyte when colourless and buried in the soil ?

At the conclusion of the President's remarks, Miss G. Lister proposed the thanks of the meeting to him for his discourse, and these were heartily accorded.

Mr. D. J. Scourfield then gave a lecture on " The Logarithmic Spiral in Nature," which he illustrated by a series of lantern slides and by various specimens from the Club's Museum, such as shells of *Nautilus*, *Ammonites* and various Gastropods, opercula of *Turbo*, models of shells of foraminifera, the cochlea of the human ear, etc.

Mr. Scourfield furnishes the following resumé :—

THE LOGARITHMIC SPIRAL IN NATURE.

The subject of spirals in nature is a very large and extremely interesting one ; it is proposed on this occasion to confine attention to the particular form of spiral known as the logarithmic spiral. To the question—" What is a logarithmic spiral ? "—a provisional answer can be given that it is that very beautiful expanding spiral with which all are familiar in the discoid forms of univalve shells, such as a *Planorbis* or an *Ammonite*, in the crozier of an opening fern frond, in the inflorescence of the forget-me-not, and in many other natural objects. Mathematically it is the spiral which is conceived of as being traced by a point moving with increasing velocity along a line which is itself revolving uniformly round one of its extremities, the velocity of the point at any moment being proportional to its distance from the centre of revolution (" pole " of the spiral). The appellation " logarithmic " is due to the fact that the angles about the pole of such a spiral are proportional to the logarithms of the successive radii. With the help of a table of logarithms it is therefore easy to construct a logarithmic spiral having any desired ratio of increase.

Thus, assuming a threefold increase for each revolution and ten equal

angles about the pole (and therefore ten radii, the first being taken, say, as 1″) then the lengths of the successive radii are approximately as follow:—

	1st revolution. inches.	2nd revolution. inches.	3rd revolution. inches.
Radius No. 1	1.00	3.00	9.00
,, ,, 2	1.12	3.35	10.04
,, ,, 3	1.25	3.74	11.21
,, ,, 4	1.39	4.17	12.51
,, ,, 5	1.55	4.65	13.96
,, ,, 6	1.73	5.19	15.58
,, ,, 7	1.93	5.80	17.40
,, ,, 8	2.16	6.47	19.42
,, ,, 9	2.41	7.22	21.67
,, ,, 10	2.69	8.06	24.19
,, ,, 1	3.00	9.00	27.00

These lengths (after the first) correspond to the logarithms of $\frac{1}{10}$th, $\frac{2}{10}$ths, $\frac{3}{10}$ths, etc., of the logarithm of 3, i.e., to .0477, .0954, .1431, etc.

It will be seen from the above figures that not only are the distances of the successive turns of the spiral, measured from the pole along each radius, in the ratio of 3 : 1, but that the differences between the first and second, and between the second and the third turns, (i.e., the widths of the whorls in the case of a shell) are also in the same ratio. And this is true of any radii drawn in intermediate positions.

Another peculiarity of the logarithmic spiral is that the angle between the tangent and the radius is always the same, wherever taken. It is from this fact that this spiral is often called the "equiangular spiral."

Yet another property of the logarithmic spiral is its constant similarity of form whatever its size. It follows from this that in such an example of the spiral as a shell, every increment is what is known mathematically as a "gnomon" to the pre-existing shell. And this further implies that every increment has its proportional effect upon the following increment, which suggests that the logarithmic spiral might also be called the "compound interest spiral."

Although it is probably true that there is no such thing as a *perfect* logarithmic spiral in nature, some natural objects come remarkably close to it.

The best examples are to be found among the shells of the Mollusca, especially the Cephalopoda and Gasteropoda. A section of a pearly *Nautilus* shows an almost perfect logarithmic spiral, with a threefold increment for each complete turn. But many other shells are almost equally good examples, and this applies not only to the discoid forms, but to the more or less elongated or turbinate types, i.e., to the majority of marine, land and fresh-water Gastropods, in which the logarithmic spiral can be quite easily recognised, although no longer in a plane. In these latter cases a series of measurements of the widths of the whorls, if separately visible, taken along any straight line drawn from the apex towards the mouth, will give the same constant ratio of increase as do the widths of the whorls across a radius in the discoid forms. Any other series of

comparable parts in one complete turn of the spiral apart, e.g., the widths of the openings on one side or the other, when a section is made in the plane of the columella, will also give the same result. The ratio so determined, by whatever method, is usually a specific character.

Naturally there is a very considerable range of ratios to be found among the widely different types of univalve shells. For example, in some species of *Planorbis* the ratio is very small so that the appearance is more that of the non-expanding spiral of Archimedes than that of a logarithmic spiral, whereas in such a form as the Ear-shell, *Haliotis tu erculata*, the ratio is very large, probably as much as 10 : 1.

In view of the many factors involved in the growth of an organism, it is not surprising that measurements show that the ratio is not always constant throughout life. There is very often a falling-off in the rate of increase (e.g., some species of *Planorbis*, *Pupa*, *Clausilia*, etc.), and it sometimes happens that even the spiral form is lost in the later stages of growth (e.g., the ammonitoid fossil *Lituites*). On the other hand, cases do occur in which the rate of expansion of the spiral is actually accelerated as time goes on (e.g., *Succinea*, etc.).

It is not only the shells themselves, however, which show more or less close approximations to logarithmic spirals, but sometimes also their opercula. This is very well shown in species of *Turbo* and can also be seen in the land snail, *Cyclostoma elegans*, and in the common periwinkle (*Littorina*), etc. In the case of the pearly *Nautilus* the septa dividing the shell into chambers are, in median section, also parts of a logarithmic spiral exactly similar to that of the shell itself.

Another group of animals in which many of the forms embody the logarithmic spiral is the Foraminifera. In these, for the most part microscopic organisms, the effect is produced by the addition of new chambers, each of which is a "gnomon" to the pre-existing group of chambers. Some genera, e.g., *Rotalia*, *Cornuspira*, *Cyclammina*, etc., are discoid, having the chambers arranged in a plane, and they look remarkably like diminutive forms of *Nautilus* and other Cephalopods. In other genera, e.g., *Globigerina*, the chambers are pushed more or less out of a plane into a screw pattern. As in the Mollusca, the ratio of increase is not always maintained throughout life. In *Nummulites* the spiral in its central part seems to be roughly logarithmic although the rate of increase is very small. Later turns of the spiral, however, keep at almost exactly the same distance apart and therefore form an Archimedean spiral. In *Peneroplis* and other forms the early spiral arrangement is lost in later stages, producing various fantastic effects.

The third principal group of animals exhibiting the logarithmic spiral, though only as a small part of their structure, is the group comprising cattle, sheep, goats, etc. In these vertebrates the horns are sometimes twisted round more than once into very close approximations to logarithmic spirals, though not in one plane (e.g., rams of various breeds of sheep), and in other cases, although the spiral is only partial, its logarithmic nature is quite evident.

Yet another example of the logarithmic spiral among animals may be mentioned, namely, the cochlea of the mammalian ear.

Generally speaking it will be seen that, with the exception of the Fora-

minifera, logarithmic spirals among animals are due to the coiling-up of more or less evenly-tapering tubes, which is, perhaps, one of the simplest ways of visualising such spirals.

With regard to plants the logarithmic spiral is very beautifully shown in the unfolding crozier of a fern frond and in the inflorescence known as a scorpioid cyme, which is found in the order Boraginaceæ, e.g., Forget-me-not, etc. Spiral lines of an essentially logarithmic character are also found in the arrangement of the florets on the head of most composite flowers, e.g., sun-flower, daisy, etc. The spiral arrangement seen in the cones of conifers, and even the arrangement of leaves on a plant (phyllotaxis) have been regarded as in part at least referable to a spiral of the logarithmic type, although in these cases the matter is complicated by other factors.

In conclusion it may be said that the occurrence of the logarithmic spiral in nature seems to point to the existence of what is probably a fundamental law of growth, namely, that every increment, during the normal growing period, has its proportionate effect upon the next increment, so that healthy growth may be said to follow the rule of compound interest.[2]

Following a short discussion a hearty vote of thanks was passed to the lecturer, and the proceedings terminated.

VISIT TO THE BRITISH MUSEUM (NATURAL HISTORY) (539th MEETING).

SATURDAY, 10TH DECEMBER, 1921.

A small party of members, 24 in all, met at the Natural History Museum at 2 o'clock for the purpose of inspecting, by kind invitation of Dr. W. T. Calman, F.R.S., F.L.S., the exhibited series of Crustacea under his charge.

Dr. Calman conducted the party through the Crustacean Gallery, pointing out many facts of interest in connection with the specimens on view.

The subjects touched upon included the following:—Range of size in the Crustacea; Metamorphosis; Growth; Moulting; Regeneration of Limbs; Habitats, marine, fresh-water, terrestrial; Plankton forms; Parasitism and Symbiosis; Fossil Crustacea.

The specimen of the "Coconut Crab" (*Birgus latro*), exhibited in the gallery, served as an object lesson for an interesting account of the Land Crabs, those remarkable decapods which pass their lives on land, climbing trees, and often roaming to considerable distances from the ocean, into which, however, they return at the breeding season, to hatch out their ova; the young stages are spent in the sea as free-swimming larvæ, breathing by means of gills, whereas the adult forms develop, in addition, lungs adapted for air-breathing, and may be drowned by too-prolonged immersion in the sea.

The President, at the conclusion of Dr. Calman's lecture, proposed the thanks of the Club to him for his kindness, and these were heartily accorded by the members present. Dr. Calman suitably replied, and the party then dispersed.

2 The two following books will be found useful by those wishing to study the subject more deeply:—*Growth and Form*, by Prof. D'Arcy Thompson (Cambridge, 1917), *The Curves of Life*, by Sir T. A. Cook (London, 1914).

ORDINARY MEETING (540th MEETING).

SATURDAY, 28TH JANUARY, 1922.

This meeting was held at 3 o'clock on the above afternoon in the Physical Lecture Theatre of the Municipal College, Romford Road, Stratford, the President, Mr. Robert Paulson, F.L.S., F.R.M.S., being in the chair. 48 members were present.

Mr. Colney Campbell, of 96, *New River Crescent, Palmer's Green, N.*13, was elected a member of the Club.

Mr. J. Avery exhibited and described a series of 18 Essex prints from his private collection.

Mr. H. Mothersole exhibited, and presented to the Club's Museum, a portion of Baleen, inscribed as being from the example of Common Rorqual (*Balaenoptera musculus*), which was captured in the River Crouch, near Burnham, on February 12th, 1891; a description and drawing of this whale, by the late Mr. Walter Crouch, appeared in the ESSEX NATURALIST, v., 1891, p. 124.

The Curator exhibited a series of twenty nestling birds, acquired for the Club's Museum by purchase, and called attention to the mottled markings of the down, which were believed to represent the original adult plumage of ancestral forms of birds.

Mr. Thompson also exhibited an excellent series of fifty skins of Canadian birds, collected by our member, Mr. G. A. Hardy, in Western Alberta, and which he had generously presented to the Club's Museum. On the President's invitation Mr. Hardy described his collection, and gave interesting details from personal observation of the habits of the birds in their native haunts. The following is a *resumé* of Mr. Hardy's remarks:—

ON SOME CANADIAN BIRDS.

From Essex to Alberta, Western Canada, is a far cry; fortunately, birds do not confine themselves to arbitrary boundaries, hence, on looking over a collection of Canadian birds, such as this, we find several that make one feel at home, no matter on which side of the ocean one is placed.

One bird in particular, the Horned Grebe (*Colymbus auritus*), is identical with the British form; and the Wilson's Snipe (*Gallinago delicata*) is at first glance undistinguishable from the Common Snipe (*G. coelestis*); these forms meet on common ground in Greenland, during the summer.

The Solitary Sandpiper (*Helodromas solitarius*), which replaces the British Green Sandpiper (*Totanus ochropus*), and the Yellowshank (*T. flavipes*), which is as common as our Redshank (*T. calidris*), are both occasional stragglers to these shores; the Yellowshank, as recently as last summer, to its cost.

Apart from the Holarctic Region—that portion of the merged arctic extension of the Nearctic and Palæarctic Regions where, the environment being constant and continuous, the fauna is so likewse—it is chiefly among the aquatic birds that examples are found common to the latter two regions, many of them being circumpolar in their distribution. Of this group, more characteristic of the new world are the Blue-Winged Teal (*Querquedula discors*), an inland duck, Wilson's Phalarope (*Steganopus tricolor*), among the first in spring to enliven the "sloughs" with its dainty

ways, the Dowitcher or Red-breasted Snipe (*Macrorhampus scolopaceus*), and the Bartram's Sandpiper (*Bartramia longicauda*), a bird of the grassy-uplands, rather than the marshland.

Coming to the Land Birds ; the Hairy Woodpecker (*Dryobates villosus*) recalls our Great Spotted Woodpecker (*Picus major*).

The Night Hawk (*Chordeiles virginianus*), so similar in appearance to our Night Jar (*Caprimulgus europaeus*), has the habit of flying in broad daylight, even soaring above the buildings in the heart of cities ; his downward swoop, culminating in a loud " drone," being very characteristic.

The essentially new world family Icteridae is represented by the Cowbird (*Molothrus ater*), that constant companion to grazing horse or cattle, and sly shoulderer of family cares on to others more conscientious ; the Brewer's Blackbird (*Scolecophagus cyanocephalus*), typical of the North West ; and the Red-Winged Blackbird (*Agelaius phœnicus fortis*), a sure denizen of every willow and reed bordered slough, whose oft repeated " *Keroncher-reeee-er* " denotes from afar the existence of a swamp.

The Tyrannidae, replacing the Palæarctic Musciparidae, are represented by the Chebee or Least Flycatcher (*Epidonax minimus*), whose vivacious actions enliven his woodland haunts, and the Wood Peewee (*Myiochanes virens Richardsoni*), who calls plaintively from some dead bough high up in the glade, where he keeps watch for passing insects.

The group popularly known as Sparrows—of almost as many genera as species—belonging to the family Fringillidae, is the most successful of all land birds in point of numbers and distribution, a representative species inhabiting every type of environment. On the plains are the Savannah Sparrow (*Passerculus sandwichensis alaudinus*) and Tree-Sparrow (*Spizella monticola ochracea*). In the brush-land we find the Lincoln Sparrow (*Melospiza lincolnii*) and Clay Coloured Sparrow (*Spizella pallida*), while in the woods the White-Throated Sparrow (*Zonotrichia albicollis*) will be seen scratching among the dead leaves, or his clear, ringing song fills the spaces. The wooded borders of the swamp will harbour the Chippy Sparrow (*Spi ella socialis* and the dusty trail attracts the Vesper Sparrow (*Praecetes gramineus confinis*), who flits ahead, labelled by his white outer tail feathers. The Song Sparrow (*Melospiza cinerea*), in his 20 odd forms, is the most successful and ubiquitous of them all ; his cheery lilt and confiding ways appealing to everyone.

The well-known Prairie Chicken (*Pedraecetes phasianellus campestris*), famous for his spring dancing, is found all over the plains and into the brush country; the Ruffled Grouse (*Bonasa umbellus togata*) haunts the dense woodland thickets, whence comes during the spring and summer the muffled tattoo of his remarkable " drumming."

The busy inquisitive little Chickadee (*Penthestes atricapillius*) with his pleasing " Chicka-dee-dee-dee," is a real companion, remaining steadfast and true all the year round, and coming for his meals of fat or suet, as often as a supply is forthcoming, in the coldest weather.

Last in this review, but not least, is the Bluebird (*Sialis arctica*), one of the first to announce the arrival of spring, his bright colour in vivid contrast to the sombre hues of the passing winter, his gentle voice redolent with faith and hope for the coming season.

Mr. Miller Christy complimented Mr. Hardy on his skill in making

the skins and referred to several visits he had himself paid to Western Canada in earlier years, when he had made acquaintance with all the forms of birds exhibited.

On the President's motion, the thanks of the meeting were accorded to the several exhibitors and donors.

Mr. C. Nicholson read a paper on "The Rosy-marbled Moth in Britain (with special reference to Essex)" (printed *ante*, p. 29), and exhibited specimens of the moth and its cocoon.

Thanks were passed to Mr. Nicholson for his paper.

The President then called upon Mr. George Morris, who read a paper on "Some Neolithic Sites in the Valley of the Essex Cam" (see *ante*, p. 49), illustrating same by lantern-maps and diagrams, and by the exhibition of specimens of implements and flakes from the various sites described.

An interesting discussion followed the reading of the paper, in the course of which Mr. Hazzledine Warren remarked that he agreed with the author in regarding the implements exhibited as being of Neolithic date, although some advanced students of to-day would call them Palæolithic; he added that patination is due to local conditions and not to age.

A hearty vote of thanks was accorded to Mr. Morris for his communication, and the meeting adjourned.

VISIT TO THE MUSUEM OF ECONOMIC BOTANY. KEW GARDENS (541st MEETING).

SATURDAY, 18TH FEBRUARY, 1922.

A bright sunny day, which reminded one that spring was not far distant, tempted some 25 members to attend this meeting, which had been arranged for the purpose of making an inspection of the Museums in the Kew Gardens, under the conduct of our Vice-President, Professor G. S. Boulger, F.L.S., F.G.S.

The party assembled at 2 o'clock at the Victoria Gate entrance to the Gardens, where it was met by the Conductor, and at once proceeded to Museum No. 1.

Here Professor Boulger began a detailed account of the history of the building and its collections, and remarked that the latter, though all of economic importance, were arranged in strict scientific sequence of the natural orders of plants, and not according to their economic value; but he pointed out that economic characters run with the natural orders with remarkable unanimity.

It is impossible here to give a *resumé* of Professor Boulger's lecture, which was of the most detailed character and which lasted until the visitors were turned out of the Museum at closing time! Briefly, the Professor touched upon each of the more valuable economic products of the Dicotyledons (to which Class this Museum is devoted, Museum No. 2 being in like manner given up to the Monocotyledons), such as opium, gamboge, tea, cotton, kapok, cocoa, flax, linseed oil, senna, gum arabic, etc., treating each subject with a wealth of personal knowledge which did not fail to impress his hearers.

Before leaving the Museum the President expressed the cordial thanks of these present to our Vice-President for his valuable exposition, and

referred to Professor Boulger's long connection with the Club, he being our second President, serving as long ago as 1883–1884, and our oldest surviving Vice-President.[1]

An adjournment for tea at a restaurant close to the Gardens was then made, and the Party separated, after a very enjoyable afternoon.

ORDINARY MEETING (542nd MEETING).

SATURDAY, 25TH FEBRUARY, 1922.

This meeting was held as usual in the Municipal College, Romford Road, Stratford, at 3 o'clock on the above date, with the President, Mr. R. Paulson, F.L.S., F.R.M.S., in the chair. 52 members were present.

Mr. A. W. Mera, of 5, *Park Villas, High Road, Loughton*, was elected a member of the Club.

The President referred to the recent election to the Presidency of the Quekett Microscopical Club of one of our members, Mr. D. J. Scourfield, and offered his congratulations to him for the warm reception he had received on that occasion. Mr. Scourfield thanked the President and the members present for their kind congratulations.

In anticipation of the approaching annual meeting, nominations were made for new members of Council and Officers for the ensuing year.

Notice was given by the Hon. Secretary, on behalf of the Council, of certain proposed alterations in the Rules to be proposed to the Annual Meeting.

Mr. J. Avery exhibited a special series of Essex prints, comprising some fifty etchings and drawings executed during the years 1817 to 1823 by an anonymous artist, under the initials "M.S." Some of the prints are well known to Essex collectors, but in consequence of others not being named they have escaped notice in the past. They have now been identified and the exhibit was probably the most complete collection relating to Essex by this unknown artist.

The Curator exhibited a set-up Herring Gull and a Dunlin (skin), both from Low Street, Tilbury, which had been presented (in the flesh) to the Club's Museum.

Mr. Thompson also exhibited a Little Grebe from Felsted, which had been found by our member, Mr. J. H. Owen, in the river there, floating dead, with a Bull-head firmly fixed in its throat. This interesting specimen had been presented to the Club's Museum by Mr. Owen, and had been set-up in the Museum with a cast of the fish in its jaws, exactly as found.

Mr. E. T. Newton exhibited, and presented to the Museum, the leg-bones of a small Deer, articulated for exhibition.

Thanks were passed to the donors and exhibitors.

The Hon. Secretary (in the author's absence) read, in abstract, a paper by Mr. H. Whitehead, B.Sc., on "The British Fresh-water Planarians (Tricladida)" (printed in full, *ante*, p. 1).

1 The unexpected announcement of the death of Professor Boulger on May 4th, at the age of 69, came as a great shock to those who, although they had known him for so many years, had always thought of him as a vigorous man still in the prime of life. The President represented the Club at the funeral of our lamented Past President at Richmond, on May 9th.

The thanks of the meeting were accorded to Mr. Whitehead for his communication.

The President then called upon Miss Winifred E. Brenchley, D.Sc., Botanist to the Rothamsted Experimental Station, who gave a lecture entitled "Weeds and their relation to Soils and Crops," which she illustrated by an excellent series of lantern slides. Dr. Brenchley kindly furnishes the following *resumé* of her address :—

WEEDS AND THEIR RELATION TO SOILS AND CROPS.

A weed on arable land may be defined as any plant other than the crop sown, but on grass-land it may be either a plant of low feeding value or one that grows so luxuriantly as to crowd out more valuable species.

Weeds do damage by robbing crops of food, water and light, and so reducing the yield, by adding expense to cultivation, by spoiling wool and seeds, and, in the case of parasitic weeds like dodder, yellow rattle and broomrape, by actually enfeebling or destroying the crop plants which are used as hosts. The weed problem is of such salient importance to agriculture that in many parts of the world active legislation is directed towards the destruction of weeds, and in this country a Seed Testing Station has recently been established at Cambridge to ensure the purity of the crop seeds sown.

If weeds are left unchecked they will crowd out the crop entirely, and eventually the vegetation will revert to the natural condition for the area. Half an acre of wheat left unharvested in 1882 at Rothamsted was covered with a dense weed-flora four years later, the wheat having almost entirely disappeared, and now the area has reverted to woodland. The crop plants are usually alien and depend upon man's assistance in order to flourish, they are therefore unable to withstand the keen competition of the weeds, which are usually native or very adaptable to conditions.

Weeds are readily distributed by the agency of wind, animals, manure, farm implements, etc., and in addition the seeds are often able to maintain their vitality for long periods when buried in the soil. Experiments have shown that after 32 years burial no less than three million arable weed-seeds can survive per acre, and after 10 years burial as many as 19 million ! Even after being eaten by animals and birds and voided in excreta large numbers of weed-seeds survive uninjured.

Many weeds have been transferred from one part of the world to another, especially the commonest and most harmful weeds, which are very adaptable to various conditions of soil and climate.

For some years past a weed survey has been carried out from Rothamsted to determine the associations of weeds with particular soils and crops. A preliminary classification has been made for arable weeds, but this may need modification as more records become available.

ASSOCIATION WITH SOILS.

The nature of the soil plays an important part in determining the weed-flora. The first idea was that certain weeds, as *individual species*, would be characteristic of certain soils. This rarely proved to be the case, but instead *groups of species* are characteristic. There is no hard and fast line between the weeds occurring on different soils : with few ex-

ceptions most weeds occur on occasion on *all* types of soil, but many are now frequent and more abundant on some soils than on others.

A. Weeds of General Occurrence.

These are usually abundant on any and every soil, and are provided with very efficient methods of propagation by seeds and underground parts. Many of the worst weeds are included in this group, e.g., bent-grass, chickweed, curled dock, creeping thistle, shepherds purse, groundsel, fat hen, knotgrass, etc.

B. Weeds of Heavy Land.

Not at all well distinguished from those of ordinary loamy soil; very few are characteristic other than stinking mayweed, hoary plantain, corn buttercup and cut-leaved geranium, and to some extent black bent (*Alopecurus agrestis*).

C. Weeds on Chalky Soil.

The old idea of chalk-loving and chalk-hating plants does not altogether hold good. The dominant chalk-weeds of some districts are absent or rare in other chalk areas. The most generally characteristic weeds are white mustard, toadflax, mignonette, lamb's lettuce and hardhead.

D. Weeds of Sandy and very Light Land.

These afford the chief instance of weeds indicating a particular condition of soil; in this case, deficiency of lime. Sheep's sorrel, annual knawel (*Scleranthus annuus*) and spurry occur in abundance; corn marigold (*Chrysanthemum segetum*) appears to come in the same category.

ASSOCIATION WITH CROPS.

This is less clearly marked than the association with soils, but is quite distinctive. The habit of the crop is largely the determining factor, the time of sowing and methods of cultivation and sowing also playing a part.

A. Common Weeds of General Occurrence.

Usually found with all crops.

B. Cereals.

If stand is thin, low-growing weeds, as mayweed and lady's mantle, are able to flourish and cover the ground. If crop is heavy, then tall plants can flourish, e.g., wild oat, corn cockle, sowthistle, etc.

C. Roots.

The late sowing and drastic cultivation of the crop prevents many weeds from flourishing. Chickweed is one of the most characteristic weeds, as it clings round the roots and escapes destruction.

D. Clover, Tares, etc.

Most weeds are smothered out by the crop, but special varieties are usually introduced with this crop, including field madder, geranium spp., wild pansy, carrot, ribwort plantain and campion.

The results so far obtained are based upon records from fields from a limited number of counties and geological formations. Final conclusion cannot be drawn without wider experience, as local conditions may have

much effect. An extension of the weed survey is being carried on with the co-operation of workers in all parts of the country, and assistance in this work would be much appreciated. The information desired is :—

1. Place and County.
2. Date.
3. Soil (clay, loam, sand, peat, etc.).
4. Geological formation.
5. Manuring.
6. Crop.
7. List of Weeds :—
    a. Dominant.
    b. Sub-dominant
    c. Distributed.
    d. Occasional.
    e. Scarce or rare.
8. Calcium Carbonate content of soil.
9. Any further information available.

More detailed and additional information will be gladly supplied from Rothamsted, and it is hoped that many members of the Essex Field Club will find it possible to help in obtaining records.

An interesting discussion ensued, and many questions were answered by the lecturer ; and a hearty vote of thanks was passed to Dr. Brenchley.

The meeting then closed.

VISIT TO WALTHAMSTOW (543rd MEETING).

SATURDAY, 11TH MARCH, 1922.

An all-day visit to Walthamstow, in conjunction with the Gilbert White Fellowship and the Walthamstow Antiquarian Society, was arranged for this date at the kind invitation of Mr. George E. Roebuck, the Hon. Secretary to the last-named Society, and Librarian to the Walthamstow Urban District Council. The object of the meeting was to inspect the many places of antiquarian interest still remaining in the neighbourhood, and Mr. S. J. Barns, who acted as guide throughout the day, proved to be a well of learning in respect of the various spots visited.

Brilliant spring-like weather favoured the party and added greatly to the enjoyment of the excursion.

Just over 30 members of the conjoined societies assembled at St. James's Street Station shortly after 11 o'clock, and proceeded to the first place in the itinerary, THE ELMS, an old late 17th century house in the Lea Valley, where, to the party grouped in the forecourt of the house, Mr. Barns read an account of the building and its former owners ; one of these, Anthony Todd, was secretary to the postmaster-general and in his official capacity wrote the letter to Benjamin Franklin, on 31st January, 1774, which dismissed him from his post of Deputy Postmaster-General for America. Mr. Barns's reading of an auctioneer's account of the house and its surroundings, drawn up when the property was advertised for sale in 1813, provoked much amusement, and showed that the art of "puffing" is by no means exclusively a modern one.

A few minutes walk from The Elms, on a branch of the River Lea, are premises, marked on old maps as the Oil Mills, which were afterwards occupied by Williams, Foster and Co. as Copper Mills. It was from these copper rolling mills that, from copper smelted at Landore, in South Wales, were issued the tokens commonly known as Walthamstow pennies and halfpennies. They were issued during the years 1811 to 1814, specimens bearing these dates being extant, Dies of various patterns were used, the engraver of some of them being the celebrated artist, P. Wyon. These copper-rolling works were closed about 1857 and the machinery and plant removed to South Wales.

From The Elms the party retraced its steps to Blackhorse Road, whence a tramcar (one of several kindly placed at the disposal of the visitors by the Urban District Council during the morning) conveyed it to Higham Hill, where Essex Hall and its outbuilding, formerly the academy of the famous Dr. Eliezer Cogan, were thrown open for inspection by the present owners and occupiers, the Misses Cooper, who extended a most kindly and unaffected welcome to the visitors on arrival. Assembling in the unaltered schoolroom the party listened with appreciation whilst Mr. Barns read the following interesting account of the premises and their former distinguished occupants :—

Essex Hall.

Essex Hall I believe to be the oldest remaining house in Walthamstow, and from its high commanding position at the remote end of the parish, it is evident that it has always been a house of some importance and was doubtless one of those old-time self-contained properties dependent for its food supplies on the produce of its fields and cattle ; where the baking, brewing and buttermaking were done on the premises. Concerning the house itself I propose to say but little, leaving it to your judgment upon inspection, as varying views have been expressed concerning it, electing rather to deal with the wonderfully interesting associations of the place. Its situation will have commended itself to you, with its extensive views over the Lea Valley and in another direction over what were the old common fields of Higham Hill towards Marsh Street and Leyton. Evidences of several alterations are to be seen in the building and it is probable that the remaining portion is but a fragment of the larger edifice which once stood here. Internally I commend to your notice the panelling, but whether this is original or ancient I am unable to say, as it has been painted, and the fine piece of carving over the dining-room mantelpiece. After all, the outstanding features of the place, as I have suggested, are its associations, and it is best known, and most worthily, from its connection with the famous scholar and schoolmaster, the Rev. Eliezer Cogan and his more notorious and famous pupil, Benjamin Disraeli, afterwards Lord Beaconsfield and Prime Minister of England. Cogan came to Walthamstow on the invitation of a Mr. Solly, a wealthy merchant, living in Chestnut Walk, on the borders of Leyton and Walthamstow, prominently connected with the Presbyterian, or, as we should now say, the Unitarian congregation in Walthamstow, whose meeting house stood on the site of the present Congregational Church, opposite the Central Library. He accepted the invitation, and came to the pastorate of this church in 1801

as successor to the Rev. Nathaniel Phillips. Cogan was well known and famous as a scholar before he came to Walthamstow and founded the school which added lustre to his name. The son of a doctor, practising at Rothwell, in Northamptonshire, he was born in 1762, his father being then 64 years of age, and himself a ripe scholar, he became his little son's first tutor and made him, before he was six years of age, master of the Latin grammar. Under his father's tuition he apparently remained, for it is recorded that his only school experience embraced but a period of six months spent at the academy of the Rev. Samuel Addington, at Market Harborough. Before he was eighteen Cogan was a very fine classical scholar, expert in Latin and Greek, which latter language he acquired by his own exertions, and in later life was recognized as one of the finest Greek scholars of the age. His early religious training naturally turned his thoughts to the ministry, and with that end in view he entered the Theological Academy at Daventry in 1780, where, after three years as a student, he continued other three as an assistant tutor, a position for which his scholarship and attainments eminently fitted him. Entering the ministry in 1787 he had charge of a Presbyterian congregation at Cirencester, in Gloucestershire. Three years afterwards he married Mary Atchison, of Weedon, and started a school at Ware, which, in 1791, he removed to Enfield, and afterwards to Cheshunt, and then, in 1802, after having ministered to his Walthamstow congregation for nearly a year, he decided to take up his abode in the parish and acquired a hundred years' lease of this house, and for purposes of his school built two large rooms over the coach house and stables, in one of which we now are. Mr. Solly sent his sons to the school, and to one of them, Henry, we are indebted for the best account of the establishment, recorded in his very interesting autobiography, in two volumes, entitled "These Eighty Years." The school was unsectarian and the sons of wealthy parents of all creeds received their education here; the success of Cogan as a schoolmaster is marvellous, for it is astonishing how frequently the Admission Registers of the University Colleges of the period of the school's existence record the entrance of students as from Dr. Cogan's.

Cogan resigned the pastorate of the Marsh Street Meeting House in 1816, and from then until his retirement on 1828, at the age of 66, he devoted himself to his scholastic duties. Many who afterwards achieved fame received their education at Dr. Cogan's, prominent among whom are Travers, Mackmurdo and Solly as surgeons, Sharpe the Egyptologist, Russell Gurney, Recorder of London, and Nightingale, the father of Florence Nightingale; but the name above others that will always be inseparably associated with the school is the name of Benjamin Disraeli. Wilfrid Meynell, one of his biographers, says that "If Waterloo was won on the playing fields of Eton, Disraeli reached Westminster and the Cabinet by way of Walthamstow." I need not dwell upon the career of this brilliant politician and statesman, it is doubtless well known to you, but perhaps not so well known are his novels in which, thinly-disguised, he makes more than one reference to his school life in Walthamstow.

Upon his retirement in 1828 Dr. Cogan, at the request of his old pupils, sat for his portrait to T. Phillips, R.A., which, after exhibition in the Royal Academy, was presented to him at a dinner at the Albion Tavern in Alders-

gate Street. This oil painting is now in our Public Library ; it was presented to the Walthamstow Council in 1917 by the Misses Filliter, descendants of the famous original. This picture was engraved by Samuel Cousins, and copies are very occasionally to be met with. Mrs. Cogan died in 1850, in her 82nd year, after a married life of 60 years, and the worthy doctor passed to his rest five years later, on Jan. 21st, 1855, and was buried on Jan. 27th in the grounds of the Old Gravel Pit Chapel at Hackney.

In 1861 Mr. Joseph Cooper, a member of the Society of Friends, and a prominent and untiring worker in the cause of the abolition of negro slavery and general philanthropy, came into residence here with his family, and afterwards purchased the property ; it is to the kindness of his daughters, the Misses Cooper, that we owe the privilege of meeting here to-day. These ladies still conduct a Sunday School in these rooms, which has had a continuous existence of over 50 years, and their name for good works is as a household word in the neighbourhood.

Following the reading of the above paper a detailed inspection of the house and gardens was made, under the personal conduct of our hostesses, who pointed out many objects of interest, including the bell attached externally to the wall of the house, which the worthy Doctor rang to summon his pupils. After the Hon. Secretary had expressed the thanks of the visitors to the Misses Cooper, leave was taken, and the party again took tram for the Central Library, passing *en route* the remains of Elm Lodge, the birth-place of William Morris, and the Winns, where he lived as a youth.

Lunch was taken at the Central Library, the splendid lecture hall having been kindly loaned to the party for the occasion of the meeting by the District Council.

After lunch our indefatigable guide, Mr. S. J. Barns, read a short account of Walthamstow, briefly tracing its history and development from prehistoric times, and particularly from the time of the Domesday Survey down to its present status as a large and still-growing town of some 120,000 inhabitants. Mr. Barns went on to speak of some of the many historical characters who have in their day been associated in some way or other with Walthamstow. He said :—

" It was adjoining the churchyard that in 1527 George Monoux built the almshouses and school which he endowed, and the old buildings still stand as a monument to his charity to the poor and care for education. George Monoux lived at a house called ' Moones,' in what is now Billet Lane, at Chapel End : he was a great benefactor to the parish, providing it not only with the above institutions, but with a constant supply of pure water and a safe causeway over the frequently flooded marshes. The place of his birth is uncertain, but he was a prominent London citizen and merchant, although also identified with Bristol, in which city he served the office of mayor. Seven times Master of the Drapers' Company, thirty-four years alderman of the ward of Bassishaw, Sheriff in 1509–10, Lord Mayor 1514–15 and re-elected in 1528, he refused the office on the grounds of ill-health and after some trouble was released on payment of a fine of £1,000. He was also M.P. for the City of London in 1523. George Monoux died on 9th February, 1543–4, and was buried under an altar tomb in the Church ; the tomb has gone, but his brass, with that of his wife, still exists. . . .

" It is probable that near Hale End was the house occupied by George Gascoigne, soldier and poet. His poems were written between 1575 and 1589, and are now little read. Several of his dedicatory epistles to his noble patrons are dated 'from my pore house at Walkamstowe.' . . .

" William Morris was born at Elm House in Clay Street in 1834 and here he spent the first six years of his life. His parents then removed to Woodford Hall, where they resided until 1848, in which year Morris was sent to Marlborough College. The family returned to Walthamstow to a house, also in Clay Street, then known as Water House, but now as the Winns, a yellow-brick Georgian building, with a fine entrance hall and staircase and some panelled rooms; it had spacious pleasure grounds and a moat. Elm House has been demolished, but the Winns still exists and is now the property of the District Council. William Morris left Marlborough in 1851, and before entering Exeter College, Oxford, became a private pupil of the Rev. F. B. Guy, then an assistant-master at Forest School, and residing in one of the large houses in Hoe Street. In 1856 the Morris family left Walthamstow and William Morris's connection with the parish ceases. . . .

" Sir William Batten, Commissioner to the Navy, lived at Rectory Manor, a house demolished not very long since, its last occupant being Mr. David Howard, a name well known to members of the Essex Field Club. At Rectory Manor Batten was frequently visited by Samuel Pepys, the diarist. Pepys records that on 29th May, 1661, he was present at the christening of Sir William's grandson, at Walthamstow, but not being called upon to name the child he retained half-a-dozen silver spoons and a silver porringer, which he had brought with him to present. While the plague raged in London Sir William and Lady Batten took refuge at their Walthamstow house and in the following year he regaled his London friends with 'wine grown at Walthamstow, than which the whole company said they never drank better foreign wine in their lives.' "

Proceeding next to the Parish Church, a slight delay, consequent upon a wedding then being solemnized, enabled the visitors (now reinforced to over 50 in number) first to inspect the Monoux School, facing the churchyard, which is now used as a chapel by a troop of Boy Scouts.

The party was then welcomed to the church by the Vicar, the Rev. H. D. Lampen, M.A., Rural Dean, and his churchwardens, and here Mr. Barns gave a very complete and interesting account of the edifice and its numerous monuments to departed worthies. A tour of the church was then made under Mr. Barns' guidance, and the church plate was exhibited to the party; a pilgrimage was also made by some of the botanical visitors to the tomb of the Forsters in the churchyard.

From the church the party proceeded to Walthamstow House, in the occupation of the Sisters of Mercy as a Convent School; by kind permission of the Rev. Mother Superior detailed inspection of the building and grounds, including the dormitories and " sick ward " and the beautiful chapel, was granted to the visitors, a kindness which was greatly appreciated by all. Here Mr. Barns once again expounded the earlier history of the house, which was built early in the 19th century, by Sir Robert Wigram, Bart., a wealthy tea-shipper. The house was afterwards used as a school, and here Sir Morell Mackenzie, the famous throat-specialist,

was a pupil. Before taking leave Mr. Percy Thompson, in the name of the party, expressed grateful thanks to the Rev. Mother Superior for the privilege of inspection accorded.

Returning to the Central Library in the High Street, tea was served shortly after 5 o'clock, following which the Chairman of the District Council, Councillor W. J. McGuffie, J.P., welcomed the visitors to Walthamstow in a short speech.

Mr. Paulson, on behalf of the Essex Field Club, and Dr. W. Martin on behalf of the Gilbert White Fellowship, expressed the thanks of the visitors to the District Council for its welcome and for its kindly forethought in providing for the comfort of the party in tramway accommodation and the use of the spacious hall in which they were then assembled; these thanks were heartily accorded by those present. Councillor McGuffie replied, and also the lady chairman of the Library Committee of the Council, expressing their pleasure at being present and their satisfaction that the day's meeting had proved to be so enjoyable.

Mr. Percy Thompson proposed the thanks of the party to our conductors and organisers of the meeting, Messrs. Barns and Roebuck; these were heartily given, and Mr. Barns made a suitable reply.

The visitors then dispersed.

ORDINARY MEETING (544th MEETING) AND ANNUAL MEETING (545th MEETING).

SATURDAY, 25TH MARCH, 1922.

These meetings were held in the Physical Lecture Theatre of the Municipal College, Romford Road, Stratford, with the President, Mr. Robert Paulson, F.L.S., F.R.M.S., in the chair. 42 members attended.

Mr. Hugh Boyd Watt, of 90, *Parliament Hill Mansions, Lissenden Gardens, Highgate Road, N.W.*5, was elected a member of the Club.

Mr. Avery exhibited a series of old prints illustrating the Saffron Walden district.

The Curator exhibited a cased specimen of Golden Eagle from Sutherland, also a set-up Canadian Grey Squirrel, from near Glasgow, both from the Museum collections.

Mr. Thompson also exhibited a quartzite pebble from Sutton Park, Warwickshire, from the Bunter Pebble Beds, which showed polish due to sand-blast action during desert conditions; and, for comparison, a quartz-pebble from the desert at Assouan, Egypt, which showed similar surface polishing.

The thanks of the meeting were passed to the exhibitors.

The business of the annual meeting was then taken.

The minutes of the last annual meeting were read and confirmed.

The Hon. Treasurer presented his statement of accounts for the year ending 31st December, 1921, and moved formally that they be received and adopted. Mr. Drummond seconded. On being put to the meeting the motion was carried *nem. con.*

The Hon. Secretary read the annual report of the Council for 1921.

On the President's motion, seconded by Miss Heath, the report was received and adopted *nem. con.*

The Hon. Secretary explained the circumstances which had decided the Council to propose to the annual meeting that the existing rules be amended as follows :—

Rule X. to be amended so as, in the case of future members only, to increase the annual subscription to one guinea, with an additional subscription of a half-guinea for each additional member of the same family residing in the same house, and willing to receive between them one copy only of the Club's publications ; and an entrance fee of 5s. to be imposed upon all new members.

A new Rule, No. XV.a, to be made :—

" That it shall be within the power of the Council to remove any member from the list whose annual subscription is more than two years in arrear."

On being put to the meeting from the chair, each of the above was adopted without dissentient.

No nominations having been handed in other than those made at the meeting held on 25th February last, the President formally declared the persons then nominated to be duly elected as new members of Council and officers for the ensuing year, as follow :—

As President, Mr. Robert Paulson, F.L.S., F.R.M.S.

As New Members of Council, Mr. A. F. Hogg, Mr. H. Mothersole, Mr. Hugh Main, B.Sc., F.E.S., and Mr. Charles Bestow, F.R.M.S.

As Hon. Treasurer, Mr. J. Avery, F.C.A.

As Hon. Librarian, Mr. F. J. Brand.

As Hon. Secretaries, Messrs. W. Cole, A.L.S., and Percy Thompson, F.L.S.

As Hon. Editor, Mr. Percy Thompson, F.L.S., assisted by Mr. H. Whitehead, B.Sc.

As Auditors for 1922–23, Mr. C. Nicholson, F.E.S., and Mrs. C. Whitwell.

The members of the Cole Pension Committee were re-appointed for the ensuing year.

The President thanked the members for the great honour shown him by his re-election for a third term of office, and promised to do his utmost for the good of the Club in the coming year ; he took that opportunity of expressing his thanks to the officers of the Club for their help and co-operation.

On taking his seat the President was warmly applauded.

Mr. Avery moved a resolution of sympathy with the relatives of our lately-deceased member, Mr. Andrew Johnston ; the President seconded ; and the resolution was carried in silence *nem. con.*

The President then delivered his presidential address on " Birch Groves of Epping Forest " (see *ante*, p. 69), which he illustrated by a series of lantern photographs and diagrams, and by specimens.

At the conclusion of the address, Miss A. Lorrain Smith moved " That the President be thanked for his address, and that he be asked to allow it to be published in the Club's journal." Mr. Drummond seconded ; and, on being put to the meeting, the motion was carried *nem. con.* with applause.

The President thanked the members for their attention, and the proceedings terminated.

ESSEX FIELD CLUB.

REPORT OF THE COUNCIL FOR 1921–22, PRESENTED TO THE ANNUAL MEETING ON MARCH 25TH, 1922.

LADIES AND GENTLEMEN,

The activities of the Club have been maintained in full measure during the past year.

Since our last Annual Meeting we have lost 22 Members by death or resignation, including one of our Honorary Members, Dr. Henry Woodward, LL.D., F.R.S., F.G.S., etc., whose lamented decease at the ripe age of over 88 years took place on 6th September last. We have also to deplore the recent death, on 28th February last, in his 87th year, of Mr. Andrew Johnston, J.P., D.L., of Woodford, whose name all Essex people hold in respect. Mr. Johnston was an original Member of the Club, and in its earlier (and his own younger) days, took an active part in its work.

During the year 26 new Members have joined us, so that the present membership of the Club stands at 17 honorary members and 307 ordinary members, totalling 324.

The attendance at our Stratford Meetings has been very satisfactory, ranging from 48 to 66 on each occasion, with an average of 54.

During the year several valuable papers or lectures have been read or delivered to the Club ; among these may be cited the President's Address on "Ten Years' Progress in Lichenology in the British Isles," Dr. Brenchley's lecture on "Weeds and their Relation to Soils and Crops," Mr. Scourfield's lecture on "The Logarithmic Spiral in Nature," Mr. Seabrook's lecture on "The Nile in the Service of Egypt," Mr. Morris's paper on "Some Neolithic Sites in the Valley of the Essex Cam," Mr. Nicholson's paper on "The Rosy-marbled Moth in Britain," Mr. Main's paper on "Atypus affinis in Epping Forest," and Mr. Whitehead's paper on "The British Fresh-water Planarians."

The field meetings also have been well supported, an average number of 46 members taking part. Thanks are due to our member, Mr. James Keeves, for his kindly hospitality at "Haslemere," Hutton Mount, during our summer visit to that neighbourhood.

The Club's Museum at Stratford has been enriched during the past twelve months by many valuable accessions ; among these may be specially mentioned the mounted specimen of a Roller from Ramsey, the 50 skins of Canadian birds presented by Mr. Hardy, the interesting specimen of Little Grebe, choked by a Bull-head, and a series of 20 nestling birds in down. The exhibits of living plants, and the aquaria of living marine organisms, have been kept going throughout the year, thanks to the kindness of certain of our Members in providing constantly fresh supplies of specimens.

The appointment during last summer of Mr. G. A. Hardy as museum-assistant has resulted in many examples of his skill as a taxidermist being exhibited in the Museum and at our meetings.

Some 193 volumes have been added to the Club's Library during the year, the total number of bound volumes now amounting to 4,567, in addition to numerous unbound parts and pamphlets. Some important dona-

tions of photographic views have also been made to our Pictorial Survey of Essex.

Your Council wishes to record its grateful thanks to those members who, by contributions of specimens, books or photographs, or by personal service, have aided this satisfactory progress.

Miss Oxley has maintained her exhibition of living plants, twigs, etc., at the Forest Museum at Chingford, throughout the year, and to her also the thanks of the Club are due.

The ESSEX NATURALIST has been issued at regular half-yearly intervals, one Part in October last and one Part in March ; the last instalment is just in your hands.

The increased cost of printing and postage has compelled your Council, after careful consideration and the appointment of a special Committee to review the position, to recommend to you certain alterations in the Rules, involving an increased annual subscription, and the re-imposition of an entrance fee, in the case of new members.

Public action has been taken by your Council in connection with a rumour of the intended demolition of the ancient Elizabethan court-house at Barking, and with reports of certain contemplated interferences with the natural beauties of parts of Epping Forest.

NOTES : ORIGINAL AND SELECTED.

Meldola Medal.—The first award of the newly-instituted Meldola Medal for chemical research was made at the annual Meeting of the Institute of Chemistry on March 1st, 1922, to Dr. Christopher Kelk Ingold, A.R.C.S., A.I.C.

Adders in Epping Forest.—Adders are not uncommon along the edge of the marshes at South Benfleet and Mucking. I saw three in one day in Epping Forest in March, 1914, one of them being the copper-red variety, but since then I have not seen one there, and I believe that, owing to the increase of bracken and forest fires, these reptiles are now very rare in the Forest.—G. DENT.

Raven at Latton.—I saw a Raven at Latton Park in October, 1920. Its note was unmistakeable, and I had a good view of the bird near by.—G. DENT.

Badgers in Essex.—Badgers are much commoner in the County than is generally supposed. In the south-eastern parts they are very numerous, particularly about Laindon, Grays, Tilbury, Dawes Heath and the surrounding country. On one farm of about 1,000 acres, where the owner wished to poison them on account of their supposed depredations among partridge eggs, I dug out twelve full-grown badgers in 1920, all of which found new homes within the county. Badgers are common in the Epping Forest district and in Hainault Forest, and are found as far as Ongar, Blackmore and South Weald. The soil of the Roothings is unsuitable for them, but they occur about Braintree and Colchester, and also fairly commonly about Saffron Walden, Barkway, and the Hertfordshire borders. In fact, wherever the right soil is found, throughout Essex, there also will Badgers be found.—G. DENT.

Badgers at Bocking.—There is a strong colony of Badgers in a wood near Bovingdon Hall. Two have been recently killed, one by foxhounds, but there are still signs of several being at home.—ALFRED HILLS.

Spotted Redshank in Essex.—While shrimp trawling on the Stour River, about three miles above Harwich, on October 9th, 1921, I heard the call-note of a Spotted Redshank (*Tringa erythropus*). On sailing close to shore to make certain, I heard it again more distinctly. On the next day I was at the same place in a punt and again heard the note many times during the tide, but could not get close and failed to pick out the bird from the flocks of Redshanks it was with. I am well acquainted with the Spotted Redshank, and believe its call to be too distinctive to be confused with any other wader.—C. E. HAMOND, in *British Birds*, xv., Jany. 1922, p. 190.

Smew and Black-necked Grebes in Essex.—Mr. William E. Glegg records (in *British Birds*, xvi., p. 26) the occurrence of a female Smew (*Mergus albellus*) on the Walthamstow Reservoirs on March 18th, 1922, and several pairs of Black-necked Grebe (*Podiceps n. nigricollis*), in breeding plumage, on the Blackwater, near Bradwell, on April 15th, 1922.—ED..

Arctic Skua in Essex in June.—An Arctic Skua (*Stercorarius parasiticus*) was seen on June 10th, 1922, by me and three others, at Bradfield, Essex. It was of the dark form and when first seen was circling over the river, but, apparently attracted by a terrier which I had with me, it flew up to us and circled two or three times over us at a height of about 100 feet, then made off inland, due west.—WALTER B. NICHOLS, in *British Birds*, xvi., July 1922, p. 55.

Monotropa Hypopitys (L.) in Epping Forest.—A specimen of this rare plant was gathered by Mr. Conway Gould, of Loughton, in Great Monk Wood, under hawthorn bushes, on July 16th, 1922, and has been presented to the Club's Museum at Stratford. The Yellow Bird's nest has only once before been recorded from the Forest : in July 1887 the late James L. English found several plants in Epping Forest (see note in ESSEX NAT., vi., 1892, p. 131).—PERCY THOMPSON.

Coys' Garden at North Ockendon.—Mr. R. T. Gunther calls attention in the *Times* of March 13, 1922, to his recent discovery that the Ivy-leaved Toadflax was first introduced into Britain, at the beginning of the 17th century, into William Coys' garden, at "Stubbers," North Ockendon. Coys' garden-list of 1617 gives the first mention of the plant in this country.

John Goodyer notes on September 20, 1621 : "I never saw this growinge but in the garden of my faithfull good friend Mr. William Coys in Northokington in Essex, and in my garden at Droxford [Hants] of seeds receaved from him in Anno 1618."

It was in Coys' Essex garden, also, that, in 1604, *Yucca gloriosa* first flowered in this country.—EDITOR.

Abundance of Vespidæ in 1921.—Wasps appear to have been much more numerous in many parts of the country in 1921 than of late years. On the Copped Hall Estate, near Epping, which covers about a third of a square mile, over 420 nests have been destroyed during the past season.

I saw some 20 of these, all of which, save two, were those of *V. vulgaris*, but I was informed by the head gardener that practically all the nests destroyed belonged to either *V. vulgaris* or *V. germanica*, and that the nests of each species appeared to be segregated on different sides of the estate. He could not account for this.

Between Walthamstow and Chingford I personally took 21 nests between June and December, 1921, 14 being *V. germanica* and 7 *V. vulgaris*. The prevalence of these two common species and the almost total absence of *V. rufa*, *V. norvegica* and *V. sylvestris* in this part of the country during the year seem to suggest that when the common or ground building species are exceptionally plentiful, the less common species, which usually occur in the district, are crowded out by competition.—CHARLES NICHOLSON, F.E.S.

The Stinkhorn Fungus (*Ithyphallus impudicus*).—Everyone familiar with our Essex woodlands must be familiar also with this remarkable fungus—or, at any rate, with its disgusting odour ; for it grows, I believe, in most woods throughout the county and it advertises its presence therein very effectively by means of its much-more-than-remarkable smell.

The fungus occurs, as a rule, sparingly and sporadically, either singly or in small numbers. It was not until the year 1911 that I saw it growing anywhere in Essex in anything like considerable numbers. In that year I saw it growing very freely in Broom Wood, Chignal St. James, adjoining my own garden. During the two succeeding years its numbers increased steadily, and this led me to observe it specially.

In the summer of 1914 the numbers seemed to reach a climax ; for, at the end of May or beginning of June in that year, examples sprang up in extraordinary abundance in all parts of the wood. They were often to be seen in groups, generally around the rotting stump, or " stool," of some coppiced hornbeam or beneath the dark shade of a thick bush of the same. They continued to spring up, though in decreasing numbers, until the late autumn, in spite of a severe drought then prevailing. About the end of November the phenomenon largely ceased, but on 15th January following (1915) I noticed one specially large and fine example beneath a bush.

After this I saw no more Stinkhorns until about the first week in June, after which they again became numerous—so much so that a walk through the wood was rendered quite unpleasant by reason of the all-pervading smell they emitted. As in the previous year, they grew largely in groups and flourished in spite of the extremely dry weather which was then again prevalent. Later, the appearance of fresh plants ceased almost entirely, but about the middle of September a new crop began to appear, and for some time examples were again abundant. After this, distractions due to the war prevented further observations, but I believe that in succeeding years the fungus appeared in normal numbers only.

It was always interesting to watch the development of an individual Stinkhorn. First of all, one saw a small round white object, resembling a marble, growing half hidden among the fallen leaves of oak and hornbeam. This increased slowly and became eventually about the size of an ordinary hen's egg—in fact, it looked, both in colour and shape, just

like one end of such an egg sticking up among the dead leaves. At this stage there usually ensued a period of quiescence, varying from a couple of days up to, I believe, a fortnight—the duration of this resting stage depending, no doubt, on the temperature and the rainfall in combination. Examination of the egg, or *volva*, at this period showed that it was soft and flabby to the touch and filled with a thick, glary, unpleasant-looking yellowish-white slime. Then suddenly some morning one found that the "egg" had hatched (so to speak) and the fungus had sprung up to its full height of from five to eight inches. How long this development occupies I know not, but as I never saw an example whilst it was in progess I take it that the change is rapid, occupying no more than an hour or, at most, a few hours.

It was interesting, too, to observe what happened immediately after this sudden development of the fungus was completed.

The comparatively small thimble-shaped cap, or *pileus*, which now tops the thick upright stem, has on its upper surface a number of raised ribs, arranged in an irregular reticulated pattern. Further, the whole top of the cap is covered by a thick glutinous slime, dark green at first, afterwards becoming almost black, which covers both the raised ribs and the depressed spaces between them. In this sticky slime are enclosed the spores of the fungus, and from it emanates the horrible smell always associated with the plant.

Immediately on the complete development of the fungus this putrid smell attracts numerous large flies of various kinds (chiefly the large black wood-fly and the blue-bottle), which settle thickly upon and often completely cover the cap. The flies at once start to devour the dark-coloured slime, and in so doing they become more or less smeared with it (or at least get some of it upon their feet and legs). Then, their appetites sated, they fly away, carrying with them some of the sticky slime, some of which they inevitably deposit wherever next they happen to alight. They thus effect a more or less wide dispersal of the spores of the fungus, which are contained in the slime. Occasionally, late in the summer, I saw wasps on the *pileus*, also apparently consuming the black slime (and, no doubt, afterwards helping, like the flies, to disperse widely the spores contained in it), but I have no note of having seen any other insect similarly engaged.

After this the entire fungus soon begins to wilt, bends over sideways, gradually rots away, and finally disappears altogether.—Miller Christy, F.L.S.

REVIEW.

The Evolution of the Essex Rivers and of the Lower Thames, by J. W. Gregory, D.Sc., F.R.S., Professor of Geology at the University of Glasgow, 1922, demy octavo, 68 pp., 10 illust. Colchester: Benham and Company Limited, 2s. 6d. net.

In this little volume Professor Gregory adds one more to the many attempts that have been made to determine the relative ages of our various Essex gravel patches. He accepts the view that the larger Essex river valleys and their older terrace-gravels are pre-glacial, and postulates the existence, in late Oligocene or early Miocene times, of an east to west river across mid-Essex, coming from the head-waters of the Ouse, linking on with the upper course of the Lea, and emptying into the Blackwater estuary; in this way he accounts for the introduction of Buckinghamshire detritus (Rhaxella chert) into our Roding gravels.

Professor Gregory gives some important new facts concerning the occurrence of Pleistocene foraminifera in Glacial deposits, supporting the view of the marine deposition of these beds as against the more generally accepted opinion that they were formed by land-ice, which he regards as unconvincing. "That the Essex Boulder Clay was deposited in water and not on land under a sheet of ice seems to agree best with the available evidence."

Whether the author's deductions satisfy all the puzzling facts of the distribution of the various constituents of the Gravels of our County remains open to debate, but his hypothesis is at least a plausible one, and is worked out with considerable ingenuity and with local knowledge. No student of our Essex drift deposits can afford to neglect this suggestive book.—P.T.

WILLIAM COLE, A.L.S., F.E.S

It is with deep regret that we announce the death, on June 27th, 1922, in his 79th year, of William Cole, Founder and for 42 years principal Honorary Secretary of our Club. A full biographical notice, with portrait, of the deceased will be given in the next issue of the ESSEX NATURALIST. For the present it suffices to record the great sense of personal loss which his fellow-officers of the Club, who have worked with him for so many years, feel at his death.

Requiescat in pace.

PUBLICATIONS of the ESSEX FIELD CLUB.

The specially-valuable feature of the Publications of the Club is that they are almost wholly local in character. The volumes (comprising over 6,000 pages) contain hundreds of papers on the Natural History, Geology, and Pre-historic Archæology of Essex. The articles are of the greatest interest to all persons having any regard for the County, and the scientific accuracy and detail of a large proportion of them make them of value also to students of the subjects named living elsewhere.

The publications are all of demy octavo size. Nearly all contain numerous illustrations, in addition to plates. All are still in print, but some are becoming *very rare*.

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"THE ESSEX NATURALIST" (in parts).

This publication (of which the nineteenth volume is now completed) has been since 1887 the official organ of the Club. In it are published all the scientific papers read before meetings of the Club, reports of meetings, contributed notes, &c.

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For continuation see over.

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