

istic determinant is of a very high order in all but the simplest possible cases, and certainly the purpose of the investigation, that of judging the unknown from the known, is best served by keeping the mathematics as simple as possible. Even when this is done the author obtains theoretical confirmation of the known results regarding the spectra of metallic haloid salts (Lecture 14, § 1), Lockyer's long and short lines, and observations on the dissociation of the elements in the solar protuberances (Lecture 1, § 7, and Lecture xiv., § 6), Kayser and Runge's series of spectral lines, and the phenomena of surface colours ("Schillerfarben"), under which heading the colours of butterfly scales are discussed at some length, this application being illustrated by an excellent photograph of the scales of one of the "blues," in which the dimensions of the pigment granules are equal to the wave-length of blue light.

This section deals, then, with the electromagnetic theory of spectroscopy of which Lecture 14 forms a general summary. In the fourth and last section many of the same results are established in a different way, by what the author describes as the electrostatic theory. This theory is based on the study of moving charges, and regards the molecule built up of electrified moving particles. It is, in fact, the electron theory, and the first lecture contains a proof that in the cases considered the electromagnetic forces are negligible compared with the electrostatic ones. The succeeding chapters deal with Dr. Stoney's theory of double lines, J. J. Thomson's models of atoms, and conditions of stability with special reference to the periodic law. The last lecture (Lecture 20) is a summary of the electrostatic theory, and contains explanations of the phenomena referred to above, based on this theory.

In summing up, Dr. Garbasso expresses the opinion that the electromagnetic and the electrostatic theories, and in some cases even mechanical models, are equally competent to account for observed phenomena. The electrostatic method he considers to be the most complete, but the electromagnetic method possesses considerable advantages for teaching purposes; it possesses a peculiar heuristic value, and opens up the possibility of reproducing the electrical oscillations artificially.

The book makes no claims to being a text-book, or in any way a complete account of all that might be said on the subject. It contains, no doubt, many proofs that are open to criticism, but experience has shown that objections are very generally raised years after a book has been written, and very often on work which has been accepted unchallenged by a large number of readers. The main points we have now to consider are whether the author has stated his case well and carefully, whether the book is calculated materially to help us in unravelling the many curious puzzles revealed by the spectroscope, and whether the methods adopted are the best suited to the objects in view, and on each of these points we pronounce judgment in the affirmative.

G. H. B.

#### ORIGIN OF THE ENGLISH NATION.

*The Origin of the English Nation.* By H. Munro Chadwick. Pp. viii+352. (Cambridge: The University Press, 1907.) Price 7s. 6d. net.

THE title of this work really conveys a more accurate suggestion of its scope than the first sentence of the preface, which describes it as "an account of the early history of the English nation." There was certainly room for such a work, in which all the available evidence should be carefully considered, and Mr. Chadwick has done this with the greatest minuteness. In fact, his book suffers to some extent from over-minute discussion of questions which have at best a very faint bearing upon the main subject of his inquiry. This is especially the case with the later chapters in the volume, such as that on the "Cult of Nerthus."

Another general criticism which might be made is that Mr. Chadwick is rather too much given to the common, but very unsatisfactory, process of drawing a strong conclusion from a series of very weak premises. Unfortunately, much of the evidence relating to the Germanic conquerors of England during the time before the invasion is so fragmentary and contradictory that hypotheses can hardly be avoided. It is therefore the more necessary that they should be used as sparingly as possible, otherwise they are apt to obscure the recorded facts. In particular, it is of little service in the end to set modern supposition against ancient assertion; the former is at least as likely to be wrong as the latter, even when it appears to reconcile contradictions. The author, for example, seeks to cast doubt upon the express statement of Bede that the invaders came from three nations, the Saxons, Angles, and Jutes. On various grounds, such as similarity of language and customs, he comes to the conclusion that there is not sufficient evidence for separating the Saxons from the Angles, and that the invaders "belonged not to three but to two distinct nationalities."

That the distinction cannot be clearly perceived now does not prove very much; it may have been clear enough to themselves and to Bede. It may even to some extent have become obscured through the migration to a new country, just as national differences soon tend to disappear in modern colonies. Or the difficulties raised by Mr. Chadwick may simply lie in the meaning to be attached to "nation" or "people." In Scandinavia of the tenth century we find four very distinct peoples who did not differ from each other in any essential respect. It is no argument against the reality of the Saxon element that *Englisc* and *Angelcynn* became the usual designation of the language and the people. Where no great difference was felt, the convenience of a common name would soon be obvious. The use of national names is not stable enough to be valid evidence in doubtful cases. The lowland inhabitants of Scotland in the fifteenth century called themselves Scots and their language English; and Snorri Sturluson evidently saw nothing contradictory in

making Norwegian kings speak "the Danish tongue." These instances show how readily the name of the Angles might efface that of the Saxons even at an early date.

While such objections may be made to some of Mr. Chadwick's arguments, the method he has followed in tracing the origins of the English people is a sound one. He begins with what can be learned of the invading nations immediately after their settlement in Britain, and from this works back as far as possible into their previous history. A necessary result of the method, however, is that as the inquiry advances the evidence becomes more scanty, and the use of conjecture more and more obvious. For this there is no help, but it seems a little disproportionate to give only ninety pages to the English period and two hundred and fifty to the Continental, of which so little is known. These ninety pages contain four chapters, of which the first gives a survey of England in the sixth century, showing the extent of the conquest at that date. The West Saxon invasion, and that of Kent, are specially discussed in the following chapters, and the fourth is occupied with the question of the three nations referred to above. It includes some useful tables of early linguistic variations, and remarks on these, together with an account of the difference between Wessex and Kent in respect of the various classes of the community and their *wergelds*.

The very hypothetical character of Mr. Chadwick's inquiry does not do full justice to the great mass of interesting matter which he has brought together. A very wide range of reading and research underlies every chapter of it, and each point has evidently been the subject of much study and consideration. Many of his views are highly suggestive, and may yet lead to more certain results. In the meantime, the evidence produced does not seem sufficient to convict Bede of any essential error, or to modify in any important way the usual views on the subject.

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#### THE RAINFALL OF NORTH GERMANY.

*Die Niederschläge in den norddeutschen Stromgebieten.* By Prof. G. Hellmann. In three volumes. Vol. i., pp. vi+386+140; vol. ii., pp. viii+722; vol. iii., pp. viii+872. (Berlin: Dietrich Reimer, 1906.) Price 60 marks.

DR. HELLMANN'S three volumes contain a wealth of information relating to the rainfall and allied phenomena in the North German river basins. The principal observations are elaborately reduced, and in many aspects very fully discussed. The significance of this rainfall in its wider relation as part of the world weather, and, as such, its probable correlation with solar changes, are investigated with the advantage of well-marshalled data.

The area specifically dealt with in the volume is extensive, consisting practically of the great plain which extends without interruption from the chain of mountain ranges in south Germany to the North Sea and the Baltic. The direction of the river flow

and the precipitation of the country are very largely determined by this chain of mountains, which is part of the great water-shed of Europe. The conditions of the rainfall problem over such an area would seem to be fairly simple, and capable of being dealt with in general terms. The local conditions, however, as is usual, exercise a considerable influence, the "actual" varying widely from any "mean."

The three volumes may be taken as a summary of the meteorological work of many years in the department of rainfall measurement within the district named. Its fulness and painstaking completeness is such as is expected from the efficient State-supported meteorological organisation of Germany. Much of the data is from the numerous and evenly distributed stations, daily returns from which are made immediate use of for short-date forecasting.

The first volume is general, describing and discussing the data and results. This volume is divided into five sections, of which the first, in dealing generally with the observation material and the manner in which it has been obtained, discusses the distribution of stations and the quality of the observations themselves. The recognition of the influence on these of the type and position of the gauges used is of value. Such considerations affect the credentials of the older observations, a knowledge of the standing of which allows the full length of the record to be used safely or to be rejected where untrustworthy. A long meteorological record is sometimes, like the curate's egg, merely good in parts. The ease of approximate rainfall measurement conducted to its early commencement, and very old records exist. Observations made at Breslau (1717-1727) gave an annual mean of 576 mm., which does not differ greatly from the modern value of 567 mm. A valuable bibliography of the history of rainfall measurement concludes this first part.

The amounts of rain and their reduction and inter-comparison are next dealt with. The influence and value of smoothing curves by taking means is illustrated both by actual curves and by tables. Means for several stations, for periods varying from five to forty-five years, together with the "greatest differences" in each set of means, are obtained and compared. The standing of short-period means and the necessity of taking a long period to obtain a normal value become clear. A valuable table of monthly seasonal and annual means, both actual and percentage of mean year, is given in the text for nearly 100 stations. The distribution of rainfall in the year, from ten- and twenty-year means, is discussed and illustrated by curves for Königsberg and Stettin. Abnormal rains and thunderstorms are considered at some length, while material for further discussion is given in tables of great detail.

The reduction of the data is further extended in the next section of the volume to the problem of the determination of the expectancy of greatest rainfall and the probability of the number of rainy days of definite intensity. Various mean curves are used depending on periods of observation of from nineteen to forty-three years. Snowfalls are dealt with in re-