The conditions are as follows:

"1st. The essay must be written in plain language, each term to be defined in brackets immediately following, and must not exceed 3000 words.

"2nd. Each essay must be signed with a *nom de plume*, and a sealed envelope must accompany the essay superscribed with the *nom de plume*, and containing the real name of the author.

"3rd. All the essays must be filed with Dr. Lewis Swift, Director of the Warner Observatory, Rochester, N. Y., by November 1, 1881, and he will submit them to the judges.

"I hope that this prize will produce valuable additions to popular astronomical literature."

We regret that Mr. Warner was not better advised when he arranged the title of the essay and named the conditions. By "*plain*" language we presume he calls for "simple" language, but we are unable to explain his desire that "each technical term shall be defined in brackets immediately following." For whose benefit is all this defining to be offered? Is it to aid Professor Swift and the judges? If to aid readers, when the essay is subsequently published, would not a simple glossary of the scientific terms used, added at the end, be more appropriate? If "*each* technical term is to be defined," we fear that a large percentage of the 3000 words permitted will be used for this purpose.

Again, would it not be a more creditable arrangement, that the essays be filed with some independent person, instead of Professor Swift, who is at least a beneficiary of Mr. Warner, and is both a competitor and the judge in these prize gifts? (We think Professor Swift awarded the first Warner prize for comets to himself.)

Lastly, we find that no names are given of those who are to be judges of the value of the prize essays. This omission is very important, and seems to raise a doubt whether any judges whose opinion is worthy of respect can be secured to connect themselves with a scheme proposed under such conditions. Again, what disposition is to be made of the essays received by Mr. Warner? nothing is guaranteed in this respect; and will Professor Swift once more announce to the essayists that "no conclusion can be reached which is scientific and satisfactory?"

We do not wish our remarks to be interpreted in a sense which implies that either Mr. Warner or Professor Swift are desirous of acting improperly in this matter, although their behaviour may, in some quarters, be severely criticised; we rather lean to the view that their judgment and discretion is at fault, and that they require the counsel of some friend who can so advise them, that they arrive at "conclusions which *are* scientific and satisfactory." Mr. Warner hopes that his prize "will produce valuable additions to popular astronomical literature;" we fear that under the conditions he offers, he will be inundated with vulgar scientific trash.

In conclusion, we offer Mr. Warner one word of advice. If he honestly desires to encourage real scientific work and literature, let him permit such men as Hall, Newcomb, Pickering, Young, Stone, Holder or Draper to arrange the title of his prize astronomical essay, and request them to name the conditions, and be the judges, of the merits of the papers submitted. The decision of any two of the gentlemen we have named would be satisfactory to those who are likely to be competitors, provided they acted independently, and untramelled by Mr. Warner or any of his Rochester friends.

HYPERMNESIA OR EXALTATIONS OF MEMORY.*

[Translated from the French by the Marchioness CLARA LANZA.]

Until now our pathological study has been confined to destructive forms of memory. We have seen the latter diminished, sometimes completely destroyed. There are however, precisely contrary cases, in which the apparently abolished memory comes to life again as it were, and faint recollections become intensely vivid. Is this exaltation of the memory (called technically hypermnesia) a morbid phenomena? It is at least certainly an anomaly. When we remark further that it is always connected with some organic disorder or bizarre condition, we cannot deny that it comes within our province to discuss it. There are other subjects, amnesia for instance, which are more instructive, but we should not neglect it for that reason. We will see therefore what there is to learn about *persistence of recollections*.

Hypermnesia is divided into two classes—general and partial.

General exaltation of memory is difficult to determine, because the degree of excitation is quite relative. The force of this faculty varying to a great extent in different individuals we cannot measure it by any common standard. The amnesia of one person may possibly be the hypermnesia of another. It is, if we may employ the word, a change of *tone* in the memory, such as occurs in every other form of psychological activity, thought, imagination or sensibility. Moreover, when we say that the excitation is general, it is nothing more than a probable induction. Inasmuch as the memory is subject to the condition of our consciousness, and as consciousness is only produced in the form of succession, all that we can affirm is, that in the course of a period more or less extended a mass of recollections spring up in every direction.

General exaltation seems to depend exclusively upon physiological causes, particularly the rapidity of cerebral circulation. It is therefore apparent very often, in cases of acute fever. It is also produced in insanity, ecstasy, and hypnotism, sometimes in hysteria and in the beginning of certain mental diseases.

Besides these purely mental pathological instances there are others of a more wonderful nature which depend probably upon the same cause. Numbers of persons who narrowly escaped drowning have stated, that in the moment when asphyxia began, they seemed to see all at once their entire life in all its details, even the most

* See *Les Maladies de la Mémoire* by Th. Ribot, Paris 1881.

trifling incidents appear distinctly before them. One person in particular, declared that he saw his whole existence rolled out in retrograde succession, not like a mere indistinct sketch, but in precise details, making a panorama of his life, in which every act was accompanied by a feeling of pleasure or pain.

An analogous circumstance relates to a man of remarkable intelligence who happened to cross a railroad track just as an express train approached. He had just time to throw himself lengthwise between the rails. As the train passed over him, the sense of his danger caused every incident in his life to suddenly rise before him in memory.

Even allowing for possible exaggerations, these facts reveal a hyper-activity of the memory, of which in a normal state we can form no idea.

I will quote one more instance, due to stupefaction from opium, and at the same time I will beg the reader to observe how well it confirmed the explanation of the mechanism of recollection given in another chapter.

"It seems to me," says DeQuincy in his celebrated *Confessions*, "that I have lived seventy years or a whole century in one night. The most trivial events of my youth, forgotten scenes belonging to my early years, were constantly brought before me. It cannot be said that I remembered them, for had they been mentioned to me while awake, I should not have been capable of recalling a single one of them as forming a part of my previous existence. But placed before me as they were in a dream, like so many intuitions, made up of the most vague circumstances and their accompanying sentiments, I recognized them instantly."

All these general excitations are transitory. They endure no longer than the causes which produce them. Does permanent hypermnesia exist? If the word can be accepted in this rather forced sense, it must be applied to those singular developments of the memory which are the continuation of some chance accident. In ancient authors we find many cases of this kind related. We have no reason to doubt them, for modern investigators, Romberg among others, have noted a wonderful and permanent development of the memory, following small-pox, etc. The mechanism of this transformation being impenetrable, we have, however, no reason to insist upon it.

Partial exaltations are by their very nature limited. The ordinary tone of the memory being maintained in its generality, everything beyond this can be easily ascertained. These forms of hypermnesia are the necessary co-relatives of partial amnesia.

In the production of partial hypermnesia there is nothing resembling a fixed law. It presents itself under the form of isolated facts, that is to say, it is the result of a series of conditions which escape us. Why is a certain group of cells forming a particular dynamic association put in motion sooner than another? We can give no reason, neither a physiological nor a psychological one. The only cases wherein we can affirm the appearance of a fixed law, are those of which we shall speak later, where several languages return successively to the memory.

Partial exaltations generally spring from morbid causes. But sometimes they occur in a healthy state. Here are two examples:

"A lady in the last stages of a chronic malady was taken from London into the country. Her little daughter, who was a baby, not yet able to speak, was brought with her, and after a short interview, was taken back to the city. A few days later the lady died. The child grew up without having any recollection of her mother. When she had attained maturity, however, she had occasion to see the room in which her mother died. Although she was ignorant of this fact, she trembled as she crossed the threshold. On being asked the cause of her emotion, she replied: 'I have a distinct impression of having been in this room before. There was a lady in bed here in this corner. She seemed to be very ill, and she bent over me, weeping.'"[1]

"A man endowed with a highly artistic temperament (observe this point) accompanied some friends to a castle somewhere in Sussex. He had no recollection of ever having been there before. On approaching the entrance he had a sudden vivid impression of having already seen it, and, with the remembrance of the door came also a recollection of people above and beneath the portico, together with some donkeys standing by. As this conviction grew upon him more and more, he questioned his mother, thinking she, perhaps, might be able to enlighten him. She told him that when he was about sixteen months old he had been in the neighborhood with a large party of people, that he had been carried in a basket upon a donkey to the castle and left down stairs with the servants and their donkeys while the other members of the party had installed themselves above the portico to eat their dinner."[2]

The mechanism of recollection in these two cases does not admit of any ambiguity. It is a revival, by contiguity, after a long interval. They present that which happens throughout every instant of life in a striking and uncommon form. In order to recover a lost recollection have not many of us returned to the spot where the idea arose, endeavored to place ourselves as nearly as possible in the same material situation and thus see the remembrance spring to life?

As to hypermnesia arising from a morbid cause I will give one example.

"At the age of four years, a child submitted to trefining in consequence of fracturing its cranium. When his health was quite restored he had no recollection of the accident or the operation. But at the age of fifteen, while suffering from delirious fever, he described the operation to his mother, mentioning the physicians and those present, the details of their dress, and other minute particulars, with the utmost exactitude. Up to this time he had never spoken of the matter nor had he heard any one mention it."[3]

The revival of languages completely forgotten deserves to be spoken of more at length. The instance reported by Coleridge is so hackneyed that I shall not repeat it. There are many others of the same kind which are to be found in the writings of Abercrombie, Hamilton and Carpenter. Anæsthetic sleep produced by chloroform or ether can produce the same effects as febrile excitation. "An old forester lived during his youth on the frontier of Poland, and spoke scarcely anything but Polish. Later he removed to German territories. His children testified that for thirty to forty years he had neither heard nor pronounced a single Polish word. During an anæsthetic sleep of about two hours this man spoke, prayed and sang fluently in Polish.[4]

A still more curious thing is the *regressive* recollection of several languages. Unfortunately, the authors who have mentioned this use the term and note the fact without properly interpreting either.

The most interesting case was observed by Dr. Rush, of Philadelphia. An Italian named Dr. Scandella, a man of remarkable learning, resided in America. He was a complete master of the Italian, English and French languages. He took the yellow fever, and died of it in New York. In the beginning of his illness he spoke nothing but English. After that only French, and on the day of his death, Italian—his native language.

The same writer speaks in rather confused terms of a woman who was subject to transitory attacks of acute mania. When first seized she always spoke very poor

[1] Abercrombie. "*Essay on Intellectual Powers.*"

[2] Carpenter. *Mental Physiology.*

[3] Abercrombie. Work before quoted.

[4] M. Duval. HYPNOTISME *daus le Nouveau dict de Médicine*, p. 144.

Italian. When at the height of her insanity—French. During the first period of recovery, German; and while convalescent, her mother tongue, English.

If we throw aside this regression as far as it deals with several languages and content ourselves with more simple cases, we find abundant and very precise instances. A Frenchman living in England, and speaking English perfectly, received a violent blow upon the head. During his entire illness, he was unable to say a word in any language except his native French.

There is nothing, however, more instructive than the following fact, related also by Dr. Rush: "A Lutheran clergyman, of German origin, living in America, had in his congregation a great number of Germans and Swedes, who, before dying, repeated prayers in their mother tongue. Most of these, he said, he was sure had not spoken a word of German or Swedish for fifty or sixty years."

Winslow has stated that numbers of Catholics, converted to Protestantism, have prayed strictly in accordance with the Roman ritual, during attacks of delirium preceding death

This revival of languages, lost forms and ceremonies, seems to me only to be interpreted by a particular case of the law of regression. In consequence of a morbid action, which generally precedes death, the most recent impressions of the memory are destroyed, and this annihilation descends gradually until it reaches the oldest acquisitions and impressions. They acquire a temporary activity, and are produced in consciousness for a certain period before being wiped out forever. Hypermnesia, then, is merely the result of negative conditions. Regression does not follow from a normal return to consciousness, but from the suppression of more intense and vivid conditions. It resembles a weak, faltering voice, which cannot make itself heard until the loud speech of others has ceased. Impressions, certain habits belonging to childhood or youth, suddenly return, not because they are pushed forward by some cause, but because there is no longer anything to cover them. Recollections of this kind, are, strictly speaking, only a march backwards towards certain conditions of existence which seemed to have disappeared forever, but which a final working of the memory, before entire dissolution, brings once more to the surface. I will abstain, however, from further reflections which these facts naturally suggest, reserving them more properly to moralists. It could be shown, for example, that certain religious frenzies, which have overtaken people upon their death-bed, are, to psychology, merely the necessary effect of a general breaking up, for which there is no remedy.

Independent of this confirmation of our regressive law, is the surprising persistence of these latent conditions of memory which we have called residuum. Were it not for these disorders of the memory we could form no idea of it, for consciousness reduced to itself can only affirm the conservation of those conditions which constitute life and a few others dependent upon the will, inasmuch as they have become fixed by habit.

Must we draw, then, the conclusion that nothing is ever lost in the memory? Must we infer that an impression once formed there is indestructible, and that at any moment it is likely to be revived? Several writers, Maury particularly, have given striking examples to uphold this theory. However, there is no peremptory reason to deny that even without the existence of morbid causes, there are residuums which disappear. It is quite possible that certain cellular modifications and other dynamic associations are too unstable to last. In short we may say that the persistence agrees with a fixed rule, at least, in the majority of cases.

As to the manner in which these distant impressions are preserved and reproduced in memory, we do not know. I will tell you, however, how it can be conceived in the hypothesis which I have adopted throughout this work.

If we admit cellular modifications and dynamic associations to be the material substratum of recollection, there is no memory, however crowded with facts and impressions, which is unable to retain everything. For, if the cellular modifications are limited, the possible dynamic associations are innumerable. We may suppose that the old associations reappear when the new ones, being temporarily or effectually unorganized, leave the road free. The number of possible revivals being diminished the chances augment in proportion for the return of the most stable associations, that is to say, the oldest. I have no desire to insist upon a non-verifiable hypothesis. My aim is to keep closely within the bounds of certainty, and not wander off into doubtful paths.

It has been found impossible to place under the category of any of the preceding morbid types, a certain illusion of a peculiar nature, which occurs rarely, or rather, is seldom observed. There have only been three or four cases mentioned, and up to the present time no special term has been used to designate it. Wigan has called it very improperly, double consciousness. Sander, an illusion of the memory (*Errinnerungs-tauchung*). Other writers have termed it false memory. This latter name seems to me the most preferable. The condition consists in the belief that an entirely new state has been experienced before, so that, when it is produced in reality, for the first time, it seems to be a repetition.

Wigan, in his well known work upon the duality of the mind, says that while present at the funeral service of the Princess Charlotte in Windsor Chapel, he suddenly experienced the impression of having witnessed precisely the same spectacle sometime previous. The illusion was, however, but transitory. Many others of a more lasting nature have been recorded. Lewes associates the phenomenon with some which are more common. When we are in a strange country, for instance, it frequently happens that a sudden turn in a path or river brings us face to face with a view which we are certain we have contemplated before. Sometimes, on being introduced to a stranger, we feel sure that we have already seen him. While reading, new thoughts will often present themselves to the mind as being familiar[6].

This illusion, I think, can be easily explained. The impression received, evokes in our past, similar or analogous impressions, vague, confused and hardly perceptible, but nevertheless sufficiently defined to make us think the new condition is only a repetition of a former one. There is a basis of resemblance rapidly felt between two conditions of consciousness, which causes one to be identified with the other. It is, of course, an error, but it is only a partial one, because there really exists in the past, something which resembles an identical former state.

If, however, this explanation suffices for simple instances, here are others which do not admit of it.

A sick man, says Sander, on being told of the death of an acquaintance, was seized with an access of ungovernable terror because he thought he had already experienced the impression at some former time. "It seemed to me," he said afterwards, "that I was in the same bed on another occasion and X came to me, saying 'Müller is dead.' I answered, "he died long ago. How can he die twice?"[7]

Dr. Arnold Pick reports the most complete case of false memory that I know of. It assumed the form of a chronic disorder. An educated man, of good reasoning powers, was suddenly attacked—about the age of thirty-two—with a most peculiar mental affection. If he was at an entertainment of any sort, or paying a visit, the

[5] See an article by M. Delboeuf in the *Revue Philosophique*, February 1880.

6 Lewes, See *Problems of Life and Mind*, 3d series.

7 Sander, *Archiv für Psychiatrie*, 1873, IV.

event, with all its attendant circumstances, appeared so familiar to him that he was absolutely sure he had previously experienced the same impressions, surrounded by the same people or objects, with the same sky, weather, etc. If he ventured to undertake a new occupation of any kind whatever, he was certain he had done it before and under identical conditions. Sometimes the sensation would occur the same day, in the course of a few minutes or hours, sometimes it did not strike him until the day following, but it was always a distinct impression.

In this phenomenon of false memory, there is an anomaly of mental mechanism which escapes us, and which is difficult to comprehend in a healthy state. The person affected, no matter how acute an observer he might be, could only analyze the condition when he ceased to be deceived by it. From the examples given it would seem to me that the impression received is reproduced in the form of some image. To employ a physiological term, there is a repetition of the primative cerebral process. This is a very ordinary phenomenon. It occurs in every recollection which is not caused by the actual presence of the object. The only difficulty is to discover why this image which arises a minute, an hour or a day after the real condition, should appear to be a repetition of the latter. We may possibly admit that the mechanism of recollection acts in a distorted manner, for my part, however, the following explanation seems more explicit:

The image formed in this manner is very intense and partakes of the nature of an hallucination. It is, apparently, a reality, for nothing rectifies the illusion. Consequently, the real impression is forced back, as it were, and assumes the character of a recollection. It becomes realized in the past, erroneously if we consider the facts, objectively, properly, if we consider them subjectively. The hallucination, although very vivid, does not efface the actual impression, but as the latter is quite separate, and as the former is produced at a comparatively late period, the real occurrence appears to be a second experience. The hallucination assumes the place of the actual impression, it seems to be more recent, and this is really the case. Of course, to us who judge according to what we see externally, it is false to say that the impression was received twice. To the person afflicted, however, who determines solely as his consciousness may dictate, it is true that the impression was actually received twice.

To the support of this explanation, I would call attention to the fact that false memory is nearly always allied to some mental affection. The person mentioned by Pick suffered from a form of insanity. He was continually endeavoring to escape from people he supposed were his persecutors. Hallucinations in this instance would be perfectly natural. I do not, however, wish to assert that my theory is the only possible one. In regard to this isolated condition of false memory, much more numerous and concise observations than mine are probably required.

THE EXCAVATION OF THE GRAND CAÑON OF THE COLORADO RIVER.*

By Capt. C. E. Dutton, U. S. A. U. S. Geological Survey.

The Grand Cañon of the Colorado River is the longest, widest and deepest of the almost continuous chain of cañon valleys through which the upper half of that river flows. Its length is 218 miles, its width from 5 to 11 miles, and its depth from 4500 to 6000 feet. For convenience of discussion it may be arbitrarily divided into four divisions: 1st. The Kaibab division; 2d. The Kanab; 3d. The Uinkaret; 4th. The Sheavwits division. The upper or Kaibab division is the grandest, widest and most diversified, and a little deeper than the others

* Read before the A. A. A. S. Cincinnati, 1881.

The three others are simpler in form and much alike in their topographical features. Capt. Dutton first exhibited a view of the cañon in the Uinkaret division, showing its simplest and most typical form. It consists of an inner and an outer chasm, or a cañon within a cañon. The outer chasm is five to six miles wide, and is walled on either side with palisades 2000 feet high, of singularly noble and graceful profiles, which confront each other across a comparatively smooth plain. Within this plain is sunken the inner gorge, descending 3000 feet lower, and having a width a little greater than its depth. At the bottom of the inner gorge flows the Colorado River, a stream about as large as the Ohio between Pittsburg and Wheeling. The strata in which the chasm is cut are chiefly of carboniferous age. The summit of the outer cañon wall is very near the summit of that series. The chasm throughout the greater part of its extent cuts below the carboniferous and penetrates the Lower Silurian, and even the Archæan schists, revealing the fact that before the carboniferous was deposited the country had been extensively ravaged by an erosion which swept away heavy bodies of Silurian, and probably also of Devonian strata. The carboniferous now rests upon the beveled edges of the flexed older strata, and in many places rests upon the completely denuded Archæan.

The region adjoining the chasm and for 40 to 60 miles on either side is a nearly level platform presenting the summit beds of the carboniferous system patched over here and there with fading remnants of the Permian. The strata is very nearly, but not quite horizontal. There is a slight dip to the northward rarely exceeding one degree, but as the general course of the river is along the strike, the edges of the strata disclosed in the Cañon walls are to all appearances rigorously horizontal.

From 40 to 60 miles north of the river are found the principal masses of the later formations, including the Permian, Trias, Jurassic, Cretaceous and Lower Eocene. These form a series of terraces rising successively like the steps of a gigantic stairway as we move northward. Each formation is terminated southwardly by a great cliff and the strata are nearly horizontal, collectively they have been named the Southern Terraces of the High Plateaus. The latest formation which was deposited in this region was the Lower Eocene.

To the geologist it is obvious that the formations of the Terraces now terminated by gigantic cliffs once extended further out towards the southward and formerly covered regions from which they have been denuded. Captain Dutton is confident that all these terrace formations once reached entirely across the Grand Cañon platform in full volume, and that their ancient shore line is found in Central Arizona. The thickness of the strata thus denuded was a little more than 10,000 feet on an average, and the area from which they have been swept away is more than 13,000 square miles. It is through the heart of this denuded region that the course of the Grand Cañon is laid. The denudation began probably at an epoch not far from Middle Eocene time, since at that epoch took place the final emergence of the region from a marine condition (through the brackish water and lacustrine stages) to the condition of *terra firma*.

It is apparent that the cutting and development of the present Grand Cañon is only a closing episode of a long history of erosion, extending from Middle Eocene time down to the present. Before the river could begin its attack upon the summit beds of the carboniferous which now form the crests of its upper walls, it had to cut through more than 10,000 feet of superior strata. This would alone indicate that the beginning of the present cañon cannot date far back in Tertiary time, and Capt. Dutton thinks that the evidence points strongly to the conclusion that its excavation in the carboniferous began in Pliocene time. This evidence is cumulative and not direct, but is derived from a comparison of many groups