

# SCIENCE

EDITORIAL COMMITTEE: S. NEWCOMB, Mathematics; R. S. WOODWARD, Mechanics; E. C. PICKERING, Astronomy; T. C. MENDENHALL, Physics; R. H. THURSTON, Engineering; IRA REMSEN, Chemistry; J. LE CONTE, Geology; W. M. DAVIS, Physiography; O. C. MARSH, Paleontology; W. K. BROOKS, C. HART MERRIAM, Zoology; S. H. SCUDDER, Entomology; C. E. BESSEY, N. L. BRITTON, Botany; HENRY F. OSBORN, General Biology; C. S. MINOT, Embryology, Histology; H. P. BOWDITCH, Physiology; J. S. BILLINGS, Hygiene; J. McKEEN CATTELL, Psychology; DANIEL G. BRINTON, J. W. POWELL, Anthropology.

FRIDAY, AUGUST 12, 1898.

## CONTENTS:

<i>Note on the Age of Basil Valentine:</i> C. S. PIERCE.....	169
<i>Studies from the Zoological Laboratory of Harvard University:</i> PROFESSOR E. L. MARK.....	176
<i>Raised Shore-lines on Cape Maysi, Cuba:</i> OSCAR H. HERSHEY.....	179
<i>Current Notes on Anthropology:—</i>	
<i>Archive of the Science of Religion; Archaeology of Corsica; The Races of Europe:</i> PROFESSOR D. G. BRINTON.....	180
<i>Notes on Inorganic Chemistry:</i> J. L. H.....	181
<i>Scientific Notes and News:—</i>	
<i>The Chicago Academy of Sciences; General:</i> .....	182
<i>University and Educational News:</i> .....	185
<i>Discussion and Correspondence:—</i>	
<i>Stability in Generic Nomenclature:</i> O. F. COOK.....	186
<i>Scientific Literature:—</i>	
<i>Some recent Works on Mechanics:</i> R. S. W. BRITTON and BROWN'S <i>Illustrated Flora of the Northern United States:</i> PROFESSOR CHARLES E. BESSEY.....	190
<i>Scientific Journals:</i> .....	195
<i>Societies and Academies:—</i>	
<i>Engelmann Botanical Club:</i> J. B. S. NORTON.	
<i>Academy of Natural Sciences of Philadelphia:</i> DR. EDW. J. NOLAN.....	196
<i>New Books</i> .....	196

MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

## NOTE ON THE AGE OF BASIL VALENTINE.

BASIL VALENTINE is usually reckoned as the earliest of the scientific chemists and a great light of human culture.\* He is supposed to have lived nearly a hundred years before Paracelsus, or at some time in the 15th century. One of the works which bears his name certainly embodies a tolerably correct conception of the behavior of antimony. Popular writers erroneously attribute to him the discovery and the name of that metal,† together with some of the most elementary and ancient operations of the chemist. But Hermann Kopp, the least unsatisfactory of the historians of Western alchemy,‡ has emphasized certain doubts

\* Thus, one historian, Schmieder, opens his chapter on Valentine with the words: "Ein Nordlicht lodert in farbigem Strahlen an Deutschlands Horizont empor."

† Even accepting the works attributed to him as authentic, it remains true that antimony had been used in type-founding before Basil Valentine's book on that metal was written. Berthelot finds the name applied to the same metal by Greek alchemists, to say nothing of its occurrence in the same sense in the encyclopedia of Vincentius Bellovacensis.

‡ Berthelot confines himself to Egyptian, Greek and Arabian authors. The work of Dr. Latz, himself a 19th century alchemist, affords some insight into the matter of alchemy. Kopp's book is of great value, although he does not pretend to have penetrated deep below the surface. Hoefer's history never had a high critical value. Schmieder and Gmelin are quite superseded. In his earlier *Beiträge* Kopp disbelieves in a real 15th Century Basil Valentine. In his *Geschichte der Alchemie* he admits the existence of such a chemist.

concerning Valentine which it is the purpose of this note to resolve.

This personage was never heard of until, in 1599, Johann Thölde published, as editor, the first of six treatises in the German language which he successively gave to the public as having been written by 'Basilius Valentinus, Benedictine monk.' The last of these, published, according to Kopp, in 1604, and entitled *Triumph-Wagen des Antimonii*, is the one upon which the renown of Valentine exclusively rests. All are works of alchemy, a doctrine that, at the time of their publication, had for generations been a mark of derision.\* I have only seen four of them, the *Triumph-Wagen*, the *Welt in Kleinen*, the *Grosse Stein der uhr-alten Weisen*, and the treatise *Von natürlichen und über-natürlichen Dingen*.† The *Triumph-Wagen* is the only one I have carefully studied.

I begin with a logical consideration. It is very important to bear in mind, at the outset, that the all but universal custom of alchemists was to publish their writings as having been handed down from remote ages. This custom had been traditional since the remotest periods of Egyptian alchemy. Besides, there was an obvious reason for it. Announce to the world that a gold dollar costs you but a dime, and either you are poor, when your neighbors will laugh at

\* Thus, Guljelmus Gratarolus (an Italian physician, inclined to Lutherism, b. 1516, d. 1568), who in 1561 published a collection of alchemical writings in two volumes folio, concludes an introductory dialogue on the subject with these words: 'Sapientia autem premia divitiis esse \* \* \* nemo unquam sanæ mentis fatebitur \* \* \* Necessarium est, ut priusquam capere incipiant, extremum infortunium, et ipsa 'Arx, illo miserando casu tædoque interitu dejiciat atque pessundet.'

† I only know these in the edition of 1740, which professes (for these treatises) to follow the text of Thölde, except that it corrects obvious misprints and adds some plates to those illustrating the *Grosse Stein*. I have seen these same figures attached to a different text attributed to Valentine and bearing the date 1625.

you, or your circumstances are comfortable, when you will be besieged by importunities as well as exposed to the resentment of those who dread your overturning the existing status of property. So it would be even in our well-governed age; how much more in wilder states of society! For this reason, although for books in general the *prima facie* presumption that they were written by the persons whom they name as their authors is even stronger than critics are apt to think, yet for alchemical books this initial presumption is reversed. If a book of alchemy professes to be written by an adept, that is, by one who can make gold, there is a probability amounting almost to certainty that its real authorship is concealed, and if it professes to be written long before its publication the presumption, founded on the general practice of such writers, is that the real author is he who has given it to the world. That is the theory which logic demands should first be tried.

Now these books of Valentine state repeatedly that the author has achieved the 'great work' of the alchemists. Hence, until facts drive us from the position, we ought to begin by presuming that 'Basilius Valentinus' was the *nom de plume* of Thölde. Nevertheless, in order to satisfy those who may not assent to this view, I shall begin by showing that it is impossible to believe the averments of the books themselves in regard to their authorship.

First of all, a slight sketch of the contents of the four treatises above named may be interesting. The tract '*Von der Welt in Kleinen*,' or, as it is entitled in the edition I use, '*De Microcosmo, oder von der kleinen Welt des menschlichen Leibes*,' fills but 15 small octavo pages. The author opens with an attempted explanation of the creation of the universe, or Macrocosm, and of man, or the Microcosm. The matter out of which the world was formed was nothing. The

matter and form in the first stage of creation, which he calls 'die Form oder *Materia*,' was earth and water. Creation consisted in separating these two; it was a work of chemical analysis. The principal result is the earth, and the essence of the earth is salt. The salt of man is his body. As the second step of creation, mobility was requisite. The warm air breathed by the Creator upon the earth rendered the latter pregnant, and sulphur was brought forth, which is an intangible, conscious spirit, imparting, through its inflammability, warmth and motion. The sulphur of man is his soul. All animals and plants have souls. Next, the earth became again pregnant, this time of its moisture; and mercury was brought forth, being an invisible and intangible shape identical with the power of imagination from which results all cognition. In the microcosm, owing to its volatility, this mercury resides chiefly in the upper parts. It is the invisible spirit of the human body, plainly identical with the archæus of Paracelsus. These three things, salt, sulphur and mercury, or body, soul and archæus, are the three constituents of Macrocosm and of Microcosm alike—the *tria principia*. These three constituents must exist in all animals, vegetables and minerals. A man, for example, feeds upon beef, which nourishes body, soul and archæus. The nutrition takes place by putrefaction in the stomach. Now putrefaction is nothing but chemical decomposition. This decomposition being effected, assimilation in due proportions takes place. Thus, nourishment for body, soul and archæus must exist in the beef; that is, the salt, the mercury and the sulphur must all be contained in it. The ox, in its turn, feeds upon vegetables; and by the same argument the *tria principia* must all be present in these vegetables. Finally, the plants derive their nutriment from minerals; and thus by necessity all three constituents

must be contained in the minerals. The remainder of the *brochure* seems intended to apply the doctrine of the universal presence of the *tria principia* to the tracing out of a chemical physiology of the action of various foods and medicines upon the human body. All this is diffused through a vehicle of bombastic verbiage. Curious little theories abound, such as that 'the liver must have air, else it could not laugh;' that 'the salt-spirit has its chief seat in the bladder;' 'like must be expelled by like;' 'the seven metals are fundamentally but one substance,' all of which are Paracelsian doctrines.

Following this tract, I find, in the edition I use, a sort of mountebank's speech concerning two universal medicines, called Phalaia and Asa, the former to be administered inwardly, the latter for external application. Then come some score of odes on such poetic themes as copper, vitriol, sal amoniac, tartar, etc.

In the treatise *Von dem grossen Stein der uhr-alten Weisen* we trace the same principles. The following sentence is a fair specimen of the book at its clearest: "Nimm ein Stück des allerbesten feinen Goldes, und zerlege dasselbige durch die Mittel, so die Natur dem kunst-liebenden Menschen nachgelassen, von einander, wie ein Arzt des Menschen Körper zerlegt, und dadurch den innerlichen Leib des Menschen erfahren will, und mache aus denen Gold zurück, was es zuvor gewesen ist, so wirstu finden den Saamen, den Anfang, das Mittel und das Ende, woraus unser Gold und sein Weib gemacht worden, nemlich aus einem durchdringenden subtilen Spiritu, auch einer reinen zarten und unbefleckten Seele, und einem Astralischen Saltze und Balsam, welches nach ihrer Vereinigung anders nicht ist, den Mercurialischer Liquor, dasselbige Wasser ward zu seinem eigenen Gott Mercurio in der Schule geführet, der examinirte das Wasser, und da ers recht und ohne falsch befand, da machte

er Freundschaft zu ihm, und nahm das Wasser zu der Ehe, und ward aus ihnen beyden ein unverbrennlich Oel, denn der *Mercurius* ward also stoltz, dass er sich selbst nicht mehr kannte, er warf seine Adlers-Flügel von sich hinweg, und verschlang selbst den glatten Schwantz des Drachen, und bote dem *Marti* an zu kämpfen, da fordert *Mars* seine Ritterschaft zusammen, und verschuf, dass man *Mercurium* musste gefangen nehmen, und ward ihm *Vulcanus* zu einem Stockmeister verordnet, also lange biss er vom weiblichen Geschlechte wiederum erlöset würde." I cannot help fancying that I am able to detect here a certain lack of scientific precision and perspicuity. There are books which undertake to explain how to translate that sort of lingo, telling us, for example, "aqua, quandoque vocatur lapis spiritus quintæ essentiae, quandoque vocatur terra, quandoque lapis." Probably by the aid of such a key the chemical processes of this treatise could be conjectured. I have not undertaken the task, being assured, by similar experiences, that I should only find vague hints of nonsensical cotions. Upon a long frothy disquisition follow twelve chapters entitled Keys. Each of them is furnished with an emblematic picture.

The treatise *Von den natürlichen und über-natürlichen Dingen* is written in a somewhat plainer style. After repeating the doctrine of the *tria principia*, it enters upon discussions concerning biblical miracles, the trine of signatures, spirits, sirens, succubæ, etc. Chapter the second treats of the first 'Tinctur-Wurzel' of the metals, which, we are told, 'is a supernatural, flying, fiery spirit, which keeps itself in the air, and naturally seeks its habitation in the ground and in water.' The remaining seven chapters treat in cryptical style of the methods of dissolving the seven metals.

The *Triumph-Wagen des Antimonii* contains,

embedded in vast masses of speechifying, about thirty plainly described chemical preparations. Of these, seventeen are genuine descriptions of experiments by a skillful chemist, and are distinguished from the few perspicuous chemical directions that are to be found in Raymund Lully, in Arnold de Villanova and other medieval alchemists by the far higher grade of chemical knowledge which they evince. The remaining experiments seem to me to be conjectures never put to the test. Without such an element of fancy the theory of a medieval origin for the book would be almost absolutely negatived; from its presence nothing at all can be inferred.

The German of all four works seems to me later than Luther's Bible. Upon this matter I must speak with diffidence, however; but I leave it to the reader to compare the specimen above given with any page of Paracelsus and say which is the more modern. I cannot see how there can be room for two opinions.

The author is, in the text of each treatise named, as 'Frater Basilius Valentinus, Benedictiner Ordens.' The first three works contain little concerning his personality or age. Yet the author's preface to the *Grosse Stein* tells us that, 'da mir menschlichen Furcht zu Handen stieß,' he was led to religious reflections. He joined the Benedictines, and after he had been a monk for a good while (nun eine Zeitlang) he determined to devote his leisure hours 'die Natur von selber zu legen,' and to considering what earthly natures he should find the highest. He diligently studied many books which he found in the monastery, written by wise masters who had investigated the natures. Subsequently, in the desire to cure a sick brother, he took up the distillation of herbs, and this investigation occupied him for six years. At the end of that time he began to extend his chemical studies, and gradually went on from one thing to another.

Finally, he came across a mineral (doubtless antimony) by the study of which he was led to make a medicine which restored that sick brother to perfect health, so that he lived for a long time thereafter (dann er lebte noch lange hernach). It was still later in Basil's life that he became acquainted with the matters in the treatise on the *Grosse Stein*. If the 'Zeitlange' after he became a monk and before he began to study was one year; if the diligent study of many books on the natures occupied two years; if after his six years' work in distillation he performed a hundred operations in mineral chemistry, each of which in his style of procedure would take about two months on an average, so that he was occupied in this way eight years; if the long life after restoration to health of that brother who had been ill for at least fifteen years occupied ten years, and if the interval between the writing of the *Grosse Stein* and the more advanced and certainly later *Triumph-Wagen* was three years, we have a total of 30 years between his entering the Benedictine order and his writing the *Triumph-Wagen*. At this time he was living in the monastery. When, therefore, in the *Triumph-Wagen* he speaks of having early in life made a voyage to England, that must have been thirty years or more previously. We shall see presently the bearing of this calculation.

The *Triumph-Wagen* contains more than one indication from which to infer the age of the author. It also, by the way, informs us that he lived 'oberhalb Rheins,' that is, in the Upper Rheingau, or, say, somewhere south of and not very far from Mainz. The author in the *Triumph-Wagen*, no less than three times, speaks of the desirability of economizing parchment. Now, it would have been an unusual extravagance for a man in the 15th century to write chemical treatises on parchment. Certainly, if economy were any object, paper was easily procured. And, indeed, in Chapter III. of his

earlier treatise On Natural and Supernatural Things, he himself affords the quite superfluous testimony that in his time paper mills abounded. He is always and everywhere recommending 'grobe Papier' for filters. Either, then, the talk about the necessity of abridging his book in order to economize parchment was inserted in order to impart a medieval trait, or else the *Triumph-Wagen* cannot possibly have been written later than 1460 or 1470.

Just as this indication of a date occurs thrice, so there is another which is dragged in by the head and shoulders no less than seven times in the book. It is a reference to a certain disease as having recently appeared which at the time of Thölde's publication was generally supposed to have made its first appearance in 1493. Were these seven references inserted in order to create a belief in the priority of the book to Paracelsus, or was the book really written when that disease was something new?

The name which Basil Valentine gives to this disease is very suspicious. In Germany in the 15th century it was commonly called 'die wilde Wertzen;\*' but it had various other designations. Valentine, however, uses none of these. Here are his expressions:

"Die neue unbekannte Krankheit so in jetzigen Krieg-Zügen in diese Lande eingeführt worden durch die Gallier."

"Die neue Franzosen-Krankheit."

"Die Franzosen."

"Die Franzosen-Sucht."

"Die neue Krankheit des Kriegs-Leute in diesen Zeit."

"Die neue Kriegs-Sucht."

"Die Krankheit der Gallier neulich auf uns geerbet."

It is doubtful whether the malady was brought to Germany from France or from Naples. Trithemius, a contemporary Ger-

\* Proksch, Geschichte des venerischen Krankheitsen, 1895.

man abbot, says it came both ways.\* It was much later, during the 16th century, that the theory of a French origin became generally accepted as certain.

But passing by this difficulty, and continuing to accept the seven passages as *bona fides*, to what date do they point? Johannes Salicetus, whose work on this pestilence was printed in 1501, says that it had prevailed in Germany since 1457.† The records of a monastery at Mainz (near which Valentine must have lived) show that a chorister there was attacked by it in 1472,‡ so that it was already spreading beyond the army; and so famous a physician as Basil Valentine boasts of being would certainly have heard of that case. But Valentine says it was brought to Germany, not by German soldiers coming home, but by French soldiers in the 'present war.' I do not know what war that could have been, unless it was the struggle of Charles the Bold, not far from the Rheingau, which lasted from 1464 to 1477. Thus, if the book is genuine at all, we find again that it must have been written about 1470.

There is a third indication of the date. Namely, the author tells us that in his youth he learned in England the process of making beer with hops, which process he describes. He adds that in Germany this method is not very common, thus implying that it was very common in England thirty years or more before he wrote the *Triumph-Wagen*, or, say, about 1430 or 1440. Unfortunately, all authorities agree that hop-brewed beer was not introduced into England till very long after. I find the date 1551 given as that of the first planting a hop-garden in England. Men could not have had much experience of hop-brewed beer as long as hops were considered to be an adulteration. Now, under Henry VIII.

\* Ibid.

† Ibid.

‡ Ibid.

penalties were imposed against that mode of brewing. Basil, however, speaks of it as a great improvement, and never hints at any condemnation of it. This is a difficulty that it seems impossible to avoid.

There are others. The author was a far more accomplished chemist than any other of the 15th century or of the early part of the 16th. How can it be that such a man lived a long life and never imparted any of his skill to any scholar?

Moreover, he accomplished, he tells us, cures which astounded physicians. Being a very superior man otherwise, he must have become famous. Yet Kopp, with all his learning in alchemy, declares that there is nowhere any mention of him before 1599. I know of but three statements which could be brought against Kopp's generalization, and all three break down under examination. In the first place there is a story traced to the *Sapientia Insaniens* of the Dutch alchemist, Jacob Tolle, a book which I understand to be a commentary upon the *Triumph-Wagen*,\* that the Emperor Maximilian I., in 1515, undertook to collect facts concerning the life of Basil Valentine, and that, unable to obtain any information, he finally sent to Rome and caused search to be made of the rolls of the Benedictine order, which search was unsuccessful. But this story is incredible. The busy Maximilian interested himself in everything except chemistry. In 1515 he was absorbed with Hungarian affairs. But these are the least of the objections to the tale. To suppose Basil Valentine was heard of in 1515 is almost to suppose he was living about 1470. In that case there must have been numerous persons near Mainz, who per-

\* If I have seen an entire passage of a book, or have otherwise conclusive evidence of its containing certain matter, I consider myself justified in saying so, even if I have not seen the whole book. In the present case, however, the story may be told somewhat differently by Tollina.

sonally remembered so great a healer. Besides, how should his name have been missing from the Benedictine rolls? The facts must in some way have been mistaken by Tolle. Give me leave, then, to offer a conjectural emendation of the story. Let me suppose that, instead of Maximilian, it was the Emperor Matthias who made the investigation, or possibly even Rudolph II. The latter was a devoted alchemist; the former was at least in the way of hearing a good deal about alchemy. If it was Matthias, the date might be changed from 1515 to 1615, when the Emperor, having just concluded a long truce with the Turks, was enjoying unwonted leisure. If it was Rudolph, the search must have taken place not later than 1612. In either case the recent publication by Thölde would naturally have suggested the inquiry, and the fact that the name was not found is explained in the simplest manner by supposing there had never been such a man as Basil Valentine.

In the second place, Count Guden, in his History of Erfurt, is quoted as saying that Basil Valentine lived in 1413 in St. Peter's monastery in that town. But manifestly that could not have been the author of the *Triumph-Wagen*, with his *Franzosen-Sucht*. Besides, Kopp assures us that the roll of that monastery bears no such name.

In the third place, Sprengel, writing in Ersch und Gruber, cites a passage of Guanerius referring to Basil Valentine. I doubt if the citation has ever been verified. At any rate, since Guanerius died, in 1440, our author cannot have been intended by him.

Finally, as another difficulty, the question arises where could Basil Valentine have acquired his ideas, wild as they were, and his skill in chemistry? Paracelsus, the son of an eminent physician, running all over Europe in his thirst for knowledge, and undoubtedly a great man, might very well have gained such ideas directly or in-

directly from Arabian sources. But Basil Valentine, though by no means hiding his knowledge under a bushel, nowhere boasts, as far as I know, of any acquaintance with Arabic.

Thus, the attempt to sustain the hypothesis of a real Basil Valentine creates a new difficulty with every new circumstance and feature of the facts that we learn. Let us turn, then, to that hypothesis which ought logically to have been adopted at first, namely, that Thölde was himself the author, and see whether the facts may not fit into that better. Those which we have already had occasion to notice certainly do so.

But let us ask who was Johann Thölde? He was a man of means, part proprietor of a chemical industry, the salt works at Franckenhäusen, and the secretary for many years of the Rosicrucian Brotherhood, a society founded on literary fraud and saturated with it.

And how does this secretary of a society of humbug account for his possession of the MSS? Does his tale bear the marks of truth? The story is well known. The brotherhood pretended that their founder had been buried at the ripe age of 100 in the house of the Holy Spirit at Erfurt, having directed that his epitaph should read 'Post CXX annos patebo.' Accordingly, that time having elapsed, one of the pillars of the chapter-house burst and disclosed ancient books embodying the doctrines of the brotherhood. We have a list of some of those books, but the only ones of any consequence are the treatises of Basil Valentine. If you believe the story of the bursting pillar, you will believe these books authentic. If not, you will believe them to be the forgeries of Thölde and his brethren, who really stole the ideas of Paracelsus and in one only of the books inserted some solid chemistry.

When we once come to regard the *Triumph-Wagen*, no longer as antedating Copernicus,

but as a production of the age of Galileo, Harvey, Gilbert and Kepler, it does not appear as a marvelous performance. The only circumstance at which one hesitates is that a scientific chemist, whose mind moved in the world of reality and veracity, should have mixed the description of his experiments with so much degraded bombast. We can only surmise that the wealthy Thölde, or the master spirit behind him, purchased these secrets of antimony from some indigent chemist and worked them into the otherwise nonsensical book in which they appear.

C. S. PIERCE.

#### STUDIES FROM THE ZOOLOGICAL LABORATORY, HARVARD UNIVERSITY.

THE following abstracts of papers prepared in the Zoological Laboratory of the Museum of Comparative Zoology at Harvard College have been made by the authors. The final papers will be published as soon as the plates necessary for their illustration can be prepared. Other papers, not readily given in abstract, or requiring illustrations to make them intelligible in that form, will be published soon.

E. L. MARK.

*Ovogenesis in Distaplia occidentalis* Ritter (MS.), with Remarks on other Forms. (Abstract.) By F. W. BANCROFT.

THE material was all obtained on the coast of California. In the compound ascidian *Distaplia*, only, was it attempted to make the investigation at all complete. Here the development of the sexual organs, though in several respects simpler, conforms to the type described by Van Beneden et Julin in 1885. Both ovary and testis are derived from a common fundamen-  
ment, which, on account of the differentiated oögonia it contains, is recognizable in even the smallest buds of the older colonies.

One of the diagnostic characters of the genus *Distaplia* is the capacious brood

pouch in which the embryos are kept. It is attached to the zoöid by a narrow stalk and has usually been described as a diverticulum of the peribranchial sac. The embryos are arranged so that the youngest are at the tip of the organ. It was found to be not a simple diverticulum; the stalk of the pouch is double, consisting of two narrow tubes, one of which is a continuation of the oviduct, while the other opens into the peribranchial sac. The oviducal tube opens into the bottom of the pouch, and it is on account of this arrangement that the younger embryos are always found in the tip of the organ. In passing from the ovary to the pouch the ovum is greatly compressed, assuming the shape of a sausage, but becomes oval as soon as it has entered the pouch.

The test cells are seen to be derived from the follicular epithelium, and not, as Davidoff has maintained for this genus, from within the ovum. The cytoplasm of the test cells has been stained from the earliest stages on, and strands of cytoplasm are seen during all the earlier stages connecting the test cell with the follicle in somewhat the same way that Morgan has described. However, at this period, bends in the wall of the germinative vesicle and accompanying vacuoles in the cytoplasm are occasionally encountered, and it is likely that these appearances are what has been described by Davidoff as nuclear evaginations from which the test cells are formed. They are probably due to shrinkage. There are also deeply staining granules in the cytoplasm, which often have vacuoles around them, and then look exactly like Davidoff's figures of nuclear buds that have already become detached from the germinative vesicle. But they do not produce the test cells, as this author thinks. The test cells are found to take no part in the formation of the test of the embryo, as has recently been maintained by Salensky. The outermost