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TRANSACTIONS OF THE HERTFORDSHIRE NATURAL HISTORY SOCIETY
AND FIELD CLUB. Vol. XIV, Part 3. June, 1911.

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ST. ALBANS AND ITS NEIGHBOURHOOD.

AN ACCOUNT OF THE
TOPOGRAPHY, GEOLOGY, HYDROLOGY, CLIMATE, FLORA, FAUNA,
AND ARCHÆOLOGY OF THE DISTRICT,
WITH A GUIDE TO THE HERTFORDSHIRE COUNTY MUSEUM.

BY MEMBERS OF THE
HERTFORDSHIRE NATURAL HISTORY SOCIETY.

EDITED BY JOHN HOPKINSON, F.L.S., F.G.S., F.Z.S.,
F.R. Met. Soc., Assoc. Inst. C.E.

ILLUSTRATED BY
VIEWS, A PLAN OF THE CITY, AND A MAP OF THE VICINITY.

LONDON:
DULAU & CO., LTD., 37 SOHO SQUARE, W.
HERTFORD:
STEPHEN AUSTIN AND SONS, LTD., PRINTERS, FORE STREET.

1911.

HERTFORDSHIRE NATURAL HISTORY SOCIETY AND FIELD CLUB.

THE objects of the Society are: 1. The investigation of the Meteorology, Geology, Botany, Zoology, Ethnology, Pre-Norman Archæology, and Topography of the County of Hertford. 2. The publication of the results of such investigation made by its Members. 3. The dissemination amongst its Members of information on Physics and Biology. 4. The formation of a Library of works on Natural History. 5. The discouragement of the practice of removing rare plants from the localities of which they are characteristic, and of exterminating rare birds, fish, and other animals.

Evening meetings of the Society are held in the rooms of the Watford Urban District Council (Upton House) once a month during the Winter and Spring, and also occasionally at St. Albans and other places. Field meetings are held during the Spring and Summer in various parts of the County.

Members pay an Entrance Fee of 10s., and an Annual Subscription of 10s. for which they may, if preferred, compound for life by a payment of £5. Ladies are eligible for election.

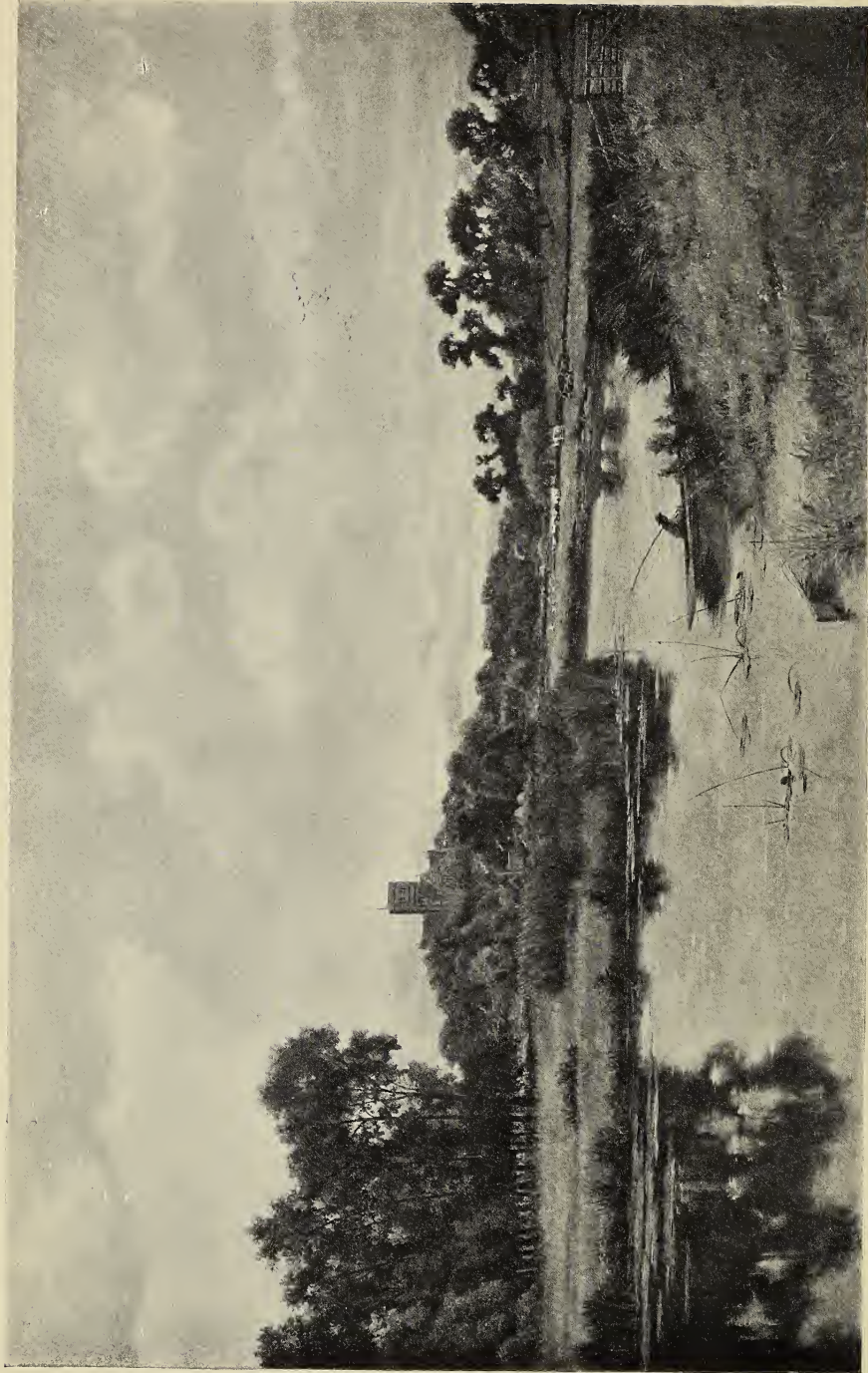
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THE RIVER VER AT ST. ALBANS.

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XXV.

ST. ALBANS AND ITS NEIGHBOURHOOD.

By Members of the HERTFORDSHIRE NATURAL HISTORY SOCIETY.

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I. INTRODUCTION.

The following account of features and objects of scientific interest in and around St. Albans has been specially compiled for use during the 16th Annual Congress of the South-Eastern Union of Scientific Societies, meeting at St. Albans from 7th to 10th June, 1911, under the presidency of Sir David Gill, K.C.B. It is hoped, moreover, that it may also form a scientific guide to the city and its immediate neighbourhood of permanent value, showing what we now know of the various subjects discussed. It will also by its omissions indicate what work there is yet to be done to complete our investigations.

From exigencies of space most of the subjects are treated in a very cursory manner, no attempt being made to give complete lists of the Fauna and Flora of the district. For such lists it is necessary to consult previous volumes of the 'Transactions' of the Watford as well as of the Hertfordshire Natural History Society, the 'Flora of Hertfordshire' by the late Mr. A. R. Pryor, published by the Society in 1887, and the first volume of the 'Victoria History of the County of Hertford' (1902).

When this Society was founded scarcely anything was known of the Natural History of Hertfordshire, using that term in its widest sense, except the geology, to which the members have added much information in the 'Transactions.' The meteorology of

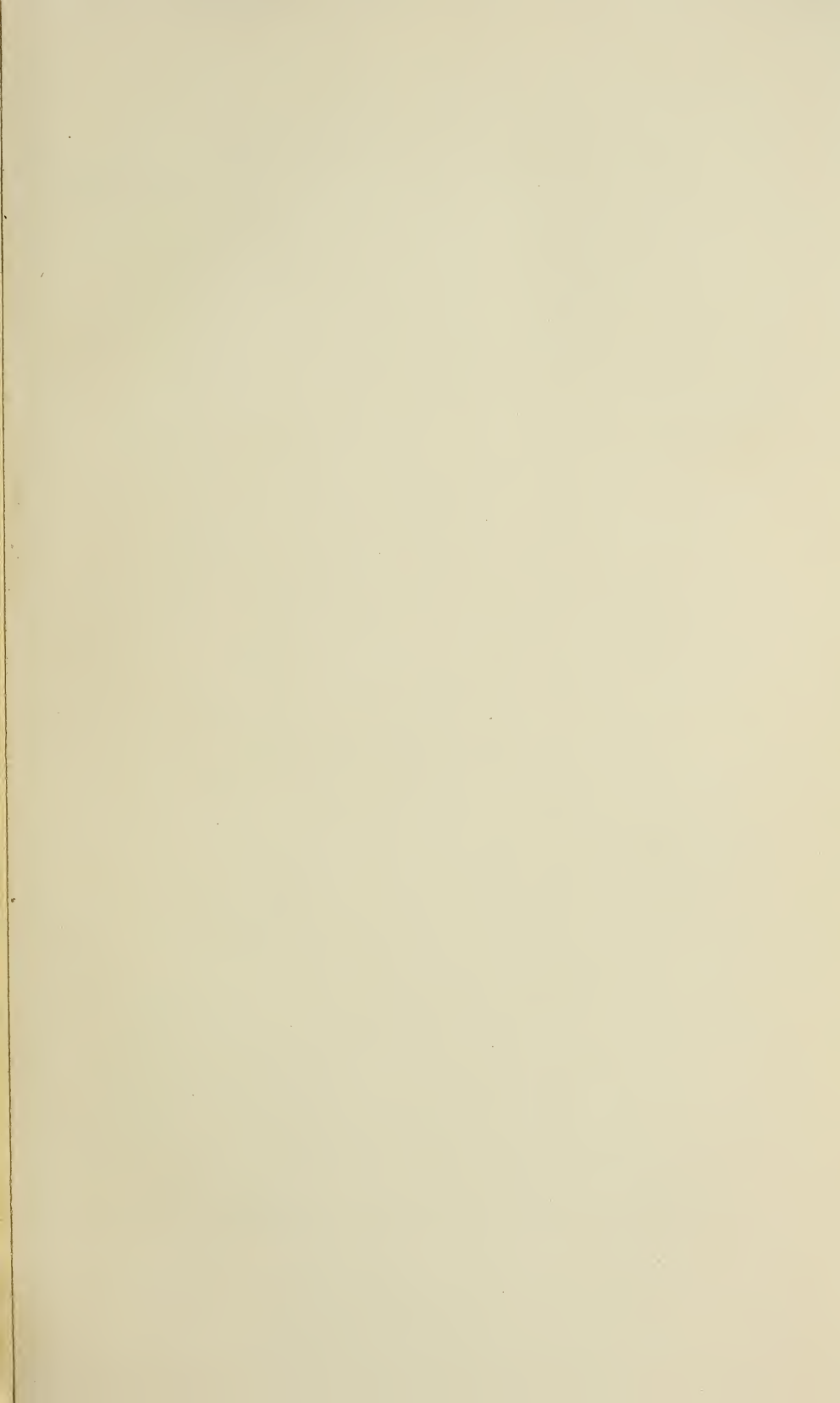
the county has been very thoroughly investigated. For 21 years the monthly results of observations at four Climatological Stations, one of which is in St. Albans, have been published annually; and for the whole period of 35 years tables of the monthly rainfall at numerous stations, now numbering over fifty, of which seven are in the district under review, have appeared. The information they give has proved of great practical value in questions relating to water-supply. In addition to the publication of Mr. Pryor's 'Flora,' much botanical information has been given, chiefly relating to cryptogamic plants. In almost all departments of zoology good work has been done, and it may be said that practically all the knowledge we possess of the zoology of Hertfordshire, and particularly of that of the neighbourhood of St. Albans, is due to the existence of the Society. The pre-historic archæology and the topography of the county have also received much attention, the most complete list extant of the maps of any English county being the catalogue of Hertfordshire maps published by the Society.

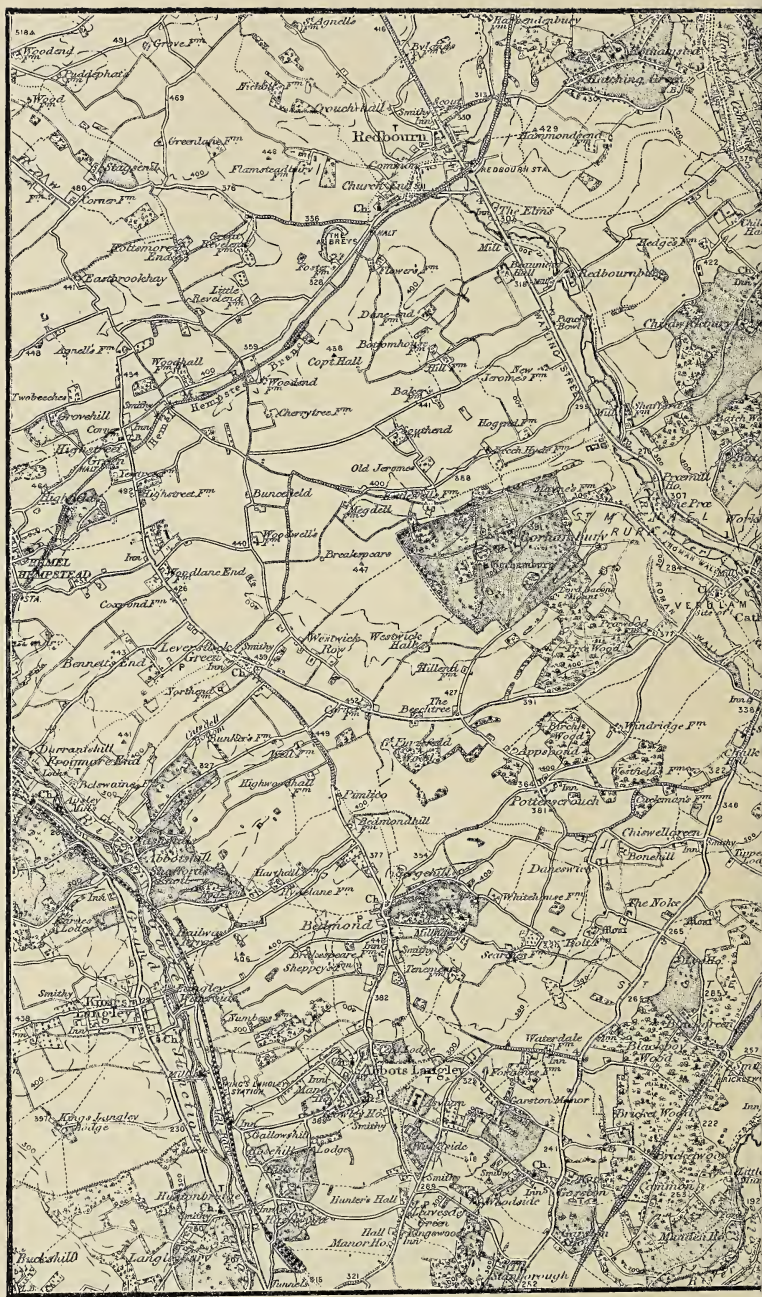
The subjects most in need of investigation in the neighbourhood of St. Albans are, in its *Flora*, Characeæ, diatoms and desmids and other freshwater Algæ, lichens, and microscopic Fungi; and in its *Fauna*, Protozoa, Rotifera, Annelida, Crustacea, Myriapoda, and Arachnida. It has not been found possible to give any account of the distribution or even occurrence in the district of species comprised in the last five divisions of the Animal Kingdom here named. There is therefore much work still to be done, and it is hoped that this Congress of Scientific Societies held in our Cathedral City will result in the infusion of fresh energy into our local naturalists, leading some of them to take up the study of the hitherto neglected plants and animals.

II. TOPOGRAPHY.

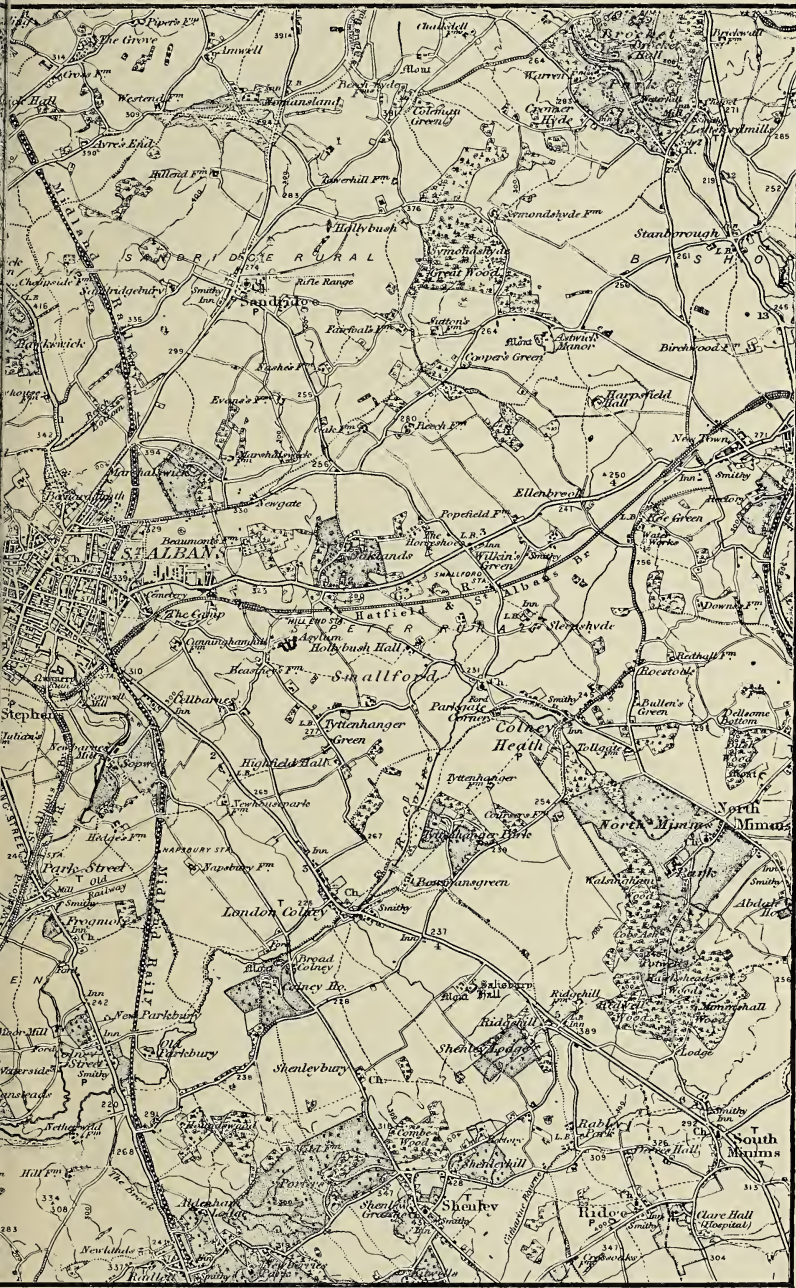
In determining the limits of the district which should for its scientific investigation be considered the neighbourhood of St. Albans it may well be assumed that the area ought not to be of too great extent for its most distant part to be reached in the course of an easy walk from our city. A radius of five miles from the Town Hall fulfils this requirement and moreover has the further advantage of not taking in any other town, for it excludes Hatfield on the east, Watford on the south, and Hemel Hempstead on the west, the nearest towns to St. Albans. All distances mentioned are taken from the Town Hall.

There is much diversity in this area and it has many interesting features. It varies in altitude from about 190 to 450 feet above mean sea-level (Ordnance Datum); a great part of it is well wooded; it is fairly well watered by the Ver, the Colne, and the Lea—the Ver flowing through it, the Colne usually rising in it, and the Lea nearly coinciding with its margin from north to east; and within it are No-Man's Land,





MAP OF THE VIC



CITY OF ST. ALBANS.



MAP OF THE VICINITY OF ST. ALBANS.

Harpenden Common, and the Rothamsted Experimental Station on the north, Colney Heath on the east, Bricket Wood with its Common on the south, and Gorhambury Park on the west.

St. Albans is in the south-west of Hertfordshire. Its latitude is $51^{\circ} 45' N.$, and its longitude $0^{\circ} 20' W.$ Within the city boundary the range of elevation is from about 240 to 410 feet; the Town Hall is situated 378 feet above Ordnance Datum. It is on the main line of the Midland Railway and has branches from the North-Western and the Great Northern—one from Watford and the other from Hatfield. Eight main roads radiate from it, their direction being nearly as follows:—(1) N. to Harpenden, (2) N.E. to Wheathampstead, (3) E. to Hatfield, (4) S.E. to South Mimms, (5) S. to Elstree, (6) S.W. to Watford, (7) W. to Hemel Hempstead, (8) N.W. to Redbourn.

(1) The course of the road to Harpenden is a little west of north. From St. Peter's Street it passes St. Peter's Church, turns to the left where the highest ground within the city is reached (410 feet O.D.), crosses Bernard's Heath, and in a mile, at the foot of the hill, the ancient British earthwork known as Beech Bottom is seen on the right. The road passes Childwick Green and crosses Harpenden Common, at the farther end of which, on the left, is the Rothamsted Experimental Station of the Lawes Agricultural Trust.

(2) The Wheathampstead road passes St. Peter's Church in a north-north-easterly direction, and in rather less than two miles the farther end of Beech Bottom is seen on the left. Running through Sandridge the road crosses No-Man's Land, beyond which, on the right, are the ancient British earthworks known as the Devil's Dyke and the Moat or Slad. Just beyond Sandridge a road on the right leads to Coleman Green, where there is a chimney of a ruined cottage with an inscription stating that John Bunyan preached there.

(3) The Hatfield road leaves St. Peter's Street at St. Peter's Green, now little but a name, and passes the Almshouses founded by Sarah Duchess of Marlborough, nearly opposite to which is the Hertfordshire County Museum. After passing Oaklands (two miles) it trends a little northwards. In three miles Colney Heath lies to the south, approached by a road starting opposite Oaklands; the Colne usually rises just above it. A little farther on Astwick Manor, a moated house, lies to the north, Sandpit Lane leading direct to it from St. Albans, and between it and Coleman Green is Symond's Hyde Great Wood.

(4) The road to South Mimms is known as the London Road. It starts opposite High Street and in three and a half miles crosses the Colne at London Colney. The river here is sometimes nearly dry, but occasionally overflows its banks and forms a lake. In five miles is Ridge Hill (398 feet O.D.), the highest point on the London Road, and just on the rise to it, to the south, is Salisbury Hall, a moated house. The interesting

“swallow-holes” which usually take and convey into the Chalk all the water in the higher part of the Colne, and extend from South Mimms to Potterells Park, are just outside our area, a short distance north-east of this road.

(5) The road to Elstree is the Watling Street, which formerly ran into the Dunstable Road between Bow Bridge and the Pondyards, taking a nearly straight course from St. Stephen's Church and past St. Michael's Church to that point. Now its London section starts at St. Stephen's, crosses the Ver at Park Street and the Colne near Colney Street, and runs through Radlett, taking a straight line throughout in a south-south-easterly direction, except where it deviates slightly at Park Street to avoid crossing the Ver more than once.

(6) The Watford road descends Holywell Hill, at the top of which the Cathedral is seen on the right, while near the bottom on the left is the site of the Holy Well. It then crosses the Ver and ascends St. Stephen's Hill to where the Watling Street branches off, thence taking a south-south-westerly direction. In about three miles Blackboy Wood is seen on the left; beyond it is Bricket Wood and its Common, otherwise called Bricket Wood Scrubs. On the right, distant about two miles from the road, lie Bedmond and Abbot's Langley, and the road leaves our area a little beyond Garston, where Leavesden Church is situated, more than a mile from the village.

(7) The road to Hemel Hempstead crosses the Ver at Kingsbury, passes St. Michael's Church and the entrance gates to Gorhambury Park, proceeds up Blue House Hill where it crosses the remains of the western wall of Verulam, and passes Præ Wood in which is the reservoir (marked “Camp” on the Ordnance maps) made by Sir Nicholas Bacon to supply Old Gorhambury House with water. The water sometimes failing, Francis Bacon built Verulam House near the Ver at Bow Bridge as a summer residence, and constructed the “pondyards” there.

(8) The road to Redbourn, better known as the Dunstable Road, starts from High Street, and follows very nearly the course of the Ver. For the first mile and a quarter, just across the river on the south-west, is the site of the old Roman city of Verulam with portions of the walls remaining here and there, and St. Michael's Church nearly in its centre. Gorhambury Park is then seen on the left, and in two miles, from Bow Bridge where the Ver is crossed, the road takes the route of Watling Street. It leaves our area just beyond Redbourn, near which is the ancient British earthwork known as Aubrey Camp or the Aubreys.

It thus appears that the neighbourhood of St. Albans will well repay investigation. Go in whichever direction we may there is something of interest to be seen, chiefly relating to the past, from the ancient Britons and the Roman occupation to the comparatively recent times of moated manor-houses, or

connected with the lives of such eminent men as John Bunyan and Francis Bacon.

III. GEOLOGY.

More than three centuries ago, long before Geology became a science, John Norden, in his 'Description of Hertfordshire' (1598), said that the soil of the county was "for the most part chalkie, though the upper cruste in the south and west parts be for the most part of redde earth mixed with gravell, which yet by reason of the white marle under it yeeldeth good wheat and oates." About a century later, Chauncy, in his 'Historical Antiquities of Hertfordshire' (1700), copied and amplified the description of Norden. "The upper cruste," he said, "in many places consists of red earth, mixt with gravel; most of the meadows are dry; the hills wet and cold, for they are clay, therefore barren; and for divers parts it contains chalk within a foot or a fathom of the surface of the ground."

The neighbourhood of St. Albans furnishes an epitome of the geology of Hertfordshire. Wholly on the Chalk, which in "divers parts" comes near the surface of the ground, Tertiary beds overlie this formation in the south-east of our area, and, as an outlier on the north, cap the highest ground within the city boundary, forming the "wet and cold" clay hills of Chauncy; there is much gravel in the immediate vicinity of St. Albans; the "red earth" of our county historians is represented here and there by brick-earth and clay-with-flints; and there is boulder-clay on the north, east, and south.

It is unnecessary in this brief sketch of the geology of our district to say more about the Palæozoic rocks which underlie the Chalk than that they are most probably Silurian, striking nearly east and west and dipping at a high angle to the south, having undergone great disturbance and denudation before the deposition of the Cretaceous beds, all formations between the two being absent. The Lower Greensand has probably thinned out to nothing in its trend from the north, but the Gault is certainly present, while there may possibly be a trace of the Upper Greensand, the Lower Chalk following.

As the Chalk dips to the south-east, its lowest beds exposed are on the north-west, and these are Upper Chalk, probably at or near the top of the *Micraster cor-testudinarium* zone, most of the Chalk of our area being in the overlying *Micraster cor-anguinum* zone. A little beyond the area, at Markyate Street, there is, however, an interesting roadside section showing the junction of the Upper and Middle Chalk, the Chalk Rock being well shown and replete with its characteristic fossils.

The Tertiaries consist of the Reading Beds and the London Clay, the Thanet Sands being absent. Only in the vicinity of Shenley and Radlett does the London Clay extend into our area from the south-east, the underlying Reading Beds forming as it were a fringe of varying width along its margin and occurring

also as outliers in various localities—near the main mass, at Abbot's Langley, at Bedmond, at Leverstock Green, and in St. Albans itself, St. Peter's Church and Bernard's Heath being situated upon one of the outliers which is a mile and a half in length and nearly half a mile in width. These beds consist of a very variable series of sands, mottled clays, and pebble-beds, which must at one time, with the overlying London Clay, have entirely covered our district, outliers far to the north and west testifying to the former presence of the main mass.

At St. Albans and near Radlett the principal pebble-bed of the Reading Series is consolidated by a siliceous cement into a conglomerate, well known as the Hertfordshire Conglomerate or "plum-pudding stone." It also occurs in the county, evidently in position, in at least two localities outside our area (North Mimms and Bushey). At St. Albans, in the gravel-pits on Townsend Farm, it has been traced for about 20 feet in one direction and 5 feet in another at right angles, lying in a horizontal position under gravel and with sand beneath it, but somewhat disturbed and broken up into blocks. In Newberries Park, Radlett, it is more clearly seen to be in position near the base of the Reading Beds, having beneath it a stratum of black-coated pebbles intermingled with sand and clay, and fine white sand above it. Masses of this conglomerate, usually called boulders on the assumption that they have been carried for some distance by ice or water, are of frequent occurrence, one of the largest known having been taken out of the Ver at St. Michael's and set up on the green opposite Kingsbury.

Another rock from the Reading Beds is known as Sarsen Stone. It is an aggregation of sand forming a hard sandstone, often with a mamillated surface. Boulders of it frequently occur, and good examples may be seen at the County Museum, on either side of the path near the entrance, one having been brought from the corner of Dagnall Street and Market Place, St. Albans, where it probably formed an old landmark, and the other from the Long Valley Wood gravel-pits, Croxley, near Rickmansworth, where it and others were found in a "pipe" of the Reading Beds.

The Reading Beds have been largely worked for brick-making on Bernard's Heath, St. Albans, and at the Bennett's End brick-fields near Leverstock Green, but it is chiefly brick-earth which is now worked there.

When these Tertiary beds were laid down the Chalk was in the horizontal position in which it was deposited, the very slight curvature forming the London Basin and giving to the Chalk and Tertiaries at St. Albans a slight dip towards the south-east having probably taken place in Miocene times during a period of volcanic activity in North Britain. A long interval then elapsed during which no deposits were formed in our district, but rivers were doing their work in excavating our valleys, a work much of which was obliterated by the ice-sheet which spread over the

country from the north, extending so far south as the London Clay hills on the borders of Middlesex and Hertfordshire. Before the Glacial Period, however, a bed of gravel was deposited on the London Clay, the "gravel of the upper plain" of Prof. Hughes, the Westleton Shingle of Sir Joseph Prestwich. It occurs on the Tertiary outlier on Bernard's Heath, and on the London Clay at Shenley and elsewhere, but nowhere directly on the Chalk, which seems to show that the erosion of the Tertiaries from the surface of the Chalk had not taken place when this marine pebble-gravel was deposited.

The Glacial deposits consist of gravel and sand overlain in places by boulder-clay, but sometimes, as west and south of Wheathampstead, boulder-clay rests immediately upon the Chalk. The gravel is mostly of sub-angular flints from the Chalk with fragments or boulders of "foreign rocks," or rocks derived from a distance, and there is much chalk in its composition, both in large masses and small fragments. The Devil's Dyke and the Moat, south of Wheathampstead, are cut through boulder-clay; No-Man's-Land Common is on gravel mapped by the Geological Survey as glacial, and the village of Sandridge is on the same, but its church is on boulder-clay; there is much boulder-clay about midway between St. Albans and Hatfield, overlying gravel and sand; and the most south-westerly patch known is that on which Bricket Wood is situated. In gravel believed to pass under it there the tooth and tusk of an elephant have been found, but the stratigraphical position of the gravel is somewhat uncertain.

A great part of St. Albans is situated upon glacial gravel; it is worked in the large gravel-pits of Sopwell; according to the map of the Geological Survey that part of the dry valley to be mentioned later which extends from south of Harpenden nearly to the Colne at Colney Heath is in it, though it has more the appearance of a river-gravel; its largest spread in our area shown on that map is from there to Colney Street, but this also appears to be fluvial.

St. Albans is also partly situated immediately on the Chalk, without any superficial deposit but surface-soil; most of the ancient city of Verulam was so placed; but there is on the Chalk in part of the city, and on part of the site of Verulam, a deposit, usually thin, called clay-with-flints. This is a stiff brown or reddish clay with large unworn flints. It was formed, and may still be forming, by dissolution of carbonate of lime, of which the Chalk chiefly consists, its aluminous matter being left as a matrix for the indestructible flints, and possibly some waste of the Tertiary clays formerly covering the Chalk enters into its composition. There is much clay-with-flints about Childwick and south of Redbourn, and the whole of Gorhambury Park is on it.

Another superficial deposit to be mentioned is brick-earth, which is a mixture of clay and sand forming a loam much

worked for brick-making. Where, as usual, it lies upon clay-with-flints, it appears to be a reconstructed Tertiary deposit. It is widely distributed over our district, but is nowhere of any considerable thickness except at the Bennett's End brick-fields near Leverstock Green. Here it is seen to lie on a very irregular surface of the Chalk coated with clay-with-flints, and to have in its upper portion masses of conglomerate and irregular layers of flint- and quartz-pebbles.

The rivers have as usual deposited gravel and alluvium in their beds, but there is nowhere a great spread of the latter as there is lower down their valleys. There is very little peat in the district, it only being known to occur in marshy places at No-Man's Land, Colney Heath, and Bricket Wood Common. From the character of the gravel at No-Man's Land and the presence of peat, the gravel there appears much more likely to be of fluvial than of glacial origin, having most probably been deposited by the stream which formerly flowed through Harpenden and into the Colne at Colney Heath.

Further information on the geology of this district may be found in our 'Transactions,' especially in the reports of our Field Meetings, every locality of geological interest in this part of Hertfordshire having been visited and its geological features described.

IV. HYDROLOGY.

Those who are unacquainted with the physical features of a Chalk district must view with surprise the long stretches of the rivers of Western Hertfordshire without a tributary stream, and their numerous dry subsidiary valleys. That these, as well as our river-valleys, have been formed by the action of water does not admit of doubt, and we are led to infer that water must at one time have flowed down them. Again, our Chalk rivers do not now rise at the head of their valleys, showing that a shrinkage has occurred in their length which must have occasioned a shrinkage in their volume.

The accompanying table gives the results for each summer and winter of experiments on percolation at Rothamsted for the 39 years April, 1871, to March, 1910, with gauges one-thousandth of an acre in area. Of the three percolation gauges, of 20, 40, and 60 inches in depth, the results of the 60-inch gauge are alone given. As the surface of the soil in the gauge is kept free from weeds by frequent hoeing, these experiments give a much greater percolation than occurs under natural conditions, but they are of interest as showing the variation which has taken place from year to year, and the great difference maintained between the summer and the winter percolation, even under circumstances which must make this difference much less than it is in a natural state of the soil.

Almost the whole of the Chalk formation, and especially the Upper Chalk, is very permeable, the rain which falls upon it,

except that which is evaporated or absorbed by vegetation, sinking into it and partially saturating it down to the underlying impermeable Gault. Rivers on the Chalk are therefore not usually fed by surface-water as are those on impermeable

RAINFALL, PERCOLATION, AND EVAPORATION AT ROTHAMSTED
FOR THE 39 YEARS APRIL 1871, TO MARCH, 1910.

YEAR.	RAINFALL.			PERCOLATION.			EVAPORATION.		
	Summer.	Winter.	Year.	Summer.	Winter.	Year.	Summer.	Winter.	Year.
1871-72	17'22	11'52	28'74	3'25	5'60	8'85	13'97	5'92	19'89
72-73	14'13	19'99	34'12	1'57	11'64	13'21	12'56	8'35	20'91
73-74	11'68	9'83	21'51	5'8	3'16	3'74	11'10	6'67	17'77
74-75	13'10	13'40	26'50	7'9	6'21	7'00	12'31	7'19	19'50
75-76	17'39	19'28	36'67	4'59	12'97	17'56	12'80	6'31	19'11
76-77	14'92	21'36	36'28	3'82	15'31	19'13	11'10	6'05	17'15
77-78	14'43	13'92	28'35	3'06	8'75	11'81	11'37	5'17	16'54
78-79	18'66	16'97	35'63	5'99	13'25	19'24	12'67	3'72	16'39
79-80	25'75	7'03	32'78	11'94	3'82	15'76	13'81	3'21	17'02
1880-81	17'06	19'32	36'38	5'54	15'15	20'69	11'52	4'17	15'69
81-82	13'76	16'06	29'82	3'03	10'20	13'23	10'73	5'86	16'59
82-83	16'37	21'77	38'14	3'82	17'09	20'91	12'55	4'68	17'23
83-84	14'64	12'81	27'45	3'55	8'41	11'96	11'09	4'40	15'49
84-85	11'15	14'11	25'26	2'59	9'58	12'17	8'56	4'53	13'09
85-86	14'88	15'56	30'44	4'54	12'57	17'11	10'34	2'99	13'33
86-87	12'58	16'02	28'60	2'76	11'00	13'76	9'82	5'02	14'84
87-88	9'19	11'86	21'05	9'0	9'02	9'92	8'29	2'84	11'13
88-89	16'56	12'36	28'92	5'55	8'10	13'65	11'01	4'26	15'27
89-90	19'14	12'83	31'97	6'77	9'28	16'05	12'37	3'55	15'92
1890-91	13'36	8'99	22'35	2'94	5'80	8'74	10'42	3'19	13'01
91-92	14'61	16'85	31'46	3'95	13'50	17'45	10'66	3'35	14'01
92-93	13'90	13'77	27'67	3'74	9'37	13'11	10'16	4'40	14'56
93-94	8'99	16'54	25'53	0'6	11'72	11'78	8'93	4'82	13'75
94-95	14'09	14'94	29'03	3'05	11'75	14'80	11'04	3'19	14'23
95-96	12'84	15'45	28'29	3'92	9'94	13'86	8'92	5'51	14'43
96-97	15'94	19'09	35'03	6'69	15'07	21'76	9'25	4'02	13'27
97-98	12'51	8'47	20'98	2'24	4'53	6'77	10'27	3'94	14'21
98-99	9'20	14'61	23'81	1'07	10'16	11'23	8'13	4'45	12'58
99-1900	11'94	18'46	30'40	2'48	15'28	17'76	9'46	3'18	12'64
1900-01	10'94	13'87	24'81	1'59	9'50	11'09	9'35	4'37	13'72
01-02	10'95	10'78	21'73	2'56	6'73	9'29	8'39	4'05	12'44
02-03	12'18	12'30	24'48	2'90	7'63	10'53	9'28	4'67	13'95
03-04	20'67	19'47	40'14	10'52	16'29	26'81	10'15	3'18	13'33
04-05	10'88	11'38	22'26	1'30	6'84	8'14	9'58	4'54	14'12
05-06	11'95	14'06	26'01	4'05	9'51	13'56	7'90	4'55	12'45
06-07	8'59	16'34	24'93	1'75	11'00	12'75	6'84	5'34	12'18
07-08	12'64	17'04	29'68	1'48	11'70	13'18	11'16	5'34	16'50
08-09	13'85	10'29	24'14	4'01	6'78	10'79	9'84	3'51	13'35
09-10	15'01	17'05	32'06	3'84	13'34	17'18	11'17	3'71	14'88
Mean	14'04	14'76	28'80	3'56	10'19	13'75	10'48	4'57	15'05

formations, but by springs which rise in their beds. The presence of a spring indicates that the Chalk is saturated up to at least a little above the spring; were it not saturated up to the bed of the river, water would sink out of the river into the

Chalk, the spring being converted into a "swallow-hole." It is only when the river has made its bed impervious by depositing alluvium in it that this does not happen; then there can be neither spring nor swallow-hole; and this frequently occurs. The saturation of the Chalk is a work of time, and as far more rain percolates in winter than in summer, owing to the greater amount then evaporated and taken up by growing vegetation, our rivers are usually highest in spring and lowest in autumn.

Experiments with percolation-gauges at Nash Mills near Hemel Hempstead and at Lea Bridge have shown that in the six summer months (April to September) about 6 per cent. of the rain which falls passes through three feet of soil or chalk with grass growing on the surface, and in the six winter months (October to March) about 46 per cent., giving an average annual percolation of 26 per cent. of the rainfall. When grass is not growing on the surface the percolation is much greater.

The rain which percolates into the Chalk will at first tend to make the surface of completely saturated chalk—the plane of permanent saturation—follow the contour of the ground, but as the water is held up below by saturated chalk which by the force of gravitation must always be tending to have its upper limit of saturation horizontal, there is a greater distance between the plane of saturation and the surface of the ground on the hills than there is in the valleys. This plane, however, always rises from the valleys towards the hills, or from any point where water is abstracted, whether it be naturally by a spring or artificially by pumping, the depression then being known as the cone of exhaustion. It is of course an inverted cone.

The head of the valley of the Ver is between Dunstable and Kensworth, at 550 ft. O.D. The river now seldom rises higher than Markyate Street, at 400 ft.; it frequently rises no higher than Redbourn, at about 300 ft.; and except at its perennial sources there it has not a single tributary. Although beyond our area it is necessary to state that for more than two miles above Markyate Street it has formed a continuous deposit of gravel in its main valley, and for nearly two miles in a subsidiary valley; and that two former tributaries, one on each side of the river, have cut valleys for four miles above Friars Wash, which is two miles below Markyate Street, one down to the Chalk through clay-with-flints, and the other through that and brick-earth. Within our area, from Redbourn, three miles below Friar's Wash, there radiate four dry valleys varying from about two to five miles in length (one with two subsidiary valleys) cut through clay-with-flints into the Chalk, the presence of river-gravel in some of them testifying that they have been formed by streams running with considerable velocity.

The higher part of the valley of the Ver is in the Middle Chalk, the lower part is in the Upper Chalk, the dip of the Chalk to the south-east being greater than the inclination of the valley in the same direction. The river has cut its way

into the Middle Chalk through the Upper Chalk which flanks the valley on either side, from its source to a quarter of a mile above Harpenden Bury, which is about a mile above the bridge at Redbourn. It follows that at this point the Chalk Rock occurs. In normal conditions of rainfall the river in autumn usually has its source here in springs, sometimes being augmented by springs a little lower down, but more often they are dry. For a short distance the water is held in its channel by the alluvium which the river has deposited, but at Harpenden Bury it decreases in volume, showing that it is no longer so upheld, and in an orchard a little below the farm it finally disappears down a swallow-hole, the river-channel continuing dry for three-quarters of a mile. Within a quarter of a mile north of the bridge at Redbourn there are several springs in action in the river-bed, and there are others at Church End, nearly half a mile west of the river, supplying ponds from which water flows into the Ver, this little stream now being its only tributary.

In the spring of 1904, after a year of excessive rainfall, the river rose above Markyate Street, four miles at least higher up its valley than usual, and at 100 feet higher level. Then there was a stream flowing for nearly a mile into the ponds at Church End, Redbourn. This is the old Womer Brook, the flowing of which in ancient times was believed to presage some calamity. It is said that the water had a slightly red colour, hence the name of the village and the origin of the superstition.

Matthew Paris (*cir.* 1250) says that "the Werlam river," as he calls it, "was once very large, and flowed about the city."

The Colne has had a much more chequered career than the Ver. At one time it was doubtless much the larger river at its confluence with the Ver; now it is much the smaller. It usually rises in the vicinity of Colney Heath; in a dry season it has had its source a little above London Colney; and after a very wet period about ten miles higher up its valley, a mile west of Barnet. A stream rises there still, flowing north for a few miles over London Clay, but when it passes over the Reading Beds and arrives at the Chalk, it begins to sink into swallow-holes. This part of its course is called the Mimms Hall Brook. From Mimms Hall to Water End there are several swallow-holes in the bed of the brook, but the largest are in Potterells Park, just outside our area. Seldom does the water reach those, for any which escapes one higher up the stream is sure, except on very rare occasions, to be entrapped by another. The writer has, however, seen it rushing down the Potterells swallow-holes with a roar that was heard for a long distance, and on another occasion flowing continuously for the whole course of the river, converting the Water End corner of Potterells Park into a lake, and flooding the country about Colney Heath and Smallford. The Chalk was then saturated up to the surface in this district, and possibly the swallow-holes were converted into springs.

A long and narrow dry valley emanates near Chorl End between Dunstable and Luton, has in it most of Harpenden, turns south at No-Man's-Land Common, passes Sandridge, then widens, and is met between Oaklands and Smallford by a little brook flowing into the Colne near Colney Heath. Its length above the source of this brook is fourteen miles. For seven miles at least, from Badger Dell near Caddington to Harpenden Common, perhaps even by No-Man's Land to Sandridge, a former stream, once for more than two miles forming the county boundary of Herts and Beds, has deposited in it a narrow band of river-gravel. Here and there its former course is now marked by a pond. Below Harpenden the map of the Geological Survey indicates it as glacial, but it has even here more the appearance of a fluvatile gravel.

The Lea tells a similar tale, although the evidences of its shrinkage are not so striking. In a paper in our 'Transactions' (Vol. XI, p. 236) Mr. James Saunders showed that while the river formerly rose at Houghton Regis, at the time he wrote, in 1902, it had receded more than two miles, rising in Leagrave Marsh, and that while the springs there once formed a rapid stream at least three yards wide and nine or ten inches deep, it was then only about three feet wide and two or three inches deep. The river has not now a tributary until the Mimram flows into it near Hertford, although it has several subsidiary dry valleys. Moreover, the whole of the valley of the Lea within our area, and down to Water End just outside it, was once a lake known as Lea Mere, fordable at Batford, Pickford, and Mereford (now Marford), and with two islands above Wheathampstead.

It is thus evident that our rivers have been much reduced in volume by the lowering of the plane of saturation of the Chalk, which has been greatly accelerated in recent years by the large quantity of water abstracted by pumping from great depths, and by increased drainage causing their flooding with heavy rain and thus preventing the water from being stored up for their constant supply; and also that this lowering accounts for the many dry valleys which the presence of river-deposits, whether gravel or alluvium, shows to have been excavated by the action of water flowing over the surface. But we must not conclude that no lowering of the ground can take place without surface-erosion. The frequent phenomenon of streams in a Chalk district disappearing and again reappearing shows that there is often a flow of water underground in the direction of the stream, and by this the chalk will be dissolved and the surface of the ground may be lowered. The work of rain on calcareous soils is incessant, its erosive action not being confined to the surface but being constantly active wherever it penetrates, either mechanically by friction or chemically by the dissolution of the chalk or limestone by carbonic acid gas (carbon dioxide) taken up from the atmosphere or from decaying vegetable matter.

V. CLIMATE.

Hertfordshire has for long been renowned for the purity of its air. Its earliest historian, Norden, in his 'Description of Hartfordshire' (1598) already quoted, said of it: "The aire for the most part is very salutarie, and in regard thereof many sweete and pleasant dwellinges, healthfull by nature and profitable by arte and industrie, are planted there." Somewhat later Fuller, in his 'Worthies of England' (1662), remarked: "It is the garden of England for delight, and men commonly say that those who buy a house in Hartfordshire pay two years' purchase for the aire thereof." And a little later still Chauncy, in his 'Historical Antiquities of Hertfordshire' (1700), said: "The air is clear, sweet, and very wholesome."

These remarks are as true of the neighbourhood of St. Albans as they are of the county generally. The salubrity, however, which in Fuller's time appears to have become proverbial, is due quite as much, if not more, to the dryness of the soil as it is to the purity of the air.

The influence of soils and sub-soils upon the stratum of air which we breathe is very great, and the dry and bracing air of St. Albans is greatly due to the strata upon which it stands. Its position on the Chalk, partly covered by gravel, not only gives it an absorbent sub-soil, but also enables a supply of pure water to be obtained, although for many purposes its hardness is objectionable. Its situation on a hill with its steepest side facing nearly south is also favourable, allowing the health-giving sunshine to have its greatest effect.

Climate has, however, been defined by Dr. H. R. Mill as "the normal or average condition of meteorological phenomena at a given place," or in other words "the average weather of a place," and it is this aspect of it which will here be considered, or rather will merely be shown by means of tables.

Meteorological observations have been taken at St. Albans for a period of twenty-four years (1887-1910), and the results, together with those from other meteorological stations in the county, have been contributed annually to this Society, and, with the exception of last year's, are printed in the 'Transactions,' in which also there is a paper on the "Climate of St. Albans" (Vol. IX, pp. 215-228), being results of observations made at The Grange, St. Albans, by the present writer, during the ten years 1887 to 1896. Removing to Watford at the commencement of 1897, the observer transferred his instruments, with the exception of the barometer and wind-vane, to the Hertfordshire County Museum, where all the observations required for a Climatological Station of the Royal Meteorological Society have been taken regularly up to the present time by the caretaker, Mr. Polman.

The following information as to the situation of The Grange, the instruments used (barometer and wind-vane excepted), and

the method of observation, is condensed from the paper just referred to.

Latitude, $51^{\circ} 45' 9''$ N.; longitude, $0^{\circ} 20' 7''$ W. Centre of St. Albans (Town Hall), 170 yards S.W.; Parish Church (St. Peter's), 340 yards N.N.E. Ground-level at thermometer-screen 380 feet above Ordnance Datum and at rain-gauge 379 feet. Thermometers, dry-bulb, wet-bulb, Negretti maximum, Rutherford minimum, 4 feet above the ground in a Stevenson screen, over grass. Rain-gauge, Snowdon pattern, 5 inches in diameter, top of rim 1 foot above the ground (grass). Observations taken at 9 a.m. Readings entered to day of observation, except those of maximum thermometer and rain-gauge, which are entered to the previous day; all corrected for index-errors of instruments verified at the Kew Observatory.

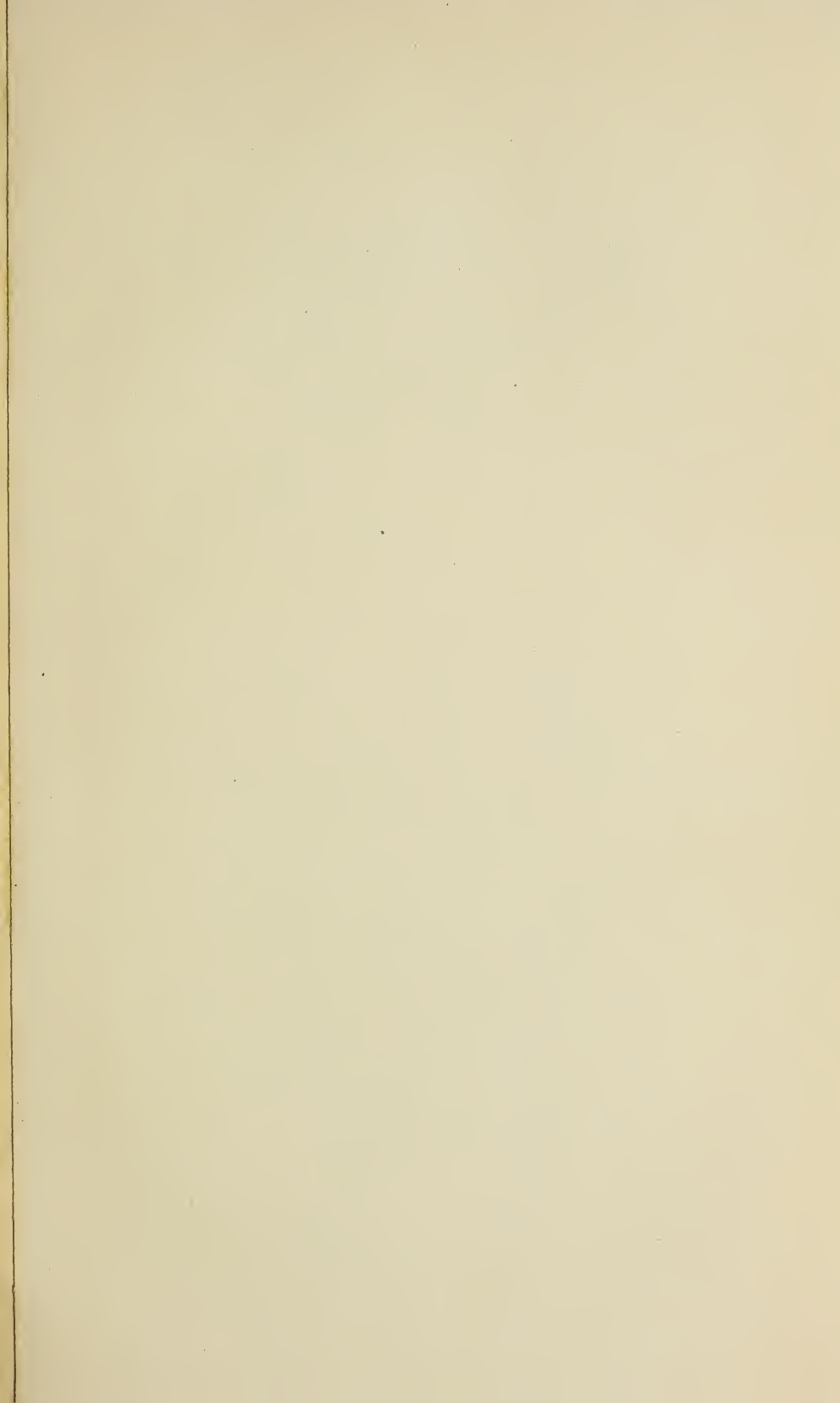
Situation very open and well elevated above the valley of the Ver. Ground sloping downwards towards the south, also falling on either side of this main gradient, giving a convex contour made up of a south-westerly slope to the River Ver, half a mile distant, and of a south-easterly slope to the River Colne, distant about three miles.

Sub-soil gravel on chalk, with a considerable depth of surface-soil, which, having very little clay in its composition, soon transmits the rain which falls upon it to the pervious gravel and chalk underneath. Natural level of the plane of saturation in the chalk about 130 feet beneath the surface, rising very slightly from the two rivers, and somewhat lowered by pumping operations.

The Hertfordshire County Museum is so near to The Grange (about an eighth of a mile N.E.), and the situation is so similar, except for its being on the edge of an outlier of Reading Beds, that the above particulars apply almost equally to it, but the situation may be thus precisely defined:—Latitude, $51^{\circ} 45' 15''$ N.; longitude, $0^{\circ} 19' 56''$ W. Town Hall 390 yards S.W.; St. Peter's Church 170 yards N.N.W. Ground-level at thermometer-screen and rain-gauge 389 feet above O.D.

Space does not allow of any disquisition on the results of the observations; the accompanying table gives all the necessary information and does not require any explanation.

The term of 24 years is sufficiently long to give trustworthy results for every element of climate but rainfall. For that a much longer period is required, and we have within our area two rainfall-stations of much longer duration—Gorhambury and Rothamsted—each with a record of at least 50 years. The former is two miles to the west of the Town Hall and the latter is four miles to the north. There are three rain-gauges at Rothamsted; the results of the 5-inch gauge are given here. Its rim is 9 inches above the ground (grass). At Gorhambury a gauge 6 inches square with its rim 2 ft. 6 ins. above the ground was replaced at the end of the year 1892 by one 5 inches in diameter with its rim 1 foot above the ground.





RESULTS OF CLIMATOLOGICAL OBSERVATIONS TAKEN AT
ST. ALBANS DURING THE 24 YEARS 1887-1910.

Months.	Temperature of the Air.						Humidity.	Cloud, 0-10.	Rain.	
	Means.				Extremes.				Amount.	Days.
	Mean.	Min.	Max.	Range	Min.	Max.				
	°	°	°	°	°	°	%	ins.		
Jan.	37·3	32·3	42·3	10·0	10·9	57·6	90	7·5	1·93	17
Feb.	38·2	32·6	43·8	11·2	10·1	65·3	87	7·1	1·70	15
March	41·2	34·3	48·1	13·8	15·8	68·2	84	6·7	2·10	17
April	46·0	37·9	54·2	16·3	25·4	77·7	76	6·6	1·60	15
May	52·0	43·3	60·8	17·5	29·1	79·3	66	6·5	1·88	14
June	58·0	49·2	66·8	17·6	34·8	86·1	74	6·7	2·38	13
July	61·1	52·6	69·7	17·1	40·6	89·6	72	6·5	2·45	13
August.....	60·5	52·1	68·9	16·8	41·0	92·7	75	6·3	2·64	15
Sept.....	56·5	48·6	64·5	15·9	30·9	92·7	81	6·4	1·77	12
Oct.	49·1	42·5	55·6	13·1	26·2	77·8	88	6·8	3·16	17
Nov.	43·0	37·4	48·5	11·1	18·6	62·5	90	7·5	2·51	17
Dec.	38·6	33·6	43·5	9·9	11·8	57·8	90	7·5	2·54	18
Year	48·5	41·4	55·6	14·2	10·1	92·7	81	6·8	26·66	183

RAINFALL IN THE NEIGHBOURHOOD OF ST. ALBANS FOR THE
50 YEARS 1860-1909.

Months.	GORHAMBURY.					ROTHAMSTED.				
	Mean.	Driest Month and Year.		Wettest Month and Year.		Mean.	Driest Month and Year.		Wettest Month and Year.	
		Ins.	In.	Year.	Ins.		Year.	Ins.	In.	Year.
Jan.	2·30	·40	1880	5·10	1872	2·24	·55	1880	4·99	1877
Feb.	1·98	·00	1891	4·40	1900	1·94	·03	1891	4·82	1900
March	1·92	·54	1886	3·94	1897	1·82	·35	1893	3·94	1897
April	1·76	·15	1893	4·46	1878	1·82	·22	1893	4·09	1878
May	2·07	·34	1896	5·27	1878	2·04	·45	1896	4·98	1878
June	2·30	·47	1868	6·55	1860	2·42	·36	1868	6·25	1860
July	2·39	·36	1885	6·02	1875	2·42	·35	1885	5·66	1875
August	2·58	·63	1880	4·98	1879	2·57	·77	1864	6·56	1879
Sept.	2·28	·48	1898	6·80	1896	2·33	·17	1865	7·66	1896
Oct.	3·09	·82	1897	8·20	1891	3·11	·82	1879	7·35	1865
Nov.	2·61	·59	1879	5·80	1877	2·55	·32	1867	5·16	1877
Dec.	2·47	·47	1864	5·83	1876	2·37	·42	1890	6·00	1876
Year	27·75	18·66	1864	38·15	1872	27·63	18·53	1864	37·35	1903

In the above rainfall table, in order to compensate for the shortness of the month of February in comparison with the length of January and March, rather less than a day's rain has been deducted from each of those months and added to its amount.

VI. FLORA.

1. PHANEROGAMIA.

Although comprising some 58 square miles, the district dealt with in this brief review (viz., that within a five-mile radius of St. Albans Town Hall) is strikingly uniform as to the nature of its soil; this is, in the main, either gravel and sand or a stiff clay (brick-earth, clay-with-flints, or boulder-clay) overlying the Chalk, which, though not infrequently coming to the surface, never becomes exposed over any large area.

The amount of calcareous soil is therefore relatively small, and the chief contrast to the clay is afforded by the sands and gravels. These owe their origin either to streams existing at the present day or whose beds were long since dry; or, in the case of the plateau gravels, are glacial in origin and frequently covered by a degradation product of sandy loam or clay. Peaty soil is one of the rarest types in the district, occurring only in one or two very restricted areas such as Colney Heath and Bricket Wood.

Bearing in mind the limited area with which we have to deal, as we should expect, the climatic factor is not sufficiently variable to play any important part in determining the distribution of species. We must therefore turn our main attention to the edaphic, or soil conditions as being the main factors influencing the nature and constitution of our flora.

A considerable portion of the land is under cultivation, either as pasture or as arable, mostly the former.

Whilst the area of cultivation offers interesting problems both as regards the specific nature of its weeds and their distribution, yet the ecologist naturally finds his chief opportunities for study in the comparatively untouched woods and commons.

The woods, as we should expect to find from the nature of the soil, are of the oak-hazel type, and the species of oak, that usually associated with clayey soil, viz.: *Quercus robur* (= *Q. pedunculata*). The ground flora is chiefly comprised of such plants as the wood-anemone (*Anemone nemorosa*), enchantress's nightshade (*Circæa lutetiana*), lesser celandine (*Ranunculus ficaria*), yellow dead-nettle (*Galeobdolon luteum*), wild strawberry (*Fragaria vesca*), ground-ivy (*Nepeta glechoma*), wood-sorrel (*Oxalis acetosella*), wood-violet (*Viola riviniana*), and *Brachypodium sylvaticum*. Less frequently the buckwheat (*Melampyrum pratense*), wood-rush (*Luzula vernalis*), and primrose (*Primula acaulis*) are to be met with; whilst the teasle (*Dipsacus sylvestris*) and *Millium effusum* are distinctly local.

Abundant forms in the more loamy woods are the pearlwort (*Arenaria trinerva*), woodruff (*Asperula odorata*), and wood-sanicle (*Sanicula Europæa*), and more locally the wood-sage (*Teucrium scorodonia*) and foxglove (*Digitalis purpurea*). The largest wood in the district is that known as Symond's Hyde

Great Wood, which corresponds with a drift soil of sandy loam and gravel. Like the other woods around, it is of the oak-hazel type, but it is interesting to find that the change in soil has been accompanied by a change in the dominant species, which is here not *Quercus robur* but *Q. sessiliflora*, Salisb. (See Moss, 'Journ. Bot.,' Jan.-Feb., 1910.)

Amongst the rarer woodland species may be noticed the saw-wort (*Serratula tinctoria*), bird's-nest orchid (*Neottia nidus-avis*), roast-beef plant (*Iris fœtidissima*), and spurge-laurel (*Daphne laureola*); the last two named are associated with chalk near to the surface. Wherever this denudation of the clay has taken place the change is usually marked by the presence, in the ground flora, of chalk plants such as the hairy violet (*Viola hirta*) and hairy St. John's wort (*Hypericum hirsutum*), though these are absent from the woods around.

The common weeds of the arable land are mostly typical clay plants; less frequent, though far from rare, are *Papaver argemone*, fool's parsley (*Æthusa cynapium*), *Valerianella dentata*, white forget-me-not (*Lithospermum arvense*), field-mint (*Mentha arvensis*), *Galium tricorne*, corn-cockle (*Githago segetum*), and Venus looking-glass (*Specularia hybrida*). Associated with the more gravelly soils are the knawelwort (*Scleranthus annuus*), field-madder (*Sherardia arvensis*), and *Sysymbrium thalianum*. *Mercurialis annua* only occurs at Harpenden and in one other locality in the county.

By far the greatest interest, both for the systematist and the ecologist alike, attaches itself to the commons; of these our area boasts four of some considerable size, viz., Bricket Wood Common, Colney Heath, Harpenden Common, and No-Man's Land.

The first of these is mostly covered with scrub, so that it is rather of the nature of a wood than a heath. A marked feature here is *Rhamnus frangula*, a rare plant in the county, though the other species, *R. catharticus*, is frequent in hedges on the Chalk outcrops. Other plants uncommon elsewhere are *Serratula tinctoria*, *Lysimachia nemorum*, and *Achillea ptarmica*.

Colney Heath is perhaps the most interesting spot botanically within walking distance of St. Albans; for not only are many plants met with here which are seldom to be found elsewhere in the county, but also several which may be ranked amongst our British rarities. This heath was formerly the home of that rare denizen of inundated spots *Lythrum hyssopifolia*; of recent years, however, diligent search has failed to discover it. A similar fate has probably befallen *Ranunculus parviflorus*, but *Teesdalia nudicaulis* is still there, though it would take but the plucking of a single vandal to render it extinct.

The heath is traversed by a small stream which, owing to the absence of any banks on the south side, forms there a considerable area of marshy ground. Here we can observe the zonation so frequently met with by sluggish streams and around

the larger ponds (Smith, "Notes on the Vegetation of Ponds," 'Naturalist,' Oct. 1903). At the margin of the marshy ground and above the water-level stands the zone of rushes which forms a sharp boundary between the marsh-association below and the furze-heath above. This is followed by a broad zone of swampy turf which, though rarely, if ever, covered by the water, is completely saturated. The chief of the plants comprising this zone are the marsh-stitchwort (*Stellaria uliginosa*), milkmaid (*Cardamine pratensis*), marsh-marigold (*Caltha palustris*), strawberry clover (*Trifolium fragiferum*), *Triglochin palustre*, *Eleocharis palustris*, and *Alopecurus geniculatus*; more rarely the sneezewort (*Achillea ptarmica*) and waterblinks (*Montia fontana*). Next follows a zone of varying width, but usually narrow and constituted by plants rooted in very shallow water; here in varying frequency are to be found the water-dropwort (*Enanthe fistulosa*), water-horsetail (*Equisetum limosum*), bur-reed (*Spartanium ramosum*), water-celery (*Sium nodiflorum*), yellow flag (*Iris pseudacorus*), flowering rush (*Butomus umbellatus*), and bog-bean (*Menyanthes trifoliata*). Owing to the shallowness of the stream at some points this zone may extend to the further bank, but here and there the water becomes sufficiently deep to mark a fourth zone comprised by such species as are more or less entirely submerged; of these the commonest are pondweed (*Potamogeton natans*), water-starwort (*Callitriche verna*), Canadian water-weed (*Elodea canadense*), *Glyceria fluitans*, and *Chara hispida*. The last named forms the home of numerous snails and leeches.

To the action of this stream, when vastly more considerable, was no doubt due the formation of the sand and gravel which characterize the major portion of the heath. With the presence of these are associated such plants as allseed (*Radiola milligrana*), dwarf furze (*Ulex nanus*), wood cudweed (*Gnaphalium sylvaticum*), chamomile (*Anthemis nobilis*), and the bird's-foot (*Ornithopus purpusillus*).

The south end of the heath differs greatly from the portion traversed by the stream, for here the soil contains a large amount of humus, and the occurrence of a new association of plants is at once apparent. Small patches of needle-furze (*Genista anglica*) alternate with clumps of dwarf furze; scattered amongst these are the upright tufts of the moor-grass and bog-rush (*Nardus stricta* and *Juncus squarrosus*), whilst red-rattle (*Pedicularis sylvatica*) and dog-violets (*V. canina*) furnish bright patches of colour. The two ponds in this part of the heath are also of interest, not only for the zonation they exhibit, but also for the richness of their algal flora.

No-Man's Land and Harpenden Common are linked together by the fact that both are traversed by the same dry river-bed with extensive deposits of valley-gravel. Both show signs of having become drier in recent years, a feature the more marked at Harpenden, where such plants as heather, red-rattle, rushes,

and ferns have either disappeared or are rapidly doing so. On the more peaty common of No-Man's Land the dwarf furze, needle-furze, and red-rattle occur in some quantity, but are absent at Harpenden, the last-named species having died out there some 15 years ago.

Of the less common plants met with here *Potentilla argentea*, cat-mint (*Nepeta cataria*), and *Filago minima* do not occur at Harpenden, whilst common to both are *Moenchia erecta*, bird's-foot (*Ornithopus purpusillus*), *Trifolium filiforme*, chamomile, and other plants characteristic of gravelly soils.

Among the grasses it is of interest to note the rapid spread during recent years on both commons of *Koeleria cristata* and *Triodia decumbens*.

A striking object-lesson for the ecologist is furnished both at Harpenden and No-Man's Land, where in each common there is a small area from which clay was at one time dug, thus exposing the chalk below. These "dells," as they are popularly termed, have now been left for many years undisturbed. We thus find in each of these two commons an isolated patch of calcareous soil surrounded on all sides by clay and gravel. In both cases a characteristic chalk association has sprung up, the most conspicuous members of which are salad burnet (*Poterium sanguisorba*), purge-flax (*Linum catharticum*), autumn gentian (*Gentiana amarella*), flea-bane (*Erigeron acre*), and the carline thistle (*Carlina vulgaris*). The total absence of these species from the surrounding common renders the contrast striking.

The chief feature of interest at Harpenden, and one possibly associated with the lowering of the water-level, is the struggle still in progress between the furze and the bracken. Little more than ten years ago the greater part was a furze heath with a small amount of bracken, chiefly at the higher southern end; this latter has gradually spread downwards and northwards, till now, when seen in summer, the major part exhibits large areas where isolated and dishevelled furze-bushes, like almost submerged islands in a sea of green, alone remain to tell of what was once a dense stretch of gorse, relieved in the more open parts by the stately tussocks of *Aira cæspitosa*. Bernard's Heath, where the soil is a gravelly loam, is mainly covered by brambles, gorse, and wood-sage; and, perhaps in part owing to its nearness to the city, has a comparatively poor flora.

The alien phanerogams of the district are chiefly of interest by reason of the rapid spread of several species. Coleman in his manuscript Flora (1839) refers to *Veronica buxbaumii* as rare; at the present day it forms one of the commonest of our weeds on arable land. The recently introduced *Matricaria suaveolens* affords an example of a species which is spreading at the present time. This portion of Hertfordshire in no way escaped the sudden invasion of its streams by *Elodea canadensis* subsequent to its introduction into England about 1841; and the monkey-flower (*Mimulus luteus*) bids fair to become equally ubiquitous.

2. FILICES, MUSCI, HEPATICÆ, AND ALGÆ.

Little can be said respecting the œcology of the Cryptogamia of our area, for with the exception of the Filices and Algæ practically no work has been done, from this standpoint, on the various groups. We are greatly in need of workers to undertake this aspect of Cryptogamic research. Records of the rarer forms alone are comparatively useless; the need is for complete lists from as many localities as possible, with data as to the soil and environmental conditions of each species together with details of association both with regard to the other Cryptogams and also to the Phanerogamic Flora.

FILICES.—The ferns of the district, though never common (with the exception of the bracken, which is increasing rapidly), are becoming rarer every year, no doubt due in the main to the lowering of the water-level and to the rapid increase of population. The most frequent of the ferns are *Aspidium filix-mas*, *A. angulare*, *Polypodium vulgare*, and *Asplenium adiantum-nigrum*. *Blechnum spicant*, *Asplenium trichomanes*, *A. ruta-muraria*, and *Ophioglossum vulgatum* are now distinctly rare, and *Ceterach officinarum*, which formerly occurred at Harpenden, is extinct.

MUSCI.—About eighty species of mosses have been recorded from the district, but the paucity of workers in this field has doubtless left many lacunæ.

The Sphagnaceæ are, like their habitat, rare in our area. *Sphagnum subsecundum* is found at Colney Heath and at Bricket Wood, in which latter locality the two varieties, var. *contortum* and var. *obesum*, and also *S. intermedium* occur. Other water-loving mosses found in the district are *Philonotis fontana*, *Webbera carnea*, *W. albicans*, and *Fissidens adiantoides*. Besides supplying our wettest forms, Bricket Wood and Colney Heath are the only localities for *Leucobryum glaucum*.

Quite a moss flora is to be found on the old walls of Verulam, including, besides the more common species, *Barbula unguiculata*, *B. revoluta*, *Encalypta vulgaris*, *Bartramia pomiformis*, *Eurhynchium crassinervum*, and *Rhynchostegium confertum*. The walls at Gorhambury also yield some interesting species such as *Barbula vinealis* and *Eurhynchium pumilum*; here also on the banks and fields may be found *Pottia starkeana*, *Didymodon rubellus*, and *Hypnum chrysophyllum*. Most of the records for the district are to be found in Mr. A. E. Gibbs' paper in our 'Transactions' (Vol. III, pp. 67-81).

HEPATICÆ.—The number of Hepaticæ recorded is small. The complete list is given in the hope that it will stimulate new workers to add to their number. *Marchantia polymorpha*, *Asterella hemispherica*, *Frullania dilatata*, *F. tamarisci*, *Radula complanata*, *Porella platyphylla*, *Odontoschisma sphagni*, *Cephalozoa zysacea*, *C. bicuspidata*, *Lophocolea bidentata*, *L. heterophylla*, *Chiloscyphus polyanthus*, *Scapania nemorosa*,

Diplophyllum albicans, *Jungermannia crenulata*, *J. incisa*, *Nardia scalaris*, and *Fossombronia pusilla*.

ALGÆ.—In spite of the paucity of our information as to the Algal Flora there is sufficient to show that it compares favourably with that of other counties.

The following list of genera and species from a pond in the district will sufficiently illustrate the character of the Algal Flora in the stiff clay:—*Spirogyra catæniiformis*, *S. Hassallii*, *S. quadrata*, *S. tenuissima*, *S. varians*, *Eudorina elegans*, *Pandorina morum*, *Chætophora elegans*, *Edogonium* sp., *Tribonema*, *Ophiocytium*, *Zygnema*, *Microspora*, *Cosmarium* spp., *Closterium lunulatum*, *C. kutzingii*, *C. acerosum*, *Ulothrix zonata*, *Microthamnion*, *Mougeotia*, *Ankistrodesmus*, *Sphærella*, *Chlamydomonas*, *Gleocystis*, *Sphærocystis characium*, *Clathrocystis*, *Anabæna*, and *Oscillaria*, with numerous diatoms.

In the more peaty soils such as one finds at Colney Heath and Bricket Wood, desmids are a prominent feature; among the more interesting Algæ found in such habitats may be mentioned *Closterium cornu*, *C. incurvum*, *Nephrocytium lunatum*, *Chroococcus turgidus*, *Bulbochæte varians*, *Aphanochæte*, and *Palmodactylon varians*.

The Algal periodicity recently investigated by Fritsch & Rich ('Ann. Bot.', vol. xxi, July, 1907, and 'Proc. Bristol Nat. Soc.', vol. ii, pt. 2, 1909) is seen to advantage in the district. The spring phase is characterized by the abundance of such genera as *Spirogyra*, *Zygnema*, and *Microspora*, all three frequently forming almost pure cultures; in the summer these give place to *Edogonium* spp., *Cladophora*, and epiphytic diatoms; and the autumn phase is marked by the almost entire absence of all forms except Diatomaceæ.

Only two species of *Chara* have been recorded for the district, viz. *Chara vulgaris* and *C. hispida*.

3. LICHENES, FUNGI, AND MYCETOZOA.

LICHENES.—The published records of the lichens observed in our district are but few, being limited to three brief lists in the reports of our field meetings ('Trans.,' Vols. III and V), one for St. Peter's, containing 7 species, and the others for Bricket Wood, in which (excluding duplicate records) 16 are enumerated. Two are common to both localities, so that the total number is 21.

So far as can be judged from this small number of records the most frequent species is *Parmelia caperata*, that being the only one which is common to the three lists. The rarest species are *Calicium melanophæum* and *Pertusaria globulifera*, both detected by Mr. E. M. Holmes at our fungus foray in Bricket Wood in 1885.

FUNGI.—The records of the larger fungi are based almost entirely upon the results of fungus forays of the Herts Natural History Society, particulars of which are given in Vols. III, V, VI, and IX of the Society's 'Transactions.' The localities visited

were the Gorhambury estate, St. Albans (Verulam Woods, the Hollows, and Gorhambury Park), in 1884 and 1896, and Bricket Wood in 1889 and 1891. The collections made at the first of these forays were examined and named by Dr. M. C. Cooke and Mr. Worthington G. Smith, and those at the other three by Mr. George Masseur.

There are about 370 items in the lists, which include duplications of certain species, either gathered on more than one occasion or observed in different localities. Deducting these nearly 250 species are recorded.

Of the Hymenomycetes the comprehensive genus *Agaricus* furnished about 120 species from Bricket Wood and 50 from Gorhambury, of which 28 are different from those recorded for Bricket Wood. Of other genera such as *Coprinus*, *Cortinarius*, *Lactarius*, and *Polyporus*, upwards of 60 species are enumerated. Of the genus *Lactarius*, 14 species were observed in Bricket Wood and 3 at Gorhambury, 2 of which are common to both localities. The edible *L. deliciosus* is absent from both lists. One of the most noteworthy records is that of *Lenzites betulinus* for Bricket Wood, this having been previously observed in only two stations in England. The genus *Stereum* is represented by only one record, that of *S. hirsutum* for Gorhambury, but the writer has observed it also in Bricket Wood. It is common on decayed tree-stumps and may be found at all seasons of the year. One may sometimes see on it the plasmodium of *Badhamia utricularis*, either feeding on the microbes distributed on the surface of the fungus, or absorbing some of the nitrogenous elements of the host plant. The passage of the plasmodium leaves the *Stereum* evidently deteriorated.

The Gastromycetes are represented by 3 species of *Lycoperdon*, of which *L. gemmatum* is the most frequent; and by 2 of *Schleroderma*.

Of the Ascomycetes the curious candle-snuff fungus, *Xylaria hypoxylon*, is recorded for both localities and is certainly one of the commonest of the fungi which grow on decayed stumps; several other genera are also represented.

Mr. Salisbury reports that the Uredineæ are well represented, many species being almost ubiquitous; such are *Puccinia anemones*, *P. malvacearum*, *Trichobasis suaveolens*, *Uromyces ficariæ*, *Æcidium ranunculacearum*, *Lecythea capræarum*, *L. euphorbiæ*, and *Phragmidium bulbosum*; and that amongst the less common forms are *Puccinia adoxxæ*, *P. centaureæ*, *Æcidium violæ*, *A. quadrifidum*, *Uromyces concentrica*, and *Uredo bifrons*.

It is evident from the preceding remarks, which give some of the results obtained during a very small number of searches, that a systematic and persistent series of observations would add considerably to the number of species which may be found in the woods which furnished these records. The writer has observed at Harpenden on several occasions the "stink-horn," *Phallus impudicus*, which, as the common name suggests, may

be detected by the sense of smell before it is seen. Bricket Wood has also furnished one species of *Irpez*. Specimens of this may usually be found on the under side of fallen branches which are in an advanced stage of decay, and in such situations they furnish acceptable feeding-grounds for the plasmodia of several species of *Badhamia*.

MYCETOOA.—The plasmodia above referred to are characteristic of the whole Class of the Mycetozoa, which, although usually grouped with the Fungi, are sharply differentiated from them by the existence of this, the motile stage of their metamorphoses. The individual sporangia are diminutive in size, but when growing in clusters are sufficiently conspicuous, as are also the æthalioid forms.

There are 66 well-defined species recorded for the county, of which at least one-half have been observed in the district under consideration.

Of the Exosporeæ, *Ceratiomyxa mucida* has been found at Harpenden. This is the only genus and species recognized in this section.

The Endosporæ include numerous Orders and genera. Of the genus *Badhamia* the species *B. utricularis* is the most frequent, and in favourable seasons may be observed in any moist woodland, especially on retentive soils. Of the 14 species of *Physarum* recorded for the county at least 7 can be credited to this district; of these the most frequent are *P. nutans*, *P. compressum*, and *P. vernum*. In the neighbourhood of Harpenden *Craterium pedunculatum* and *Dictydium umbilicatum* have been observed, and at Wheathampstead *Physarum diderma*, *Didymium clavus*, and *Perichaena depressa*. Bricket Wood has furnished four species of *Trichia*, all of which are widely distributed forms. The record for *T. persimilis* includes also *T. abrupta* ('Trans.,' Vol. V), which differs from the type in the obtuse termination of the elaters, which end in diverging spines, a character sometimes present in other species; the spores are identical in both forms. At London Colney *Perichaena variabilis*, a very local species, has been found, and at Redbourn *Stemonitis fusca*, a more common form, has been observed. Amongst the generally distributed species may be mentioned *Didymium effusum*, *D. difforme*, *D. nigripes*, *Arcyria incarnata*, and *A. punicea*.

Most of these and other ubiquitous forms would in favourable seasons be found in almost any moist woodland which is not subjected to the inroads of the general public. An undisturbed environment is essential to their effective development. Heaps of decayed leaves and of straw have yielded to the writer several interesting forms, such as *Physarum vernum*, *P. cinereum*, and *Spumaria alba*. In such situations one may observe occasionally masses of plasmodium streaming over the decayed vegetation—white if of *Didymium*, grey if of *Physarum*, yellow if of *Craterium*. These and others have been found within a few

miles of St. Albans, and such heaps would again reward careful and persistent search.

VII. FAUNA.

1. PROTOZOA.

Scarcely anything has been done in Hertfordshire towards the investigation of microscopic forms of animal life. They are nevertheless of great interest, often of exceeding beauty, and the study of many groups presents but little difficulty to those who have a microscope, which is indeed an essential equipment for every naturalist.

The freshwater Rhizopoda and their near allies the Heliozoa are very beautiful objects under the microscope, but they are mostly so minute that they cannot be seen with the naked eye, and scarcely even with a simple lens, requiring a compound microscope for their detection. They are, however, almost ubiquitous in clear but not rapidly-running water and wherever there is moisture as in the moss on shady banks; but the surest way of getting a fair number of species is to collect a handful of water-plants, especially peat-mosses (*Sphagnum*), from a shallow pool, and squeeze out the water, examining it drop by drop under the microscope.

There is such a shallow pool on Bricket Wood Common, and in it the following species of Rhizopoda have been collected by the writer:—*Amœba proteus*, *striata*, *guttula*, and *limax*, *Dactylosphaerium radiosum*, *Pelomyxa palustris*, *Arcella vulgaris* and *discoïdes*, *Centropyxis aculeata*, *Diffugia oblonga*, *Penardi*, *lanceolata*, *lobostoma*, *pulex*, *tuberculata*, *oviformis*, and *constricta*, *Lesquereusia spiralis*, *Hyalosphenia inconspicua*, *Nebela tineta*, *Cochliopodium bilimbosum*, *Trinema enchelys*, *Sphenoderia lenta* and *dentata*, and *Pyxidicula operculata*; also the Heliozoa *Actinophrys sol*, *Actinosphaerium Eichornii*, and *Heterophrys Fockei*. The full list is given as it is not a long one and very few species have previously been recorded for Hertfordshire.

Until recently the identification of freshwater rhizopods has been a matter of some difficulty, but now most of them can be identified from the monograph of the 'British Freshwater Rhizopoda and Heliozoa' by the late Mr. James Cash in course of publication by the Ray Society, and of which two volumes, containing the Amœbina or naked forms and the lobose Conchulina, have already been issued. For the rest of the Rhizopoda (the filose Conchulina) and the Heliozoa, it is necessary to consult the works of Dr. Penard until Mr. Cash's monograph is completed.

2. MOLLUSCA.

St. Albans is partly built on an outlier of the Reading Beds, which, with the London Clay, impinge upon the south-eastern border of the district, but otherwise the whole of the country

within a radius of five miles from the centre of the city lies upon the Chalk, a formation peculiarly suited to the needs of many land Mollusca. The calcareous nature of the soil implies a deficiency in surface-water, and ponds and marshes are few. This deficiency is to some extent remedied by the Ver and Colne, which traverse the district, and the Lea, which skirts it for a short distance in the north-east. These rivers flow through low-lying meadow-land, and the ditches and water-cress beds associated with them provide congenial quarters for many fresh-water forms. The Grand Junction Canal, which passes just beyond the western boundary, is the habitat of several species, including *Neritina fluviatilis*, *Unio pictorum*, *U. tumidus*, *Sphaerium rivicola*, and *Pisidium supinum*, which have not been recorded for the district, whilst *Paludetrina jenkinsi*, a notable colonist, which abounds in the Colne at Watford, has probably ere this invaded our area. No systematic investigation of the Mollusca of St. Albans has apparently ever been made, and the paucity of our information is no measure of the actual fauna; all or nearly all of the land molluscs known to occur in Hertfordshire will probably be found eventually in the district.

Arion ater is plentiful, perhaps the commonest form being the var. *oculata*, whilst the vars. *succinea*, *brunnea*, and *plumbea* also occur. *Limax maximus*, *L. arborum*, *Arion subfuscus*, *A. intermedius*, *A. hortensis*, and *A. circumscriptus* are common in woods in autumn, and *Limax tenellus* occurs in Præ Wood. *Agriolimax agrestis* is a common pest, but its congener *A. lævis* is local. The type and the var. *maculata* occur in the meadows of the Colne near Park Street.

Hyalinia helvetica is the commonest member of its genus. *H. nitidula*, *H. alliaria*, *H. cellaria*, *H. pura*, and *H. crystallina* are generally distributed. *H. radiatula* has been found in Præ Wood and at Aldenham, and *H. nitida* in the meadows near Park Street.

Euconulus fulvus, sometimes abundant in rushy places, is found too, although more sparingly, in woods, where it is often associated with *Vitrina pellucida*. *Punctum pygmaeum* has been taken near St. Albans, and is probably not uncommon in suitable situations elsewhere. *Sphyradium edentulum* occurs sparingly in Præ Wood. *Pyramidula rotundata* is ubiquitous. *Ena obscura*, *Clausilia laminata*, and *C. bidentata* are fairly common in woods and copses, whilst *Carychium minimum* abounds in such places. *Cochlicopa lubrica* is general, but *Azeca tridens* is local. It has been found at St. Albans and Sandridge, the var. *crystallina* being associated with the type at the latter place. *Pomatias elegans* may be found in hedgerows and about old chalk-pits at Wheathampstead, Gorhambury, and Munden. *Jamnia muscorum* and *J. cylindracea* are sparingly distributed, whilst *Vertigo antivertigo* has been taken in rushy places in the Colne Valley near Munden. *Succinea elegans* and *S. putris* occur among rushes and coarse vegetation in wet places.

Helix pomatia is rare; it has been recorded from Wheat-hampstead and Verulam Woods, St. Albans. Many members of the family Helicidæ are abundant. *Helicella cantiana* and *Hygromia rufescens* with its vars. *rubens*, *albocincta*, and *alba*, are common hedgerow forms, and reference must be made to the following species, which are all more or less abundant:—*Helicella virgata* and vars. *subalbida*, *albicans*, and *lutescens*, *H. itala*, *H. caperata*, *Hygromia hispida*, *H. granulata* (Sandridge and Munden), *Acanthinula aculeata* (Symond's Hyde), *Vallonia pulchella*, *V. excentrica*, *V. costata*, *Helicigona lapicida* (Sandridge), *H. arborum* (the var. *fuscescens* equals the type in numbers), *Helix aspersa*, the protean *H. nemoralis*, and *H. hortensis*, whose vars. *lilacina*, *incarnata*, and *lutea* may be found in hedgerows on the St. Albans—Hatfield Road.

To cite exact localities for the commoner freshwater shells would be tedious, but the following list of those known to occur in the low-lying valley between St. Albans and the boundary of the district near Munden may be of interest:—*Ancylus fluviatilis*, *Acroloxus lacustris*, *Limnæa auricularia*, *L. pereger*, *L. palustris*, *L. stagnalis*, *Planorbis corneus*, *P. carinatus*, *P. umbilicatus*, *P. vortex*, *P. spirorbis*, *P. contortus*, *Physa fontinalis*, *Aplecta hypnorum*, *Bithynia tentaculata*, *B. leachii*, *Valvata piscinalis*, *V. cristata*, *Anodonta cygnea*, *Sphærium corneum*, *S. lacustre*, *Pisidium amnicum*, *P. henslowianum*, *P. subtruncatum*, *P. pulchellum*, *P. casertanum*, *P. pusillum*, *P. obtusale*, and *P. gassiesianum*.

Limnæa truncatula is apparently rare, but has been taken near London Colney. *Planorbis albus*, *P. crista*, and *P. lineatus* are all recorded for the neighbourhood of Sandridge, and *Sphærium lacustre* from a pond at North Mimms. *Vivipara vivipara* occurs sparingly in the River Ver.

3. INSECTA.

The physical features of the immediate neighbourhood of St. Albans do not differ materially from those of the greater part of the County of Hertford. There is very little waste land, and untilled flowery places, loved of entomologists, where bees and butterflies revel among the blossoms of tall umbellifers and other plants, are becoming increasingly difficult to find. The rural districts are generally in a high state of cultivation, under either plough or pasture, but considerable areas are covered with timber, the luxuriant growth of the trees, especially the oaks, making the woodlands a characteristic and beautiful feature in a Hertfordshire landscape. In these old woods, which are often of considerable extent, much game is raised, and as a consequence the visits of entomologists are not always welcomed, but where permission can be obtained to work in the ridings and clearings, interesting results can generally be attained. At Bricket Wood there is a large stretch of boggy land, covered with underwood, known as the Scrubs, and the

paths which cross it, often much encumbered with entangled branches, are well worth working. The area under review also includes parts of three river-valleys, the Lea, the Ver, and the Colne, and although there are no extensive marshes, the banks of these streams, with their semi-aquatic flora, yield many a desired species to the collector, in whichever Order of the great Class Insecta he may be interested.

COLEOPTERA.—The beetles of the neighbourhood do not appear to have been adequately studied. In the long and very valuable list prepared for the 'Victoria History of the County of Hertford' by Mr. E. G. Elliman, there are but few records from the neighbourhood of St. Albans, Mr. Elliman's observations having been chiefly made in the extreme north-west of the county. It is to be hoped that some student of this interesting Order of insects will be found to devote attention to the local beetles.

ORTHOPTERA.—This small Order, which only includes about 60 British species, is interesting from the fact that several exotic insects have been introduced into the neighbourhood, chiefly with stove plants. Two large species of cockroach have established themselves in greenhouses, and the presence of one or two foreign grasshoppers and locusts has also been recorded. Of our local British Orthoptera no list has been made.

ODONATA.—So far as the dragonflies are concerned, Mr. E. R. Speyer has collected at Shenley on the south-eastern boundary of our district, and a few years ago he furnished a list of the Odonata he had taken there. Probably some of them were found just outside the area covered by these notes, but so close to the boundary-line that the following list, which has not previously been published, may be useful:—*Sympetrum striolatum* ("unusually plentiful in August and September, 1895"), *S. flaveolum*, *S. sanguineum*, *S. scoticum* ("a few"), **Libellula depressa* ("fairly abundant"), *Orthetrum cærulescens* ("not captured"), *O. cancellatum* (male, "not captured"), **Cordulegaster annulatus* ("not captured"), **Anax imperator* ("usually plentiful but rather uncertain"), *Æschna mixta*, **Æ. cyanea*, **Æ. grandis*, *Lestes viridis* (male taken 11th August, 1899, and now in the collection at South Kensington), *L. sponsa*, *Pyrrhosoma nymphula* ("observed only in June, 1905, when it was rather plentiful"), **Ischnura elegans*, *Agrion puella* ("always abundant"), and *A. cyathigerum* ("sometimes in swarms"). Those marked * also occur in the writer's garden at Kitchener's Meads. To the species above enumerated may be added *Calopteryx splendens*, which has been taken by Miss Alice Dickinson in the Lea valley, between Harpenden and Wheat-hampstead, bringing up the total for the neighbourhood to 19 as against 24 recorded for the county.

TRICHOPTERA.—When getting together a collection of Trichoptera for the County Museum the following species were found in the vicinity of the city, and here again those captured round the

fish-pond at Kitchener's Meads are marked with an asterisk:—
**Phryganea grandis*, **Glyphotælius pellucidus*, **Lymnophilus lunatus*, *L. extricatus*, *L. hirsutus*, *Anabolia nervosa*, *Stenophylax concentricus*, **Notidobia ciliaris*, **Molanna angustata*, and *Mystacides longicornis*.

Very little is known about the occurrence in the vicinity of St. Albans of species comprised in the smaller Families of the old Linnean Order Neuroptera, local students of entomology not having given attention to these insects.

HYMENOPTERA.—The collections in the County Museum contain a fair number of local Aculeata and saw-flies, but the more obscure entomophagous Families have not been locally investigated.

LEPIDOPTERA.—The butterflies and moths are the only insects which have been carefully studied so far as their distribution within the area now being dealt with is concerned. For the first locally published notes on the subject we are indebted to the Rev. C. M. Perkins, a former master of the St. Albans Grammar School, who, in 1878, contributed a paper on "British Butterflies" to the Watford (now the Hertfordshire) Natural History Society ('Trans. Watford N. H. Soc.,' Vol. II, p. 63). In the course of his remarks Mr. Perkins recorded the occurrence of several species of Rhopalocera at St. Albans, but the paper is a general one, and does not profess to give a complete list of our local butterflies. In 1884 the investigation of the Lepidoptera of the neighbourhood was greatly stimulated by the publication by Mr. A. F. Griffith of a systematized list of species observed in the Sandridge district, the locality concerned being within the five-mile radius of St. Albans, and 514 species were therein enumerated ('Trans. Herts N. H. Soc.,' Vol. III, p. 58). In a supplementary paper read in 1890, dealing chiefly with the Tineina, Mr. Griffith brought up the number of the species in his Sandridge list to 832 (*ibid.*, Vol. VI, p. 97). Since that time other observers have been at work in the neighbourhood, and of late years the writer has kept, as recorder of the Insecta for the Natural History Society, a register of all species taken in the county. In the subjoined list are set out the number of species of the different Families which have been observed up to the present time within five miles of St. Albans (931) compared with the numbers recorded for the whole county (1182):—

	Herts.	St. Albans.		Herts.	St. Albans.
Rhopalocera	50	34	Geometræ	193	155
Sphingidæ	26	16	Pyralidæ and Crambi	100	74
Bombyces	78	62	Tortrices	176	149
Noctuæ	200	161	Tineæ	359	280

In comparing these figures it should be remembered that the county list contains many records, made in the neighbourhood of Hertford by J. F. Stephens, the veteran entomologist, in the

early part of the last century, of species which have long since disappeared from their old haunts, including among the Rhopalocera, for instance, such butterflies as *Apatura iris* and *Vanessa c-album*, which we can hardly hope will occur again. We can, however, boast of having received a visit in recent years from another rare diurnal, *Vanessa antiopa*, a specimen having been taken in the Hatfield Road School, in the centre of the city, in 1900, and there are one or two other records of it having occurred in the neighbourhood of St. Albans. Butterflies which have been caught in our district include *Colias hyale*, *C. edusa*, *Brenthis selenæ*, *B. euphrosyne*, *Argynnis paphia*, *A. adippe*, *Vanessa polychloros*, *V. cardui*, *Thecla w-album*, *T. quercus*, *Lycæna argiolus*, and *L. corydon*, the last-named on a farm many miles from its usual habitat on the chalk downs, it being very abundant on the Chilterns in the north-west of the county.

Turning to the Heterocera, our largest Sphingid, *Acherontia atropos*, the death's-head moth, is occasionally seen, sometimes at rest on posts, etc., but more frequently in the larval or pupal stage in potato fields, where it is found when the crop is being harvested. In some years the convolvulus hawk-moth (*Sphinx convolvuli*) appears in small numbers. The two elephant hawk-moths are also present. The larvæ of the larger one, *Cherocampa elpenor*, is sometimes abundant along the river-side at Colney Heath, feeding on willow-herbs and water-betony, and is seen now and again in gardens on fuchsia and vine. The smaller species, *C. porcellus*, is less frequently met with in the district, its head-quarters being on the chalk hills, where the larvæ feed on the yellow galium. Of the clearwings, *Macroglossa bombyliformis*, *Trochilium apiformis*, *T. crabroniformis*, *Sesia asiliformis*, and *S. tipuliformis* occur, but only the last-named can be said to be common.

The best hunting-ground in the neighbourhood of St. Albans is undoubtedly Bricket Wood, a large stretch of timbered land, probably a survival of the primæval forest which once covered this part of Britain. The trees are mostly oaks, the sub-soil being boulder-clay. Around these woods, especially along the railway-line, there are many willow-bushes, which in the early spring offer a tempting bait to the catkin-haunting Noctuæ. Indeed, all the British species of the genus *Tæniocampa*, except *T. opima*, which can scarcely be expected, occur, it being one of the few Hertfordshire localities for the beautiful *T. miniosa*. The wood used to be a good sugaring-ground, but of late years the bait does not appear to allure the large numbers of "peach-blossoms" and other attractive species which used to reward the night worker. Dusking in this and other Hertfordshire woodlands and the country lanes often proves very remunerative, for many interesting geometers have been taken in this way.

The Micro-lepidoptera of the neighbourhood have not received so much attention as they deserve, but the record-books show that 149 out of the 343 species of Tortrices given in South's list

have been observed. Our knowledge of the local Tineina is much more limited, the presence of only 280 of the 720 British species having been detected.

It is impossible in these short notes to attempt to give a list of the butterflies and moths which are known to inhabit even the small area which is being dealt with, but those desirous of further information with regard to our insects should consult the list printed in the 'Victoria History,' and inspect the collections at the County Museum, where all species recorded to have occurred in Hertfordshire are marked with a red disc. There are many British insects still wanted in the cabinets, and the writer will welcome help from those willing to assist in making the collections more complete.

HEMIPTERA.—The following species of Coccidæ, the plant-pests well known as scale-insects, are recorded as occurring at St. Albans:—*Mytilaspis pomorum*, on apple and cotoneaster; *Lecanium viburni*, a very local species, but plentiful at St. Albans on hawthorn; *Lecanium caprea*, abundant on hawthorn; *Asterolecanium variolosum*, exclusively confined to the oak; *Aptero-coccus fraxini*, on the ash, comparatively rare; *Cryptococcus fagi*, common on the beech. These records are from the personal observation of Mr. Robert Newstead, author of the 'Coccidæ of the British Isles' (Ray Society), who has presented to the County Museum specimens of *Lecanium bituberculatum* on *Cratægus oxyacantha* from King's Langley, just outside our district.

DIPTERA.—In 1907, in conjunction with Mr. P. J. Barraud, the writer presented to the Hertfordshire Natural History Society "A Preliminary List of Hertfordshire Diptera" ('Trans.,' Vol. XIII, p. 249) largely made up from the extensive collection presented to the British Museum (Natural History) by the late Mr. Albert Piffard of Felden, but containing also a good many records of flies taken by the authors. There are 116 species included which occur within the five-mile radius, and of these the great majority were taken in the garden at Kitchener's Meads. Some interesting specimens were captured in Præ Wood on the Gorhambury estate, a locality which appears to afford better collecting for the dipterist than the lepidopterist.

4. PISCES, BATRACHIA, AND REPTILIA.

PISCES.—Remains of ancient fish-stews at St. Albans and elsewhere are evidence of the sometime importance of coarse fish as food. What are still known as the "pond-yards" at Gorhambury were constructed by Sir Francis Bacon, and there he bred and fed and caught carp and other species, which in his day were held in higher esteem for the table than is now the case. Such information as is available about the fishes now to be found in the district is of interest mainly from the angler's standpoint, and the group has received scant attention from naturalists. The detailed distribution of the different species

and their ecological relations still await investigation. The calcareous nature of the soil involves a scarcity of ponds and marshes, but the Lea skirts the northern boundary near Wheathampstead, and the confluent Ver and Colne traverse the whole district. The Lea is one of the few British rivers in which the barbel is taken, but there is no evidence to show whether it occurs in the short stretch of the stream that comes within our purview, and the same must be admitted of some of the other fishes that have been recorded for the Lea. The salmon is referred to by Izaak Walton as a Lea fish, and no doubt in his day it regularly passed through Wheathampstead on its way to the redds in the upper reaches of the stream, but it has long been extinct. The brook trout, provided it has some measure of protection from the voracious and abundant pike, does well in the Hertfordshire streams, and the Colne at Munden has furnished some good fish. In 1896 one was taken which scaled 6 lb. 6 oz., and between two and three hundred fish averaging more than 1 lb. in weight is the yearly catch in the Munden waters.

Of coarse fish the rivers yield perch, ruffe, gudgeon, chub, rudd, roach, bleak, dace, bream, and eel in greater or less abundance. The carp is found at London Colney and elsewhere, but this species and the tench should be sought in still waters rather than in the streams. Among the smaller species, which the angler disdains, the miller's thumb is not uncommon in small gravelly streams, the loach has been taken in the Ver, and the minnow is plentiful. The three-spined stickleback is abundant, and the ten-spined stickleback is found in the Lea and in the Ver at St. Albans. The lampern has been taken in the Lea, and no doubt occurs in many of the smaller streams.

BATRACHIA.—Britain, by reason of its insular position, is poor in amphibians when compared with the neighbouring countries of the European continent, and of the meagre total only such species as are generally distributed have been observed in the St. Albans district. It may be remarked, however, that the natterjack toad and palmated newt are recorded from Hertfordshire localities not far from the confines of the district, and further search may show that they occur within a radius of five miles from the centre of the city.

The four common batrachians—the great crested newt, the common newt, the common frog, and the common toad—are so abundant and generally distributed as to warrant only passing comment.

REPTILIA.—The remarks as to the scarcity of amphibians in Britain apply equally to reptiles. The viper is now rare in England, and the only record of its occurrence in Hertfordshire is of one found in the parish of Kensworth and now in the possession of Mr. James Saunders. Although probably extinct in our district, it was no doubt at one time to be found on the heaths and commons. The grass or ringed snake is rare.

There are specimens in the County Museum from Bernard's Heath and Shenley, captured in 1902 and 1903 respectively, and it has been observed at St. Albans and Munden. The viviparous lizard is occasionally seen on the heaths and in sandy hedge-banks, while the slow-worm, though now rare, has been taken in recent years near Wheathampstead and St. Albans.

5. AVES.

A rigid classification of the birds of a restricted area can seldom prove entirely free from exception or objection; yet, as this brief account of the birds which have been recorded within a radius of about five miles from St. Albans is written mainly for the information of visitors to the district, it is thought well, both for the sake of clearness and with the object of giving a detailed review of the birds which may be found here "according to their seasons," to attempt the classification here given.

(1) *Resident Species.* These are species of which individuals may be found throughout the year, and which therefore include, generally speaking, our native, resident, breeding birds. It is not suggested, however, that in all cases the individuals of any particular species met with in summer are also those which are present in the winter, nor is it suggested that every bird which appears in this list nests every year within the district. The list comprises the following 55 species:—Missel-thrush, song-thrush, blackbird, stonechat, redbreast, goldcrest, hedge-sparrow, long-tailed titmouse, great titmouse, coal-titmouse, marsh-titmouse, blue titmouse, nuthatch, wren, tree-creeper, pied wagtail, greenfinch, hawfinch, goldfinch, house-sparrow, tree-sparrow, chaffinch, linnet, bullfinch, corn-bunting, yellow-hammer, reed-bunting, starling, jay, magpie, jackdaw, carrion-crow, rook, skylark, swift, greater spotted woodpecker, lesser spotted woodpecker, green woodpecker, kingfisher, barn-owl, brown or tawny owl, little owl, sparrow-hawk, kestrel, common heron, mallard, ring-dove, stock-dove, pheasant, partridge, red-legged partridge, moorhen, coot, lapwing, and little grebe or dabchick.

Of the birds in this list it may be remarked that as nesting species, the stonechat, the goldcrest, the hawfinch, the reed-bunting, the carrion-crow, the woodpeckers, the kingfisher, and the owls are by no means common, while the goldfinch, the tree-sparrow, the corn-bunting, the magpie, and the sparrow-hawk are decidedly rare. The little owl, moreover, is a recent addition to the permanent bird life of the district; while the heron, though it may be seen more or less all through the year, has never (to the writer's knowledge) been known to nest in the district. In fact there is no known heronry in the whole county of Hertfordshire. The goldfinch, it is gratifying to record, has decidedly increased in numbers during recent years.

It is possible that the long-eared owl, as also the cirle-bunting, may occasionally occur in the district, though, never having received a record of either of them, the writer has not felt justified in including them in the list. There is, too, more than one ideal nesting haunt for the Dartford warbler in the district, but so far the bird has never yet been recorded.

(2) *Summer Visitors*.—These birds, nearly half of which consist of warblers, are known, as a rule, to come to the district in the springtime for nesting purposes, and having fulfilled their object in this respect, to leave again for more southern climes in the autumn or early winter. The list includes the following 25 species:—Whinchat, redstart, nightingale, greater whitethroat, lesser whitethroat, blackcap, garden-warbler, chiffchaff, willow-wren, wood-wren, sedge-warbler, grasshopper-warbler, yellow wagtail, tree-pipit, red-backed shrike, spotted flycatcher, swallow, house-martin, sand-martin, nightjar, wryneck, swift, cuckoo, turtle-dove, and corncrake.

The birds included in this list may mostly be described as fairly common, though naturally, as some of the species find the district more congenial to their requirements than others do, they are more numerous. Three of them, however, are decidedly rare, viz., the wood-wren, the grasshopper-warbler, and the corncrake, the last named having for some mysterious reason undergone a most striking diminution in numbers during recent years. Of the presence of the grasshopper-warbler a record has not been received for several years.

With regard to the blackcap there is a most unusual record, a couple of birds of this species having been observed for several days in a garden within the city during the bitterly cold weather of *February, 1902!*

It is possible also that the white wagtail and the reed-warbler might be added to this list, though there is no record of the occurrence of either of these species.

(3) *Passing Migrants*.—These are birds which, as a rule, appear in springtime with the so-called "summer visitors," but which, unlike them, do not appear to find congenial nesting-quarters in the district, and so pass on "further north." Generally speaking, they again pass through the district on the return migration in the autumn. They include the ring-ouzel, wheatear, quail, stone-curlew, common sandpiper, and green sandpiper.

Of these, the wheatear probably, and the stone-curlew certainly, nest every year within the county borders, though in diminishing numbers. The quail formerly nested freely in the north of the county, and the common sandpiper has been known to do so on one occasion. A wheatear's nest was found at Smallford in June, 1887, "under a tuft of grass by the side of a gravel-pit"; the only nesting record of the species for the district. Similarly the reported nest of the ring-ouzel found at Gorbambury in 1902 is the single instance of the

nesting of that species near St. Albans. There are only four records for the whole county.

(4) *Winter Visitors*.—These birds, as a rule, come into the district from more northerly haunts for the winter season, and disappear again with the return of more genial weather in spring. They include the redwing, fieldfare, grey wagtail, meadow-pipit, siskin, brambling, lesser redpoll, hooded crow, water-rail, golden plover, woodcock, and common snipe.

Of these it may be remarked that the lesser redpoll seems to be extending its summer range southwards, nests having been found of recent years in several of the Home Counties. It is reported, indeed, that a nest was found at Sopwell in 1898, and a local observer saw a pair of redpolls at the same place in July, 1909. It is probable that the meadow-pipit nests occasionally in the district, as may also, very exceptionally, the woodcock and the common snipe.

The hooded or grey crow and the golden plover are regularly seen every winter—the latter in large flocks—in the east of the county, and they are reported in much smaller numbers almost every year from the St. Albans district. Further west in the county (save perhaps at Tring) they are almost unknown, so that apparently the St. Albans district forms the western limit of their annual distribution in Hertfordshire.

(5) *Casual and Irregular Visitors*.—In this class are included (a) birds which, like the waxwing, the crossbill, and the sand-grouse, occur irruptively, in greater or smaller numbers, and at irregular intervals; and (b) birds of which only occasional stragglers are seen and recorded. In either case such exceptional visitors are mostly shot down as “rare birds,” though in not a few cases they have been killed by flying against the telegraph wires. The following have been recorded:—Golden oriole (1899), great grey shrike (1879 and 1901), waxwing (1895), mealy redpoll (a pair caught in the winter of 1881, the only record for the county), crossbill (large flocks, 1879, 1909, and 1910), snow-bunting (1883), chough (May, 1884, the only record for the county), raven (1881), woodlark (1878–79), short-eared owl (1877), common buzzard (1881 and 1900), peregrine falcon (two occurrences, dates uncertain), cormorant (1885), gannet (1884), purple heron (1903, the only record for the county), bittern (date uncertain), wild goose (“nearly 100 wild geese,” species unknown, seen March, 1895), goosander (1890), Pallas’ sand-grouse (seven seen near Batch Wood, May, 1888), spotted crake (1880 and 1910), ringed plover (1884), dunlin (1890), sanderling (1893), redshank (1891), black tern (1886), common gull (1880), herring gull (1881), kittiwake (1884), little auk (1885 and 1910), puffin (1894), and storm petrel (1886).

The raven doubtless formerly nested in Hertfordshire, and the bittern is known to have done so on one occasion. But perhaps the “most misplaced” bird in this list is the woodlark which

was observed in March, both of 1878 and 1879, in a field close to Symond's Hyde Wood, Sandridge, and of which the observer wrote: "It was, I have no doubt, about to breed, as it is a very early nester, but I left too early each year to find the nest." And this is the only known record of the bird for this district during thirty-two years!

Summing up, the following result is obtained:—

Residents	55 species.
Summer visitors	25 "
Passing migrants	6 "
Winter visitors	12 "
Casual and irregular visitors	31 "

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From the ornithological point of view it is unfortunate that there is no large sheet of water (like the reservoirs at Elstree and Tring) within the St. Albans district, for with an attraction of this kind the number of species visiting the district could not fail to be largely increased.

In conclusion it should be stated that the above lists have been very largely compiled from records contained in the Annual Reports upon Birds which appear in the 'Transactions of the Hertfordshire Natural History Society' from 1875 to 1911. Many local recorders have taken part in supplying notes for the preparation of these reports, but the Society is particularly indebted to Miss Dickinson, to Mr. A. W. Dickinson (New Farm, St. Albans), to Mr. A. E. Gibbs, and to Mr. Henry Lewis for their many years' observation of the bird life of the district.

6. MAMMALIA.

In the neighbourhood of St. Albans, as in most parts of England, the mammalian fauna is, in point of species, a declining one. Divers causes have contributed to this state of things, and have operated for centuries, but speaking broadly the changes brought about by the growth of population and the consequent intensive cultivation of land, and the increasing rigour with which the preservation of game—fur, feather, and fin—has been practised, have been more potent factors in the status of many species than has the internecine war between different forms which is involved in the struggle for existence under natural conditions. Indeed, it may be said that the mere existence of many creatures is incompatible with our modern civilization.

Since the earliest times wild beasts have been reduced in numbers and finally exterminated, but the causes to which I have referred have probably operated more stringently on our native fauna during the last hundred years than ever before, and such has been and is the popular apathy with regard to the matter, that species after species has gone under before it was realized that they had even become uncommon. The result is, that

although we may say with certainty that particular animals were formerly common and generally distributed, no actual evidence exists, or at the best we have to rely upon a vague reference in some old book, the chance discovery of some bones, or a stuffed specimen whose history is mainly a matter of conjecture. We know almost nothing of the wolf, wild boar, wild cat, and deer, which disappeared in mediæval times, whilst the recent discovery of antlers of the red deer and roe in alluvial deposits of the Colne Valley, near Watford, interesting though it is, furnishes but meagre evidence of the then state of things.

Until quite recently the marten was, no doubt, abundant in the wooded district about St. Albans, but it has gone utterly, and the only evidence of its former existence in Hertfordshire is the record of one that was killed in Oxhey Woods in 1872. The polecat, too, has become extinct in our own time; one in the County Museum which was killed at No-Man's Land about the year 1847, is one of the few known Hertfordshire specimens. The badger and otter, if they still occur in the district, are extremely rare. Most of the mammals which are still to be found are either nocturnal or crepuscular in habit, and are therefore apt to be overlooked, but a careful investigation would probably show that other species than those of which we have actual knowledge occur.

Bats are frequently seen but seldom identified. The pipistrelle and long-eared bat abound, but it is unwise to conclude that every small bat one sees is referable to one or other of these. Daubenton's bat has been observed flying over quiet reaches of the Colne near Munden and elsewhere. The barbastelle has been taken just beyond the confines of the district, and the lesser horseshoe is recorded for the county without precise locality. Both of these, as well as the whiskered and Natterer's bats, probably occur in the neighbourhood of St. Albans. The high-flying noctule is common.

The hedgehog is often encountered at dusk, and the presence of the mole is proclaimed everywhere by the hillocks it casts up in its subterranean wanderings. The "fortress" in which it dwells is a conspicuous object in spring in the low-lying meadows of the river-valleys. Cream-coloured examples of the mole have been trapped on several occasions in the district. The common shrew occurs everywhere in hedge-banks and similar places. There are albino specimens in the County Museum, captured at Symond's Hyde in 1903 and at St. Albans in 1910. The water-shrew is not uncommon in watercress beds and small streams, but there is as yet no definite record of the lesser shrew.

Among the Carnivora the fox lives by sufferance, tolerated and even fostered in the interests of sport. The weasel and stoat still maintain a footing in spite of relentless persecution by the game-preserve. Even if it were not illegal and public opinion countenanced it, the cruel sport of badger-baiting would



PART OF THE ROMAN WALL, VERULAM WOODS.

now be impossible if its votaries had to depend upon locally caught badgers, but in the first half of the last century badger-baiting is said to have been a feature of Sandridge Fair, and at a later date—in the seventies and eighties—badgers were trapped in the neighbourhood of Munden and Aldenham. The otter often strays from its customary haunts, and we may still hope to hear of its occasional visits to the local streams, but any such occurrence would be noteworthy. A dog otter which was shot at Munden—not far, by the way, from Otterspool—in February, 1875, is said to have scaled thirty-two pounds—an exceptionally heavy beast.

The Rodents bulk largely in the fauna of most parts of England at the present day, and “rats and mice and such small deer” are certainly more abundant in the district than they would be if their natural enemies, the predatory mammals and birds, were given fair play. The black rat, once ubiquitous, has, it is true, disappeared entirely, and no authentic record of its actual occurrence even exists. In this case the creature’s foes were “they of its own household,” for it succumbed in competition with its more powerful congener the brown rat, which, like the house-mouse, is an all too common and destructive pest. A melanic example of the brown rat was caught at Wheat-hampstead in 1892. The wood-mouse, locally “hog-mouse,” is plentiful in hedge-banks and coppices, and in such situations the bank-vole abounds. This vole, which is partial to beech-mast and may often be seen feeding among the fallen leaves in autumn, is perhaps the most abundant of the small mammals. The field-vole affects meadow-land rather than hedge-banks, while the water-vole, another abundant species, is to be found in every watercourse. There is no certain record of the harvest-mouse, but it probably occurs, as it has been taken elsewhere in the county. The dormouse, known to the country folk as “the sleeper,” is fairly abundant, and the same may be said of the squirrel. The rabbit everywhere abounds, and the hare, thanks to protection, exists in numbers sufficient to afford sport for a pack of harriers.

VIII. ARCHÆOLOGY.*

Scattered finds of flint implements are all that remain to tell us of the conditions of the district around St. Albans in the earlier part of the pre-historic period. A few flakes from Bernard’s Heath and a couple of ovate implements from No-Man’s Land are the only relics of Palæolithic man which have been discovered in the immediate neighbourhood. The Neolithic Age has been more fruitful; celts and flakes have been found at Bedmond, Abbot’s Langley, Sandridge, and

* The Society is indebted to Messrs. Gibbs & Bamforth, Ltd., for permission to reproduce Plates X and XI illustrating this article, and to the Homeland Association for Plate XII, which is from a photograph by Mr. Stanley Kent.

Wheathampstead, but as yet no other indications of habitation have been seen. The Bronze Age has yielded nothing but some rough lumps of metal found at Westwick in St. Michael's parish. During the two last-named periods, however, this district was dense forest, which would have been incapable of supporting a population, and therefore the objects discovered are probably merely the relics of a few chance inhabitants and not of a settled population.

It is not till we arrive at the Late Celtic Age, when implements of iron were brought into use to clear the forest, that there was any organized settlement. The site where St. Albans now stands was within the area of south-eastern Britain overrun about B.C. 200 by Belgic tribes, who came from north-east Gaul. Their civilization was in advance of that of the native inhabitants. They introduced coinage and carried on a fairly considerable traffic with the continent. The tribe which settled in what became Hertfordshire was the Catuvelauni. It may be to this people that we can attribute the original earthworks surrounding Verulam, their chief seat, and the causeway now leading to Verulam Woods, for as yet no objects of a date earlier than Late Celtic have been found at Verulam. It was to the *oppidum* of Cassivellaunus, the Prince of this tribe who led the coalition of British tribes against the Romans, that Cæsar during his second invasion in B.C. 54 directed his march, and eventually took it. This *oppidum* it is reasonable to identify with Verulam, which well agrees with the description given by Cæsar of the stronghold of Cassivellaunus. Cæsar's invasion was only of the nature of a punitive expedition. It established a Roman influence and opened up political and trading relations between Britain and the Roman Empire, but it left the government of this country in the hands of native princes.

One of the results of the Roman influence was the inscription of British coins in Latin, the earliest British inscribed coins being struck at Verulam by Tasciovanus, who succeeded Cassivellaunus about B.C. 30. Tasciovanus was succeeded about A.D. 5 by Cunobeline, the Cymbeline of Shakespeare, who died shortly before the Emperor Claudius began the conquest of Britain under Aulus Plautius in A.D. 43. The south-east of Britain was soon placed under Roman rule. Verulam, being the most important town in the south if not in all Britain, was made a *municipium* or town which enjoyed self-government, and was the only Romano-British town that was ever thus privileged. Together with Colchester and London it was sacked by Boadicea in A.D. 62, and shortly after this date it was probably somewhat overshadowed by the trading town of London then rising into wealth. From the little we know of its buildings, it must, however, have continued a place of considerable importance till the withdrawal of the Roman Legions in A.D. 410, and probably for some time later.

The episode for which Verulam is perhaps best known is the

beheading of St. Alban, traditionally the first Christian martyr in Britain, which took place under the edict of Diocletian published in A.D. 303. This and the fact that St. Germain saw the shrine of St. Alban here when he came to this country to refute the Pelagian heresy in A.D. 429 would indicate possibly that Christianity was firmly established at Verulam.

The earthworks of Verulam, except on the east face which adjoined the dammed up waters of the River Ver, consist of a bank of earth piled against the wall on the inside, a berm in front of the wall, and a dry ditch of considerable dimensions. On the south-west side this ditch is doubled, possibly because the ground on the outside is higher here than that within. The city wall is probably of the end of the third century, and can be traced for the greater part of the circumference of the city. It is of flint-rubble, faced with flints, with lacing courses of tiles at irregular intervals. The thickness of the wall varies from 9 ft. to 13 ft. 6 ins., and the greatest height now standing is 10 ft. The most important pieces of the wall are St. Germain's block, the continuous line of wall in the Verulam Woods, a piece in a field to the north-west of Blue House Hill, and Gorhambury Block, a little way up the Drive to Gorhambury House. The chief buildings which have been excavated are the Theatre, the remains of which lie on the west side of the Gorhambury Drive, and part of the Forum, which lies in St. Michael's Glebe. The Theatre, the only one of Roman date discovered in Britain, was opened and planned by Mr. Grove Lowe in 1847. It consisted of a stage 8 ft. 8 ins. wide and 46 ft. long, and a nearly semi-circular auditorium 190 ft. in diameter. The Forum was partially opened in 1898-1908 by the Rev. C. V. Bicknell and the writer. It consisted of a courtyard 215 ft. by 308 ft. surrounded by corridors and apartments of considerable size opening into them.

The Roman city was intersected by streets dividing it into squares in the usual manner adopted in a Roman town. The principal street was formed by Watling Street, which came from London by the Edgware Road through Elstree and Radlett, and followed approximately the present road through Park Street to St. Stephen's. Here the existing road diverges in a northerly direction to St. Albans, but the Roman road continued across the fields to the east gate of the city, the approach to which over the ditch can be seen just north-east of the entrance to Verulam Woods. It crossed the Roman city and left it by the west gate which stood a little to the north-east of Gorhambury Block. It followed the line of the Gorhambury Drive for a short way, and then, continuing in a straight line across the fields to Bow Bridge, there joined the existing road again, coinciding with it to Redbourn and with slight deviations on to Chester. The other main road entered the city from the south-west by the south gate which stood a little to the north-west of the footpath which runs from King Harry Lane to St. Michael's Church, where the approach to it over the ditch can be seen in the meadow.

The site of the north gate is lost, and the line of this road north-eastward can only be conjectured.

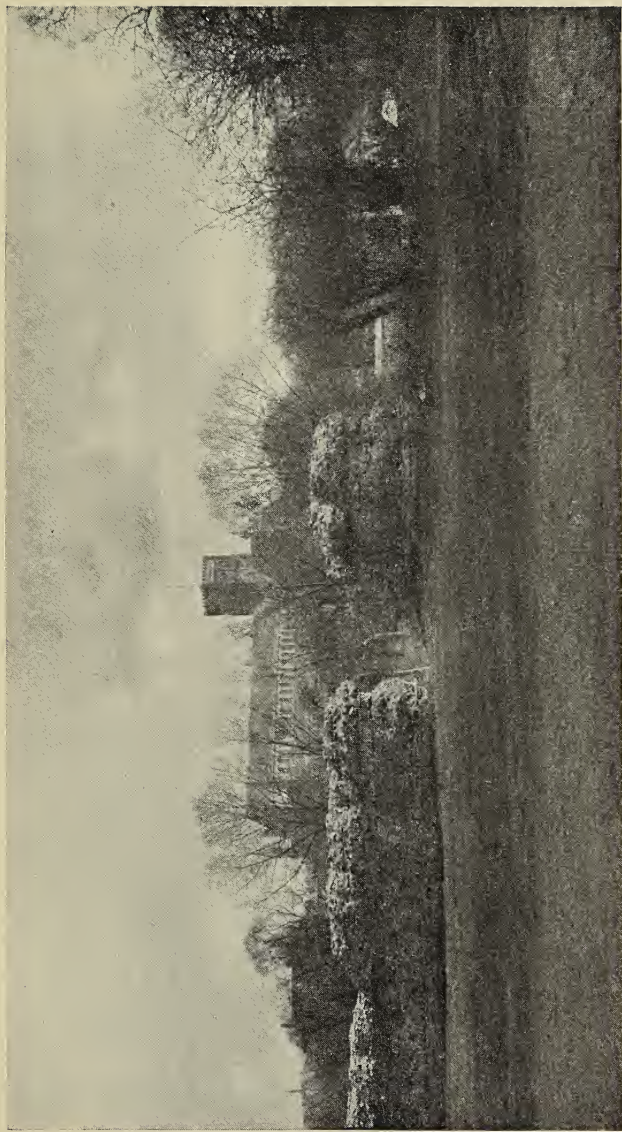
It is not known how Verulam fell, but from the evidence of excavations it was deserted and became a quarry for the builders of St. Alban's Abbey and town. Coins found on the site point to its having been inhabited up to the sixth century, but it appears from Gildas, who wrote in the middle of that century, that the site was then desolate.

Some time after the fall of Verulam a settlement was established at Kingsbury on the north side of the River Ver. The earthworks of this town can be seen much mutilated in New England Fields and in the gardens on the other side of Mount Pleasant, on the north side of Fishpool Street, on the east side of Branch Road, and on the south side of the Verulam Road. Only one entrance can be traced, which was at the point where Mount Pleasant enters the earthworks. At the south-east angle is a projecting bulwark causing the bend in Fishpool Street.

Kingsbury was a royal borough and a fortified town probably of some importance, a council it is said having been held here in the ninth century. It was also an administrative centre where as we learn from the 'Gesta Abbatum' the King's officers were maintained for keeping the peace of the district.

St. Alban's Abbey was founded in 793 by Offa II, King of the Mercians, in atonement, it is reported, for the murder of Ethelbert, King of the East Saxons, a suitor for the hand of his daughter Elfleda. The little church, built by British converts on the site of the martyrdom, was restored and may have been incorporated in the Saxon monastic church then built. The only relics of the Saxon church now remaining are some of the baluster shafts in the triforium of the north and south transepts of the Abbey. Offa and his son Egfrith granted a rich endowment to the monastery, including nearly all the south-western part of the country. This district was apparently forest waste which the monks gradually cleared, colonised, and divided into parishes.

Abbot Wulsin about 950 laid out the present market-place at St. Albans, which then extended from what is now the High Street to St. Peter's Church and from the west side of French Row to the east side of Chequer Street. The Town Hall and the buildings southward, and also the east side of French Row, are encroachments of an early date. The Abbot cut up the land fronting the market-place into plots which extended back to the borough boundary, and encouraged people to settle here by assisting them with money and building materials. The town was probably at this time bounded and possibly defended by a ditch called Tonman's Dyke which certainly existed in the time of King Stephen some two hundred years later, and remains in places to this day. St. Albans thus gives us the plan of a Saxon market-town. It was laid out on the north of



PART OF THE RUINED WALL OF VERULAM.

the Abbey precincts around a large triangular market-place formed on the west side of a high road by the widening of that road, and was defended probably by a ditch.

The Abbot's town flourished, and there consequently arose a rivalry between it and Kingsbury, its neighbour. The Abbot, to gain an advantage for his tenants, purchased between 957 and 975 from King Edgar the lake on the south-west side of Kingsbury, which was a source of livelihood to the King's townsmen, and drained it. The drainage was effected by cutting through the British dam or causeway on the south of the lake where the opening still remains, though recently spanned by a small brick bridge. This, however, had not the desired effect of ruining the royal town, so a few years later the Abbot bought from King Ethelred the whole site of Kingsbury except the small eastern bulwark before referred to. He summarily turned out the inhabitants and levelled the town. The bulwark remained in the hands of the Crown *quasi spina in oculo* of the monastery till King Stephen granted it to the abbey about 1152, when the site was levelled, ploughed, and sown.

At the time Abbot Wulsin laid out the market-place at St. Albans, he also built the churches of St. Peter, St. Michael, and St. Stephen at the three approaches to the town. No part of the existing churches seems to be of so early a date as Wulsin, but the church of St. Michael is a Saxon church probably of the early part of the eleventh century, and originally consisted of a nave and chancel, the existing features of this date being the remains of the Saxon windows over the nave arcades, and the blocked doorway on the north side of the chancel. The present St. Stephen's Church, and Sandridge Church, formerly a chapel of St. Peter's, were probably both built just after the Conquest.

Of objects of archæological interest outside the city of St. Albans, mention must be made of the Aubreys Camp at Redbourn. The earthworks of this camp have a resemblance to those at Verulam, on a smaller scale, and may be of the Late Celtic period, but no systematic excavations have been made and no finds indicative of a date have been discovered. The camp is oval in shape and covers about 23 acres. The rampart and ditch are double, except on the west, where they are single, and on the east, where a single rampart and ditch alone remain, the other having been destroyed. There is only one well-defined entrance, but indications exist of a small opening on the north.

The Hills of the Banners at Redbourn Common, where the bones of St. Amphibalus and his companions were supposed to have been found in 1178, were clearly, from the minute descriptions given by the chronicler, two Saxon barrows, and the bones found those of pagan Saxons.

The Dykes in Sandridge and Wheathampstead parishes, known as Beech Bottom, the Devil's Dyke, and the Slad, are unlike ordinary boundary dykes as the two last-named at all events have no ramparts. The object and date of these earthworks are

entirely unknown and must remain so till we get to know more of this kind of work.

Two Romano-British pottery-kilns were found at Loom Lane, Radlett, in 1898. They were for the manufacture of ordinary Romano-British ware, but their particular interest was that the "mortaria," of which numerous pieces were found, were stamped with the name "Castus," evidently the name of the potter.

Many objects of interest of pre-Norman date have been discovered in the neighbourhood of St. Albans, especially on the site of Verulam, but space will not permit of their enumeration here.

IX. THE COUNTY MUSEUM.

The Hertfordshire County Museum is situated in Hatfield Road, St. Albans, upon a site generously provided by the late Earl Spencer. The foundation-stone of the first portion of the permanent building, i.e. the Museum as it now stands, was laid on 20th July, 1898, by Lady Evans, and in less than sixteen months later this wing was opened and dedicated to public use by Lady Cowper. The Museum and its contents are vested in the Herts County Council, the governing bodies being a general committee elected from the County Council, the various local authorities, and the scientific societies of Hertfordshire, together with an executive committee, known as the Board of Curators. The official staff consists of a Curator and a Caretaker.

The Museum is open free to the public every week-day except Friday from 10 a.m. to 1 p.m. and from 2 p.m. to 4 p.m.; on Thursdays also from 7 p.m. to 9 p.m. The St. Albans and Herts Archæological Society, the St. Albans Camera Club, and the St. Albans and District Beekeepers' Association have their headquarters here and hold regular meetings in the lecture-room, and occasional lectures are delivered in it during the winter months under the auspices of the Hertfordshire Natural History Society.

The Museum is primarily intended to be illustrative of the Topography, Geology, Natural History, and Archæology of Hertfordshire, but whilst special prominence is given to objects of a local character the collections cover the whole of the British area.

In the main hall are temporarily placed two cases containing the last half of the mounted ornithological collection. The orders here represented comprise the *Limicolæ*, *Columbæ*, *Gallinæ*, *Anseres*, *Gaviæ*, etc. As with the rest of the collection at present situated in the Natural History room, a red disc is affixed to the label when the species has been recorded for Hertfordshire.

The lecture-room, which adjoins the hall, is partly devoted to the purposes of a Library, and here are housed the

“Lewis Evans Collection” of Hertfordshire books, pamphlets, manuscripts, drawings, engravings, and maps, an important accumulation of upwards of five thousand items, acquired by purchase from Mr. Lewis Evans in 1901; and also the library of the St. Albans and Herts Archæological Society and sundry other collections of literature dealing with the county. The task of indexing this large mass of literary material was undertaken a few years since by the Hon. Librarian, Mr. H. R. Wilton Hall, and it is due to his untiring work that the Museum Committee was enabled to publish a catalogue (in two parts) of the bound volumes contained in the collection.

The greater portion of the Topographical Art Section is also shown here upon covered screens and around the walls. A remarkably fine series of drawings by the late Mr. F. G. Kitton, a former Hon. Secretary of the institution, is shown at the north end of the room, whilst sundry water-colours executed by Mr. E. A. Phipson and others give an excellent impression of picturesque Hertfordshire, past and present.

A lack of more suitable quarters has necessitated the temporary display of part of the collection of mammals at the south end of this room. Several of the specimens have been cased with natural surroundings, and it will be seen that the series, although far from complete, includes several items of interest.

On the stairway, amongst other framed prints and drawings of local interest, there is a fine painting in oils of Sleepshyde Farm by the late Mr. H. G. Moon.

On the first landing is the Natural History room. Here may be found zoological collections of a rich and varied character.

The first half of the Bird collection is exhibited in two cases, and, comprising as it does the Passeres, Picariæ, Striges, Accipitres, Herodiones, etc., embraces several examples of much interest to the local zoologist. There is a fair sprinkling of “varieties”, amongst which may be specially mentioned a fine cinnamon-coloured blackbird, similarly coloured hedge-sparrow, a pied specimen of the same species, and several pale varieties of other common birds. Notice should also be given to the locally-taken specimens of waxwings, nut-crackers, Royston crows, little owls, and purple heron.

A representative series of birds' eggs is shown in a cabinet standing in the centre of the room, also a small set of avian skulls.

The strongest section of the zoological collections, however, may be found in the department of Entomology. Few provincial museums can show such a well-ordered, well-prepared, and exhaustive collection of Coleoptera, Orthoptera, Neuroptera, Hymenoptera, Lepidoptera, Hemiptera, and Diptera, as is here displayed in several cabinets. With the exception of the fine series of beetles, the gift of Mr. E. George Elliman, and other smaller accessions, the whole of this extensive and valuable collection is due to the generosity of Mr. A. E. Gibbs, who,

since the foundation of the Museum, has made the Insecta his special care. Here may be found many rarities and types for comparison generally lacking from the cabinet of the ordinary collector. The rudiments of the science are moreover conveyed by means of a most interesting and attractive series of cases, also prepared by Mr. Gibbs, in which the structure and classification of the several orders of insects are set forth by brightly coloured exotic specimens and exhaustive labelling.

Several drawers of the last cabinet have been devoted to the display of a general collection of inland Mollusca, a fine group of the sporangia of Mycetozoa, presented by Miss K. Higgins, and sundry Invertebrata.

Contained within two table-cases directly in front of the window is an almost complete series of the Decapod Crustaceans, whilst ranged on shelves on either side there is a fairly extensive collection of marine and freshwater fishes and various marine Invertebrates in fluid. Unfortunately the lighting here is inadequate to permit critical inspection, but it may be seen that the Museum possesses something more than a nucleus of a collection embodying every class of the Animal Kingdom found within the British area. The specimens here shown, i.e. the fishes and marine invertebrates, were largely collected by the present curator.

Along the gallery is a series of cases prepared by Mr. Gibbs, illustrating the general economy of insect life. "Protective Resemblance," "Mimicry," "Warning Coloration," etc., are here most effectively shown by means of well-selected British and exotic examples. Below are a few birds generally mounted in pairs amongst natural surroundings. A sectional model of a mole's fortress, with albino moles from Woolmer Park, stands at the angle of the gallery, whilst on the stairs are a model of the nesting-site of the house-martin and a fine specimen of the Scotch mountain hare. Many choice prints and drawings of local subjects are displayed on the walls of the stairway and gallery. Several of the drawings were presented by the artists themselves, whilst others are gifts selected by the Herts Art Society from works sent to its annual exhibition.

The main exhibition room is chiefly devoted to Geology, Archæology, and Technology. On the left is a general series of fossils arranged in geological sequence. The majority of the specimens here shown, many of them being of considerable interest, were presented by Mr. John Hopkinson, who was also instrumental in obtaining, by exchange with the Sedgwick Museum at Cambridge, a number of other choice examples. To him and to Dr. John Morison the institution is indebted for the representative collection of geological specimens from the county, which is displayed at the north end of the room. Of these a small group of Wenlock fossils from a deep well-boring at Ware, and a large gathering of specimens from the Chalk Rock at Chiltern Green railway cutting, are of particular interest.

The Archæological Collection, contained in several wall- and table-cases, comprises many objects of exceptional interest. The Palæolithic and Neolithic ages are well represented by several choice implements of Hertfordshire origin, presented or lent by the late Sir John Evans, K.C.B., Mr. Worthington G. Smith, Mr. A. E. Gibbs, Mr. W. J. Pavyer, and others. Included in this section are a number of specimens of Danish origin, lent by Mr. A. E. Gibbs for purposes of comparison, and others from the Fayoum and other parts of Egypt and India presented by Mr. W. H. Seton Karr.

Amongst the specimens representing the Bronze Age may be seen a small but choice "find" of four objects from Hitchin.

The Romano-British Section comprises, amongst other objects, many examples of pottery of varied type, common ware of local make, Upchurch, Castor, Black, and Pseudo-Samian. Amongst the pottery of purely Romano-British type may be seen specimens from a kiln excavated at Radlett which bear the potter's mark, and examples discovered with an interment at St. Stephen's. Roman glass is to be seen in a choice group of sixteen perfect pieces lent by Mr. Pavyer, and a large vessel discovered in St. Albans of a type similar to certain others from Hertfordshire now in the British Museum. A further important exhibit consists of certain objects discovered on the site of the Roman villas at Boxmoor excavated by the late Sir John Evans in 1882.

The mediæval and later periods are well illustrated, largely by objects of local origin and by others from London and elsewhere. Specially interesting are a 14th-15th century bone seal-matrix discovered in the Abbey, the mediæval lead glaze flooring-tiles from Hertfordshire churches, authentic fourteenth century pottery from a kiln at Gustard Wood, and a well-preserved "Black Jack" from Rye House. Mediæval and later pottery, glass, metal-work, objects of domestic life, etc., are largely represented by the gifts or loans of the late Mr. F. G. Hilton Price, Mr. William Page, Mr. A. E. Gibbs, Mr. W. J. Pavyer, and others. Mr. Pavyer has also placed on exhibition a choice and representative group of antique china, and has laid the foundation of a collection of the Hertfordshire Regimental medals, badges, and other insignia.

The Numismatic Section is founded upon a collection originally formed by Mr. Gibbs to which numerous additions have subsequently been made. Particular local interest is attached to the Herts seventeenth century tokens and also to the finds of late Roman coins from the site of the Forum of Verulam.

Local Technology is shown by objects illustrative of straw-plaiting and lace-making. The centre of the room and a certain amount of the wall space is occupied by objects of decorative art lent by the Trustees of the Victoria and Albert Museum. Owing to a lack of accommodation it has become necessary to place certain cases of zoological specimens in this room.

A case standing near to the door is devoted to the display of certain groups of Invertebrates, including representative examples of the British Cœlenterates, Echinoderms, Tunicates, and Cephalopods. Exhaustive labelling and many descriptive diagrams are also shown with a view to giving a rudimentary insight into the structure and bionomics of these several types of the Animal Kingdom.

In addition to the collections displayed, the Museum possesses several series of geological and biological specimens which are available for purposes of study. Of these mention may be made of the "Wigram Bequest," consisting of named and chiefly localized shells of worldwide origin; British fossils and minerals; a collection in process of formation of the Mollusca of Hertfordshire presented by Mr. Charles Oldham; the valuable Herbaria of Messrs. Coleman & Webb (authors of 'Flora Hertfordiensis'); and other collections of plants, both phanerogamic and cryptogamic. In the Strong Room are deposited the muniments of the Gape Family, the Clarendon Court Rolls, and sundry other historical documents relating to the county.

At the entrance gates the Daily Weather Reports of the Meteorological Office are displayed, and at the rear of the building is situated a Meteorological Recording Station, the instruments being the gift of Mr. John Hopkinson. The observations are made by the caretaker, Mr. Polman, who furnishes weekly reports for publication in the 'Herts Advertiser,' and the monthly results are embodied in an annual report on the weather in the county published by the Hertfordshire Natural History Society. The grounds have partly been laid out as a botanical garden for the cultivation of indigenous Hertfordshire plants, and here during the summer months may be seen many interesting and scarce species in bloom.

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