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THE STUDENT.

VOL. II. OCTOBER, 1892. NO. 10.

POMPEII AND VESUVIUS.

MANTIE E. BALDWIN.

THE Spangler party started at two P. M. yesterday, to visit the ruined city, Pompeii, and to ascend the volcano Vesuvius. The day was almost painfully bright, but there was a cool breeze blowing landward from that bluest of bays, the Bay of Naples.

We went to Pompeii by train, out through the villages and olive groves skirting the bay. A few steps from the railway station, we passed through the gateway in the wall enclosing the ancient city. A very polite Italian guide, who spoke English reasonably well and who was well informed on the history of the region, accompanied us. We passed up the narrow streets, over the well worn pavements that thousands of years ago echoed the tread of the noble Greeks and Romans, who made this their favorite summer home. Streets so narrow that a modern cart would have trouble in getting along, and with sidewalks only wide enough to admit the passage of one person at a time. At the intersections of the streets are large circular-shaped stepping stones, so that foot travelers need not step down and up from the street to the sidewalk in crossing. Grooves are worn in the streets at these places, showing where the wheels of the heavy vehicles of former times have so frequently rolled.

There are no roofs on the houses now, of course, simply the outside and the partition walls are standing. But the numerous stairways show that many of the houses were two and three stories in height. In the houses of the wealthy are still standing fountains, in the open courtyard upon which all the rooms of the house opened. There are no doors opening upon the streets save the one entrance door which led into a passage-way or vestibule. No windows either, upon the street side. The ancient home was sacred and secluded from the gaze of the outside world.

Some of those homes must have been elegant indeed, for the mosaic floors are still in excellent preservation, and the walls are adorned with frescoes that are still bright and beautiful. Marble columns supported the roofs and the chief

rooms were adorned with beautiful statuary.

Only the shops or stores faced the streets. Above the doorways are yet seen the signs indicating the kind of business that was carried on within. These signs are either indelibly painted on the stone walls, or are inlaid in mosaic. At the corners of the principal business streets may be seen notices of public meetings to be held.

The bakery still shows the yawning bake-oven; the winery still contains the large urn-shaped earthen wine-jars; the mills where the grain was ground are still as they were when the great calamity befell the city. Loaves of bread, fragments of fruits, and handfuls of grain are now shown in the museum near the entrance gate. These were all found in perfect preservation when the city was excavated, after having been buried two thousand years.

We paced up and down the great forum or senate-place and imagined we could see it in its former grandeur, with its statues and altars to the propitious gods, and fancied we could hear the impassioned voices of the Roman senators, reverberating through the lofty corridors. We descended into the orchestra or pit of the great theater where tragedy was enacted under the clear sky. We peered into the mysterious dressing rooms under and behind the stage. Just beyond this once magnificent building lies the smaller theater that was roofed and devoted to comedy only. In close proxmity are the barracks and parade ground of the famed Roman soldiers.

The bath houses, once marvels of beauty and elegance, are perhaps the best preserved of all. Hot baths, steam baths, cold baths, and swimming baths were there, the buildings for the women and the men being on different streets. Nothing that skill could devise or money purchase was wanting to make these places luxurious, for the bath was the great assembly place for social enjoyment for the learned and the wealthy of that ancient time.

As we walked along the deserted streets, under the blue sky, and gazed upon Vesuvius, the mountain now so quiet, but once the cause of all this desolation, a keen feeling of pity came over us. Two thousand years ago, happy people worked or amused themselves here where we, as happy, now stood. Unconscious of the dread calamity so swiftly coming upon them and this fair city, they planned and hoped and dreamed of days and years of happiness. But the great cloud of red-hot ashes fell, choking up the streets and passage-ways and burning all that could be consumed. Then the torrents of boiling water poured over the helpless city imbedded in the burning ashes, solidifying the mass that for nearly two thousand years afterward lay untouched and forgotten.

Shortly before sunset, we left the interesting and historic spot, and entered a train which bore us back a few miles nearer to Naples. At Resina we left the train and entered the carriages which were in waiting to convey us up Mount Vesuvius to the foot of the inclined railway.

Resina is a compact village, as all Italian villages are. It is built on the crust of lava that covers Herculaneum, another city buried when Pompeii was. But this city was covered with lava instead of ashes and boiling water; consequently it was more securely buried, and this modern town, Resina rests upon it. Excavations of the streets and some of the houses have been made, but

to go through these is like going through a cavern, and gives but little idea of how Herculaneum was in its time of life and prosperity.

Our ride up the narrow and steep streets of Resina was both annoying and amusing. It was the twilight hour. The Italians, free from the labor of the day, thronged the streets, laughing, talking, singing, or buying at the market places. Hundreds of dirty, half-naked children, seeing us and divining that we were tourists, swarmed upon, around and under the carriages, turning somersaults on the hard stones of the streets and begging pathetically. Each carriage was drawn by three horses all abreast and with many tinkling bells upon the harness. These bells served to notify the people in advance of our approach. Mothers and fathers stood upon the narrow sidewalks and encouraged their offsprings in the dangerous begging performances. The wheels of the carriages almost rolled over them and the feet of the horses could hardly avoid stepping upon them, but still they persistently clung and tumbled and begged. Italy is a nation of beggars. We realized that the moment we crossed the boundary line from Austria. But it had not so fully impressed itself upon us anywhere else in Italy as in this ride.

One child wearing only a short calico apron, and with a form and face so beautiful that he might have served for a sculptor's model, followed us persistently for nearly a mile. Running ahead, turning a somersault upon rough stones, then clinging to the carriage and climbing upon it, begging in the most musical of voices, the tender, sympathetic heart of our most chivalrous gentleman was so wrought upon that coin after coin slipped from his deep pocket into the dirty but exquisitely shaped hand of that little Italian Apollo.

Finally, their clamoring ceased, they went back down into the town and we drove on up into the stillness and beauty of the olive-groves and vineyards on the lower slopes of the slumbering volcano. Just as we left the last villa, three Italian musicians stepped forth and played the mandolin, flute, and violin, and sang airs from the finest operas. They kept step with our horses and filled the air with music. Many a time in America have we paid good sums to hear music of far less merit than this was. For a long distance up the narrow road they went with us, and when we gave them a few coins, thanked us repeatedly, and played and sang again.

At length, when twilight had merged fully into night, we were left alone to continue the long, toilsome ride up the mountain. The stillness was broken only by the tinkling of the bells upon the horses as they bravely stepped along up the steep, winding road. We talked softly or turned alternately to gaze at the moonlight that fell upon the blue waters of the enchanting bay below us, or up at the mountain that stood so clearly outlined against the grey sky above us. At every turn in the winding road, the view increased in beauty. The vineyards and olive groves were left behind. The stunted bushes and evergreens in their turn sank below us. Rugged masses of lava were about us on every hand, while far above us shone, like stars, the lights of the electric railway. Several times in this part of our ride, venders of fruits and drinks sprang out from among the rocks and temptingly offered their wares. One persistent fellow stopped the carriages, and had a sparkling soda drink down the throats of three of our party

almost before they realized what they were doing. He then frantically gesticulated and exclaimed and almost wept because he was not paid three times the value of the cooling draught.

Shortly before eleven o'clock, our carriages drew up in front of a small house. Two soldiers and a road official appeared. Our tickets were given to the official, the guards sprang out into the road-way to protect us from possible molestation by straggling marauders, and on we went to the railway station a short distance above. Here, a comfortable hotel and the station and engine house occupy a sort of plateau or level space.

Descending from the carriages we entesed the hotel, obtained a drink of cool water, put stockings over our shoes to protect them from the cinders while climbing, and then made our way out to the railway car, to be carried up eight hundred twenty feet farther on the volcano. We seated ourselves in the open car and shivered in the strong, cold wind that, up there, blew with considerable force. We wore no wraps because they would be greatly in our way when we began the final ascent. Slowly and carefully the car moved upward. At intervals along the railway were poles on which electric lights flashed. As the car passed each of these, the light was extinguished, probably as a signal to the engineer below that the car had passed that point in safety. There were no curves in the track; it was straight from bottom to top, and anything more nearly perpendicular in railways, it would be hard to conceive of. We looked upon the ashes and stones covering the almost vertical side of that volcano and wondered whether we would have been wiser to try to climb instead of ride. But in twelve minutes, we were at the upper railway station, and with a feeling of comparative relief we stepped from the car to the narrow platform. Comparative relief because we knew not what peril might be in store for us yet before the night ended.

At this station, each of us four ladies was provided with a stalwart guide whose duty it was to help us in climbing up the remaining four hundred feet to the rim of the crater. A man with a huge, flaring pine torch led the way; an officer of the road accompanied us; and we sallied forth. The stars were shining over our heads but we did not see them because we had all we could do to maintain our footing in the shifting stones and ashes, and the wind blew the fine dust furiously into our faces. With mouths closed and eyes nearly so, we pushed on. My guide and I started bravely up after the torch bearer. In less than five minutes, we were told to go more slowly because some of the other ladies of the party could not move so rapidly up over the toilsome path. But my guide being Italian, could not understand me when I told him to slacken his pace, and dragged me on as rapidly as before. Numbers of guides who were not in the employ of the railway company pushed themselves against the various members of the party, striving to force us to take their aid also. But we had been previously warned against this, and declined their services. One fellow so resolutely planted himself in in my path that I was compelled to stop and appeal to the officer to drive him away. They pushed ropes into our hands, that they might force us to let them pull us up, but we crowded them aside and struggled on till we reached a low place between the two cones, for

Vesuvius is a sort of double peaked volcano, one cone being considerably lower than the other. At this spot we halted, gasping and puffing and crying all at once, for the hot, sulphurous smoke and vapor blew down upon us from the upper crater, and we were almost exhausted by our arduous climbing. Our hearts throbbed painfully with the exertion and the altitude, our eyes and throats smarted from the sulphurous bath of vapor. One of the ladies exclaimed "I'm dying." But in a few moments the wind quieted somewhat, the vapor cleared away, and there at our feet yawned a great gulf of fiery lava, glowing and throbbing in the darkness, and sending up its ruddy light against the sky. It was a recent opening in the low place between the two cones and we gazed into it with a feeling of fascination mingled with fear.

Soon the guide turned to make the final ascent to the rim of the great crater. The ashes were hot and deep. We sank into them up to our knees, slipping backward almost as rapidly as we moved forward. But the top was reached at length, and we stood, at midnight, on the quivering rim of the crater of Mount Vesuvius. We peered down into the depths of that bowl-shaped, awful opening, but dense clouds of vapor were so swiftly ascending that we could see but dimly the fires of that seething boiling mass of lava. Sharp lightning-like flames darted about through the vapor, but did not rise above the rim of the crater. We could hear the labored boiling and surging of the fiery mass; we could feel the trembling of the great mountain on whose summit we stood, four thousand feet above the sea at its base. Had the volcano been in violent action, we would not have dared to ascend to that perilous place. We were thankful for its quietude, but we did not care trust it long. Plunging down into the steep crust of ashes forming this highest cone, we were, in an incredibly short time, back between the cones, gazing again into the glowing furnace we had first seen. Drawing a fresh breath, we pushed our way through the sulphurous vapor, around to what is called the old crater. Here the stones were hot beneath our feet, and in their crevices the fire still smoldered with a dull red light. Here dozens of stray guides again crowded about us, offering —for a consideration of course—to put some coins into the hot lava for us to take home as souvenirs. But when we had gratified our curiosity by looking at this once dangerous place, we turned our hot feet towards the path leading down to the railway station. Heated, tired, and dazed, we arrived there, and taking leave of our guides who had served us so faithfully, we entered the car for the descent.

What a view lay above and below us! The young moon had long ago set; the innumerable stars glittered above our heads; above us and behind us towered the cones of the treacherous volcano; the light from the great fissure in its side reddened the northern sky. Below us lay the cities with millions of twinkling lights, like diamonds in the circlet about the bay, while far out lay the smooth Mediterranean, peacefully rocking as if in slumber. No words of mine can do justice to the view nor tell of its effect upon us.

Silently our car moved downward over the steep track; one by one the electric lights above us were extinguished; and we, at last, like ghosts from another and darker world, were once more

upon the solid earth. Gladly we left the lower station and hurried over to the snug hotel where a good washing removed the sulphur and smoke from our hands and faces, and a delicious warm supper restored us to the state of comfortable mortals.

At half past one in the morning, we entered the carriages for the long drive down the remainder of the mountain. Another man with another torch ran ahead of the horses to enable the drivers to see the winding way; the guards again walked before us to protect us from molestation: and so we went back down to civilization. At half past four, in the rapidly advancing light of a new day, we drove up to the door of our hotel in Naples, and the eventful trip was ended.

EDUCATIONAL PICTURES IN LITERATURE. II.

HUBERT M. SKINNER.

FRANCOIS de Salignac, son of the Marquis of Fenelon, was born in his father's baronial castle in what is now department of Dordogne, France, in 1651. He was carefully educated for the church, and at the age of twenty was perhaps the most eloquent pulpit orator in Paris. Appointed to re-establish the power of the church in a district which had become largely protestant, he was distinguished for his moderation in speech and in action. After serving in various positions of ecclesiastical preferment, he was made Archbishop of Cambray. He died in 1715. His life and death were a beautiful exemplification of Christian character. King Louis XIV., who had persecuted him with expressions of ill-will, exclaimed, on learning of the archbishop's death, "Alas, we have lost him, when we require him most!" Fenelon's greatest service to mankind grew out of his appointment —at the age of thirty-eight—to be tutor to the young Duke of Burgundy, grandson of the king, and heir presumptive of the throne of France. The tutor's task was such as comes to but few. He developed his idea of a school of one pupil in the composition of a prose epic, which is unique in literature. Taking for his subject Telemaque (the son of Ulysses, the Greek hero) who is represented by Homer as having for his guardian the sage Mentor—an incarnation of the goddess Athena—Fenelon follows the young prince in a tour of the ancient world, and weaves into his story the lore of ancient epics and tragedies. The "Telemaque" became a sort of secular "Pilgrim's Progress", and was read and admired in every European nation. It is the classic model of a large class of writings. In our own country Jacob Abbott, who has largely influenced American character and education, availed himself of the idea of the work to write various series of books of travel, in which he protrayed the mental and moral training of supposititious youths, each pursuing his travels and his studies under the care of an elder companion, or mentor. Fenelon's success as a tutor has been thus described.

"Confidence creates responsibility; and the more honorable the circumstances which distinguish any trust con-

ferred on the individual, the greater must be his solicitude to discharge it in such a manner as not to disappoint the expectations of others. But this feeling was among the least of those difficulties which Fenelon had undertaken to surmount. The prince whose moral as well as literary education he was appointed to conduct had attained to an age at which the human disposition is in some measure fixed; when the passions, inflamed by early indulgence, have become obstinate through habit. His pupil, who had already learned his individual importance in the state, and who seemed in imagination a monarch, was haughty, presumptuous, irritable, untractable, confident of being right, unaccustomed to contradiction, and impatient of control. He found himself born to dictate obedience to others, and accordingly viewed himself as exempted from any necessity to regulate and govern his own inclinations. Fenelon, however, had prepared the only system of tuition calculated to affect and improve. He aimed not merely at scientific instruction, but at moral amelioration—he aspired to the formation of character. His first step was to touch the heart of his royal disciple, and then to acquire his esteem and confidence. He knew that a preceptor must seek to be loved, if he would be listened to with delight. He therefore divested teaching of its formality, and rendered that at first desirable, which should at last be considered indispensable. He was the Mentor of his Telemaque."

Perhaps no compilation of literature relating to school-masters would be considered representative that should omit the inimitable classic of Fenelon. The school of one pupil may often prove the most difficult to teach aright. To the educational world the archbishop's labor of love is a legacy of great moral power and beauty.

Characterization.

The Telemaque of the celebrated archbishop of Cambray is a work of such reputation that it would be scarcely less absurd to recommend it than to recommend the writings of Homer and Vergil. It holds the first class among the moral works of imagination in France; it has passed through innumerable editions; art has been exhausted to adorn it, and learning to illustrate its beauties; it has been translated into every language in Europe, the Turkish not excepted, and there are no less than five translations of it in our own. To translate it, indeed, is easy; but to translate it so as to give it the same rank in a foreign language that it holds in the original, is difficult. —*Dr. Hawkesworth.*

Born at the beginning of the second half of the great century which he served in no small measure to render illustrious, Fenelon was one of the last representatives of that classic epoch, and he preceded Louis XIV to the tomb by only a few months. Member of the French Academy, Archbishop of Cambray, the illustrious writer owes to his immortal "Telemaque" his characterization as "the Racine of Prose." This *chef d'oeuvre* of poetic style, of morals, and of politics, was composed for the edacation of the Duke of Burgundy, of whom Fenelon was the worthy preceptor. * * His Fables, full of eloquence, of grace, and of naturalness, as also his Dialogues of the Dead, where lofty moral lessons are concealed under familiar and interesting discussions of illustrious personages of history, were to the same end. Fenelon is the first of all the

French prose writers, by reason of his pure, flowing, harmonious style, full of grace and of imagination.

—*Edward H. Magill.*

The School of One Pupil.

(Selected from Telemaque.)

Principal Personages.

TELEMAQUE, or Telemachus, a youth of sixteen years (the son of Ulysses, King of Ithaca) who is traversing the seas in search of his father, whom he has not seen since early infancy.

MENTOR, the companion of Telemaque, in appearance an elderly man; in reality, the disguised goddess Athena (Minerva), who is the guardian of the youth.

CALYPSO, an inferior divinity of the Greeks (fabled to reign over the isle of Ogyges), whose unhappy love for Ulysses and Telemaque—who were successively shipwrecked upon her shore—tempted them to remain away from home and from duty.

Calypso was unable to console herself for the departure of Ulysses; and she regretted her immortality, as that which could only perpetuate affliction, and aggravate calamity by despair. Her grotto no more echoed with the music of her voice; and her nymphs waited at a distance with timidity and silence. She often wandered alone along the borders of her island, amidst the luxuriance of a perpetual spring; and the beauties that bloomed around her, instead of soothing her grief, only impressed more strongly upon her mind the memory of Ulysses, who had been so often the companion of her walks. Sometimes she stood motionless upon the beach; and while her eyes were fixed on that part of the horizon where the lessening bark of the hero had at length disappeared, they overflowed with tears. Here she was one day surprised by the sudden appearance of a shipwreck. Broken benches and oars lay scattered about upon the sand; and a rudder, a mast, and some cordage were floating near the shore. Soon after she perceived at a distance two men, one of whom appeared to be old, and in the other, although a youth, she discovered a strong resemblance to Ulysses; the same benevolence and dignity were united in his aspect, his stature was equally tall, and his port majestic. The goddess knew immediately that this was Telemaque, but notwithstanding the penetration of divine sagacity, she could not discover who was his companion; for it is the prerogative of superior deities to conceal whatever they please from those of a lower class, and it was the pleasure of Minerva, who accompanied Telemaque in the likeness of Mentor, to be concealed from Calypso. Calypso, however, rejoiced in the happy shipwreck, which had restored Ulysses to her wishes, in the person of his son. She advanced to meet him; and affecting not to know him,

"How hast thou presumed," said she, "to land on this island? Knowest thou not, that from my dominions no daring intruder departs unpunished?"

By this menace she hoped to conceal the joy which glowed in her bosom, and which she could not prevent from sparkling in her countenance.

"Whoever thou art," replied Telemaque "whether thou art indeed a goddess, or whether, with all the appearance of divinity, thou art yet mortal, canst thou regard with insensibility the misfortunes of a son who, committing his life to the caprice of the winds and

waves in search of a father, has suffered shipwreck against these rocks?"

"Who, then, is thy father, whom thou seekest?" enquired the goddess."

"He is one of the confederate kings," answered Telemaque, "who, after a siege of ten years, laid Troy in ashes; and his name is Ulysses—a name which he has rendered famous by his prowess, and yet more by his wisdom, not only through all Greece, but to the remotest boundaries of Asia. This Ulysses, the mighty and the wise, is now a wanderer on the deep, the sport of tempests which no force can resist, and the prey of dangers which no sagacity can elude. His country seems to fly before him. Penelope, his wife, despairs at Ithaca of his return; and I, though equally destitute of hope, pursue him through all the perils that he has passed, and seek him upon every coast. I seek him, but alas! perhaps the sea has already closed over him for ever! O goddess, compassion upon our distress; and if thou knowest what the fates have wrought, either to save or to destroy Ulysses, vouchsafe this knowledge to Telemaque, his son!"

Such force of eloquence, such maturity of wisdom, and such blooming youth, filled the bosom of Calypso with astonishment and tenderness. She gazed upon him with a fixed attention; but her eyes were still unsatisfied, and she remained some time silent. At length she said,—

"We will acquaint Telemaque with the adventures of his father, but the story will be long; it is now time that you should repair by rest that strength which has been exhausted by labor. I will receive you to my dwelling, as my son; you shall be my comfort in this solitude; and if you are not voluntarily wretched, I will be your happiness."

Telemaque followed the goddess, who was encircled by a crowd of young nymphs, among whom she was distinguished by the superiority of her stature, as the towering summit of a lofty oak is seen in the midst of a forest, above all the trees that surround it. He was struck with the splendor of her beauty, the rich purple of her long and flowing robe, her hair, that was tied with graceful negligence behind her, and the vivacity and softness that were mingled in her eyes. Mentor followed Telemaque, modestly silent, and looking downward. When they arrived at the entrance of the grotto, Telemaque was surprised to discover, under the appearance of rural simplicity, whatever could captivate the sight. There was, indeed, neither gold nor silver, nor yet marble; no decorated columns, no paintings, no statues were to be seen; but the grotto consisted of several vaults cut in the rock; the roof was embellished with shells and pebbles, and the want of tapestry was supplied by the luxuriance of a young vine, which extended its branches equally on every side. Here the heat of the sun was tempered by the freshness of the breeze; the rivulets, that with soothing murmurs wandered through meadows of intermingled violets and amaranth, formed innumerable baths that were pure and transparent as crystal; the verdant carpet which nature had spread round the grotto was adorned with a thousand flowers; and at a small distance there was a wood of those trees that in every season unfold new blossoms, which diffuse ambrosial fragrance, and ripen into golden fruit. In this wood, which was impervious to the rays of the sun, and heightened the beauty of the adjacent meadows by an agreeable opposition of light and shade,

nothing was to be heard but the melody of birds or the fall of water, which, precipitating from the summit of a rock, was dashed into foam below, where, forming a small rivulet, it glided hastily over the meadow.

The goddess, having displayed this profusion of beauty to Telemaque, dismissed him.

"Go, now," said she, "and refresh yourself, and change your apparel, which is wet. I will afterwards see you again, and relate such things as shall not only amuse your ear, but also affect your heart."

She then caused him to enter, with his friend, into the most secret recess of a grotto adjoining to her own. Here the nymphs had already kindled a fire with some billets of cedar, which perfumed the place, and had left change of apparel for the new guests. Telemaque, perceiving that a tunic of the finest wool, whiter than snow, and a purple robe richly embroidered with gold, were intended for him, contemplated the magnificence of his dress with a pleasure into which young minds are easily betrayed.

Mentor perceived his weakness, and reproved it.

"Are these, then", said he, "O Telemaque, such thoughts as become the son of Ulysses? Be thou rather, studious to appropriate the character of thy father, and to surmount the persecutions of fortune. The youth who, like a vain woman, loves to adorn his person, has renounced all claim to wisdom and to glory. Glory is due to those, only, who dare to associate with pain, and have trampled pleasure under their feet."

Telemaque answered with a sigh,—

"May the gods destroy me, rather than suffer me to be enslaved by voluptuous effeminacy! No; the son of Ulysses shall never be seduced by the charms of enervating and inglorious ease. But how gracious is Heaven, to have directed us, destitute and shipwrecked, to this goddess or mortal, who has loaded us with benefits!"

"Fear, rather," replied Mentor, "lest her wiles should overwhelm thee with ruin; fear her deceitful blandishments more than the rocks on which thou has suffered shipwreck; for shipwreck and death are less dreadful than those pleasures by which virtue is subverted. Believe not the tales which she shall relate. The presumption of youth hopes all things from itself, and, however impotent, believes it has power over every event; it dreams of security in the midst of danger, and listens to subtle wit without suspicion. Beware of the seducing eloquence of Calypso, that mischief which, like a serpent, is concealed by the flowers under which it approaches. Dread the latent poison. Trust not thyself, but confide implicitly in my counsel."

They then returned to Calypso, who waited for them; and her nymphs, who were dressed in white, and had their hair braided, set before them a repast which, though it was simple, and consisted only of such game as they had either taken with their nets or killed in the chase, was yet of exquisite taste, and served up with the utmost elegance. Wine, more richly flavored than nectar, was poured from large silver vases, and sparkled in cups of gold that were wreathed with flowers; and baskets were heaped with all the variety of fruit that is promised by spring and bestowed by autumn. In the mean time, four of the attendant nymphs began to sing.

Their first theme was the battle of the gods and Titans ; then they celebrated the loves of Jupiter and Semele ; the birth of Bacchus, and his education under old Silenus ; the race of Atalanta, with Hippomenes, whom she conquered with golden apples that were gathered in the gardens of the Hesperides. The wars of Troy were reserved to the last ; the prowess and the wisdom of Ulysses were extolled with all the hyperbole of praise, and the principal nymph, whose name was Leucothoe, to the harmonious voices of the chorus joined the music of her lyre. When Telemaque heard the name of his father, the tears which stole down his cheeks added new lustre to his beauty ; but Calypso, perceiving that he was too sensibly touched, and neglected to eat, made a signal to her nymphs, and they immediately changed the subject to the battle of the Centaurs with the Laphithæ, and the descent of Orpheus to bring back his Eurydice from Hades.

When the repast was ended, Calypso took Telemaque aside, and addressed him thus,—

"Thou seest, O son of the great Ulysses, with what favor I have received thee. Know that I am immortal. No human foot profanes this island unpunished ; nor could even shipwreck have averted my indignation from thee, if my heart were not touched with more than thy misfortunes. Thy father was equally distinguished by my favor ; but alas ! he knew not how to improve the advantage. I detained him long in this asylum ; and here he might have lived forever, in a state of immortality with me ; but a fond desire of returning to his wretched island blinded him to the prospect of superior felicity. Thou seest what he has lost for Ithaca, a country to which he can never return. He resolved to leave me, and departed; but a tempest revenged the insult, and the vessel in which he was embarked, having been long the sport of the storm, was at last swallowed up in the deep. Let this example influence thy conduct. All hopes of again seeing thy father, and of succeeding to his throne, are now at an end ; but do not too deeply regret his loss, since thou hast found a goddess, who offers thee superior dominion, and more permanent happiness."

Calypso, perceiving that it was not now her interest to press him further, feigned to participate in his sorrow, and to regret the fate of Ulysses ; but that she mlght gain a more perfect knowledge of the means by which his affections were to be engaged, she inquired the particulars of his shipwreck, and by what accident he had been thrown upon her coast.

"The story of my misfortunes," said he "will be too long."

"However long," said Calypso, "I am impatient to hear it ; indulge me, therefore, without delay." Telemaque often refused ; but she continued her solicitations, and at length he complied.

"I set out from Ithaca to inquire after my father, of those princes who had returned from the siege of Troy. The suitors of Penelope, my mother, were surprised at my departure, because from them, whom I knew to be perfidious, I had concealed my purpose ; but neither Nestor, whom I saw at Pylos, nor Menelaus, who received me with affection at Lacedemon, knew whether my father was among the living or the dead. I was at length impatient of perpetual suspense and uncertainty, and therefore formed a resolution to go into Sicily, whither my father was said to have been

driven by contrary winds. But the prudence of Mentor, who is here the companion of my fortunes, opposed the execution of so rash a design, by representing my danger, on the one hand from the Cyclops, the gigantic monsters who riot upon human flesh, and on the other from the fleet of Æneas and the Trojans, who were hovering about those coasts. 'The Trojans,' said he, 'are irritated against all the Greeks; but, above all, against Ulysses, whose son, therefore, they would rejoice to destroy. Return, then, to Ithaca; perhaps your father, who is beloved by the gods, may have returned already; but if Heaven has decreed his death, if he shall see Ithaca no more, it is fit that you return to avenge him, and to deliver your mother; to display your wisdom to attending nations, and to let all Greece behold in Telemaque a sovereign not less worthy of the throne than Ulysses.' This counsel, which was the voice of reason, I rejected, and listened only to the suggestions of my passions; but such was the affection of my friend that he embarked with me for that voyage, which, in the folly of my presumption, I undertook contrary to his advice; and the gods, perhaps, permitted the fault, that the calamity which it drew upon me might teach me wisdom."

While Telemaque had been speaking, Calypso had attentively considered Mentor, and was suddenly chilled with astonishment. She imagined that she perceived in him something more than human; and not being able to resolve the perplexity of her thoughts into any probable determination, the presence of this inscrutable being continued to agitate her mind with suspicion and dread. But fearing yet more that her confusion should be perceived,

"Proceed," said she to Telemaque, "to gratify my curiosity;" and Telemaque accordingly continued his story.

(*To be continued.*)

THE CAUSE OF EARTHQUAKES.

H. N. Hutchinson.

RECENT investigations have shown that *terra firma* is a phrase indicating a condition of things which, scientifically, has no existence. The crust of the earth is in a state of constant movement. Geologists have begun to study systematically the phenomena of earth-movements of all kinds, and some of the results are such as cannot fail to interest even the general reader. We all have a stake in the condition of our planet. However, those who live in a region seldom visited by earthquakes are apt to overlook the importance of the subject. "Out of sight is out of mind," but as new methods of investigating and recording earth-tremors, or throbs, are invented, these things are brought more prominently before us. Seismology, or the study of earthquakes, has lately been making great advances, and has revealed slight movements, the existence of which was previously unsuspected.

In view of these additions to our knowledge of an important branch of natural science, we propose to say a few words on earthquakes and earth-tre-

mors of all kinds, dividing the subject under three heads: (1) *What they are*, (2) *What they do*, and (3) *How they are caused.*

An earthquake has been defined by a high authority, as a wave or series of waves, of elastic compression, through the crust of the earth, in any direction, and from any given "centre of impulse." To understand this definition, think of what takes place when a stone is thrown into a pool. A disturbance is made at the place where the stone strikes the water; that spot corresponds to the "centre of impulse," the particles there communicating the movement to those next them, and these in their turn to others, and so on. In this way a series of concentric waves is produced, which get fainter and fainter, until finally they reach the edge of the pool. This is very similar to what happens when a subterranean disturbance gives a blow to the earth's crust, and a series of earthquake waves is produced from some seismic centre. But, in both cases, the waves really travel in spherical shells. These waves, be it remembered, are due to wave-motion, like waves of sound, and are by no means waves of translation. Each particle of earth merely moves as the heads of wheat move in a field when they bend to the wind, and produce waves which travel across the field before the wind. It is clear that the undulatory movements due to an earthquake shock must strike the surface of the earth at different angles, according to the distance of the seismic centre. Thus, a person who might happen at the time to be standing on a spot in a vertical line above such a centre would feel an up and down movement, and a block of stone lying near him might be thrown straight up in the air; but if the person were some miles away from this spot, it is evident that the waves coming sideways would strike him to the ground he stands on obliquely; and "the angle of emergence" becomes less and less the further we recede from the spot lying just over such a centre. Now, it is possible, by observing the effects of earthquakes on buildings, to determine the direction in which the shock arrived, and to calculate the "angle of emergence." This is done chiefly by studying the cracks produced in buildings, and making allowance for the circumstances of each case. If, then, this angle can be ascertained for two places, and the distance between them is known, a triangle is obtained, the base of which is known, and the angles at the base; hence it is easy to calculate the depth of the centre of disturbance. Such calculations have been made in several cases, and the results arrived at are of considerable interest; for they tell us that in no case is the seismic centre at a greater depth than thirty miles. In some cases the earthquake has been found to have originated at a much less depth. If these results are trustworthy, as there is reason to think they are, the conclusion is that earthquake phenomena are not connected with the deeper-seated portions of the mass of the globe, but with those superficial portions commonly included in the earth's crust; and probably with the stratified series of rocks and their associated volcanic and plutonic rocks, rather than with the original mass which we believe to have solidified from a molten and highly-heated state.

Earthquake waves can be measured, and it is found that they are quite small, having amplitude of perhaps only a few inches. The crust of the earth vibrat-

ing in response to a seismic blow may be compared to a big bell resounding after its inner surface has been struck by the clapper. In either case the amplitude of the vibrations is capable of measurement, but the undulatory movements are not visible as we look at a sounding bell, through a marble suspended by a string and allowed to touch the bell's rim would at once demonstrate their existence by oscillating to and fro. The rebounding marble aptly illustrates the case of a block of stone being hurled up into the air by an earthquake wave. It is known that sound travels with different velocities through different substances, according to their compactness and elasticity. Hence we need not be surprised to learn that earthquake shocks have sometimes been heard twice; once through the solid rock, and so up to the ear, and again through the air which transmits the waves more slowly. Mr. Mallet made some interesting experiments on the velocity of transmission of waves due to a blow, through different substances.

In *air* the mean velocity of sound-waves is 1138 feet per second, but it varies with the atmospheric temperature and pressure—in water 4692 feet, and in a bar of iron 11,040 feet per second. The movements of the ground during an earthquake are of a complicated character. In addition to the two kinds of movement which have generally been observed—namely, the upward shock, and the long undulations, spreading in all directions, like marine waves—most authorities have added a rotating or gyratory movement. This causes a twisting of the ground, which has not only been seen but felt. Humboldt says that in Chili three great palm trees were seen to twist round one another like willow-wands, after each had swept a small space round its trunk. Pinnacles of buildings have likewise been found to be twisted. The noise accompanying an earthquake often resembles that of an explosion. Since the velocity is affected by the hardness of the rocks, it follows that strata containing any hollows partly break and check the waves, as stakes driven into a shore break the force of sea-waves in a storm. Hence we find that the early Greeks and Romans dug wells to fortify some of their cities, and prevent their complete destruction. In South America the natives have long ago adopted the same plan. Springs and natural underground passages for this reason afford considerable protection to cities which are liable to be visited by earthquakes.

Much has of late years been learned regarding seismic disturbances by taking observations which give the direction of the wave or waves, its velocity (obtained from the exact time at which it reached different places), and the "angle of emergence" as previously explained. The results are mapped out, and thus an "earthquake chart" is made, somewhat resembling the "weather charts" published daily in the newspapers. This done, it is invariably found that the greatest destruction is effected directly over the "centre of impulse," and the waves run roughly in circles or in ellipses from such a central spot. But the shapes as mapped out are often very irregular. This will be due to the nature of the surface of the ground and of the rocks below. It appears that in mountainous countries, like Switzerland and the Pyrenees, the great undulations are propagated in the direction of the valleys. In striking against the tilted strata at the bases of mountain masses

they behave like waves of a river which dash against a bank, breaking up and changing their courses, and running along at the foot of the heights in the the same direction as the stream of the valley. Earthquakes, though violent in their effects, are fortunately of very short duration. The great Calabrian earthquake lasted barely ten seconds!

We must now pass on to our second question, and consider the *effects* of earthquakes. First, they make many noises, variously described as resembling explosions of mines, distant artillery, peals of thunder, roar of cataracts, &c. Sometimes the shocks are felt before they are heard. Take the famous Lisbon earthquake of 1755. Towns in Portugal were overthrown, and places even in Morocco suffered considerable damage. The undulations extended over one-twelfth of the earth's surface! Thousands of persons were killed in Lisbon, and the sea was greatly disturbed. In England, lakes and pools oscillated to and fro like water in a basin suddenly tilted. Even Iceland was affected. The sea rose in a great wave round the coasts of Britain, and ten hours after, the sea round the West Indies was greatly disturbed! Shocks occurred for some months afterwards.

Sometimes, as at Jamaica in 1692, the sea-waves does more damage than the land-wave. At Port Royal, 2500 houses were covered with water to a depth of 33 feet. It is interesting to note the behaviour of animals before an earthquake. They seem to be able to detect slight tremors of the ground which we ourselves do not notice, and which precede earthquakes. Rats and mice leave their holes. The ground is frequently rent asunder, and sometimes permanent changes of level take place.

But it is not of the effects of seismic disturbances that we wish now to speak; they are well known, and have been repeatedly described. Their nature and origin, though less clearly understood, afford more interesting matter for a brief paper such as the present. Let us therefore pass on at once to consider our third question: how earthquakes are caused. It has been shown in Switzerland that they are more frequent at night than during the daytime; and during winter than during summer. Facts of this nature seem to indicate that the contraction of rock masses, due to a lowering of temperature, such as absence of sunlight would involve, is intimately connected with whatever causes are at work in the earth's crust to produce earthquakes. Such contraction might produce dislocations in the rocks, and these would set up vibrations. Again, by burying charges of gunpowder and gun-cotton, and exploding them, Prof. Milne has succeeded in producing, on a small scale, phenomena closely resembling seismic disturbances. Experiments of this nature lead to the conclusion that some sudden blow, or impact, is the most frequent cause of earthquakes. But we must be careful not to assume that only one cause exists, and that all earthquakes are due to the same cause. Evidently this is not the case. During volcanic eruptions, and also previous to an eruption, the ground trembles, and rumblings are heard, as of earthquakes. In Switzerland, avalanches of snow in slipping down a mountain side cause slight earth-tremors. The occasional falling down of great masses of rock produces similar effects.

The distribution of earthquakes helps to throw light on this difficult and, as yet, rather obscure subject. Thus they are

found to be more frequent in mountainous regions than in flat, low countries. They have a connection also with volcanic regions, but rather an indirect than a direct one; for it is clear that earthquakes in general are not due to volcanoes or volcanic phenomena. Some geologists wrongly considered that all earthquakes were to be regarded as incomplete or unsuccessful attempts to establish a volcano. In other words, they are not caused by the struggles and efforts at escape made by superheated steam retained at high pressure below the surface of the earth. Steam undoubtedly is the power chiefly concerned in the production of volcanoes and of volcanic phenomena. But although earthquakes are concomitants of volcanic action, they are not to be attributed generally to the same causes. Volcanoes are associated with great mountain chains, because it is only along these lines of weakness in the earth's crust—where the strata has been contorted, crumpled, folded, and cracked, over and over again, on a stupendous scale—that the masses of heated rock below the surface, charged as they are with superheated steam at enormous pressure, can find relief and come up to the surface.

By burying telephones and microphones in the earth, it has been found that slight noises and tremors which would otherwise never be noticed—unless by animals — can be detected. Transient shiverings of the earth's crust are thus found to be very frequent. Wherever these little earthquakes occur the earth sends forth a medley of confused sounds—crackings and snappings—probably caused by the rocks creeping toward relief from the strains which urge them to change their position. Thus we begin to realize that the world is quivering like a mass of jelly! It is hardly too much to say that this method of observation has enabled us in part to perceive the constant working of the great telluric machinery which continually builds our lands! Between these tiny movements and those which cause ordinary earthquakes there is only a difference of degree. They are essentially of the same nature. By means of delicate spirit levels, the bubbles of which move very easily, certain other movements, called "earth pulsations," have been detected by Prof. Milne. All these phenomena must be taken into account if we wish to find a satisfactory explanation. Mr. Mallet submitted for consideration the following possible causes:—(1) The sudden formation of steam by water coming in contact with highly-heated rock; (2) The escape of steam at a high pressure through fissures in the rocks and its condensation on reaching the sea; (3) Volcanic explosions; (4) Great fractures and dislocations in the earth's crust, suddenly produced by pressure or contraction, in any direction. The first three of these suggestions are not sufficient to account for earthquakes which occur outside volcanic regions; the last one seems to supply what is wanted, namely, an explanation which connects earthquake phenomena with those movements of the crust of the earth which raise our continents, elevate our mountain chains, and afford means of escape for highly-heated rocky matter and associated steam from those deeply buried regions where the internal and external portions of the earth react upon each other. In mountain building and the folding of strata we may look for the main cause of earthquakes. It is titanic work, and

must necessarily involve innumerable snappings and much slipping of rocks past each other. Probably the slipping movements—the existence of which is abundantly proved by the numerous "faults" so familiar to geologists—took place gradually, that is, only a few inches at one time; so that a single fracture may have given rise to hundreds, or even thousands, of earthquakes. There is in mountain building a chance for many slight shocks with but a small amount of motion. In the formation of such folds as those composing Mount Blanc the tremors may have been numbered by the million. If earthquakes are associated with the raising up of mountains, who shall say that they are of no use?

—*Knowledge.*

THE TEACHER.

THE STORY OF COLUMBUS.

FLORENCE A. BLANCHARD.

[The following fine exercise for Columbus Day is taken from the N. E. Journal of Education.]

Have room decorated with flags and picture of Columbus. Draw on the board map of Spain and the most western islands in the 15th century, also draw picture of the ship in which he sailed and the house in which he died. [Winsor's History of Columbus.]

1. *Reading* (*in concert*): — Psalm CVII., 23-30.

2. HIS ANCESTRY.

All writers have found great difficulty in mastering the genealogy of Columbus. A pride in the name of Columbus has been shared by all who have borne it, and there has been a competition among many branches of the common stock to establish the evidence of their descent in connection with the greatest name of the family. Many pretenders have arisen. It would be impossible to determine the *exact* relationship between the various French and Italian Colombos and Colons of the fifteenth century. Famous though these mariners were, there is no evidence to connect them with the line of Christopher Columbus.

Giovanni Colombo, the grandfather of the Admiral, lived probably in Quinto al Mare, a region east of Genoa. It was this Giovanni's son, Domenico, who came from Quinto, at least as early as 1439, and settled himself in the woolweaver's quarter, so called, in Genoa, where in due time he owned a house. From there, he seems to have removed to Savona, where various notarial acts recognize him, at a later period, as a Genoese resident in Savona. About 1484 he returned to Genoa, but misfortunes followed him there as elsewhere. When we lose sight of him in 1494, he may have heard rumors of the transient prosperity of his son, and perhaps have read the marvelous tale of the great discovery.

The mother of Columbus was Susanna, a daughter of Giacomo de Fontanarosea, from the Bisagno country, a region east of Genoa. She died in his early youth. There were four other

children, three brothers and one sister.

3. His Birth and Birthplace.

Several dates are given for his birth covering a range of twenty years, but the best authority places it in the twelve months between March 15, 1446, and March 20, 1447. The birthplace of Columbus yet remains undecided. That he was a Genoese is not disputed; but in 1492 Genoa comprised a territory; and among the small towns in it, or near it, which have claimed the honor, may be mentioned Plaisance, Cogoletto, Cuccaro, Pradello, Finale, Quinto, Milan, Modena, Savona, and others. The claim of Genoa stands first and after Genoa, that of Savona has always received the best recognition. In Cogoletto, a small town about fifteen miles from Genoa, there is still a house claimed to be the one in which Columbus was born. But there is no doubt that he was born in Genoa where

> "Gently, as roses die, the day declines;
> On the charmed air there is a hush the while,
> And delicate are the twilight tints that smile
> Upon the summits of the Appennines."

The city was slow to claim the honor, and it was not until about 1825 that a statue was erected to Columbus in Genoa. A house in the Vico Dritto Ponticello, No. 37, has been identified as the one in which his father lived during the younger years of Christopher's life. Probably he was born there. The city bought the estate in June 1887 and placed over its door an inscription recording the associations of the spot.

4. His Advantages.

The wool-combers of Genoa established local schools for the education of their children and Christopher may have had his share of their instruction. He acquired the manual dexterity of a good penman and could draw maps with such skill that, while in Portugal in later life, he practiced it for the gaining of a livelihood. For a brief period, not far from 1460, he may have been at the University of Pavia, seeking to understand the mysteries of cosmography, astrology, and geometry. That he had a broad acquaintance with books,—both of the elder writers and his contemporaries,—his later life shows. Doubtless he pursued the trade as weaver with his father for a time, but in early boyhood, he began to follow the sea.

5. *Singing:*—"Speed our Republic."

6. The Age of Columbus.

The age of Columbus is almost without a parallel. It saw Martin Luther burn the Pope's bull. Erasmus was added to the broadeners of life. Ancient art was revived. Modern art was represented by Da Vinci, Michael Angelo, Titian, Raphael, Holbein, and Durer. Copernicus searched the heavens. The route of the Portuguese by the African cape and the voyage of Columbus opened new worlds to thought and commerce. Articles of trade multiplied. A great desire for geographical knowledge was awakened. The compass and the astrolabe,—an instrument for reckoning latitude,—had given a new impulse to navigation. Voyagers were braver and struck boldly out into the open sea. The art of printing had just come into use, and books of travel were eagerly read. Marco Polo and other adventurers returning from the east told wonderful stories of the wealth of Asiatic cities. Genoa, Florence, and Venice, commanding the commerce of the Mediterranean had become enriched by trade with the East. The journey east was made by caravans, to the Red Sea, thence on camels across the desert to the Nile, and lastly by ships over the

Mediterranean to Europe.

The great problem of the age was how to reach the East Indies by sea, and thus give a cheaper route to their rich products.

The discovery of Columbus came in the ripeness of time.

7. *Recitation:* "Columbus"—(James Montgomery);

Longfellow's Poems of Places, Vol. V. "New England."

8. The Allurements of Portugal ane Her Seamanship.

The fame of the Portuguese voyaging out upon the vasty deep, or following the western coasts of Africa had been for some time a common topic of talk among the seamen of the Mediterranean. They were reputed to be the most expert seamen in Europe and many times had these hardy mariners pushed boldly out into the Sea of Darkness, as the Atlantic ocean was then called, making many discoveries. Prince Henry the Navigator stands out as the exemplar of this great age of discovery and he it was who rendered the career of the Genoese possible. What more natural than that Columbus, in life's prime, should have cast his fortunes with that nation?

9. Columbus in Portugal.

And August 7, 1473, we find him in Lisbon. His brother Bartholomew was already in that city. Not long after his arrival, he married Donna Felipa Muniz, thd daughter of a seaman and distinguished navigator, who had been governor of Porto Santo. Columbus received all his books, charts, and nautical instruments. His associates were navigators and seamen,—well versed in all the geographical lore of the day.

Time went on. He laid his plan before King John of Portugal, who, being pleased with the idea, referred it to the geographers of his court. They pronounced it a visionary scheme. But the king, thinking there might be truth in it, had the meanness to dispatch a vessel secretly to test the matter. The pilot had the charts of Columbus but lacked his courage. After sailing westward from Cape Verde Islands for a few days, and seeing nothing but a wide waste of tossing waves, he returned, ridiculing the idea.

10. His Theories.

Columbus believed that the earth was round, not a novel idea to all, and that by sailing west he could reach the East Indies. His faith was strengthened by pieces of wood curiously carved, by trees, and seeds of unknown species, and especially by the bodies of two men of strange color and visage which had been washed on the shores of the Azores, Maderia, Canary, and Cape Verde Islands,—the most westerly lands known. He sought to test the truth. He must have men and ships. It *may* be that he believed himself to be divinely called to "carry the true faith into the uttermost parts of the earth," but the desire to extend the Christian faith to heathen was often on the lips of the discoverers of the fifteenth century, yet it was never so powerful but that gold and pearls made them easily forget it.

11. His Waiting-Time.

In the life of every great man, there is always a "waiting-time." That of Columbus covered a period between 1473 and 1487. These fourteen years made possible his later career, and though we would like much to follow him through that time, there are no authentic records to give us the facts. It is *said*, that he visited Genoa. He left Portugal secretly, however, in 1484,

after the death of his wife, taking with him his son Diego, born sometime between 1475 and 1479.

12. COLUMBUS IN SPAIN.

By what route, or by what means, he reached Spain, is uncertain, but the opening scene of his career there, is found in the picturesque story of the appearance of a forlorn traveler accompanied by a little boy, and begging for bread and water for the child at the gates of the convent of Rabida, which stood on a height within sight of the sea, not far from the little seaport of Palos.

The friar of the convent was interested in the story he heard, and through his influence Columbus was enabled to lay his plan before Ferdinand, king of Spain. During seven long years, he importuned the king for a reply. At last, the learned men of the University of Salamanca declared the plan too foolish for further attention. In the beginning of February, 1492, he started to leave Spain for France, when Isabella, finally won to his cause, called him back. The queen agreed to pledge her jewels for the money, but her sacrifice was not required, for the treasurer of Aragon and the friends of Columbus advanced the money. After eighteen years of waiting he was ready to equip his fleet.

13. *Singing:* "Hail Columbia."

14. THE FLEET.

Though armed with the king's authority, Columbus obtained vessels and sailors with the greatest difficulty. The boldest seamen shrunk from such a desperate undertaking. At last Palos was impressed for two ships. The people of the town assembled in the church of St. George while a notary read the royal commands laid upon them. It took time for the simple people to divine the full extent of such an order and their reluctance was so great, it was reported to the Court. Even then, not until Martin Alonzo Pinzon, aided by his brother,—both navigators,—came forward did matters straighten. Within a month three ships were fitted out,—not tall, stout ships such as we see lying at our wharves to-day with their broad sails, huge wooden sides, and wide decks, —but small frail crafts called caravels, not so large as those we see sailing up and down our rivers and lakes. The Santa Maria was his flag ship but it proved a "dull sailor and unfit for discovery." The other two were named Pinta and Nina. About a hundred men in all, some say ninety and some one hundred and twenty, were pressed into service.

15. DEPARTURE FROM PALOS.

On Friday morning, August 3, 1492, a half hour before sunrise, the fleet sailed away

"Not over violet seas that rise and fall
With whispering winds beneath an eastern sky,"

to the mysterious Islands of the Blest, but to the distant West, "where the ocean tumbled down a great hillside."

16. *Recitation:* "Palos"—(Joanna Baillie);

Poems of Places, by Longfellow- Vol. 14–15.

17. *Singing:* "Crawford's National Hymn."

18. THE VOYAGE.

We will pass over the many incidents of that voyage,—the storms and tempests which they encountered, the delusive appearances of land, the hopes and fears of the sailors, their excitement and their dejection, the murmurs and even mutinous spirit of the crew when they determined to throw Columbus overboard. But signs of land began to ap-

pear. Birds came and rested on the masts, a large branch from a tree floated by; and even the dullest sailor could not fail to believe those signs and their murmurs were silenced. It is the 20th of October and the indications of land were so strong that at night a double watch was ordered on the forecastle. At daybreak, the joyful cry of "Land!" rang out from the Pinta, the foremost ship. A shore, green with tropical verdure, lay smiling before them.

19. THE LANDING.

Clumbus, dressed in a military suit of scarlet embroidered with gold, and attended by his men, stepped upon the new world, Friday, October 21, 1492, and planting the cross, took possession of the country in the name of Ferdinand and Isabella.

Much discussion has been made as to what was the land discovered. In the 17th and 18th centuries the claims of San Salvador or Guanahani were urged. Modern research has chosen Watling's Island. Columbus supposed that he had reached the islands lying off the eastern coast of India, and therefore called the dark-hued natives, Indians. They crowded the shore, and gazed on the spectacle with awe, supposing the ships to be huge white winged birds, and the Spaniards to have come from heaven. How soon they were undeceived!

20. RECITATION.—"The First Voyage of Columbus." *Longfellow's Poems of Places, Vol. I.*, "New England."

21. RETURN TO SPAIN AND RECEPTION.

A short stay was made at Guanahani, Cuba, and Hayti or Hispaniola, as the Spaniards called it. Other islands were visited in the vain hope of securing Oriental treasures. At last, urged by his crew, Columbus relinquished the search and leaving thirty-five of his men as a colony on Hispaniola, on the 1st of January, 1493, turned his vessels homeward. A violent storm on the return voyage threatened his frail ships with destruction, but it abated and after being driven to Lisbon, the shattered vessels sailed into the port of Palos. His reception was flattering in the extreme. The whole nation took a holiday. The king and queen were dazzled by their new and sudden acquisition. As Columbus told them of the beautiful land he had discovered, its brilliant birds, its tropical forests, its delightful climate, and *above all its natives waiting to be converted to the Christian faith*, they sank upon their knees, and gave God thanks for such a signal triumph.

22. HIS DOWNFALL.

Enemies arose on every side. Serious charges were made against him. Complaints were made of his management at Hispaniola and he returned to Spain to plead his own cause before the throne and was once more received into favor. But the clouds thickened. His repeated stories of the wonderful richness of the region had done their work. The gold had not been found. On his third voyage to Hispaniola, while regulating the affairs of the colony, he was interrupted by the arrival of Bovadilla, whom the Spanish soverigns had invested with power to examine into his conduct, and, if needful, supersede him in the command. Columbus was sent back to Spain in chains. Dec. 17, 1500, he was delivered from irons and held his first interview with his sovereigns. He repelled the charges, but his rights were never restored.

23. HIS LAST YEARS.

We can find only pity for his last years. Broken in spirits, almost help-

less of limb, he passed his last years in want. Isabella died and the king not being interested in Columbus, the latter gave up hopes for himself but on his sick bed pleaded for his son. We read of his conference with and advice to Vespucius, with whose fame his own is so sadly conjoined.

The making of his will was his last act. On the next day he partook of the sacrament and uttering,—"Into thy hands, O Lord, I commit my spirit,"—breathed his last May 20, 1506, in the city of Valladolid. The home No. 7, Calle de Celon is still shown to travelers.

24. BURIAL.

His death passed unnoticed except by a small circle of relatives and friends. Twenty-seven days after, the briefest notice was made in an official document of the town to the effect that "the said Admiral is dead." His body was buried at Valladolid, but in 1513 was transported to the Carthusian Monastery of Seville, where a monument was erected by Ferdinand, with the inscription,—"To Castile and Leon Colon gave a new world." In 1536 it was removed to San Domingo, Hayti, and later in 1796, was taken to Havana with imposing ceremonies. The tomb in the Cathedral is inscribed in Spanish:

"O, rest thou, image of the great Colon,
Thousand centuries remain, guarded in the urn,
And in the remembrance of our nation."

In 1877 while excavating near the Cathedral in San Domingo, the vault was opened and a leaden coffin found containing human bones and inscribed in Spanish:

"Illustrious and renowned name,
Christopher Columbus."

It is thought that the body taken to Havana may be that of his son.

25. PERSONAL APPEARANCE AND CHARACTER.

It is not easy to draw a picture that his contemporaries would surely recognize, but let us think of him as he stood on San Salvador,—a man of impressive statue with lofty, not to say austere, bearing; his face long, his cheek bones high, his nose aquiline, eyes a light gray, complexion fair with freckles, hair once reddish, but then turned gray. His favorite garb seems to have been the frock of a Franciscan Monk. As a man he was not above his age, doing little to improve his contemporaries but much to prepare the way for improvements. As the developer of a great world movement he was the embodiment of his times.

27. *Recitation* (school).

Far, like the comet's way through infinite space,
Stretches the long untraveled path of light
Into the depths of ages; we may trace,
Distant, the brightening glory of its flight,
Till the receding rays are lost to human sight.
—*Bryant.*

O Land, the measure of our prayers,
Hope of the world in grief and wrong,
Be thine the tribute of the years,
The gift of Faith, the crown of song.
—*Julia Ward Howe.*

28. *Song*, "America."

29. CLOSING EXERCISE.

Have the school assemble outside and raising and saluting the flag, sing "Red, White, and Blue."

SUBJECTS FOR ESSAYS.

"Columbus and His Times."

"Geographical Knowledge of the Fifteenth Century."

"The Sea of Darkness."

"Tracking the Flight of Birds."

"The Views of Columbus."

"Was Columbus in the North."

"That First Voyage."

"Later Voyages."
"The Lands Discovered."
"The Colonization of Hispaniola."
"Queen Isabella."
"Lessons from the Life of Columbus,"

BOOKS OF REFERENCE.

"Winsor's History of Christopher Columbus."
"Columbia,—A story of the Discovery of America."—John R. Musick.
"Irving's Columbus."
"Higginson's Young Folk's History of the United States."
"Richardson's History of Our Country."
"Butterworth's Young Folk's History of the United States."
"Monroe's Story of Our Country."

GRAMMAR. III.

H. B. BROWN.

IF the noun has received proper attention, the pronoun will not be difficult to comprehend. As the *relation* of words is under discussion, it is supposed that all of the different relations of the noun have been met and understood. And as a *pronoun* is a word used for or instead of a noun, it will be anticipated that many of the relations of the noun will be found with the pronoun.

Pronouns are of three classes, personal, relative, and interrogative, each distinct in use. The word, phrase, or clause for which personal or relative pronouns stand is called the antecedent. This always goes before, as the term implies. Authors have with this, as with many other terms, permitted much latitude. It is always best however to take the terms as they are. Since antecedent means going before, let it be so used *always*. In the same way let interrogative pronouns *always* refer to *subsequents*. By being definite in all these terms much embarrassment is avoided.

A personal pronoun is one that always represents the same grammatical person. The pupil will readily understand the different forms of the personal. These correspond in some sense to the noun. A noun is used in the first person in but one case, and there is but one personal pronoun of the 1st person viz., I. A noun is used in the second person in two cases, and there are two personal pronouns of the second person viz., you and thou. Nouns are of the 3rd person in all other cases. All other pronouns but the ones mentioned are of the 3rd person. These, however, are limited to three viz., he, she, it. Thus it will be seen that there are six simple personal pronouns. The compound forms are myself, yourself, thyself, himself, herself, itself. These latter have some special uses. One of the most important is for *emphasis*, as "I myself will do the work." The other uses are simple and need not receive attention here.

None of the simple personal pronouns have any peculiarities excepting "it". This has been constructed in so many ways, that pupils are sometimes perplexed in determining its proper construction. One about which there is the most discussion is in such examples as the following: "It is said that wisdom

is better than gold", or "It is wrong for me to oppose him." What is true in one case is true in the other. It does seem evident that in both instances "it" is unnecessary, excepting for euphony, and should be parsed as an expletive.

If the question were asked in the first example. "What is said?" the answer evidently would be, "Wisdom is better than gold" is said; thus making the substantive clause the true subject. In the second, the sentence would read, "For me to oppose him is wrong." In both instances "it" is omitted.

Again, if "it" is a pronoun that to which it refers for its antecedent is expressed. In the first it is the substantive clause ; in the second the infinitive phrase. This being true it must be admitted that the *antecedent* does not mean antecedent. Again by some authors the clause is placed in apposition with "it," as though the antecedent of a pronoun could explain anything of the word which represents it. Again, change these sentences so that the verb may be in the active voice and see how readily the "it" disappears. Thus, they say that wisdom is better than gold. If the student will keep in mind the real nature of a pronoun, its office, antecedent, etc., much of that which now perplexes will not appear.

A relative pronoun is one that may represent any grammatical person as its antecedent to which it joins a clause. There are five relative pronouns, who, which, what, that, and as. These relatives join two kind of clauses, restrictive, and non-restrictive or explanatory. A restrictive clause is one that can not be changed to an independent clause. It always has the force of a pure adjective. Thus, "Boys who are happy are prosperous." That is *happy* boys are prosperous. "Men who are honest are respected." That is *honest* men are respected, etc. If we say "The man who went to town returned", "who went to town" merely explains which "man." In both instances however the clauses are adjective. "Who," "which," "that" and "as" are called simple relatives. "what" is called the double relative, not that it is double in the sense in which that term is used, but because it includes more than one word, and "double" is the best term that can be used. All other relatives are compound.

With the explanation as to the kinds of clauses joined by relative pronouns, the pupil may parse all the simple relatives by the same form as is given for personal pronouns. In giving the constructions of relative pronouns, the following hints may prove valuable.

I. Determine the clause which the relative joins.

II. Determine the verb in this clause.

III. Determine the subject of the verb.

IV. If the subject be the relative the investigation ceases.

V. If the subject of the verb be not the relative pronoun, and the relative pronoun be not the object of a preposition, then usually, it is the object of the verb.

VI. A relative pronoun which is the object of a verb always precedes that verb.

In the next article, the relatives "what" and "as" will be carefully explained, and also the interrogative pronoun.

EXOGENOUS AND ENDOGENOUS EDUCATION.

CHARLOTTE A. POWELL.

ONE of the most marked differences between the old-time and the modern school systems is in what might be called their mode of growth. In the former, what growth there was, came from within the structure itself whence it was supposed to reach out and teach the outside world, sitting humbly at its feet.

The modern school, instead of arrogating this wholesale power of instruction, becomes itself the petitioner, and getting its growth from the outside, its expansion is only limited by that of its prototype.

The endogenous character of the old educational system was shown alike in teachers and school. We appreciate the conscientious motives and hard work of many of the teachers of those days, but the character for narrow exclusiveness, so long attributed to people in this profession, was undoubtedly deserved by many.

The school was a miniature world, entirely removed from everyday life, hugging within itself the old-time traditions of learning without once stopping to ask what the object of this very learning was. If school is a preparation for work in the world, then surely the more intimate the acquaintance, and the closer the sympathy of one to the other, the better able are we to cope with the problems and difficulties of life. If we desire to learn something about the science of geology, we study rocks not plants. If education means the ability to do our work in the world, then the outside world and what pertains to it, should be our study, and not a few straight-laced text-books removed as far as possible from even a suggestion of this object. If there is any doubt as to the efficacy of this principle, a glance over the remarkable progress of the past twenty years will reassure the investigator. Now that we have started on this, not royal, but natural road to learning, it is timely for us to think over the means of preserving and perpetuating our progress.

First, as to the teacher. A schoolmaster should be a man among men; a school mistress, a woman among the thoughtful, progressive women of the age. Narrowness in those who have to do with the guidance of the minds and souls of their generation, is nothing less than a crime, and should be shunned as if it were the plague. This vice is particularly hard to avoid, as the life itself tends to a straight-laced, pedantic frame of mind, and nothing but constant struggling with this tendency, and frequent intercourse with people in other fields of work, will succeed in keeping this unpleasant, cloven foot of our profession out of sight.

Now as to the means of attaining the necessary breadth of mind and character. Besides one or more of the best educational publications, every teacher should take a good daily paper, so as to be thoroughly familiar with the live issues of the day. All other work in the line of reading, might well be governed by Emerson's rules on this subject—

viz.: 1. Never read any book that is not a year old. 2. Never read any but famed books. 3. Never read any but what you like.

Then the examination papers must go. Any teacher who spends all or nearly all of his or her time out of school, in correcting papers, is doing an irremediable wrong to himself and his class by shutting off at once, all means of the very self-broadening which would make his services the profitable adjunct they should be to the school in which he teaches.

Opportunities for meeting people in other walks of life should be promptly embraced, and society in the best sense of the word, should be an important feature in the life of every progressive teacher. A teacher who never looks beyond the four walls of his school-room, must have false ideals and false standards; while the one whose mental corners have been worn smooth by friction with the world, may be equally prompt in detecting offenders against school discipline, but his justice will ever be tempered with mercy and good judgment.

The best music, art, lectures, even the best plays are within the reach and means of all who teach in large cities, and like virtue they are their own reward, for, while refining and cultivating the æsthetic tastes, they create a power for higher enjoyment which keeps mind and heart young in spite of years of arduous work.

But perhaps the most potent of all means, we almost said duties, of the all-round teacher, is travel. Besides learning and unlearning geography, etc., it is worth all the time and money to receive one of the mental shower-baths experienced when we find good and even cultured people in another part of the world, cherishing sentiments which our little home-corner disapproves.

This sets us thinking in the right direction, and we end by refuting the idea which some one has humorously expressed, and so many of us in our hearts believe, that "a crank is a person who takes a burning interest in something we don't like." We learn to meet such people, without setting them down as cranks either.

We have devoted most of our time to the teacher, leaving little for the school itself. But, "as the teacher, so is the school," so after all, we have perhaps nearly covered the ground.

The first blow at the old endogenous system was when some intelligent people started a series of Socratic questions and common sense gave the answers.

"What is education for?"

"To prepare people for their work in the world."

"What powers must people have in order to be able to do this work?"

"They must know, at least, how to use their eyes, hands and brains."

And so the natural sciences and manual training have become important features of the school curriculum, and behold, the brain is at the same time provided for, for all this involves the very brain-work needed.

One great lesson which we are slowly but surely learning from our model, the world, is, that all the best results are brought about by specialists. The time is not far distant when it will be considered as absurd to expect one person to teach a dozen different subjects as to ask one man to make a piano from beginning to end. The man who can do some *one* thing as perfectly as possible, is the one whose services are most in

demand—not the one who can do a dozen or more, indifferently well. We shall have attained a far higher degree of excellence, when this idea has been thoroughly grafted on our school system. —*Education.*

PRACTICAL LANGUAGE LESSONS.

ELLA M. POWERS.

ASK your pupils to raise their hands if they like grammar. The uplifted digits will be painfully few. Ask how many are fond of a good story, and the restless digits will wriggle with startling rapidity. Why is this? Isn't a story composed of good English?

English grammar, a terror to the average pupil and a puzzle to the average master, is, after all, nothing but the English language; but, unfortunately, the master does not think so, and the pupil knows there is a vast difference. The first valuable lesson a pupil learns is from the language of well-educated people about him. He is unconscious of the lesson; but, whether he knows it or not, he has learned it.

As the child advances and enters our public schools, and even in the primary grade, he must and should learn to make his own language, and it is evident he is not a professional in the art; he must be helped, and this assistance cannot be offered too early; yet, how much time does a primary teacher devote to this subject of propriety in speaking? Now this valued help you can impart with one of the first reading lessons, and thereby save your pupil from that fright and horror which he experiences when told he is studying English Grammar, for no other study in the curriculum brings with it more terror.

Set aside ten minutes in the day to "Mistakes." Let those minutes be spent in discussing the correct use of words and sentences. When errors in grammar occur, be prompt in detecting and skillful in correcting them; do not be indifferent to their existence. Do not be afraid to put before these children words they have never heard of. Who can better do this? A bright teacher keeps a paper at her elbow and upon it jots down the careless, ungrammatical words and sentences she has heard during the day in her school-room; at the close of each day reads them as they have been spoken, and asks the school for the correct form, explaining why it is wrong, and in this way does not reveal the guilty culprit.

Again, a simple lesson in synonyms can be learned by a child, if you are careful to conceal the fact that it is a study of synonyms; teach them to say a great deal in a few words.

You may say the home influences of many are against us. Does that free us from our duty? What language can we expect of children who live surrounded by an ungrammatical atmosphere at home, who find no better in the street, and to whom the school furnishes no incentive to better language? I repeat, teachers, your efforts, even under those circumstances, must have an influence.

The first language our children need to know and learn is their mother tongue, and they need above all things to be

helped to use it correctly.

Teach these little ones to talk well and express themselves correctly ; and when older, writing will not create a paroxysm of fears.

Let these little ones write sentences, stories from pictures and objects, letters and descriptions. Recite a stanza of poetry (standard poet always), and let them write out its meaning. Tell them something of the author who wrote it.

In the grammar grade, day after day, the grammar class can predict what the recitation will be. John will parse *"is"* as an adjective, and, *Mirabile Dictu !* he proceeds with his marvelous comparison of "is, iser, isest," in blissful ignorance of the intransitiveness of that hideous, irregular verb ; and as other phenomenal dispositions will be made of other words, the recitation ends with an eloquent plea from the teacher on the importance of the study of grammar. What help have those dejected grammarians had? What lasting benefit would they have derived from that lesson had it been perfectly recited ?

Could they talk better, write better, or express their thoughts more clearly ? Whose fault is this ? The fault of time-honored custom, all good enough, but not so good as it would have been if it had been better. Let a refreshing breeze strike that grammar class and turn ye. Let them try to express "He is a wise man" in seventy-two different ways. This will vary the recitation and spare Mary's tears for one day at least.

In the High School, rhetoric and language will be of added benefit to pupils if the teacher is a master of logic and without the aid of technical jaw-breaking rules the pupils may be taught to throw arguments into syllogistic form, to state premises and conclusions, and to discover fallacies.

In figures of speech, there stand forth stars of the first magnitude : the climax, the simile, and the metaphor. The first is invaluable in strong discourse, the second and third give precision and beauty to all thought and speech. Dry facts, rules, and laws must be learned ; but give to your language class an occasional spice.

Select some day to be devoted to journalism. Treat each pupil as if you were the editor of the "Goahead Times" or some other local paper of more euphonious name, and let your class be your staff. To one say, "The corner stone to the B. C. Church will be raised this A. M. ; be there and let me have a description of five hundred words." Let another reduce half a column to fifteen lines. Dispatch a third to a picture gallery, a fourth to a mill, another to the public library, let another write the current events, review a book. Vary by giving a lecture and all take notes. All this may be served up into a dainty dish.

Here in the High School the character of the work in lower grades is manifested ; the seeds sown by teachers in lower grades begin to bear fruit, the character of which is determined by the love or the hatred of the work. All thinking, talking, and writing is practically done in words, *language*, which is the most powerful instrument in determining man's character. Why should language not be paramount ?

—*The Teacher.*

THE GULF STREAM.

JOHN ELLIOTT PILLSBURY.

THE subject of ocean currents is one that has engaged the attention of practical and scientific men for centuries. There is no part of the vast expanse of waters but has a movement, either due to tides or to a regular, constant flow; and an accurate knowledge of the laws relating to these movements is of great importance to mankind. Many branches of scientific inquiry are concerned in their examination, for they bear directly upon the dissemination and evolution of species, and the deposit and structure of geological formation, while in the every-day business of the world they enter as a factor in the price of everything that is carried afloat as well as in the safety of all those "that go down to the sea in ships."

The currents of the ocean are the great transporters of the sun's heat from the torrid zone to temper the climate of the polar regions. It is argued by some that such a stupenduous change as that which occurred in Europe and America at the time of the glacial period was caused simply by a deflection in the currents in the northern hemisphere whereby its share of tropical heat was partly diverted toward the south.

In the three great oceans, the Atlantic, the Pacific, and the Indian, there is to be found a similar circulation—a generally westerly movement in the tropics, a flow toward the poles along the eastern shores of the continents, an easterly set in the temperate zones, and a current toward the equator along the western shores. This system thus becomes a grand circular movement, some parts being very slow, but still quite constant, and other parts very swift. There are offshoots here and there, due to local causes, and perhaps in the slowly moving current there may be a temporary interruption, but, taken as a whole, the movement is continuous.

The part of this circulation flowing along the eastern coast of the United States is the greatest of all these currents, and, in fact, is the most magnificent of all nature's wonders. This is the Gulf Stream. When you are on board a vessel floating upon its waters, there is nothing remarkable in the surroundings, so far as the sight is concerned, which cannot be seen in many other places on the earth's surface. You look over the vessel's side and see a beautifully clear water, with perhaps a little sea weed floating on its surface, a dolphin or a shark playing about the ship, a school of flying-fish darting out of the water and skimming over the waves, myriads of little animal life sparkling like motes in the sunlight; but all of these sights are not enough to impress the beholder as being anything different from what might be expected at other places. You put your hand into the water, and find that it has a summer temperature. When the captain takes his observation of the sun to ascertain the position of the vessel, and you find that she has been moved over the surface of the earth a hundred miles

more than the motive power of the engines could drive her, you begin to think that there is something wonderful in the force of the Gulf Stream.

People think the Mississippi River a grand stream, and it is so in truth, as far as land rivers go; but, great as it is, it would require two thousand such rivers to make one Gulf Stream. The great ocean river is an irresistable flood of water, running all the time, winter and summer, and year after year. It is as difficult for the mind to grasp its immensity as it is to realize the distance of the nearest stars. At its norrowest part in the Straits of Florida it is thirty-nine miles wide, has an average depth of two thousand feet, and a velocity at the axis (the point of fastest flow) of from three to more than five miles per hour. To say that the volume in one hour's flow past Cape Florida is ninety billion tons in weight does not convey much to the mind. If we could evaporate this one hour's flow of water and distribute the remaining salt to the inhabitants of the United States, every man, woman, and child would receive nearly sixty pounds.

Even those who navigate its waters do not fully realize the strength of its current. Two or three years ago a government vessel was anchored in the Stream observing the current. The wind was very light when a sailing vessel was sighted ahead, drifting to the northward. As she came nearer and nearer it became evident that there would be a collision unless steps were taken to prevent it. The crew of the sailing vessel trimmed their sails to the gentle air; but it was useless, for onward she went, carried by the irresistible force of the current directly toward the bow of the steamer. As the vessels approached each other, by a skillful use of the rudder on board the steamer she was moved to one side, and the sailing vessel drifted past a few feet distant. The captain of the latter was as astonished as he was thankful that his vessel was not lost. All that he could cry out in broken English as he flashed by was, "I could not help it; the water bring me here."

The current divides into two branches as it approaches Europe, one flowing to the southward, along the African coast, and one toward the Arctic Ocean. Both are very slow in their movements, but the latter is of sufficient magnitude to force a return current along the coasts of Greenland and Labrador, which carries immense fields of ice and enormous bergs past the Newfoundland Banks and across the shortest steamer track to Europe. This ice, together with the fog which usually accompanies the meeting of currents of such markedly different temperature, compels those steamers seeking safety rather than economy and the quickest passage to make a detour around the ice limits, thus lengthening their voyages materially. The track of the steamers bound to the eastward is farthest to the southward, so as to be near or within the edge of the favoring current, while the route of the steamers in the other direction is as near the ice limit as prudence will allow, and as far removed as posble from the adverse current.

The theories as to the cause of this and other ocean currents have been very numerous. Columbus thought that the waters, the air, and the stars all partook of the same motion around the earth from east to west. He brought forward as evidence of the great force of the currents in the West Indies, that

the Windward Islands were caused by the land being washed away in places, thus forming the islands. Toward the end of the seventeenth century the idea seemed to prevail that the ocean circulation was maintained by means of subterranean passages or abysses. A current at the end of its circuit, or upon meeting land, was supposed to descend into the bowels of the earth, and to appear again on the other side of the land, or very far distant, where it started again on its journey. A little later a theory was advanced that the sun evaporated so much water at the equator that a current was forced to run along the coast of Africa to fill up the hollow. Another was that the heat of the tropical sun attracted so much that a long mountain of water was formed. This was supposed to be carried around the earth until it met the obstruction of land, where it would divide and thus cause side currents. In comparatively recent times the cause of most currents has been laid to the rivers, and of the Gulf Stream chiefly to the Mississippi. The flow of all the rivers in the world will not equal the volume of the Gulf Stream alone. Some eminent men have attributed the currents to the revolution of the earth. It is said that the water, being fluid, does not fully partake of the revolution of the earth from west to east, but is left behind as it were. Many have decided that differences in in the density of the ocean at the poles and the equator cause a flow from the latter on the surface and from the former along the bottom. The surface equatorial water is warm and light, while at the poles it is cold and heavy. The latter is said to sink, and is replaced by a surface current from the equator. This in turn draws its supply from the depths, and so a vertical circulation is maintained. Franklin's theory, which has many advocates at the present day, is that the winds produce the current by the friction of the moving air on the surface of the water. None of the theories have been based upon direct evidence, but all are inferences drawn from temperatures, school-room experiments, the drift of vessels, or from reasoning based upon opinions of what ought to be.

The importance of a complete knowledge of the Gulf Stream to the commercial interests of the United States was recognized by Congress in the passage of an act authorizing the Coast Survey to include it within the scope of its examination. Later, authority was given to investigate the Sargasso Sea (the body of water in the Atlantic lying at the center of the grand circular movement of currents) and also the mate to the Gulf Stream in the Pacific, called the Black Stream of Japan. The first regular and systematic examination of the Gulf Stream was made by the United States Coast Survey while under the superintendence of Professor A. D. Bache, between 1844 and 1860. Reasoning on the same basis that the current could be defined by its temperature, he caused many thousands of thermometrical observations to be taken on lines extending across the Stream at intervals from Key West to beyond Nantucket. He found by this means that all along our coast the surface is divided into bands of warm and cold water. They are spread out or separated at the northern end, and converge at the Straits of Florida. The warmest band, Professor Bache concluded, was the axis or the swiftest current, and each of the others was a part of the Stream, which spread as

it increased its distance from the tropics. The cause of the cold streaks was supposed to be irregularities in the bottom over which the current runs; but this was based upon erroneous measurement of the depths, and in recent years, with better instruments, the bottom has been found to be nearly even.

We are now beginning to realize the magnitude of this "river in the ocean" from actual observation instead of from speculation. The investigation has resulted in many discoveries as astonishing as they are valuable. The average volume of the Gulf Stream flow has been fixed by many hundreds of observations to be nearly ninety billion tons of water per hour. Perhaps the most valuable is the discovery that the Stream changes in velocity daily and monthly, and that predictions can be made of the times of these changes. It will be remembered that the tides rise and fall daily, this depending chiefly upon the position of the moon in its revolution about the earth. In the same manner the current varies in velocity daily. For example, the equatorial current along the South American coast is running fastest at about six hours before the moon crosses the meridian. Between Cuba and Yucatan the maximum current is ten hours before, and in the Straits between the Bahamas and Florida the time is nine hours. These variations in some parts of the Stream amount to more than three miles per hour at certain times in the month, and at other times may be less than one mile. It is readily seen how important this information is to the mariner whose chief endeavor is to make a quick and safe passage.

During the month there is another change taking place, which follows the moon in its journey north and south of the equator. The current always runs weakest at the sides, and strongest at some point usually to the left of the middle of the Stream. This strongest point (called the axis) changes its position. Two or three days after the moon has passed the equator, and is going toward the highest declination, the current at the axis is nearest the middle or farthest to the right, and two or three days after the moon's highest declination it has expanded, and the maximum is farthest to the left. Accompanying both these variations, the daily and the monthly, the temperature of the Stream changes, caused by a greater or less admixture of the warm surface with the cold bottom waters. At one time during the day the lower currents incline in direction toward the axis, while again they run more parallel with the general course of the Stream. This causes the surface water to intermingle with the lower water, and to cool. The observations, besides giving definite and decided information as to the actual limit, direction, and velocity of the Gulf Stream, bear strongly upon the question of what causes the ocean currents.

In the tropical regions there is a continued movement of the air from east to west known as the trade-winds. South of a certain line situated near the equator these winds blow from a southeasterly direction, while north of the equator they come from a more northeasterly direction. The position of this belt on the earth's surface is continually changing. In our winter, the sun being in the southern hemisphere, the belt is farthest south, while in our summer it extends higher into northern latitudes. In the temperate zones the prevailing direction of the wind is in an opposite

direction to that of the trades ; that is, the winds predominate from the west.

Winds blowing over the surface of water induce a current in the latter. At first it is only the merest skim that moves, but gradually the movement is communicated from layer to layer until at last the whole mass is in motion. To allow the trade-wind to affect the ocean over which it blows sufficiently to cause a current to reach the bottom, would require many thousands of years with a steady force and direction. As the winds vary in both (although predominating in one direction), the induced current is shallow and weak, rarely extending much below three or four hundred feet. The superficial current produced by the southeast trades in the Atlantic finally reaches the coast of South America, and divides at its most salient point, Cape St. Roque. A part of the current then turns south toward the Antarctic, and a part follows along the northern side of the continent toward the Caribbean.

The northeast trade-winds also induce a current, and a part of the latter joins the other outside the Windward Islands, while a part passes north of the Caribbean toward the coast of the United States. All the passages between the Windward Islands carry some of the current into the Caribbean, and it is driven across that sea until it reaches the coasts of Yucatan and Honduras, from which it escapes by the easiest route, which is into the Gulf of Mexico. The water entering the Caribbean by this means is about half the amount which flows through the Straits of Florida from the Gulf of Mexico, and the other half is supplied from a source which does not come under the head of a measurable current. This other source is the wave caused by the wind. Every ripple carries a certain amount of water in the direction toward which it is moving, and when the waves become large, hundreds of tons of water are thrown from the crest into the trough every time the wave breaks. In a large area like the Caribbean Sea, having a comparatively constant wind blowing over its surface, this action is practically a simultaneous movement of the surface to the westward, and a continual escape of the water heaped up at the obstruction offered by the land. This escape is with the current into the Gulf of Mexico, through the Straits of Florida, and into the Atlantic.

The Gulf Stream, grand as it is in comparison with other ocean currents, would be but little felt on the European coast did it not receive an addition to its volume while *en route*. It will be remembered that a portion of the northeast trade-wind current flows outside the West India Islands and the Bahamas. This slow current, meeting the obstruction of the continent in its path, gradually curves to the northward, and joins the Gulf Stream in its journey to the Old World. The temperature of this outside current in its passage along the West Indian Islands is about the same as that of the Gulf Stream, but it is less violent in its movements, and there is less intermingling of its lower and upper waters. It consequently arrives off Cape Hatteras with a much higher temperature than that of the more rapid and turbulent Gulf Stream.

The water thus delivered to the region of the prevailing westerly winds above the thirty-fifth parallel of latitude is moving in a northeasterly direction. The impelling force from behind—the trade-winds—has ceased to act on the

surface, and the velocity of the current is consequently diminishing. By the time the Newfoundland Banks have been passed, the Gulf Stream as a separate and distinctly defined body has been almost obliterated, and in its place there is being formed a broad, slowly moving drift caused by the prevailing westerly winds. As this current reaches the obstruction of the European coast the water escapes in two directions, one toward Africa, to join the trade-wind current at the starting-point, and the other toward the Arctic. The latter must also have some means of escape, because the Arctic is a *cul-de-sac*, and as the line of least resistance is on the west side along the coasts of Greenland, Labrador, and Newfoundland, the Labrador current is formed.

The question is often asked, To what extent does the Gulf Stream modify the climate of the United States? To its supposed erratic movements is laid the blame of every abnormal season. There is every evidence that the Gulf Suream is governed absolutely by law in all its changes. The course through the ocean is without doubt fixed. Its fluctuations are by days, by months, by seasons, or by years, and they do not vary materially one from the other. Its temperature changes, depending upon the relative heat of the tropical and polar seasons, and upon the strength of the producing trade-winds. The warm water may be driven toward the shore by the waves caused by a favorable wind, but the current remains in its proper place. The warm water gives off a certain amount of heat to the air above it, and if this air is moved to the land we feel the heat. The presence of the warm water on the coast of Europe would in no way modify the climate if the prevailing winds were easterly instead of westerly. If the prevailing winds in New England in winter were southeast instead of northwest, the climate would be equal to that of the Azores Islands, mild and balmy. For the cause of abnormal seasons we may look to meteorology. The current is in its place ready to give off the heat and moisture to the air whenever the demand is made upon it, but by the erratic movements of the air this heat and moisture may be delivered at unexpected times and seasons, and thus give rise to the erroneous belief that the Gulf Stream itself has gone astray. —*Century.*

LIVING QUESTIONS.

RT. REV. SAMUEL FALLOWS.

(Delivered before the Scientific Class, Aug. 10, 1892.)

I WAS but nine years of age when the great factory regulation of the country was passed by the English Parliament. I was deeply interested in it, although a mere lad, because my father himself had risen from the ranks to be a Manchester cotton manufacturer. The danger appeared to the cotton manufacturers. The wealth of the whole United Kingdom was enlisted against factory reform. Men and women and little children were worked from twelve to fourteen hours per day and were herded together in a manner, detrimen-

tal to health and morals. These little children were employed at the lowest wages during excessive hours of toil. This is the point I particularly want to make: —The law was on the side of the manufacturer, entirely on his side to begin with. Public opinion at first was on his side also. It is one of the most stern suggestions of history to read the story of that conflict. The English Parliament was slow to uncover and to interfere with trade and was reluctant to have anything to do with sentimental legislation—for an Englishman, especially in parliament, knows nothing about sentimentalism. At last, in spite of the desperate and determined combination of capital against the efforts to bring about the reform, this English parliament, set up under a debased tradition of the English law, came to the relief of the overworked and under-paid. Remember that every step in that reform, from the very beginning to the end, was contested bitterly by the larger part of the leading manufacturers on the ground that the vested rights of capital would be destroyed, and the laborer would be unduly benefitted if the changes were to be made.

There must be an interference by the state with the relation of capital and labor to-day, and in the future as there has been in the past, but labor will have its just rights. New conditions will demand new regulations. The old idea was that the laborer was from his birth an inferior being, and was separated by an impassable gulf from refined society, and that he must lead a mere animal and mechanical life with no high aspirations. Read the wage theory of the earlier political economists, and how that theory confronts us in all its boldness and in all its horribleness, that the minimum wages must be paid, and for the most part just enough to keep the soul and body of the toiler together, and just enough to keep his family from absolute want. And not such a very old idea was this either, of the last century.

The late Dr. Johnson told us of the exercise of liberal kindness to the people over whom the proprietor was placed by Providence. That was the idea which that old Scotchman, a century or more ago, refuted with all his soul, that God could send into this world some men, already booted and spurred, to ride other men, already bridled for their use. The landlord never dreamed of the condition in which the laboring poor should rise out of absolute want and possess more than the barest necessaries of life.

Thomas Cooper, a famous English Chartist has just died. I recollect him. I was nearly twelve years of age when he was in his pride. My father was a Chartist also. For simply asserting the rights of the laboring man to cast his ballot, Thomas Cooper was repeatedly imprisoned. My father, escaped simply by leaving his own country, for his own good, if not the country's.

You remember the suffrage question and the masterly flank movement Disraeli made, when as a tory prime minminister, he extended it widely to the laborers of the United Kingdom. Mr. Cooper, very naturally, when he had an interview with the great Lord Beaconsfield, asked him the question, "Why is it my lord that I should have been imprisoned twenty years before, for advocating the very thing which has made you prime minister of England?" The brilliant statesman could only say, "Mr. Cooper, the times have changed since then, that is all."

A little over three weeks ago—just

about three weeks ago—I stood facing an audience different from this. There were no young women in that audience. Nearly twenty-eight hundred men were before me whose action is to become historical. I stood before them, having by their grace been invited to take my place on the platform. Outside the building, standing sadly, were from fifteen to twenty reporters of the different papers of the Union, all wishing they were in my place inside, to hear what the men had to say. They were the twenty-erght hundred locked out men at Homestead, but they were locked in this very house holding a secret meeting. I wanted to know from the men themselves, their leaders, Mr. O'Donnell, Mr. Weihe and others, what the situation was. I wanted to see the homes of these working men. I wanted to see if there was any possibility of acting the part of a mediator, with other ministers of Christ, including Roman Catholic priests; to see whether the men and their employers could not come together in some kind of understanding and stop the destruction which was taking place. These men were before me. Now I wanted to see these for they were not different from any of us; these were men who were American citizens, a very large number native born and naturalized. A large part—I don't think I would be erring if I said the larger part—were members of the church of Christ, different branches of that church, Methodists, Christians, Baptists, and Presbyterians. The gentleman who presided at that meeting was a prominent member of the Methodist church. I looked into the faces of men who wore grand army buttons, and knew from experience the story of their struggle in the past. These men were my brothers. And as I thought of the past and of capital in its dealings with labor, whatever might be the specific nature of the case before me, I said, if I don't do my duty, by these laboring men, now that I have the opportunity, "Let my right hand forget her cunning and my tongue cleave to the roof of my mouth."

I spoke to these men substantially what I am going to tell you in a few words. You will see whether I gave them any advice which as a political economist, having taught its principles to the senior classes in colleges and universities years ago, and whether, as a Christian minister who ought to be a mediator between man and man I told them the truth or not. Let me now very rapidly present you the facts in this case at Homestead as illustrated therein and as great examples of the patriotic principles I wish to present.

The population in that once thriving town is constituted mostly of working men and their families, employed in that great iron and steel manufactory. The head of that firm, as you know, is a widely known man who can work with his own hands, and who is perhaps to be the leading iron manufacturer of the United States.

The firm at Homestead proposed a new scale of wages on the basis of twenty-three dollars and fifty cents per ton instead of twenty-five dollars as before. The reason alleged by the firm was the addition of new and expensive machinery, which increased the productive capacity of the men, and which advantage, they said, did fifty per cent. of the increased work, for which the men wanted pay. The firm also asserted that the proposed reduction of wages affected three hundred twenty-five men only, out of the twenty-eight hundred

workmen, and these workmen were among the best paid laborers the world could show,—they received from two dollars twenty-five cents to fourteen dollars and sixty-six cents per day, and the majority earned from six dollars to ten dollars per day. The firm also claimed that some of these men came down to their work in their own carriages and in the evening they had these carriages waiting to take them home again, and who, they say, would not have earned fifty dollars per month if they had depended on their own brains for a living. Now this shows that the wages were certainly more than those received by the average clergyman and teacher throughout the country. I mean even in the upper grades of preaching and teaching.

Let us see what the workmen have to say on their side of the question. And very naturally, too, I think they were receiving good wages. They contended they were not high enough for American workmen, engaged in the employ of a firm making such magnificent profits; they say that both skilled and unskilled labor, in our own highly favored land, does not receive excessive consideration.

With an increase of wages comes an increase of wants. Their homes, contrast them now with the hovels and huts of the English workmen; contrast them with the squalor and filthy surroundings of the German and the workmen in other countries. What does this mean? Better homes, better living, better schooling, more books, more music, fine arts, and the like, all come with these better wages; children are better clothed, and the children of these laborers in our own splendid common schools are to take their places, side by side, with the children of the rich. But has the improvement in these regards in the condition of the best class of workmen kept pace with the improved condition of the employing class? That is the question. It is not whether two dollars and fifty cents are paid to day or a dollar and a half twenty years ago; It is the question whether two dollars and a half, considering the increase, will go further than a dollar and a half a few years ago, that is the question. Suppose that it is the case that the very best of these mechanics could ride in his own carriage to his work, as our farmers now ride on their sulky plows as they go daily to their fields. Grant this may be the case, in how many carriages can his chief employer ride, and in how many does he ride? Granted, that a workman may have a neat comfortable home; how many palatial residences can the employer afford?

The attention of these men was called to the fact that they were not receiving much wages from the product of capital, made productive by their labor at the lowest rate of wages; and in this they were standing for a principle which does not relate to themselves, simply, but to the great army of laborers throughout our country.

Machinery has come and will do the work of ten to a hundred men, but while the employer is reaping the benefit, the workman is still working, relatively for the same old wages. We are not through with the Homestead matter. Unless something is done in the line I am going to advocate we will see such widespread disgrace and confusion as we have not yet seen in the United States.

Now I say that with the issue adopted it is safe, therefore, to say that there is no necessity for the firm to lower the

wages of the men a single cent—there is no pretense made of that question. Then the workmen asked for arbitration. When the militia came every man was on the outside of the Carnegie works ; they were not in possession of them. They asked for arbitration ; they asked before the militia came. This the firm refused. The firm absolutely refused to treat with the amalgamated association at all, and would not recognize any kind of workmen's organization. It took the ground that it would simply treat with individual workmen only, and that non union men should be in their places if at a certain period they did not resume work. Now then the firm itself distinctly made up the issue, no recognition of workmen's organization, no arbitration. It brought in as evidence before the congressional committee, as given by a representative of the firm, that special preparation had been made in advance for the coming of the watchmen and the detectives, the Pinkerton men, as they are termined, to defend their property and defend the non-union or other men. They, also, barricaded their works and in other ways prepared for the inevitable conflict. And such a labor question was the question; a question which is as irrepressible as was the conflict with slavery and the battles for the union were. The war for the Union was, after all a war for free labor.

These Pinkerton detectives came; the men were recruited from Ohio, Indiana, and Illinois ; then followed the bloody conflict which startled the nation ; and then ensued that shameful scene after the detectives surrendered which was enacted by a resistless mob.

To the honor of leaders, overpowered by a majority of the workmen, then, be it said, that the beating and maiming of these unarmed people, was as much deplored by them as could be by any lover of justice, of peace, or of manhood. These foul acts must not be laid at their doors, who escaped the frenzy of the uncontrolable men and women, maddened at the sight of blood of their own fathers, brothers, husbands, and sons.

Three points are now to be considered : The refusal of the firm to treat with the workmen through the Amalgamated Association, their employment of the Pinkerton force, and their refusal to arbitrate. In these days of progress it seems to be uttering merely a truism to say that the degredation of labor in the past was just precisely in proportion to its inability to combine. The end of the nineteenth century has witnessed the most gigantic combination of capital the world has ever known. Even in the law or in spite of the law these combinations continue to increase ; nay, the law itself seems powerless to throttle the trust or such combinations in anthracite coal as now have the whole United States by the throat.

Month by month the price of this needed article has been advancing, and millions of dollars are pouring into the coffers of the ungodly combines. No corresponding advance in the wages of any miner has taken place ; the minimum pay is still the same. The most eminently recognized and supreme organization of labor has had but a recent recognition on the part of the public. In 1878, Mr. George Howe, member of the parliament in England, issued his first book on capital and labor ; he has just issued his second edition. He says in this second edition, "When my first book was issued all the press,

including newspapers and magazines, all the pulpits, and all the parliament, was against trades unions, in 1878." He says in 14 years a change has taken place, and now in spite of, and notwithstanding the brilliant and persistent opposition of fourteen years ago, there has been a unanimous change of sentiment regarding these things. He says leading political economists have gone in this direction. I am much of the opinion of John Stuart Mill when he states that there has been in the past, an abnormal state of things, but in the present there must be combines among the workmen, even as there has been among the masses, in order that simple justice may be done to the laborers. Now let me say that it is an absolute necessity that labor should organize. It is an unhappy state of affairs, but it must be, it is an unhappy state of things but it is a necessity,—it must be combination against combination. Capital has always combined and is combining more judiciously and extensively than ever before. Hence, labor must now combine itself more thoroughly and more widely and more successfully than ever before. We know that there have been walking delegates, great nuisances, going about like mad lions seeking whom they may devour; we know that deeds of violence are done in spite of organized strikers; we know how these deeds of violence have shocked the sensibilities of the community: but these are not necessary attendants to the combination; they are not the essence of its being; they but mark the manifestations. "O Liberty, Liberty, what crimes have been committed in thy name!" said that noble French woman as she went to the guillotine, in the cause of liberty. But liberty is so dear to us that we deem the millions of lives and the billions of treasure so freely given for it, but a poor offering for its priceless possession.

Now we have no room in this country for the class of men who are always striving, while not laboring men, to bring discredit upon them by their wild views. O, America has been the place, above all others, where these men were welcomed. We have made our own beloved country a paradise for anarchists; and we have made it a third Heaven for the meanest strikers. But you know we in Chicago, some time ago, determined that we would reverse this state of things, and by the grace of the people, and by the help of the laws, and by the favor of Almighty God, we are giving to all the world due notice that hereafter we will make the United States a Purgatory for the one and the hottest kind of a place for the other. Now I can not help but believe that the refusal to recognize the rights of organized labor, was the most serious mistake that possibly could be made and is now being made at Homestead.

[*Concluded next month.*]

JUPITER AND OTHER PLANETS.

W. J. Hussey.

WHEN Galileo had completed his first rude telescope he began to examine the heavenly bodies with it and among the observations which especial-

ly pleased him were those of the planets. He found that they were unlike the other stars, for when viewed with a telescope they did not retain their point-like appearance but became enlarged into round bodies like the sun and moon. With his first telescope Jupiter did not appear different from the other exterior planets except that its disc was larger. He made a more powerful telescope and examined Jupiter with it on the evening of January 7, 1610. In doing so his attention was attracted by three small bodies near the planet which he supposed to be small fixed stars. They seemed, however, brighter than other stars of the same magnitude. Two were east of the planet and one west. They were arranged nearly in a straight line and were of nearly the same brightness. On looking at Jupiter the next evening, he was surprised to find that they had changed their places and were all on the west side of the planet. The change could be explained by supposing that the planet had moved eastward among the stars instead of westward as indicated by the tables of its motions for that date. It seemed to Galileo that the tables were wrong and that the planet had moved eastward thus passing the two stars which were east of it on the preceding night. But such was not the case. It was cloudy on the 9th. It being clear on the 10th, he again observed the planet and found only two of the small bodies, and they were both east of the planet. Galileo supposed the third one to be concealed behind Jupiter.

Knowing that he had observed the same bodies on the different nights and that the changes in their positions could not be accounted for by any probable movements of the planet itself, he was led to the conclusion that the small bodies which he had previously regarded as fixed stars were themselves in motion. They thus acquired a new and important interest and he accordingly resolved to watch them with the utmost care, and if possible to obtain data from which the nature of their movements could be determined.

On the 11th, two small bodies were again seen on the eastern side of the planet as had been the case on the preceding night. There was a difference however. On the preceding night the two seen were of nearly the same brilliancy. Now the more eastern of the two was much the brighter. Clearly it was not one of the two seen on the night before. On the 12th, three were again seen, one of them being so near the planet as to be almost lost in its bright light. On the next night there was an added interest, for then there were four of these small bodies to be seen. They were situated nearly in a straight line passing through the center of the planet, three of them being on one side of it.

A day or two before this time Galileo had recognized the true character of these little bodies. He had come to regard them as revolving around Jupiter in the same manner as Venus and Mercury and the other planets revolve around the sun. In other words he had concluded that they are satellites or moons of Jupiter, a conclusion which he fully verified in the course of a series of observations made during the two or three months following his discovery.

The moon is the earth's satellite. With the exception of it these four moons of Jupiter were the first ones discovered. Since the time of Galileo, it has been found that several of the planets are attended by satellites. Mars has

two, Saturn eight, Uranus four, and Neptune one. Most of these have been discovered with powerful telescopes. The regions surrounding the planets Mercury and Venus have often been explored in vain, for no satellite has yet been found attending either of them. Many times also have the regions surrounding the other planets been explored in the hope of finding new satellites. Such explorations have usually been in vain. There is however, a recent brilliant exception. In making such an exploration on the night of September 9th Mr. Barnard of Mt. Hamilton found a fifth moon of Jupiter. This new satellite is a very small body and can only be seen with the most powerful telescopes. Its diameter is not known but probably does not much exceed a hundred miles.

It is yet too early to make definite statements as to its exact distance from the planet and its exact period of revolution. Accurate values of its periodic time and of its distance from Jupiter can only be obtained by combining observations extending over a considerable period of time. Approximate values have, however, been already obtained from the early observations. The distance is estimated to be about one hundred thousand miles, or approximately one and a fourth times the diameter of the planet. This is relatively a very small distance. If the earth had a moon relatively as near, it would be only about six thousand miles from the earth's surface. At that distance it could not, if it were revolving in the plane of the equator, be seen by observers in latitudes higher than about sixty-six degrees. And at the distance of six thousand miles from the surface it would revolve around the earth very rapidly. In fact it would make a complete revolution in approximately eighteen hours, or in less time than it takes the earth to rotate on its axis. Such a moon would rise in the west and set in the east. [This supposes it to revolve around the earth from west to east.] Its motion across the sky would be very slow. From one rising to the next it would be three days, from the time of rising to setting it would be a little more than twenty-six hours, or somewhat more than a third of the interval from one rising to the next. Were it not for parallax it would remain above the horizon continuously for thirty-six hours and then be below the horizon for an equal interval. The earth has no known satellite fulfilling such conditions. There is however an analogous case in the solar system. The inner satellite of Mars, Phobos, revolves around the planet very much more rapidly than the planet rotates. It makes more than three revolutions to one of the planet. Consequently to an observer on Mars it would actually rise in the west and set in the east. There is no other known case like it. The newly discovered satellite of Jupiter revolves around the planet in very nearly twelve hours, which is greater by about two hours than Jupiter's period of rotation. It, therefore, to an observer on Jupiter, rises in the east and sets in the west. Its westward motion, however, is very slow. It would be nearly seventy hours from the time of its appearance above the visible eastern horizon till its disappearance below the western.

Whether other satellites to Jupiter may be found remains to be seen. There is no reason to suppose that there may not be others. Indeed in the nature of things there is no reason for supposing

that there may not be several undiscovered satellites not only of Jupiter but of the other planets. It may be that this recent discovery will direct attention to this field of research and lead to the discovery of other satellites in unexpected places. There may be satellites much more remote from the planets than those hitherto found, and some industrious observer having at his disposal a most powerful telescope may be fortunate enough to make one or more such discoveries.

In conclusion some notes on the positions of the constellations and planets for October will now be given. At 10 o'clock in the evening at the beginning of the month, or at 9 o'clock at its middle, or 8 o'clock at its end, the constellations have the following positions. Pegasus is a little south of zenith. Andromeda is north-east of Pegasus and the Swan north-west of it. Cepheus is south of the pole in the milky way. Cassiopeia and Perseus are east of it, both in the milky way. Ursa Minor is west of the pole. The Big Dipper is near the northern horizon, and Aquarius near the southern. The Dolphin and the Eagle are west of Pegasus and Lyre west of the Swan. Hercules and the Northern Crown are near the western horizon, while Taurus and Auriga are appearing above the eastern. Aries is south-east of Andromeda and south-west of Perseus. Pisces is south of Andromeda and south of Pisces is Cetus.

Jupiter rises early in the evening. It is the most conspicuous star in the east. Mars is in the constellation Capricorn in the south-west. It is the most conspicuous star in the west. Venus is a morning star and will continue so until next April. Saturn is too near the sun to be seen, Uranus is in the constellation Virgin and can not be seen in the evening. Mercury will be at superior conjunction with the Sun on the seventh of October. It, of course, cannot be seen at the time. After that date it will become an evening star, but throughout the month, it will be so near the sun that it is probable that it can not be seen without a telescope.

On the 20th of October there will be a partial eclipse of the sun. It will be visible over the Atlantic Ocean and the greater part of North America. It will not, however, be visible along the Pacific Coast. The eclipse will be greatest at a point in the Atlantic Ocean somewhat east of the southern extremity of Greenland. At that place the eclipse will be at its middle at sunset. In Central Alaska the middle of the eclipse will be at sunrise.

On the 3rd of November there will be an eclipse of the moon. It will be visible in the United States.

PSYCHOLOGY—THE APPLICATIONS.

H. N. Carver.

THE applications of psychology to rhetoric must be passed over altogether, and its applications to the teacher's art may be deferred until the sensibilities and the will have been discussed. There remains one part of gram-

mar upon which they throw so much light that some attention should be called to it.

The most significant terms in grammar are the two, subject and object; and yet there are none which are more vaguely understood by the young student. The word subject means, thrown under; and the word object, thrown against; both words taken passively. Of course, what the subject is thrown under, is the attribute; and what is thrown against the object, is the attribute too. Consequently, the precise definition of the term subject, in grammar, is any word thought of as the basis of an attribute; and of the term object, any word toward which an attribute is directed in thought. We have already seen that the adjective is the proper form for the name of an attribute. Hence, the subject or the object must, primarily, be the subject or the object of an adjective. If I say, a good boy is courteous, the word boy is the subject of both the adjectives, good and courteous; the only difference is in the construction of the adjectives, that is, in the way they stand related in the thought to their subject. This has been discussed in a former article and need not be gone over again. The only point that needs noticing is this: boy is not the subject of "is," nor of "is courteous," —it is the subject solely of courteous. "Is" is a mere copula, a connective; it is meaningless, though it once had meaning; it is really only a preposition so far as its office in the sentence is concerned. Again, if I say, the boy is like his father, the word father is the object of "like," which is a mere predicate adjective, as was "courteous" in the sentence already used. There is no preposition understood, or to be supplied. Indeed, no preposition can be supplied without making bad English of the sentence, and grammar is certainly not the art of making bad English sentences in order that they may be parsed. Usually the attribute and the copula are fused into one word, but the subject or object is always the subject or object of the attribute. The participle is the adjective form of the verb, that is, the participle is the word-form which we use when we wish to state explicitly what is implicitly in the verb, and this can always be done; indeed, it must be done, if we wish to see the exact structure of the sentence; just as in algebra we must develop any function to see the relations of its elements. Even in such a sentence as, the boy is good for nothing, "nothing" is the object of "good," the specifying object, we call it; and the preposition is used merely to make the relation clear. In some languages, a preposition is hardly ever used in this construction, unless the prepositon is intended to retain some of its original significance, or notional import. In the sentence, apples are good to eat, the infinitive, which is always an abstract noun, is the specifying object of "good," the prepositon having lost all its original significance of indicating motion. Of course, it is often convenient to say that a word is the object of a preposition, but it must be remembered that the expression is inexact; unless, indeed, we choose to make the preposition significant, when it becomes an adverb or other notional form. (See James's Psychology, Briefer Course, p. 162.)

But adjectives and verbs are not the only kinds of words that may have subjects and objects. Abstract nouns are often used in the same way. If I say, the love of a mother is holy, and the

understanding is that the mother does the loving, the word mother is the subject of the noun love. It is not an object at all. If I say, the love of money is the root of all evil, the word money is the object of the noun love, as much as it would be the object of the verb, were I to say, I love money. That is to say, the relation between "love" and "money" is an objective one in both cases. Sometimes it is difficult to determine just what the relation should be called. In the sentence, the leader of the army is brave, if the word leader is thought of as referring to simply one of the individuals composing the army, "army" is a modified case of the subject, it is what we call a partitive ; if the army is thought of as possessing the leader, "army" is the subject of "leader"; but if we think of the army as the thing which the leader leads, "army" is the object of "leader."

It might be a matter of interest to some of the younger teachers, to look at this group of constructions, the partitive, subjective, and objective, and see how they stand related to one another, especially to see how it is that the same preposition "of" for example, has come to be used to express such opposite relations as it now does. Language like all other institutional things, is a growth from the simple to the complex, with a tendency to aggregate into groups, in which there will be a typical construction and others more or less divergent. The type of the construction, perhaps it would better to say the start of it, is undoubtedly the partitive, the relation of a part to its whole. If I say, the top of the tree, "tree" is the whole and "top" the part referred to, and the relation is that of a mass part to a mass whole ; if I say, the oak is the noblest of trees, again the relation is that of part to whole, class part to class whole, or species to its genus. Now, since the species is always to be regarded as springing from the genus as its source, or origin, by analogy the action springs from the actor, possession from the possessor, thing made from the material, etc., etc. ; hence, in such expressions as, the love of a mother, the boy's books, and a ring of gold, "mother," "boys," and "gold" are all regarded as subjects of the words modified by them. The objective constructions, the love of money, etc., have all arisen from a shifting of the point of view. From one point of view, "money" is the source of the love, it called out the love; but this is not the most important practical matter in this instance, the love goes to the money as its object, the thing aimed at by the agent, and in consequence the latter view has completely dominated the original one.

In almost all other languages this group of constructions has been called the genitive construction, the case, that is, of the genus ; but in the English we taken the possessive relation as the typical one, and have named the construction, as a group, accordingly. There are many other interesting and important things that might be said in connection with the subject, and what has been said must be taken rather as hints and illustrations, than as anything very formal or complete. The classification of the objective constructions is a matter outside of the applications of psychology, or rather outside of any attention which we can give it here. It is interesting, and sometime a separate article may be given to it, if circumstances seem to make it desirable.

A word may be added upon the util-

ity of these applications, as we have been working them out in this fragmentary way. In all our schools, the teaching of literature is coming to be a matter of increasing importance, and here, if nowhere else, the utility will show itself. The writer is the last person to say that no good work can be done in teaching literature without formal grammar to help in it; but he does say that formal grammar can be put to no use so valuable as in this helping the reader to get at the exact thought of some great writer. And he believes that one reason why the Latin and the Greek languages still keep their relatively high position as educational means lies in the fact, that we have grammars of those languages written by men who have some competent knowledge of what language and grammar are, and editions of the Latin and Greek writers suited to class use with the grammars. There is no reason why we should not have English grammars written by equally competent persons, and editions of our great English classics fit to be used with them. When our schools are furnished with this equipment and our teachers are taught how to use the means at their command, the exaggerated importance of a foreign language as means to educational ends will pass away, and we will all come to have some conception of the beauty and strength of our own noble mother-tongue, and the richness of its literature.

SCIENCE OF TO-DAY.

PRINCE KROPOTKIN.

VI.

THE world of chemical phenomena is so immensely wide, and the phenomena themselves are so complicated, that the founders of modern chemistry were compelled to limit the area of their investigations, and sharply to separate their own domain from those of the two sister-sciences, physics and mechanics, leaving it to the future to find out the bonds which might unite all three branches into one harmonious whole. They and their followers elaborated their own methods of investigation; they discovered their own chemical laws and worked out their own hypotheses and theories; and, with the aid of these methods, laws, and hypotheses, they created a science which not only interprets, discovers, and predicts the phenomena it deals with, but already has brought us within a measurable distance of a general theory of the structure of matter altogether.

In proportion as chemical research went deeper into the study of the wonderful movements and interactions of molecules and atoms, the intimate connection which exists between chemistry, physics, and mechanics became more and more apparent. The physical and the chemical properties of matter proved to be so closely interdependent that they could be explained no longer with the aid of chemical theories alone; the very fundamental laws of chemistry appeared to be but so many expressions of physical facts; and chemistry stands now in such a position that no further advance in its theoretical part is possi-

ble, unless it enters the borderland which separates it from physics, recognizes the unity of chemical and physical forces, and, availing itself of the progress recently made in molecular mechanics, boldly attacks the great problem of a physical—that is, a mechanical — interpretation of chemical facts. This is the work which now engrosses the attention of most chemists.

The points of contact between physics and chemistry are very numerous, and the work is being carried on in several directions at once. The discovery by Mendeleeff of the so-called "periodical law of elements" has called into life numerous researches, some of which accumulate correct numerical data to express the dependence between the physical properties of various bodies and their chemical constitution; while others endeavor to interpret this very periodicity in the properties of the elements under the assumption of their compound nature. On the other side, the recent development of the mechanical theory of heat, and the interest awakened of late in electricity, have given rise to numerous researches aiming at a representation of chemical reactions as mere transformations of heat-energy or electricity. And, finally, most skilful investigations are being made, and most suggestive hypotheses advanced as regards the possible distribution of atoms within the molecules, under the supposition of their remaining in a state of equilibrium; and thus the way is prepared for a higher conception of the atoms—not motionless and mutually equilibrated, but involved, like the planets of our solar system, in complicated movements within the molecules. Works of importance have appeared of late in each of these directions. But no other domain has lately been explored with such a feverish activity as the vast domain of *solutions;* and to these researches we must now turn our attention.

In former times, it was supposed that if some table-salt, or sugar (or any other solid, liquid, or gas) is dissolved in water or any other liquid, the particles of the dissolved body will simply spread, or glide, between the particles of the solvent, and simply be mixed together —just as if we had made a mixture of two different powders or two gases. But on a closer study a succession of most complicated and unexpected phenomena was revealed, even in so simple a fact as the solution of a pinch of salt in a tumbler of water. The solutions proved to be the arena upon which phenomena cease to be purely physical, and become chemical, and they were studied accordingly with the hope that they might give a physical cue to chemical reactions. Hundreds of researches are contributed every year to this subject; and although there is yet no final result to record, we are bound nevertheless to examine the present state of investigations which so much interest and excite chemists.

Few scientific hypotheses have proved so productive in the development of science altogether as the so-called "kinetic theory of gases." A gas, according to this hypothesis, is an aggregate of molecules which move very rapidly in all directions and endeavor to disperse in space—the rapidity of their movements being increased by every increase of the temperature of the gas. In their endeavors to escape in all directions the molecules of the gases continually bombard the walls of the vessels which contain them. They break them if they are weak enough, or else they exercise

upon them a pressure which is nothing but the sum of all energies of the molecules which strike a unit of surface in a unit of time. In our steam-engines the molecules (or rather particles) of steam bombard the walls of the cylinder ; they push the piston by their aggregate energies and, setting it in motion, make it move the huge masses it has to move. This is, of course, but an hypothesis ; but since it so perfectly explains the pressure, the elasticity, the diffusion, and the internal friction of gases, and permits us to predict the consequences of the invisible bombardment; and since its consequences, mathematically duduced by Maxwell, Clausius, Boltzmann, and many others, fully agree with the reality of facts—it can be considered no more as a mere guess : it is a theory.

Now, the Dutch chemist Van 't Hoff proved in 1886 that the same theory holds good for weak solutions as well. If some sugar, or some sulphuric acid, or any other liquid or solid, be dissolved in some liquid, the bonds which keep together the particles of sugar or of the acid are torn asunder by the solvent. The particles spread among those of the solvent, and they take up the same movements which they would perform if the sugar or the acid were brought into a gaseous state in a free space. They bombard the walls of the vessel, and exercise upon them a certain pressure which will be increased if the bombardment is rendered more violent by either raising the temperature of the solution, or increasing the number of bombarding particles by a limited increase of its strength. Though there is not the slightest reason for supposing that the dissolved solid or liquid may be in a gaseous state within the solvent, the very fact of scattering its particles over a broad space is sufficient to free them from their mutual bonds ; they behave exactly as if the sugar or the acid were brought into a gaseous state by evaporation and filled the space occupied by the solution. They obey all the physico-chemical laws (the laws of Boyle, Marriotte, Gay Lussac, and Avogadro) which hold good for gases.

The kinetic theory of *gases* was thus extended to *liquids*, and this first step was soon followed by another, even more important step, when Van der Waals—also a Dutch chemist — still more effectively bridged over the gap between the gaseous and liquid condition of matter. He studied that state of gas when, under an increasing pressure and a decreasing temperature, it becomes a liquid ; and he found a mathematical expression (an equation) which very approximately represents the mutual dependence between the volume occupied by the gas under a given pressure, its temperature, the volume occupied by its particles, and their mutual pressure. He thus expressed in a more comprehensive way how, in proportion as the lengths of the paths of its particles decrease, a gas becomes a liquid.

The long-since suspected continuity between the gaseous and liquid states of matter was thus demonstrated once more, and rendered easy to investigate ; and the importance of these conclusions was stlll more enhanced by Clausius when he demonstrated that a slight alteration of Van der Waal's equation makes it also represent the absorption or dissipation of heat-energy which always takes place when a body passes from the liquid to the gaseous state, or *vice versa*.

And, finally, another step in the same direction was made by the French phy-

sicist, Raoult. We all know that if some table-salt, or saltpetre, or some other salt, be added to water, the water may be cooled below zero without freezing. Its freezing temperature is lowered. Now Raoult studied the lowering of this temperature caused in water and other liquids by the addition of various amounts of various salts, and he came to a most remarkable result. It appeared that, whatever the nature of the dissolved salt may be, the freezing temperature of a solution will always be lowered by the same amount (nearly six-tenths of a degree) if we add one molecule of the dissolved body to each hundred molecules of the solvent. Thus, again, a purely physical fact, such as freezing, proves to be dependent upon a purely chemical fact—the molecular weights of the solvent and the dissolved body; and this physical law is so general that it has become a very accurate means for determining such chemical data as molecular weights. Chemistry and physics appear again so closely interwoven that there is really no means of separating them.

It is not possible to describe in a few words the impetus given by the discovery of these connections to physico-chemical research altogether. A school, headed by Ostwald, of most enthusiastic supporters of what has been termed (not quite properly) the physical theory of solutions, has grown up; and this school, while bringing out a mass of important researches and widening the field of chemical investigations, has naturally come to consider itself as being on the right track for elaborating a complete theory of the subject. Unhappily, this is not the case, because the chemical reactions which undoubtedly take place in solutions are not taken into account in the just-mentioned physical laws. In reality, so long as but small amounts of solids, or liquids, or gases are dissolved in a liquid, and so long as only such bodies are brought into contact as have no strong chemical affinity to each other, the above theories are quite correct. But as soon as the solution is rendered stronger, or the solvent and the dissolved body are endowed with a mutual chemical affinity, chemical reactions set in. Part of the molecules of the dissolved body dissociate, and the atoms of which they were composed, on being set free, combine with the atoms of the solvent. Chemical forces, much more energetic than the physical forces, enter into play, and most complicated chemical reactions—the intensity of which may be judged of from the changes of temperature—begin. To deny them is simply impossible, although this has been done in the excitement of polemics. The chemical reactions which take place within the solutions, and especially the formation of definite though unstable compounds of salts, acids, and bases with water, have been rendered evident by so many careful investigations of experienced chemists, that the secondary importance given to them by most adherents of the physical theory would be simply incomprehensible were it not for the hope which they cherish of ultimately explaining all chemical processes by the above-mentioned molecular movements. At any rate, in order to account for the effects of the chemical reactions, the followers of the physical theory were compelled to seek support in an additional agency — electricity. Starting from the familiar fact of solutions being decomposed by an electrical current, they admitted that in every solution part

of its molecules dissociate, breaking up into their component parts, which are charged with either positive or negative electricity (the name of "ions" is usually given to those component parts). By means of this admission, they attempted to explain the discrepancies between observation and the conclusions drawn from the above-mentioned laws, especially in the case of water solutions of salts, acids, and bases, and the stronger solutions altogether. It must be recognized that many important relations between electrical conductivity and chemical action have been brought out in this way by Arrhenius and his followers, and many discrepancies between the laws of Van 't Hoff and Raoult and the observed facts have been explained. But it is also evident that, once a partial dissociation of molecules is admitted, the whole takes a chemical aspect, and reference to such an unknown cause as electricity does not simplify the matter. All kinds of chemical reactions take place in solutions. Some molecules of the dissolved body simply exchange their atoms in succession, while maintaining the same grouping of atoms, and consequently the same chemical composition. In other molecules the grouping only of the same atoms is changed, and we have reactions of replacement, or isomerism. But, at the same time, new and more or less stable combinations between the atoms of both solvent and dissolved body take place in various proportions; double decompositions most probably occur as well; while the physical phenomena of sliding of undecomposed particles continue at the same time—the *physical* movements of the particles being impressed by, and acting upon, the *chemical* movements of the atoms within the molecules.

It must be confessed that neither theory has as yet succeeded in following this multitude of movements and of catching the moment when the movements of particles are transformed into atomic movements and re-distribution; and though we may name several equally important works which have been published on this subject during the last twelve months, we can mention none which have thrown new light on the subject. Let us only add that the subject itself has been immensely widened of late by the wonderful researches of Heycock and Neville on the lowering of the temperature of solidification of metals, by the addition of other metals, and of Roberts-Austen upon alloys—that is, metals dissolved in metals—which behave very much like all aqueous solutions. However, a new departure in this branch has been made, quite recently, by Messrs. Harold Picton and S. E. Linder. They studied the structure of solutions of sulphide salts which offer the advantage of giving a whole series of gradations between real solutions (that is, liquids which seem to consist of liquid particles only) and such as contain extremely small particles of solid matter in suspension. By submitting the series to various tests, it was ascertained that all these solutions, even those reputed as homogeneous, contain infinitely small solid particles, the presence of which is revealed, on Tyndall's method, by a beam of light. In some of them the particles—all of the same size and performing rapid oscillatory movements—are even seen under the microscope, when magnified a thousand times; while in antimonium sulphide the very formation of coarser agglomerations out of invisible particles can be followed under the microscope. In-

short, the authors came to the conclusion that there is no sharp limit between a state under which the mutual attractions between the particles of the solvent and the suspended particles of the dissolved body are very feeble, and a state when, these aggregations becoming a smaller size, the forces which keep them in the solution become of a decidedly chemical nature. A new and promising method is thus given.

If we take into account the rapid accumulation of data relative to the subject of solutions and the various theories already germinating, we may hope that the day is not far off when a complete theory of these phenomena will be possible. Let us only remark that all the work hitherto done confirms more and more the idea which becomes more and more popular among chemists, and which Mendeleeff has so well expressed in a lecture delivered before the Royal Institution in May 1889; namely, that the molecules of all bodies, simple or compound, borrow their individualities from the characters of the movements which the atoms perform within the molecules. Each molecule may be considered as a system, like the systems, of Saturn or Jupiter with their satellites—each separate type of such systems giving a separate type of molecules, and the chemical properties of the molecules being determined by the character of the system and its movements. It may already be foreseen that further progress in the great investigation into the mechanical basis of chemical energy will be made in this direction.

—*Nineteenth Century.*

THE EDITOR.

Lost Time in Colleges.

The new University of Chicago proposes to be in session the entire year, and students in good health may prosecute their studies each full year, instead of about three-fourths of the year, as is the almost universal rule. This is a very wise step on the part of the new institution.

Colleges are generally at work from nine to ten months, of four weeks each, in a year. They have one or two weeks vacation at Christmas holidays, and usually adjourn for every national, and often for each local holiday. The average college does not do full work for more than two-thirds of the year, and fully one-third of the student's time is lost. More than this: students in these institutions generally work from six to eight hours per day for only five days in the week, and thus from four to seven years are required to complete a college course. Now add to this the two to four years the student requires in preparation for his special life-work, and it will be readily seen why comparatively so few young people complete a college course, and why so many people can be found who think it does not pay. The whole scheme is made too expensive; not only in money, but much more in time. Not only this, but habits of indolence are acquired, and young people are taught to think that after eight or nine months' labor they require

three or four months' rest, and as this fractional part of the year cannot be used in any regular business, being too fragmentary and too short, if the student undertakes any work of any kind, it is sometimes like a worthless book agency, or other matters of as trivial a nature.

Is school work so severe that both student and faculty are exhausted at the end of nine months, and require the rest of the year for recuperation? Merchants, salespeople, travelling men, mechanics, and in fact almost all classes of people labor devotedly for almost the full year, with a short vacation of from two to four weeks. It is conceded by all experts that worry and not work is what wears out. Every person, no matter what his work or calling may be, should have a vacation of from two to four weeks each year, and this, under all ordinary circumstances is found sufficient. People whose work is particularly annoying, or who may be victims of very delicate health, certainly require more. Is a student's work particularly annoying? On the contrary, it is generally free from care and ought to be of a most delightful nature; and, as in most institutions the student prosecutes three or four different lines of study, for instance, one in mathematics, one in language, one in science, and usually something in literature, there is, or at least there may be, sufficient variety in his work that he can readily keep out of what is known as the "monotony of the tread-mill".

We honestly believe that the plan of the Chicago University in having school the entire year, will be earnestly appreciated and greatly prized by thousands of young men who are not willing to lose so much of their valuable time. In colleges students are required to work from six to eight hours per day, and this only for five days in the week. On entering the universities students are usually 20 or more years of age, and, where in good health, are physically able to do nearly double this amount of work. We see no reason why from ten to twelve hours a day of study and recitation in a variety of branches, as above described, should in any way be harmful to the health of the student. On the contrary, we have noted a number of instances where students have entered an educational institution in poor health, and where, by observing the rules of good living, and being systematic in their work, they have worked from ten to twelve hours per day for the entire year, and have recuperated health, and gone out from the institution after three or four years, in very much better physical condition than when they entered it. Would not three or four extra hours per day in study and recitation be less harmful to young men than the midnight dissipations that are common to so many institutions? Any young person in fair health who will allow himself eight hours for sleep, who will give himself one hour for each meal, who will also allow himself one hour per day in which he feels he has nothing to do, and will spend that hour in exercise, either walks, gymnastics, or light work, or in any cheerful manner, may then devote the other twelve hours per day to careful study and recitation, and will never suffer the slightest in his health.

It is often remarked about many of our great men that they worked themselves to death. The writer does not believe there is a single instance where this is true. On the contrary, when we know the secrets of their lives, we find

it was some annoyance or some worry, or some irregularity that shortened the life, and not the work ; and there can be brought an unbroken line of testimony that earnest, honest, systematic work, with reasonable time for sleep and meals, never result in harm.

The Crescent.

The following named officers were elected for the fall term of '92 : M. X. Geske, President; W. H. Johnson, Vice Pres.; Martha Fulton, Recording Secretary ; Carrie DuVal, Corresponding Secretary; J. W. Whiteside, Treasurer; William Dunn, First Critic; Marie Chatfield, Second Critic ; P. H. Moroney, Chorister ; Nora Whitney, Assistant Chorister; E. P. Harmon, Editor; Nicholas Schilling and B. G. Snow, Marshals; W. H. Johnson, L. A. Martin, and Mary Fulton, Executive Committee.

The anniversary exercises were listened to by an audience of over two thousand people, and were a success in every particular.

A. H. Kreiling has taken the principalship of schools at Hebron, Indiana.

Miss Edna Landis is teaching near Duluth, Minn.

Many once familiar faces were again seen among the Crescents during commencement, conspicuous among them being those of Miss Lillian Stockwell, ex-presidents, Stokoe, Rogers, and Stroeter.

Mrs. W. E. Volkee, formerly Miss Emern Nolan, is visiting in Bristol South Dakota, where she expects to spend the winter. She has been very successful in a number of elocutionary entertainments which she has been giving in that part of the country. E. P. H.

The Star.

Miss Lillie Jones, Scientific of '92, who is teaching the Brighton Park School, Chicago, spent Oct. 1, 2, with friends on the Hill. Marie Larson of '92, accepted the assistant Principalship under E. Manley, Dawson, Minn. F. P. Young returned to Medical College, Louisville, Ky. G. G. Feldman is in Ann Arbor, Michigan, taking Post graduate in Law. Miss Rosa Brown is teaching in her home city, South Bend, Ind.

Prof. J. B. F. Showalter and N. C. Stott have rearranged the Star program so that it now presents an artistic appearance. The efforts of these gentlemen are highly appreciated by the public.

The present officers are : President, N. C. Stott ; Vice President, Maxwell Hoffman ; Recording Secretary, Lizzie Baker ; Corresponding Secretary, Beth Wood ; Treasurer, R. L. Moore ; 1st Critic, G. C. Glassel ; 2nd Critic, Hattie Baker ; 1st Editor, Andrew Clark ; 2nd Editor, Jas. Riggs ; Vocal Chorister, J. Hayward ; Instrumental Chorister, Rachel Curtis ; 1st Marshal, E. O. Busenburg ; 2nd Marshal, Emma Darst; Reporter, J. J. McManaman ; Commissioners, J. H. Cloud, C. B. Goodrich, J. E. Kearnes. J. J. Mc.

BOOKS AND MAGAZINES.

Among the recent important changes in the magazine world is the transfer of the KINDERGARTEN MAGAZINE to the Misses Andrea and Amelia Hofer, who assumed charge of this interesting educational monthly with the September number. The magazine has been remodeled and appears under a new cover, which does justice to the dignified cause it represents. The September number presents a strong table of contents, among other articles, a discussion of Columbus and the Schools, the Kindergarten and the Primary School, Art Studies from Life, and a generous department for practical work and suggestions for the Kindergarten and home.

The OCTOBER OVERLAND MONTHLY contains a very carefully prepared and fully illustrated article on the University of California, the greatest of Pacific Coast institutions of learning. Its history, growth, and present condition, is told by Milicent W. Shinn, whose article last year on the Stanford University

attracted general attention. The number also contains another of the OVERLAND'S popular outing articles. *Lawn Tennis in California* is a paper written by J. J. Archibald, an experienced tennis expert, and carefully illustrated under his supervision. No pains have been spared to make the paper accurate and reliable. The illustrated papers on Pacific Coast scenery are continued by Mabel H. Closson, on a trip to Cook's Inlet, entitled *An Alaskan Summer.*

The October ATLANTIC opens with on able paper by James C. Carter, entitled *Mr. Tilden.* He gives an interesting resume of Samuel J. Tilden's place in public life. Alexander Brown, author of *Genesis of the United States,* has a paper on *The English Occupancy of North America,* and incidentally endeavors to put Captain John Smith back into his rightful obscurity. Mr. Hale's amusing papers on *A New England Boyhood* are continued, and Boston Common and his associations with it forms the subject of this new installment. Professor Shaler writes on a subject of the day, namely, *The Betterment of our Highways,* and Mary A. Jordan has an article on *The College for Women.* There is the usual amount of good poetry and fiction. The number is a striking and altogether excellent one.

Do you read the ARENA? This great review occupies a field all its own, and ought to be read by every thoughtful American citizen.

The October number contains the fourth and closing paper in the Brief for the Plaintiff, in the now celebrated Bacon-Shakespeare case. In the November nnmber, the Brief for Shakespeare will be opened, Mr. Reed contributing the opening paper. He will be followed by Prof. W. J. Rolfe, the eminent American Shakespearean critic, and by Dr. F. J. Furnivall, of London, and Rev. Dr. A. Nicholson, of Warwickshire, two of the most celebrated Shakespearean scholars of England. Ignatius Donnelly will furnish a brief closing argument for the plaintiff. The ARENA has long since forged its way into the very foremost of the great liberal and progressive reviews. Now it enters the field of literary criticism in such a way as to command the attention of America and Europe. The Bacon-Shakespeare controversy will elicit the attention of more eminent critics than any other purely literary discussion of the year.

A valuable and pleasing number is THE POPULAR SCIENCE MONTHLY for October. There is a timely article on *Specifics for the Cure of Inebriety,* by Dr. T. D. Crothers, who tells what the signs are by which a great quackery may be distinguished. A notably interesting article is that on *The Evolution of Dancing,* by Lee J. Vance, which is accompanied by ten spirited illustrations. In his Lessons from the Census, Carroll D. Wright treats of *The Native and Foreign-born Population*—a subject on which every citizen should be informed. In *Language and Brain Disease,* Dr. H. T. Pershing shows how loss of speech from brain disease throws light upon the process of obtaining the mastery of a language. John Coleman Adams describes the grand work of Redfield, Espy, Hare, Loomis, and other American meteorologists. There are many other excellent articles and an exceptionally good number is closed with a sketch of the life of Alexander Winchell.

"From every man according to his ability; to every one according to his needs," the motto of the vigorous COSMOPOLITAN, is well exemplified in the September issue. For general excellence and variety it is unexcelled, and admirably calculated to charm all classes of readers. No description can be more charming than Mary Hasbrouck's *Jersey,* with its restful illustrations. Charles W. Dabney's *Advance of Education in the South* is suggestive, and the note of warning sounded in the thoughtful "*Homestead*" *Lesson* should be listened to by every American voter. Many other timely papers are presented, and several poems and stories among

which the dainty *Amma-San* is particularly noteworthy.

In the CALIFORNIAN for September Prof. Elliot Coues discusses the question *Can Ghosts be Photographed?* The article is well illustrated by a variety of grewsome pictures from original photographs. Local interests are represented in *Yachting Around San Francisco, A California Loan Association, The Missions of California,* and a well written illustrated paper on Throop University. A thought provoking article is Richard H. McDonald's *How to Secure Good Municipal Government.* The issue is an excellent one and fully up to the high standard maintained by this excellent publication.

WHAT THEY ARE DOING.

M. C. Landis teaches in LeClaire, Ia.

W. E. Hagy teaches in Kanopolis, Kan.

H. D. Wilson goes back to Monroe, La., for another year.

M. T. Flanncry superintends the schools of Cloverdale, Ind.

C. R. Spicer will give instruction to the youth of Rochester, Ill.

John Loeffler is Principal of a ward school in Decatur, Illinois.

O. W. Storer began Sept. 5, as principal of the Dunkirk, Ind., High School.

Miss Laura McCaw has a good position in the schools of Bay City, Mich.

O. O. Haga is Principal of a prosperous school in Mt. Sterling, Wisconsin.

I have a pleasant letter from A. M. Otwell who writes from Lewisville, Texas.

R. G. Popham has charge of the schools of Walker, Ia. There are eleven grades.

Miss Alice McCann, of '91, has charge of the Grammar Dept. of the Dundas, Minn. School.

J. S. Puett is Superintendent of the schools of Southport, Ind. He also teaches the High School.

Albert Lynch is managing the schools of Flushing, Mich. He likes his work and surroundings.

J. C. McGhee has accepted a position in San Francisco, at a salary of $100 per month.

John Lowe writes a pleasant letter from Weatherford, Texas, where he is located.

W. T. Roper of Parkman, O., has been elected Supt. of the schools of Perry, Ohio, at a salary of $90 a month.

E. T. Blackney is Principal of the Swartz Creek, Mich., schools, and treasurer of the Teachers' Association of Genesee Co.

A. L. Moore is doing a good business as special agent for a N. Y. Insurance Co. He expects to be in school next year.

A. A. Quinlan is doing university work in Lawrence, Kansas. Cassie is Assistant Principal of the Kiowa, Kan., school.

W. A. Root has been elected Principal of the High School of Highmore, S. D. He is in a pleasant place and likes his work.

Miss Clara L. Weyer, who has been teaching for a year in Kansas, has accepted a position in the schools of Janesville, Wis.

L. D. Gillespie, now teaching in Humbolt, Ill., writes that he will be with us to enter the Law Department next year.

S. D. Bickford is doing good work for the people of Neche, N. D. Such men as he are a help to every community in which they live.

N. P. Hull, who has been teaching in Minnesota for the past two years, goes, this year, to Port Byron, Ill., a Principal of the High School of that place.

Lyma A Vest teaches music in Zanesville, Ohio. Lily C. Ruegg gives instruction in the same branch in Garner, Ia. Both merit success.

J. W. Bence is the Principal of the Southern Iowa Normal, Scientific, and

Business Institute. C. M. Jansky teaches in the same school. They announce an excellent opening.

J. P. Mullin has resigned his position in Fremont, Neb., to accept the chair of ancient languages in the Western Normal College of Lincoln, Neb.

D. D. Feldman writes encouragingly from Creighton, Neb., where he has a good position. L. M. Troup and S. G. Baker are also teaching in the West, the former at Frankfort, S. Dak.

Miss Tillie Shay will teach the coming year in Snohomish, Wash., having charge of the High School of that place. She has a good position and is pleasantly situated.

C. O. Smith is Deputy Treasurer of Fulton Co., Ind. Mrs. Smith teaches in the Rochester schools. G. R. Fish remains at Bloomingsburg, and Milo King will be Principal of the schools of Fulton.

C. M. Holt, after a delightful summer spent in New England, is back at his work in Ann Arbor. He reports Messrs. Wray and Larson as being students in the same school.

Three marriages to announce this month: Edward VanFleet and Lena Wheelock, at Bedford, O., Sept. 14; J. M. Canfield and Anna Garrett, at Hoskins, O., Aug. 3.; J. L. Burns and Dollie Jenkins, at Centre Point, Ind., on the 11th of Sep. THE STUDENT extends kindest wishes to all of them.

Mr. and Mrs. C. W. Vance have accepted positions in the school of Spangle, Wash., Mrs. Vance, in the primary department and Mr. Vance the Principalship. They have taught in the schools of Schuyler, Neb., for the last six years.

The Dwight, Ill., Schools are superintended by W. T. Wilson. Mr. Wilson writes,—

School is in a very flattering condition here. I have nine assistants, with a total enrollment of 400 pupils The High School numbers fifty-nine. Mr. C. E. Swanson, principal of one building, is doing good work. All my teachers are good, and everything seems to point toward a successful year's work.

F. F. Heighway has begun his second year's work in Clifton, Kansas. He writes,—

School is progressing finely with a much larger attendance in the High School than last year. I like Kansas quite well and am very much pleased with my work here. I will show THE STUDENT to some of my friends here and perhaps they will like to take it. I am quite sure that they can get no better journal.

THE STUDENT is proud to number W. H. Hounsley of Carlinville, Ill., among its friends. Here is an extract from a recent letter:—

I can't do without THE STUDENT. I can find but one fault with it and that is it comes untrimmed and I get so anxious to read that I some times tear the leaves in trimming them.

[The leaves have been left uncut of late for the benefit of those who wish their volumes bound. If it suits our readers better, however, we will trim as heretofore.]

L. I. Knowlton, of Butte, Montana, writes,—

I have been employed to teach in one of the Public Schools of this city, at $80 per month, for a term of ten months. I consider THE STUDENT to be the best School Journal published in the United States for $1.25. And I think that all of the former pupils, of Valparaiso, will do all in their power to extend its circulation. I met J. M. Traughber, a Scientific of 1889, in Ellensburg, Wash. He is candidate for County Superintendent of Kittitas County Wash., on the People's Party Ticket.

Mr. Worstell, who went to Texas last fall with myself, has been engaged as one of the teachers in the Ft. Worth High School.

The following is an extract from a communication from J. S. Landers who writes from Mascoutah, Ill.

I have changed locations this year notwithstanding an offer of favorable increase of salary at Irving. This is the first time I have accepted a position outside of my home county, and I regret somewhat leaving the place where my former work has been; but I feel justified in changing this year because of a better position. I have a principalship a school of nine rooms. We teach nine months beginning to-day. (Aug. 29.)

Last week, I met a number of former Valparaiso students at the Southern Illinois Teacher's Association convening at East St. Louis. Among others was L. H. Carson the esteemed Co. Supt. of Washington County. I still anxiously watch for the coming of THE STUDENT. Valparaiso students like no other so well. I wish it all success.

PUBLISHER'S PAGE.

THE STUDENT.

M. E. BOGARTE, EDITOR.

H. N. CARVER, MANTIE E. BALDWIN, ASSOCIATE EDITORS.

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In addition to the trains now running on the Nickel Plate they have lately put on two new through passenger trains between Buffalo and Chicago. Train going west leaves Valparaiso at 6, A. M.; east, 11-45 P. M.

* * *

Ripan Tabules: for torpid liver.

* * *

We want at this office several copies of THE STUDENT for September, 1891. Any one sending us a copy of that issue will have his subscription advanced one month in payment therefor.

* * *

The American Book Company has recently introduced Appleton's School Physics into the schools of Ft. Wayne, Goshen, Oxford, Knightstown, Salem, and Pendleton. Among their orders for Harper's Inductive Latin Primer are 15 copies for the Vincennes High School, 18 copies for Oxford, 30 for Bluffton, 30 for Greensburg, 75 for Bloomington. "Nothing succeeds like success."

* * *

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* * *

THE STUDENT has received more encouraging words this month, than during any other time in its history. We thank you for your renewals and kind expressions of appreciation.

* * *

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AUGUST EXAMINATION QUESTIONS FOR INDIANA.

ARITHMETIC.

1. In 10,977,120 square inches of land, how many acres, and how much is it worth at $75.18¾ per acre?

2. If $6 be deducted from ⅝ of A's money, he will have 6 times as much as B, who has $4. How much has A? Analyze and explain fully.

3. If $8,000 of five per cent. stocks be sold at 90, and the proceeds be invested in 3½ per cent. stocks at 60, find the alteration in income per annum.

4. If the area of a square field is 2,209 square rods, how many rods of fence will be required to enclose it?

5. A man buys ⅝ of a piece of property and sells 20% of his share for $5,000, thereby clearing 25% on its cost. What was the original cost of the whole property?

6. A cistern has three receiving pipes. One can fill it in 11 hours; another in 8 hours, and another in 7 hours. In what time can all three pipes fill it?

7. Bought a check on a suspended bank at 55% of its face value, exchanged it at par for stock in a manufacturing concern at 60% which pays 7% annual dividends. What per cent. do I make on the money invested?

8. Date of note, Oct. 25, 1884; principal, $1,750.25. Credits, Feb. 28, 1885, $50.25; June 14, 1885, $25; Oct. 20, 1885, $350; May 8, 1886, $575. Find amount due Sept. 8, 1886. Interest, 6%.

ANSWERS.

1. 6,272,640 sq. in. = 1 acre.

$$1 \text{ sq. in.} = \frac{1}{6272640} \text{ acre.}$$

$10{,}977{,}120 \text{ sq. in.} = \frac{10977120}{6272640} \text{ acres} = 1\frac{3}{4} \text{ A.}$

1 acre = $75.1875

$1\frac{3}{4}$ acre $= \frac{7}{4} \times \$75.1875 = \$131.57\frac{1}{8}$.

2. Six times B's money is 6 × $4 or $24.

⅝ of A's money diminished by $6 = $24

∴ ⅝ of A's money = $30 *

⅛ of A's money = ⅕ of $30 or $6

⅜ of A's money = 8 × $6 or $48.

* This equation is gotten from the preceding one by adding $6 to each member of the equation.

3. 100% = $8,000, P. V. of 1st stock.

1% = $\frac{1}{100}$ of $8,000 or $80.

5 per cent. = 5 × $80 or $400, income from 1st stock.

90 per cent = 90 × $80 = $7200, M. V. of 1st stock.

60 per cent. of 2d stock = $7200, proceeds of 1st stock.

1 per cent. = $\frac{1}{60}$ of $7200 = $120.

3½ per cent. = 3½ × $120 or $420, income on 2d stock.

$420 − $400 = $20, the difference in the incomes.

4. $\sqrt{2209} = 47$, no. of rods in one side of field.

4 × 47 = 188, no. of rods required to enclose the field.

5. 20 per cent. of ⅝ = ⅕ of ⅝ or ⅛, part of property sold.

25 per cent. on = 20 per cent off.

20 per cent of $5,000 = ⅕ of $5000 or $1000.

$5000 − $1000 = $4000, cost of ⅛ of property.

∴ ⅛ of property = $4000

⅜ of property = 8 × $4,000 or $32,000.

6. The 1st pipe will fill the cistern in 11 hrs.

∴ the 1st pipe will fill $\frac{1}{11}$ cistern in 1 hr.

The 2nd pipe will fill the cistern in 8 hrs.

∴ the 2nd pipe will fill ⅛ cistern in 1 hr.

The 3rd pipe will fill the cistern in 7 hrs.

∴ the 3rd pipe will fill ⅐ cistern in 1 hr.

∴ The three pipes will fill $(\frac{1}{11} + \frac{1}{8} + \frac{1}{7})$ of the cistern in one hr.

$\frac{1}{11} + \frac{1}{8} + \frac{1}{7} = \frac{221}{616}$

∴ $\frac{221}{616}$ of the work = 1 hr., all working together.

$\frac{1}{616}$ of the work = $\frac{1}{221}$ hr, all working together.

$\frac{616}{616}$ of the work = $\frac{616}{221}$ hr., all working together, = 2 hr. 47 min. 14.4 sec.

7. 100 per cent. = P. V. of check.

55 per cent. = M. V. or money invested

60 per cent. of inv. = 100 per cent. P. V.

1 per cent. of inv. = ⅝ per cent. P. V.

100 per cent. of inv = 166⅔ per cent. P. V

7 per cent. of 166⅔ = 11⅔ per cent., rate of income on 60 per cent.

11⅔ per cent. is what per cent. of 55 per cent.?

55 per cent. = 100 per cent.

1 per cent. = $\frac{20}{11}$ per cent.

11⅔ per cent. = $\frac{35}{3} \times \frac{20}{11}$ per cent. or $\frac{700}{33}$ per cent. = $21\frac{7}{33}$ per cent.

8. 1886—9—8
1886—5—8
1885—10—20
1885—6—14
1885—2—28
1884—10—25

4—3 ($50.25)
3—17 ($25.00)
4—6 ($350.00)
6—18 ($575.00)
4—0 (Settlement).

Principal of note =	$1750.25
Int. on P. to Feb. 28, 1885 =	$35.98
Amt. of note at time of 1st credit =	$1786.23
First credit =	$50.25
Balance due =	$1735.98

Int. on N. P. to June 14, 1885 is (by inspection) more than the payment. We therefore find int. on N. P. to Oct. 20, 1885.

Balance due on N. P. =	$1735.98
Int. on N. P. to Oct. 20, 1885 =	$67.40
Amt. due at time of 3rd credit =	$1802.38
2nd and 3rd credits =	$375.00
Balance due =	$1427.38
Int. to May 8, 1886 =	$47.10

Amt. due at time of 4th credit =	$1474.48
4th credit =	$575.00
Balance due =	$899.48
Int. to time of settlement =	$17.99
Sum due at settlement =	$917.47

NOTE: In subtracting dates I have used the method suggested by Ray: viz., When a month is borrowed count the actual number of days in that month. Hence, in the second date above, I have 3 mo. 17 da. instead of 3 mo. 16 days.

GRAMMAR.

1. Write a sentence containing a clause within in a phrase. Designate.
2. State what uses a noun may have in a sentence.
3. What functions in a sentence may a clause fulfill?
4. Correct any errors in the following: I shall return on Monday unless it rains. They proposed to have visited Rome the following year.
5. Write sentences illustrating the use of the noun in each of the persons, using the same noun in each of the sentences.
6. In what respects do pronouns differ from nouns?
7. In what respects are adverbs like adjectives?
8. When Louis the Fourteenth said, "I am the State," he expressed the essence of the doctrine of unlimited power. Analyze above sentence. Give construction of "State," "essence."
9. Though you took his life, bury him as a prince. Though Tom were a year younger he would still be too old for an infant school.
   In what mood is the verb *took*? Give reason for your belief. Same of the verb *were*.
10. Write a sentence containing a relative clause that is restrictive, and one containing a relative clause that is not restrictive. Punctuate each correctly, and give reason for each mark used.

ANSWERS.

1. "For him to say that he will not return is unjust"; "that he will not return" is a clause, the object of "to say."
2. This depends entirely upon which particular property is indicated. If construction is meant, then the noun may be used between twenty and thirty ways, which would be impossible to give in answer to the question.
3. That of an adverb, adjective, noun.
4. The first sentence may be considered correct. The second should be "They proposed to visit Rome the following year." This sentence might mean differently, but as we understand it the grammatical construction is all that is to receive attention.
5. (a) I, John, will go to town. (b) You, John, may go to town. (c) They said that John might go to town.
6. Pronouns differ from nouns in form, in some of the constructions, and in their use.
7. Adverbs are like adjectives in their restrictive sense.
8. "He" is the subject and "expressed" the predicate. "Expressed" is modified first by "essence" and its modifiers, an objective element; "essence" is modified by "the" and by "of doctrine" with its modifiers, adjective elements; "doctrine" is modified by "the" and "of power", adjective elements; "power" is modified by "unlimited," an adjective element. "Expressed" is also modified by "Louis the Fourteenth said", 'I am the State', "an adverbial element. It is also a complex clause, of which "Louis the Fourteenth" is the subject and "said" the predicate; "said" is modified by the clause "I am the State," an objective element, of which "I" is the subject and "am the State" is the predicate; "am" is the copula and "State" is the attribute, the attribute modified by "the," an adjective element. "Said" is also modified by "when," an adverbial element. "State" is in the predicate with "am," referring to the subject, "I."
9. "Took" is in the indicative mode; it asserts a fact as existing. "Where" is the subjunctive mode, because it represents a condition as not existing now.
10. The farm which he is tilling is valuable. The man who purchased the farm has not returned.

HISTORY.

1. Name five European nations that made permanent settlements within the present limits of the U. S., and state one place where each nation made a settlement.
2. Give a brief account of each of the following named persons in connection with American history: Roger Williams, Wolfe, D'Estaing, Perry, Robert Morris.
3. Name ten of the leading American inventions, and tell by whom each was made.
4. On what ground did the English claim that they were justified in taxing their American colonies? On what grounds did the colonies refuse to pay the taxes?
5. To what political party did Clay belong? J. C. Calhoun? J. Q. Adams? Thomas Jefferson? George Washington? Andrew Jackson? Alexander Hamilton? Stephen A. Douglas? Daniel Webster? A. Lincoln?

ANSWERS.

1. England, Massachusetts; France, South Carolina; Spain, Florida; Holland, New York; Sweden, New Jersey.
2. Roger Williams came from England to Massachusetts in 1631 and settled at Salem. He was banished in 1635 for holding that the civil law should have nothing to do with matters of faith and worship. He founded Providence, R. I., in 1636, and made it a place

where perfect freedom in religious belief and practice might be enjoyed. Gen. Wolf was was the commander of the English forces in "the expedition against Quebec" in 1759. He captured the city Sept. 15th, but was killed in the engagement. Count D'Estaing was the commander of the fleet which France sent to aid the Americans in 1778. He took an active part in the French Revolution and was guillotined in 1794. Commodore Perry was born at Newport, R. I., in 1785. He commanded the fleet which defeated the English fleet on Lake Erie Sept. 13, 1813. He died of yellow fever at Trinidad in 1819. Robert Morris was born in England in 1734. He came to America and was a merchant in Philadelphia before the Revolution. He was a signer of the Declaration. In 1781 he was made superintendent of finance and rendered most important services to the new government. He lost his fortune and was imprisoned for debt in his old age. He died in 1806.

3. Cotton Gin, Eli Whitney; sewing-machine, Elias Howe; Steam boat, Robert Fulton; screw-propeller, John Ericsson; telegraph, S. F. B. Morse; telephone, A. G. Bell; Armored war-ship, John Ericsson; repeating fire arms, Col. Colt and Dr. Gatling; air brake, Geo. Westinghouse; cylinder printing- press, R. M. Hoe.

4. England had a heavy debt, part of which had been contracted in defending the colonies against the French and Indians; hence England claimed that the colonies should help pay the debt. The colonies objected on the ground that they had no representation in the parliament which enacted the tax laws.

5. Henry Clay was a Whig; J. C. Calhoun, a Democrat; J. Q. Adams, a Whig; Thomas Jefferson, a Democrat; George Washington, a Federalist; Andrew Jackson, a Democrat; Alexander Hamilton, a Federalist; Stephen A. Douglas, a Democrat; A Lincoln, a Republican.

PHYSIOLOGY.

(*Answer seven questions.*)

1. What are tissues?
2. Minute structure of bone.
3. Coagulation of blood.
4. Action of auricles and ventricles.
5. Structure of Stomach.
6. Explain inspiration and expiration.
7. Structure and work of skin.
8. Structure of the globe of the eye.

ANSWERS.

1. Tissues are fundamental structures composed of anatomical elements, *i. e.* cells and fibers; they enter into the composition of organs and systems.

2. Bone is composed of Haversian systems which consist of lacunal, caualiculi and Haversian canals. Surrounding these are thin laminae of bone tissue with long axes placed so as to receive the stresses which fall upon them and which the bones are designed to support.

3. Blood coagulates when exposed to any but perfectly normal conditions in the healthy blood vessels. Delicate fibrils of fibrine are formed which entangle the corpuscles and form a firm coagalum.

4. The auricles receive the blood, the ventricles are force pumps to raise the blood from the low pressure veins to the high pressure arteries.

5. The stomach is composed of 4 membranes, outer serous, middle muscular, inner mucous. The latter two are connected by the submucous areolar tissue.

6. They are the two acts of respiration. In inspiration the diaphragm descends, the sternum raises and moves forward and the angles of the ribs move outward, air rushes in to fill the space. In expiration precisely the reverse takes place.

7. The skin is composed of two layers, the cuticle and cutis. The former is composed of flattened scales, nonvascular and without nerves. The cutis is composed of a dense network of fibres, of connective tissue, oil glands, perspiratory glands and muscles. It is well supplied with nerves and blood vessels. Its function is to protect, enclose, etc. It regulates body temperature, and is secretory and excretory.

8. It is composed of 3 coats: outer, sclerotic; inner retina; middle, choroid. It has an anterior and posterior chamber, an aqueous and vitreous humor and a crystalline lens for the refraction and focusing of light upon the retina. It is nature's camera obscura, or magic lantern.

GEOGRAPHY.

(*Answer any seven.*)

1. Draw a sketch of Africa so as to show the zones. On the drawing place names showing the native vegetation of the different parts of the continent.
2. What are the chief conditions which determine the climate of a place?
3. Compare and contrast Germany and the United States in respect to the following points:
   a. Form of government.
   b. Industries.
   c. Educational interests.
4. Compare the difference between the longest and the shortest day in St. Petersburg with the same difference at New Orleans.
5. Compare and contrast Minnesota and Mississippi as to productions, and account for differences found.
6. Locate the vertical sun on the 21st of June, the 22d of September, and 22d of December. State the limit to which the slanting rays of the sun extend at each date.
7. Sketch a map showing the drainage of Europe.
8. Explain why regions far from the equator and

regions far above the sea level have a likeness of temperature.

9. Give one distinguishing physical characteristic, and one distinguishing mental trait of each race of men.

ANSWERS.

1. ——

2. Latitude, ocean currents, altitude, influences of various bodies of water and relative positions to hilly and mountainous regions.

3. (a) Germany is a monarchy; United States a republic. Their legislative departments are each vested in two houses, the members of one of the bodies of each country being appointed by their several state governments; and of the others by vote of their people. (b) The agricultural and mineral products of both countries are abundant, but in the quantity and variety of production United States excels on account of its area; however, Germany has the largest steel works and leads in the production of zinc. (c) Schools of all kinds are liberally provided for in both countries. Germany excels in Universities of high rank, and the United States in the character of its public schools.

4. (a) The longest day, $18\frac{7}{10}$ hours, shortest $5\frac{3}{10}$ hours. (b) The longest day, 14 hours; shortest, 10 hours The comparative difference is $4\frac{7}{10}$ hours.

5. Both states produce lumber in large quantities. Distinguishing productions: (a) Cotton in great abundance, also rice, corn and sugar cane. Causes,—warm climate, low, level, and fertile surface. (b) Much wheat. Causes—fertile soil and temperate climate; also on account of its water power it is a great flour manufacturing state.

6 (a) Tropic of Cancer, the Arctic Circle beyond the North Pole. (b) Equator, the poles. (c) Tropic of Capricorn, the Antarctic Circle beyond the South Pole.

7. A straight line drawn from the Strait of Gibralter north-east to Mt. Toll-Pass in the Ural Mountains almost exactly indicates the main water-shed of Europe.

8. Because the density of the atmosphere decreases from equator to poles and from sea level to high regions.

9. There are three types of mankind, the wooly haired, the wavy haired, and straight haired. The wavy haired is noted for its acuteness of reason. The straight haired for its superstition, and reverence of the past. The woolly haired is noted chiefly for its lack of any distinguishing mental trait.

SCIENCE OF EDUCATION.

(*Answer any eight.*)

1. What is meant by a law of the mind?
2. State a mental law.
3. Define these terms: Information, instruction, education
4. Would you permit pupils to study their lessons together? Give reasons for your answer.
5. What is meant by the logical order in teaching a subject?
6. If we speak of the psychological order of the topics in a subject what do we mean?
7. Define the term method.
8. In what sense is all education self education?
9. Describe the method of discovery or development.
10. What is meant by the method of instruction?

ANSWERS.

1. One of the definite ways in which the mind does its work.
2. The depth and accuracy of a perception depends upon the amount of interested attention given to the perception.
3. The terms are not strictly logical terms and cannot be defined very strictly. As processes, or products, they might be described with some accuracy. Perhaps it might be said, that information, as a process, is the act of arranging materials already present, but not in organic relations; instruction, the act of building up what is but rudimentary; and education, the act of leading out what is potential in the mind, and so making it actual.
4. Only under very unusual circumstances.
5. The logical order of topics, is from the simple to the complex, from principles to cases involving the most complex application of the principles. The logical order in studying the natural sciences would be from chemistry to physiology.
6. The psychological order of topics, is from the concrete to the abstract. The psychological order of studying the natural sciences would be from botany to chemistry.
7. The *word* method means manner; and this must suggest the meaning of the *term*. The question probably refers to what was once regarded as a part of logic, that, namely, which discussed the proper arrangement of the parts of discourse.
8. The method of discovery is something like this: we first take as many instances as possible, we examine them as carefully as possible, and make as good a guess as we can make at the general law which explains them all. Thus, we assume the guess to be true, and see what consequence must follow deductively from the assumption. Lastly, we make an experiment in which all the conditions of the problem are carefully provided for, and see whether the experiment verifies our prediction, after making due allowances for all errors. If it does so, we infer that the guess was a good one, and call it an hypothesis. Further experiments and verifications may make it a theory, or way of looking at the things.
9. The method of instruction is the reverse of the foregoing It starts with knowledge, with the theory, and simply applies the principles in understanding the various cases met with in life.

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If I were starting to learn Phonography now, I should get Benn Pitman's *Manual* and other books and follow them.—*Dennis F. Murphy, Official Reporter of the U.S. Senate.* (*See* PHONOGRAPHIC MAGAZINE, *Vol. V, page 105—April, 1891.*)

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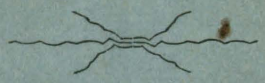

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