

table beneath it than the simple remark that where there is a tendency to imitate, the imitation of imitations will multiply imitations. The second law is, that "Impulsive social action varies inversely with the habit of attaining ends by indirect and complex means." Here again, the language is to a mathematician repellent. Is anything more meant than the truism that when men are in the habit of acting reflectively, they are less under the dominion of impulse? If so, why should it not be expressed non-mathematically? So, likewise, why cannot a sociologist content himself with saying that, other things being the same, the older a tradition is, the more it overawes men, instead of laying it down that "tradition is authoritative and coercive in proportion to its antiquity"? The use of mathematical phrases in the other laws leads the reader to suppose a mathematical proportion is intended here. There are several other laws which the reader will find in the book. If this class of writers would study the mathematical theory of measurement — say, Clifford's "Analytical Metric" — sufficiently to perceive how such talk as theirs must appear to those who understand what quantity is, we believe that all such phrases would disappear from their pages. Prof. Giddings's work would only be strengthened if this were done.

Perhaps there may be persons who do not reckon the syllabus as a distinct form of literary composition, but there is none which calls for a severer classicality, meaning by that the effect resulting from an abhorrence of the too much, and from long pondering every sentence, as if papyrus were costly and the use of the stylus laborious. It has been the mathematicians who have most excelled in it. A syllabus needs to be a feat of intellectual strength, under pain of sinking to an exhibition of a wooden model, less like science than a painter's mannikin is like a man, by far; for a mannikin may take an expressive pose. The specimen we have given will have convinced the reader that Prof. Giddings is a man of no mean analytic power. Such a scheme as he has drawn up will have its utility in the incipient state of sociological science, even if it is not what a syllabus of sociology ought to be. The index is like the book itself. It is not perfect; but it is much more than pretty good.

Scottish Men of Letters in the Eighteenth Century. By Henry Grey Graham. Macmillan. 1901.

It was the intent of Plutarch, as he tells us in beginning his life of Alexander, not to write histories, but only lives. For, he explains, the noblest deeds do not always show men's virtues and vices, but oftentimes a light occasion, a word, or some sport makes men's natural dispositions and manners appear more plain than the famous battles won, wherein are slain ten thousand men, or the great armies, or cities won by siege or assault. So Mr. Graham declares his aim to be not so much to give a history of the literature produced by Scotsmen in the eighteenth century as an account of the men who made it. In this undertaking he has been helped very little by such diaries and correspondence as abounded in England and have enabled us to reconstruct the social life of that

age, for the Scots were not addicted to diaries, and if letters were written, few were preserved.

Nor is much to be gained from biographies, for those who wrote them thought it beneath the dignity of literature to mention such trivialities as Plutarch eagerly caught up. Dugald Stewart wrote the Lives of Reid, of Robertson, and of Adam Smith; but he was careful not to draw their frailties from their dread abode, and disclosed their merits only in sounding platitudes and stately periods. Even in 1811, when the relatives of Dr. Carlyle of Inveresk thought of publishing his autobiography, which is a mine of instructive gossip, "they were discouraged by those whom they consulted—Adam Ferguson among the number—on the ground that the incidents and anecdotes were too unimportant to interest the public." Adam Smith, it is true, said in his lectures on rhetoric that he was glad to know that Milton wore lachets in his shoes instead of buckles; but this Plutarchian touch must have offended the pedantic taste of the day. Fortunately, before it was too late, the artificial proprieties of Lord Kames ceased to shackle literature, and a few inquisitive spirits rescued some of the oral traditions, which, like the old ballads, were on the point of sinking into oblivion. What was thus preserved Mr. Graham has cleverly sifted and assorted to make this entertaining volume.

It must be said, however, that he goes rather too far in omitting the noblest deeds and dwelling on the "light occasions." It is well enough to describe the clothes, the gait, the manners, the follies, the personal oddities and defects of by-gone worthies; but more than this is necessary to understand a "character." Mr. Graham is very rigorous in his exposure of corpulence. Some of his heroes were indisputably gaunt; but he eagerly notes all tendency to adipose deposit, and "paunchy" is his favorite epithet. We are told much about Hume; but the chief impression that we receive is that he was fat. On page 35 he is called "the obese philosopher"; at page 36 he is "becoming fatter"; he is "portly"; his "physical exuberance" is to pass into "unwieldy corpulence." At page 39 he has a "broad, fat face," and his corpulence is "vast." On page 42 we read of his "bulky body," and on page 43 of his "unwieldy self." At page 45 he is a "portly man"; at page 46 he is "ponderous"; his face is "broad and fat," his person "corpulent"; he distributes "fat, amiable smiles." His face continues "broad" on the next page, on the next he is "ponderous," then he is a "corpulent pagan," then he is "fat," and his "fatness" and "corpulence" are again referred to, as well as his "huge paunch" and "ponderous frame," and at last the grave closes over his "huge, corpulent form." That should end the matter, but when he is mentioned in other parts of the book we have to be reminded of his fleshiness.

This illustrates the vice of Mr. Graham's style. Often he fails to be sympathetic and appreciative because he is trying to be effective. He has a jaunty, superior manner, and looks down on his subjects with amused and sometimes contemptuous condescension. He has acquired Macaulay's tricks of style, and it is no more than fair to say that he does the tricks nearly as

well as his master. Nor can we deny that he is graphic; his pictures of individuals and of society are vivid and impressive. After we overcome our annoyance at his affectations, we are fairly captivated by his entertaining stories, his incisive criticisms, his lively descriptions. Never was there such an age for "characters"; uniformity was not expected, nor even conformity. Every one was poor, and even those who passed for rich lived on incomes which day laborers would now think meant starvation. The muse was cultivated literally on oatmeal, and little of that; although drink was a prime necessity. With a moderate excise and active smuggling it was abundant, and was, according to our standards, almost the only luxury of the time.

The housing of the better class was mean, gloomy, and cold, and the general filth was appalling. To get a suit of clothes was the event of a lifetime, and people could no more vary their raiment according to fashion than leopards can change their spots. It signifies much when men can count on finding their friends wearing the same coats for years, and every coat as distinguishable as the features of the wearer. It means that men have opinions and habits of their own, and care not whether they suit the prevailing taste. Even George III. could appreciate sturdy individuality, and we are ready to forgive the awful misdeeds enumerated by our forefathers in justifying the Declaration of Independence, when we read of his message to that Jacobite of Jacobites, Laurence Oliphant, the laird of the "Auld House of Gask" and father of the gifted Lady Nairne: "The Elector of Hanover presents compliments to the laird of Gask, and wishes to tell him how much the Elector respects the laird for the steadiness of his principles."

None of these sketches is better than that of Lord Monboddo, whose whims were only less amazing than the sincerity with which he believed in them. He was to be seen in court, sitting among the clerks, having quarrelled with his fellow-judges because they had found against him in a case wherein he was personally interested. He held that all knowledge was of Greek origin, and, following ancient customs, daily anointed himself with oil, after bathing; the latter practice being as much out of vogue with his contemporaries as the former. Carriages and sedan-chairs being unknown to the Greeks, he would not enter them, although if it rained when he came out of the Parliament house, he would put his wig into a chair and walk by its side. He held to our descent from simian ancestors, questioning travellers as to their meeting with survivals of the lost appendage, and even watching at bedroom doors, when children were expected, to catch the midwives snipping off their tails. He was well mated on the bench with Lord Hailes, who once dismissed a cause because a document had the word "justice" spelt without the final "e," and with Lord Hermand, who would smite his bosom as he gave an opinion, exclaiming: "My laards, I feel my law—I feel it here." Worthy of their company was Lord Kames of the "Elements of Criticism," who was interested in everything from law to letters, and so devoted to agriculture that he allowed a pet pig to sleep in the same bed with him. His industry and inquisitiveness never flagged, and two days

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making complete collections of reproductions for the use of special students of art history—in effect, reference libraries of art.

It is the recent advance in the art of photography which has made it possible to study under one roof the art of the world. The isochromatic photograph is, for the trained eye, a sufficient record of any work of art. The enterprise of photographers has now gone so far that the more important pictures, statues, and drawings in public galleries have been adequately reproduced, and a good beginning has been made with the private collections. Meanwhile, the price of such reproductions has become so reasonable that the making of a student's collection becomes rather a matter of discrimination than of sheer expenditure, and the photographs are now so permanent that the risk of the deterioration, or even of the total destruction, of a collection is quite obviated. The utility of such a repository is obvious. If no study of reproductions can ever replace first-hand knowledge of the originals, it yet is an indispensable complement to such study. It has, in fact, certain distinct advantages, for in the art library the works of a master, which are scattered through a score of galleries in many lands, may be placed upon one table, and the comparison of work with work, which otherwise would usually depend upon that fleeting thing, the visual memory, may be made in all leisure, photograph being confronted with photograph. It is the perfection of photographic reproduction which has revolutionized art history, making what was previously matter of opinion matter of demonstration, and raising art criticism to the plane of the other historical sciences.

That American librarians have laboriously built up reference libraries in the historical sciences, philology, and natural science, while virtually slighting the field of art, is very natural. In the first place, there was a superstition that art history must be studied chiefly in books, or, in another view, only in galleries. The idea that photographs and similar reproductions are the indispensable apparatus of the art historian has only lately made its way. This kind of study was a very new thing, and tainted with the suspicion of amateurism. Only a very liberal librarian—one who would strain the last point for a minute palaeontologist or entomologist—could be expected to appropriate good money and devote unwonted pains for the benefit of people who merely wanted to look at pictures.

This attitude of depreciation has changed as art history has come to be a recognized science. Many librarians have given their energies to this new and fruitful field of library activity. Boston, though with a sadly insufficient appropriation, still leads in the com-

pleteness of its collection for the study of the fine arts. The Avery Library at Columbia University and the Cooper Institute have notable collections for the study of architecture and the industrial arts respectively. In Brooklyn the Pratt Institute and the Brooklyn Institute have made good beginnings, and doubtless many other libraries throughout the country have done something in this direction. We believe that many of the great libraries would undertake such collections if they could be fairly informed of the probable expense of an art department—its first cost and charges for maintenance. Benefactors, too, would probably adopt the idea readily if it came to them in a practical form. As with any new project, the question of ways and means is all-important.

Here Sir Martin Conway, Slade Professor of Art in Cambridge University, England, has some valuable suggestions in his recent book, "The Domain of Art." He writes:

"The great age of Italian painting from Cimabue to Tiepolo might perhaps be fairly completely represented by 20,000 photographs of pictures and drawings. The cost of the photographs would not be less than \$1,000. They would have to be mounted, boxed, and shelved for purposes of general reference by students, and that would cost at least \$1,000 more. In practice the whole cost of such a collection would work out at nearer \$3,000 than \$2,000. That would enable us to produce a kind of illustrated index, chronologically classified, of all the chief paintings and drawings that have come down to us from the old Italian schools."

It is a comparatively simple calculation to deduce from this the probable cost of a complete collection for painting. Assuming that Italian painting, including drawing, comprises rather more than half of what would be necessary for an art-reference library, and remembering that photographs for northern painting are relatively more expensive, the minimum cost of a collection for painting may be reckoned at double Sir Martin Conway's figures—that is, £6,000, or \$30,000; the maximum cost might fairly be put at £9,000, or \$45,000. It would take several years, under ordinary conditions, to buy, mount, and properly classify the initial collection. Afterwards the cost of accessions would be comparatively small. The expense of maintenance would be at most the salary of a special curator, with an assistant. Much of the work might be distributed to the regular staff. Many of the larger libraries already have a special art-librarian, in which case the additional expense would be comparatively less.

To speak in round numbers, a gift of \$100,000 would provide generously for the establishment and maintenance of a reference library of art reproductions. When these facts are known and properly presented, we believe it will not be long before the New York Public Library, the Congressional Library at Washington, and one at least of the

three great Chicago libraries will be in a way to add such departments. It should not be forgotten that, while such a collection is primarily for the use of specialists, it can readily be made available also for the general purposes of art education. It would be a valuable resource as well to our artists, for by the use of such a collection they could very readily find the necessary contact with the finest traditions of the past. Under modern conditions, photographs of great works of art are to the young artist what Horace's "Exemplaria Græca" were to the young poet of Augustan times.

THE NATIONAL ACADEMY OF SCIENCES.

WASHINGTON, April 19, 1902.

The April meetings of the National Academy of Sciences, which are held in Washington, are usually more important, scientifically, than the autumn meetings, which are held elsewhere. The relations of the Academy to the Government would naturally render them so; and other circumstances tend to the same result. At the meeting which has just adjourned, twenty-six papers were presented, of which four were biographies of deceased members. Of the remaining twenty-two, five related to Astronomy, as many in a broad sense to chemistry, three each to biology and geology, two each to psychology and logic, and one to metrics; while one was a description of Mösso's station on Monte Rosa.

Of the five papers upon astronomy, one, a review of the present state of our knowledge of the constant of aberration, by Dr. S. C. Chandler, was read by title only, and one upon the coefficients of precession and nutation, by Mr. Ira Ibsen Sterner, was an affair of computation. In a paper upon the planet Eros, Prof. E. C. Pickering expressed the belief that the photographic observations of that planet thirty years hence would yield the best value for the solar parallax; but Prof. Asaph Hall held that the best value would quite possibly be derived from a certain inequality of the moon's motion. Professor Pickering discussed in a very interesting way the irregular variations of light of the same little asteroid, Eros. The period of time during which the planet goes through all its changes of brightness seems to be constant at about two and a half hours, but the amount of the change appears to depend upon the direction from which the planet is viewed. The inference is that the planet rotates about an axis which must be invariable in direction, or nearly so. Yet the planet does not appear to be displaced in position during the period of its rotation; from which it may be inferred that it is about equally bright in all parts. Hence, its variations of brightness would be owing to the angular area exposed to the eye, as the object is viewed from different sides. Thus, the amount of variation, the mean brightness, and the law of variation, as the planet is viewed from different sides, afford means for a study of its form, and of the causes of variation, in a way hitherto unparalleled in photometry.

this fantastic measure, which is, however, urgently pushed by Gen. Comstock. At present the American screw system is in use generally upon the Continent of Europe. There has been, of late years, some attempt to revolt against it; but if America only maintains her position, those countries must ultimately come to the inch for mechanical purposes, because it and its modes of subdivision are more convenient and advantageous for those purposes. America is now, said Mr. Sellers, fifty years in advance of the rest of the world in mechanics. Really, to discard the inch would be to surrender our preëminence, which could not, under those circumstances, continue, such advantage should we be at once putting into the hands of England.

The newly elected President of the Academy, Mr. Agassiz, gave a brilliant reception on Wednesday at the Arlington. President Roosevelt received the Academy on Wednesday morning with the utmost grace.

MADAME RÉCAMIER.—III.

PARIS, April 19, 1902.

Madame Récamier returned to Paris after the fall of Napoleon in 1814. She found there all those who had been persecuted like herself under the Empire. She was as handsome as she ever had been, and to the prestige of beauty she added the halo of triumph. Her friends, the Montmorencys, Mathieu and Adrien, the Duke de Rohan, Alexis de Noailles, were all in high honor. Adrien de Montmorency presented to her his son, who fell at once in love with her, which gave him occasion to cite a verse of La Fontaine, in the "Animaux Malades de la Peste"—

"Ils n'en mouraient pas tous, mais tous étaient frappés."

During these first hours of triumph Madame Récamier had the pleasure of extending her kindness to Queen Hortense, who was at Saint-Leu, as well as to Queen Caroline of Naples. She drew more closely to the royalist cause Benjamin Constant, who became very seriously enamoured of her. Queen Caroline begged Madame Récamier to find in Paris some one who could defend her interests and those of Murat at the Congress of Vienna. Madame Récamier cast her eyes on Benjamin Constant; he refused to undertake the task, which he thought unworthy of him, but this circumstance brought him in daily contact with Madame Récamier, and what had been at first only a natural attraction grew into a most violent passion.

Benjamin Constant was a man of extraordinary talent and of an unbridled disposition. He never seems to have been able to understand that Madame Récamier did not return his love, and he was exasperated at her resistance to a passion which in the end amounted almost to madness. It was strong enough to influence his politics; he was not a royalist at heart, but made himself a royalist. When Bonaparte lands in France, after having left the island of Elba, Benjamin Constant writes in his diary: "I throw myself à corps perdu on the side of the Bourbons. It is Madame Récamier who drives me to this." Napoleon approaches, and, on the 15th of March, Benjamin Constant, who remains in Paris (Madame Récamier had left for Switzerland, taking with

her twenty thousand francs which Benjamin Constant had lent her), writes in the *Journal des Débats* an article which ends with this celebrated phrase: "I will not, a miserable deserter, drag myself from one party to the other, cover infamy with sophism, and 'balbutier des mots profanes pour racheter une vie honteuse' [I cite the text in its eloquence]."

Constant started for Nantes, but, learning on the way that the town was in the hands of the Bonapartists, he returned to Paris, thinking that he was to be arrested. He received, to his astonishment, the visit of a negotiator who invited him, in the name of the Emperor, to go to the Tuilleries. After some hesitation, and on hearing that Lafayette and all the Constitutional party were united in a policy of conciliation with Napoleon, he went to the Tuilleries, and, after a long conversation with the Emperor, accepted the post of Councillor of State. In the first letter which he wrote to Madame Récamier after this reconciliation with the Empire, he said merely: "The life of a courtier or a statesman be damned! I think that I shall resign, to-morrow, and I am sure I would do so if I only thought that you would thank me for it."

He added: "I have had the most curious conversations. . . . They will be good to hear, if you are curious." His versatility was not rewarded; the dream of a liberal Empire soon vanished. After Waterloo, Constant found a change in Madame Récamier's attitude towards him. "I feel there," he writes in his *Journal intime*, "a barrier which paralyzes me." There is some truth in these remarks of M. Turquan: "Benjamin Constant's love for Madame Récamier seems to have dried up his brain. The unfortunate man produces nothing more; he seems to have been arrested in full development." Michelet did not hesitate to attribute Constant's failure to his unhappy love for Madame Récamier.

Madame Récamier saw the Duke of Wellington in Paris, in 1814. M. Turquan reproaches her for doing, in these circumstances, what Madame de Staël, the Duchess d'Abrantès, all the ladies of the Faubourg, St. Germain did; and at any rate, she received very coldly the homage of the Duke. In 1815, after Waterloo, Wellington paid her a visit, and among his first words to her he said, alluding to Napoleon: "Je l'ai bien battu." Madame Récamier was offended by these words, and from that day she did not see the Duke of Wellington again.

Madame de Staël fell ill, and Madame Récamier, who visited her constantly, made in her house the acquaintance of Chateaubriand, who was much struck by her beauty; but their intimate relations began only some time after the death of Madame de Staël. In 1818, Madame Récamier went to Aix-la-Chapelle, during the sitting of the Congress, meeting there, as I have said, the Prince Augustus of Prussia; on her return to Paris she paid more attention to Chateaubriand than she had done at first. She knew that he had made a deep impression on a number of great ladies, Madame de Beaumont, Madame de Castille, the Duchess de Mouchy, the Duchess de Duras. It seemed natural for her to count the author of the "Genius of Christianity" among her ordinary courtiers. Chateaubriand soon held the first place among them; but she kept them all, even those who at first suffered the pangs of jealousy. She was a great master in the

art of mingling natural coquetry with real friendship.

M. Récamier, who, after his great failure in the time of the Empire, had attempted to rebuild his fortune, failed again under the Restoration. His wife had to shut up her house, to sell a hôtel which she had bought, and she took rooms in a sort of convent for ladies, called L'Abbaye-aux-Bois. She was, of course, to live there as she liked, to receive her friends, and to keep a few servants. Chateaubriand has described her apartment:

"A dark passage separated two small suites. The bedroom was adorned with a library, a harp, a piano, a portrait of Madame de Staël, and a moonlight view of Coppe. In the windows were flower-pots. When, all panting after the ascent of three flights of stairs, I entered this cell at the approach of evening, I felt enchanted. The windows afforded a view on the garden of the abbey, on the lawn where nuns walked around and where their pupils were running. The top of an acacia reached to the height of the eye. Pointed spires cut the sky, and on the horizon the hills of Sèvres were seen. The setting sun covered everything with gold and entered by the open windows."

It was in this retreat that Madame Récamier received her friends, who were faithful to her to the end. Chateaubriand had his chair near the chimney, where he invariably sat every day for some hours. Every means were tried to amuse him. One day, Rachel, who was then at the beginning of her career, came and recited some parts of "Polyeucte" and of "Esther." She was just reciting the famous verses which Corneille places in the mouth of Pauline when she feels the operation of grace and becomes a Christian—

"Mon jeune époux mourant m'a laissé ses larmes
Son sang, dont ses bourreaux viennent de me
couvrir.
M'a dessillé les yeux et me les vient d'ouvrir;
Je vois, je sais, je crois!"

when the door opened and an archbishop was introduced. Mademoiselle Rachel was a Jewess, and when she was presented to the archbishop she did not dare to repeat again the scene from "Polyeucte," but recited the verses from "Esther":

"Est-ce toi, chère Elise."

In 1820 there came a new visitor to the Abbaye-aux-Bois, Ampère, the son of the great Ampère who may be called the father of modern electrical science. Young Ampère naturally fell in love with Madame Récamier, and became her devoted friend. He was a charming man and became a member of the French Academy.

The assassination of the Duke de Berry (February 13, 1820) was followed by many changes in the interior policy of the Restoration. Decazes left the Home Office; it was thought for a moment that Chateaubriand would enter the Cabinet. Louis XVIII., who disliked him, contented himself with sending him as Ambassador to Berlin; he was sent later to London and to the Congress of Verona. When M. de Villèle became Prime Minister, he gave the Foreign Affairs Department to Chateaubriand. In 1823 Madame Récamier made a journey to Rome with her young niece (who became Madame Lenormant), Ampère, and Ballanche. She received almost daily letters from Chateaubriand and from Mathieu de Montmorency. At Rome she was received by the French Ambassador, the Duke de Laval. She stayed a long time in Rome,

Professor Pickering also gave an account of the present state of research into the distribution of stars of different magnitudes over the heavens, a work begun by the immortal William Herschel, from which—with such assistance as proper motions and possibly some minor sources of information may afford—must be deduced whatever knowledge of the form and constitution of the star cluster in which the solar system is as a grain of sand upon a sea-beach, the denizens of earth may be destined ever to attain.

Professor Hall, who preserves a manifest attachment to analytical devices for getting at facts where observation is more or less in default, discussed the possibility of a comet's being disrupted by gravitation alone, and wrote down the general differential equations of the problem—equations which a skilled mathematician might study for many months without finding any really good way of handling. Professor Pickering remarked that a series of photographs had demonstrated the existence of a repulsive force between parts of a certain comet, at a certain epoch, which was many times as strong as the disrupting force of gravity.

Of the five papers I have classed as chemical, one by Professor Nichols, on the optical properties of asphalt, and one by Professor Morley, on the tension of mercury vapor below the boiling-point of water, were of technical interest. Professor Morley finds that the tension, as experimentally determined, is greatly less than that which had been deduced by extrapolation. Professor Crafts gave a brief statement of the progress he has made since November in the study of the catalysis of comparatively concentrated solutions, using as a catalyser what will be understood by all students of chemistry as $C_6H_5SO_3H$.

Professor Richards, who at present looks after the atomic weights more than others do, has determined that of the very rare potassium-metal cesium. The number he obtains is about 132.879; with a range of from 132.873 to 132.882. Hitherto, 132.8 has been the number given. He also offered a largely speculative, yet highly useful, contribution to the question of what hypotheses may reasonably be tried in order to account for changes in atomic volume. It seems very extraordinary that, notwithstanding the stupendous mass of chemical facts that have been collected and the very considerable researches that have been made into physical chemistry, we are still almost entirely ignorant of what a chemical compound is, or how its constituents are held together. We are not even sure that they are held together by mutual attractions; for although heat is generally evolved when bodies combine, showing that mutual forces are satisfied simultaneously with the act of combination, yet in some cases, on the contrary, heat is absorbed during combinations—a fact which naturally leads us to inquire whether there may not be other agencies than mutual forces whose action indirectly results in the formation of chemical bodies; and whether, if so, it is not probable that such agencies, whatever they may be, are a factor even of those combinations in which they are aided by direct forces. When hydrogen and chlorine come together to form muriatic gas, there is no condensation—or none of which account is commonly taken—although

there is enormous evolution of heat. But then, the extreme chemical activity of the resulting gas seems to prove that it is not a fully complete chemical compound. Notwithstanding the tremendous energy with which the ions have approached one another, they are still so active that the case must be very different from what it is when a mixture of hydrogen and oxygen loses one-third of its volume in combining. A body may undergo contraction without combining with a different body; as when aqueous vapor is cooled. In all such cases heat is plentifully evolved, and molecule unites with molecule. It is a question how far the heat of chemical reaction is anything more than heat of contraction. Contraction does not necessarily consist solely in the approach of atoms towards one another. If an atom is a vortex, it must be in itself elastic and capable of deformation; and it may be so even if it is not a vortex. If atoms are compressible, the mutual attraction between two atoms would naturally tend to deform them. Another question, therefore, to be considered is the relation between such deformations and their valency. It seems to be a fact that highly compressible elements have low valency, while carbon and other elements of high valency are little compressible. All these are interesting and valuable considerations to be borne in mind in the construction of new hypotheses upon which experimental investigations are to be based.

The geological papers were of remarkable interest. Two, by the new President of the Academy, Mr. Alexander Agassiz, related to the mode of formation of coral reefs and to the somewhat peculiar coral reefs of the Maldiv Islands, which Mr. Agassiz has lately visited. Instead of being in the trade-winds, these islands are in the monsoons; and, instead of being exposed to the tremendous surf of the Pacific, they are in the gentler Indian Ocean. Darwin's theory of the origin of the coral reefs, which, as is generally known, was that the work of the coral animals began when the Pacific was a shallow sea, and that, as its floor has gradually sunk, the corals have built higher and higher, until they now rise in some cases from the deepest ocean, seems, at any rate, to be definitively exploded. In the first place, it does not seem to be generally true that the sea-floor is everywhere sinking where there are coral-reefs. In the next place, borings show that the coral-rock extends only to a moderate depth. In the third place, an admirable survey was made of the Maldives, about 1830 to 1836, from comparison of which with the existing islands it is found for certain that older and younger atolls exist side by side in the same sea, which is hardly compatible with Darwin's theory. There are several other arguments to the same effect, not so easily stated in a few words.

On the other hand, the differences between the Maldives and the Pacific coral islands, which are very remarkable, are easily explicable on the theory of their formation which is supported by Agassiz. The Maldiv atolls are excessively composite. What may be called an atoll, and upon a small-scale map has every appearance of such a formation, may be found to be a composite of tens or of hundreds of partially independent atolls; and the lagoons will contain rich growths of corals, in striking contrast to the atolls of the Pa-

cific. This is attributable to the wide and deep passages existing in the reefs. In the Maldives, as in the Pacific and near Yucatan, manganese nodules were found upon the floor of the ocean, and these are held to be necessarily of eruptive origin. Not limestone, but eruptive rocks form the foundation structures upon which the coral islands are built. Next above these rocks are limestones that are not coralline, but are composed of fragments of shells of globigerinæ. These deposits are raised to such a height as to be moved by the action of the sea and to be further thrown up in places to within 30 or 40 fathoms of the surface, at which depth the work of the coral animals can begin. After that, everything seems to depend upon the action of the sea, and so upon the prevailing winds. The nature of the changes which individual islands have undergone since 1830 are extremely interesting and significant. A coral reef is not necessarily circular. That type occurs but seldom. It is more apt to be shaped like a pear or a gourd. According to circumstances, in the Maldives, in course of time, a faro, or island, or several, may be formed upon the reef; quite commonly two, where the seas of the two monsoons strike tangentially. These islands put out spits in one direction and the other as the wind changes, and thus the two islands at length join together and the one island takes the form of a broken ring.

Professor Osborn summarized the evidence that North America and Eurasia were, during the Mesozoic and Cenozoic, joined in such wise as to constitute a single zoological realm. In regard to the latent homology of which he told us last October, he has since found that this had been long ago remarked by Owen, and named homoplasia. Professor Osborn presented part third of a monograph on the bombycine moths of America. This part relates to the Sphingicampidæ.

Professor Cattell read a paper on psychophysical fatigue, in which he showed that Mosso's method of experimenting upon lifting a dead weight from the ground, the amount of work being measured by the product of the mass into the height through which it was lifted, is open to the objection that there is much effort before the weight is stirred. By experimenting upon pulls against a spring, Professor Cattell has entirely avoided this objection; and the consequence is, that the strange anomalies of Mosso's results now completely disappear. Three papers by Mr. C. L. Peirce, on Color Sensation, on the Postulates of Geometry, and on the Classification of the Sciences, were read by title.

Mr. William Sellers read a paper on the compulsory introduction of the metric system into the United States. This referred to a bill which the doctrinaires of the metric system, with their usual utter neglect to ascertain the state of facts, have introduced into Congress requiring every bureau of the Government (including the Bureau of Weights and Measures, the Mint, the Bureau of Construction of the Navy, etc.), from and after a given date, to use no other than the units of the metrical system for any purpose whatsoever. That this would render every plan in the Navy Department worthless, that it would be impossible to repair the engines of any ship, are among the smallest inconveniences which would result from carrying out the purposes of