

of the Potomac, with which he was popular to the last.

In his book, "The Peninsula," General Webb says: "This then to be the first deduction from the narrative of the events of 1861 and 1862: General McClellan did not give to the will of the President, and the demands of the people, that weight in the formation of his plans of campaign to which they were entitled."

Probably the author did not express his meaning accurately in the foregoing quotation. Strictly construed, the criticism is not correct. The formation of his plans of campaign is one of the things in which the general cannot rest upon "the people," nor even upon the President, though of course the latter must always be im-

PLICITLY obeyed. The formation of plans of campaign is a professional matter of the highest importance. It belongs to the soldier, not to the civilian, and the general is bound to proceed in that duty of his office according to his own judgment and conscience. The plan of campaign is one of the things which by its nature must be kept from "the people," as long as possible, lest it become known to the enemy. McClellan's failure to give weight to the will of the President and the demands of the people in *this particular* was not his mistake. The trouble was that, from an honest conviction of his own high mission, he put himself above both President and people in all matters relating to the war. In short, he acted conscientiously as the chosen savior of his country, instead of a subordinate soldier of the Republic.

James B. Fry.

SOPHIE GERMAIN.

AN UNKNOWN MATHEMATICIAN.

IF a thin circular sheet of metal be fastened firmly at the center by a clamp, and if a violin bow be drawn across its edge, a musical note will be produced. The plate is thrown into vibration by the bow; the vibration does not all come up at once and all go down at once, but it divides itself into some even number of sectors, say six or eight, and as one sector goes up the sector on each side of it goes down. The line between two adjacent sectors goes neither up nor down, but remains at rest. If sand be scattered evenly over the plate before the musical note is produced, it will be shaken off the parts which are most in motion, and it will collect in the lines of rest, or "nodal lines," as they are called. Different musical notes cause the plate to be differently divided up, and the state of vibration of the plate is made plain to the eye by the lines of sand marked out on it. This experiment, a very striking one, which is still performed in all physical laboratories, was exhibited at Paris, soon after its discovery by Chladni, in 1808. It created a great sensation, and a commission was appointed to repeat it with various modifications, and to make a report upon it. The Institute of France, at the suggestion of Napoleon, offered its grand prize for a mathematical discussion of the phenomenon. There were not wanting great mathematicians in Paris at that time — Lagrange, Laplace, Legendre, Poisson, Fourier, but none of them were inclined to undertake this question; Lagrange, in fact, had said that it could not be solved by any of the then known mathematical methods. The offer was twice renewed by the Institute, and in 1816 the prize was conferred upon a woman, Mlle. Sophie Germain. It is very remarkable that so great a distinction as to have received the prize of the Institute of France for a pro-

found mathematical discussion should not have preserved the name of Sophie Germain from oblivion, but it has not done so. There are probably not a score of persons in this country who have ever heard of her, and in her own country she is not usually mentioned among its famous women. As proof that women may be pure mathematicians, Mrs. Somerville has had, outside of Italy and Russia, to stand alone. This is unfortunate, for the detractors of her sex have maintained that her work, though exceedingly profound, was not remarkable for originality. That charge cannot be brought against Sophie Germain. She showed great boldness in attacking a physical question which was at that time entirely outside the range of mathematical treatment, and the more complicated cases of which have not yet submitted themselves to analysis. The equation of elastic laminae, which is still called Germain's equation, formed the starting-point of a new branch of the theory of elasticity. In her later years Sophie Germain turned her attention to questions of philosophy, and high German authority has recently discovered that her philosophical writings contain the germ of the Positive Philosophy of Comte. It is a curious thing that a woman so deserving of recognition has not received it in a fuller degree; it must be looked upon as one of those accidents by which the distribution of praise for merit is too often badly regulated. A mathematician, so remote is his subject from the ordinary concerns of men, has to be a very great mathematician indeed to be so much as heard of by the general public. Sophie Germain, besides deserving remembrance on account of her contributions to science, had a charming personality, and the few details that have been preserved concerning her life will not be found to be without in-

terest. The authority for them is an article by Libri, the Italian mathematician, which appeared in the "Journal des Débats" at the time of her death. Later writers, including the author of the biography prefixed to the new edition of her philosophical works, which was published in 1879 (Paris: P. Ritti), have added little that is important to his account.

On April 1, 1776, in a modest house in the Rue Saint Denis, in Paris, Marie Sophie Germain was born. Her parents were Ambroise François Germain and Marie Madeleine Gruguelu. Not much can be said about her family. It is only known that her father, a skilful goldsmith, belonged to the cultivated and liberal bourgeoisie, and that he was the partizan, if not the friend, of the philosophers and the political economists. It is plain that she must have passed her earliest years in a family in which there were plenty of serious subjects for conversation. She soon exhibited great maturity of intellect, and remarkable depth of feeling. Her gloomy anticipations concerning the future of her country were a distinct cause of suffering to her, and she sought for some occupation sufficiently absorbing to distract her attention from her fears. At the age of thirteen she was one day turning over the pages of Montluca's "History of Mathematics" in her father's library, when she came upon the eloquent account of the death of Archimedes — how he was so absorbed in the consideration of a geometrical figure that he heard nothing of the taking of Syracuse, or of the plundering of the city, and that, when a Roman soldier appeared before him, he met death at his hands without raising his eyes from his work. She conceived a sudden passion for a science which could procure such absolute concentration and such total oblivion from the cares and griefs of life, and she resolved at that moment to devote herself to the study of mathematics. That resolution she carried out. She had no teachers, she had few books, but she had an unlimited store of energy. She studied by day and by night. Her family were alarmed at so much ardor, and endeavored to turn her attention to more ladylike pursuits. They tried the plan of putting out her fire and taking away her clothes at night, but she was found in the morning wrapped up in blankets, absorbed in her studies in a room so cold that the ink was frozen in the inkstand. It is a curious coincidence that Mrs. Somerville, at that very same

time, in her little village in Scotland, was obliged to wrap herself up in blankets to pursue her studies before breakfast, because her whole day had to be devoted to the practice of music and painting, and to her lessons at the shop of the pastry-cook.¹ Before a strength of will so remarkable at her age Sophie Germain's family at last yielded, and she was allowed to dispose of her time and her talents at her pleasure.

But no matter what the energy brought to bear upon them, the higher mathematics present a long and toilsome course of study to any one who wishes to master them. Sophie Germain carried on this laborious work with constantly increasing satisfaction. Toward the end of her life, she still spoke with animation of the happiness she experienced when she first found herself in a position to take up the Differential Calculus of Cousin. But soon a new difficulty presented itself. It was absolutely necessary to her further progress that she should read certain works which were written in Latin, and she did not understand that language. Unaided and alone, she proceeded to learn it, and in a short time she was able to read the works of Euler and Newton. Her ambition at this time took a wider range, and, carried away by the philosophical spirit which held sway in the great encyclopedia, she extended her reading over the entire field of the sciences, and laid the foundations for that work which, forty years later, was to secure her a place among the founders of the Positive Philosophy.

In 1794 the École Polytechnique was founded. Lagrange, Prony, Fourcroy, Monge, were among its lecturers. Sophie Germain was then eighteen years of age. Anxious to profit by so valuable a means of instruction, she procured for herself students' note-books specially of the courses in chemistry of Fourcroy, and in analysis of Lagrange. She did more. The students were in the habit of handing in to the professors, at the end of a course, their observations in writing on the lectures which they had attended. Under the supposed name of a student, Le Blanc, she sent her note-books to Lagrange. He noticed them, publicly praised them, found out their real author, and, having made her acquaintance, became the friend and counselor of the young mathematician. The circumstances under which she was discovered, the approbation of the illustrious author of the "Mécanique Analytique," her youth, some details concerning her studies — all this excited at-

¹ The general law that women's learning must be got by heroic measures, if at all, is not yet obsolete. Ellen Watson, the highly gifted young woman, Clifford's pupil, who died at the Cape of Good Hope at an early age, did all her studying before breakfast, because she was required to spend the day-time in teaching her younger brothers and sisters; and the very last number of the

"Nineteenth Century" contains an account of a girl whose sympathetic family secure her two uninterrupted hours every day for an afternoon nap on account of her delicate health, not knowing that her afternoon sleepiness is due to hours of hard work before breakfast — work for which, it goes without saying, she would not dare to ask for two uninterrupted hours in the afternoon.

tion, and procured for her sympathetic friends. Soon she had established relations, either directly or by correspondence, with all the learned men of the period. Every one was solicitous of the honor of being presented to her, learned works were dedicated to her, and her house became a center for the brilliant conversation of the most distinguished men of the day.

Some years later, Gauss's great work on the "Theory of Numbers" appeared. Mlle. Germain at once turned her attention to this subject. She made numerous researches in it, and, under the pseudonym of *Le Blanc*, she sent her notes to the celebrated professor of Göttingen, persuaded, she writes, that "he will not disdain to enlighten with his advice an enthusiastic amateur of that science which he cultivates with such brilliant success." *M. Le Blanc* was far from being a simple amateur, and Gauss was soon well aware of it. His answer contained a warm recognition of her talents, and a friendly intercourse was kept up between them for several years without his becoming aware of the sex of his correspondent.

In 1808 Sophie Germain contended for the prize offered by the Institute for the best memoir giving the mathematical theory of elastic surfaces, and comparing it with experience. She deduced the equation of those surfaces from a certain hypothesis concerning the forces of elasticity, but there was an error in her mathematics, and her equation was not correct. Lagrange, to whom the paper had been referred, deduced from the same hypothesis the equation which is still recognized as the correct one. She did not receive the prize. Two years later she sent in a second memoir, in which the same equation is correctly given, and a more complicated hypothesis leads to the equation for the state of things which obtains at the boundaries of the elastic plate. Her theoretical solution she had also confirmed by a long series of experiments. This paper received honorable mention. Nothing daunted, she tried a third time, and received the prize, although the commission was not absolutely satisfied with the rigor of her demonstration. Germain's equation for elastic plates is still the fundamental equation of the theory. Her boundary-equations have not stood the test of time; Poisson, fourteen years later, gave a different set of boundary-equations based upon a different hypothesis, and Kirchoff, in 1850, showed that neither hypothesis was tenable, and that neither set of equations was correct.

In 1824 she sent another paper to the Institute entitled, "On the Employment of the Thickness in the Theory of Elastic Surfaces." This paper was given to a commission, consisting of Poisson, Prony, and Laplace, to re-

port on. They never brought in their report, and she was never able to regain possession of the manuscript. Only a few years ago it was discovered among the papers of Prony, and it was reprinted entire, in a supplement to Liouville's "Journal des Mathématiques."

Not spoiled by her success, Sophie Germain continued her studies with all her former enthusiasm. She attended the sessions of the Academy of Sciences, kept herself abreast of the scientific researches of her contemporaries, and found time to perform various friendly offices for her acquaintances. She contributed to the "Annales de Physique et de Chimie" an examination of the principles which lead to the laws of movement of elastic solids. In this paper she establishes, in opposition to Poisson, that no hypothesis in regard to the molecular constitution of bodies is necessary in a discussion of elasticity. Her views on this subject have been abundantly confirmed. Two papers of hers in "Crelle's Journal" — one on the curvature of surfaces, and one on the theory of numbers — were composed by her during the noise of the cannon of July, 1830. Her hope of finding a profound absorption in the study of mathematics had not been disappointed.

There are many testimonials to the charm of her character and of her conversation. She was imbued with a pure love of science, and she was remarkably indifferent to her own fame. She rejoiced when ideas which she had let fall in conversation were appropriated by others. It made no difference, she said, from whom an idea came; it was only of consequence that it should be true and useful. Fame she defined to be the small space which one occupies in the brain of his neighbors — a definition which Schopenhauer has since repeated. Virtue she looked upon as a sense of order, which the cultivated understanding must admire, even when the heart does not love it. Her conversation was full of gaiety and freshness, and bore constant marks of originality of thinking, and of a poetic handling of her thoughts. She died at the age of fifty-five. Her grave at Père la Chaise, fifteen steps from that of Comte, is in a neglected condition. The railing is rusty, the stone has fallen, the border of box is wild and overgrown.

The philosophical writings of Sophie Germain were given to the world two years after her death, by her nephew, Lherbette. Besides some detached thoughts, they consist of a long article entitled, "Considerations on the State of the Sciences and of Letters at the different Periods of their Culture." Her main idea is the extension of the principles of law, and of the harmonious interaction of causes which prevail in the physical sciences, to the re-

gions of politics, of morals, and of art—the same idea which Comte expounded with much greater detail in his “Cours de Philosophie Positive.” Comte’s indebtedness to Condorcet and to Saint-Simon has frequently been mentioned. It is only recently that it has been discovered how distinctly he was anticipated in the main features of his system by Sophie Germain. Dühring, in his “Critical History of Philosophy from its Beginnings to the Present Time” (third edition, Leipsic, 1878), says, after

giving a full abstract of her work, “One sees from the above that the Positivism which, without the use of the word, one finds in the writings of Sophie Germain, contains the essential features of that which has hitherto been associated with the name of Auguste Comte.” The “Zeitschrift für Philosophie” has had two long articles by Göring entitled: “Sophie Germain as the Predecessor of Comte.” Her “Considerations” are still very interesting reading, and they would well repay translation.

Christine Ladd Franklin.

TOPICS OF THE TIME.

The New “Life of Napoleon.”

AN ANNOUNCEMENT TO THE READERS OF “THE CENTURY MAGAZINE.”

INTO the midst of the drama of the French Revolution—upon a scene of social and political wreck, of confusion, and of carnage, such as the world had never before witnessed,—entered a youthful figure, slight, pale, emaciated, and of a foreign name and race. This singular and poignant personality suddenly became the center of the entire action, and put forth a force which dominated virtually every group and class, and which, gathering up the passion of the people into an ordered military impulse, turned France from a self-destroying mob into a thoroughly equipped army, and hurled that army like a thunderbolt against the conquered and amazed enemies of the new republic.

The Revolution in every outward manifestation by him suppressed or transformed, we see Napoleon Bonaparte rising by his single might from power to power and from rank to rank, until he lifts from the ground and places upon his own head the crown of empire. He transforms and glorifies France by magnificent material improvements, at the same time depriving her of the last vestige of liberty. He inflicts order at home and dominion abroad with equal severity, administering both wise and unwise laws by tyrannous and unwise methods. He defends his country and his own prestige with a fury and ruinous excess which make lasting peace impossible. Tearing to pieces the political and social fabric of Continental civilization, never to be restored to its original texture and condition, he soars in his ambitions not only to the dream, but strangely near to the accomplishment, of universal rule.

We see this extraordinary force exerting itself, near and far, upon men, events, and institutions, with a rapidity and to an extent unknown hitherto among mankind: a gigantic spirit acting freely on an unprecedented field without hindrance of conscience, sentiment, precedent, or law, until all Christendom, and a large part of heathendom, seem to revolve about one untrammelled and well nigh unopposable will.

Again we see this same figure, mentally and morally always the same, notwithstanding the physical changes that adulating art records from year to year—we see this same figure as suddenly as it came disappearing from the theater of great events; the world-con-

queror and king of kings conquered and exiled. We see him again flashing back unimpeded from his origin in the Mediterranean to the height of empire; again beaten to the ground and flung upon a distant rock of the Atlantic, there to rot soul and body out in disdain, despair, and agony.

We see him, as he said, “wallowing in glory,” and once more steeped in sublime misfortune; beloved and praised as has been no other human ruler; despised and vilified as has been no other human being; but praised, blamed, or appreciated, to him we see ascribed the most tremendous purely human energy ever crowded into human form.

To attempt to describe the origin, temperament, acts, and lasting effects, beneficent or harmful, of a personality and career thus astounding and unparalleled could never prove a slight task, and it is one which from the nature of things could not well be satisfactorily performed before the present time.

The realization of the fact that in no language exists a reasonable, complete, consecutive, unprejudiced life of Napoleon, based upon sufficient and competent documents and memoirs, was the origin of the scheme of publishing in THE CENTURY such a life. Professor William M. Sloane of Princeton has produced a work answering this description. He has written with historical fairness, and absence of partizan bias. His history is marred neither by adulation nor abuse. His work corrects the blind and absurd hero-worship inculcated by certain popular but unscientific biographers, while doing full justice to the character and genius of the man, and to his part in the advance of human society.

Every resource of THE CENTURY MAGAZINE has been brought to bear to enrich the narrative with pictorial illustrations not unworthy of the subject. European and American collections have been ransacked for portraits of the period, and for the most trustworthy pictures by contemporaries of the events described. To these have been added some of the greatest modern masterpieces of French art dealing with Napoleonic events. In addition, commissions have been given to French and American artists for illustrative designs, and artists have been sent to various localities to make drawings of buildings and places as they now exist. The theme creates an opportunity for the most interesting and most brilliant pictorial series of a historical character yet presented in the pages of a magazine, and the con-