8-1891

The Student (Vol. 1, No. 8)

Northern Indiana Normal School

Vol. I. No. 8.

THE STUDENT.

AN EDUCATIONAL MONTHLY MAGAZINE.

AUGUST, 1891.

CONTENTS.

PUBLISHED AT THE
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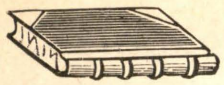

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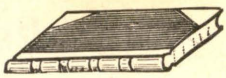

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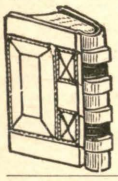

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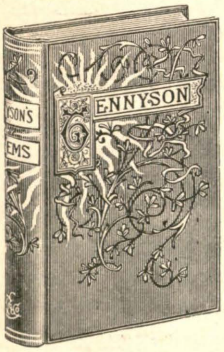

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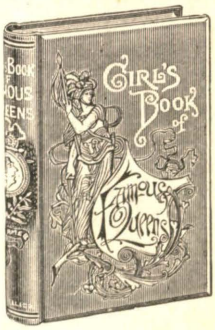

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THE STUDENT.

VOL. I. AUGUST, 1891. No. 8.

SHAKESPEARE IN THE SCHOOLS.* II.

King Lear.

H. N. CARVER.

THERE is abundance of evidence, too, that Lear is not lacking in sound judgment. He has been a good king. He has managed the affairs of the realm so well, that when the drama opens every thing seems stable and promising. He has so little apprehension of internal trouble, that he proposes to lay aside all public cares, and "unburdened crawl toward death." So prosperous are his affairs, that France and Burgundy both seek an alliance through marriage with his daughter. And every one else shares this confidence. The evils that fall upon the state come with such little premonition, that, as Edmund mockingly says, they must be explained by a "divine thrusting on." If such are the elements of Lear's character, how are we to explain his conduct in the opening scene? Were his faculties, as many critics have thought, already beginning to waver and slip? Was he insane? The answer must be, no, except in the sense that the great railroad king was insane when he wandered over the country consulting this wizard and that witch about his future, and manufactured materials for his children to use in proving his lunacy in the courts; or the sense in which the great merchant-prince was insane, when he crushed out remorselessly rival after rival, and placed such a premium upon his gold, that the resting place of his bones is known to as few as that of the Hunnish king. Without doubt, such men have a dash of irrationality in their constitutions; but they are foolish rather than insane, thoughtless, rather than wrong-thinking. "The ox knoweth his owner, and the ass his master's crib; but Israel doth not know, my people doth not consider." That was the trouble with Lear. He did not know, did not consider. He tells us himself how it was, "To say aye and no to everything I said aye and no to, was no good divinity. Go to, they are not men of their words. They told me I was every thing. 'Tis a lie. I am not ague-proof." There is the trouble. His mad-

ness has opened his eyes. Lear has been living a lie and making others do the same. He has come to think that every one will say aye and no when he says aye and no; that every one is in the market, and has nothing which may not be bought and paid for in "shadowy forests and wide skirted meads." He is so much accustomed to his own habit of capriciously commanding and the unvarying venality of his court and its love of meaningless show, that he proposes to signalize his abdication with an unwonted display. He will have his children put their love for him upon exhibition, that he may feast his heart and tickle his ears with the ribbald flattery. He knows nothing too sacred for a show, nothing too holy for an exhibition, no pearl too precious to be cast before the swine of his court. Accordingly, he turns to his child and commands her to speak, expecting a gush of flattery so fulsome that it will open the blear eyes and foul mouths of his courtiers; and her "nothing, my lord," with its sheer unexpectedness, strikes him like a stone from a catapult. The shell he has been building around him so long, and that he has thought so strong, is shattered, though he does not realize how utterly. By a little fatherly discipline, he attempts to repair the breech, only to widen it, and he sends her away, "new-adopted to his hate, dowered with his curse and strangered with his oath."

Now, what are we to say of Lear? Condemn him without qualification? By no manner of means. He is "a man more sinned against than sinning. The results, terrible as they are, are no more to be laid at his door than at the courtiers." We have no adequate conception of the power of a fool. There would be no demagogue if there were no mob; for the demagogue is but the flower of the mob, and the mob is but a commonwealth of fools. The world's disaster-days are the carnival days of its fools; and the palterings seen in the lives of earth's heroes, are but their efforts to escape from the clutch of its fools.

Something should be said of that "splendid madness," as Hallam called it, which ultimately came on; but there is time for only a reference to the vast world of science and art involved.

It is not a drivelling imbecility that falls upon him, nor a sudden breaking down of the powers of his mind. His madness comes on gradually, is indeed but the normal development of his former life and what he had permitted himself to become. No doubt, the issues are greatly hastened, but his days simply go on to their legitmate end. If the mere physiological processes of nutrition could go on normally and without abatement for a hundred years after the currents of life had become fixed in their appropriate channels, the life of such a man as Napoleon would end as did Lear's. The heart shall not feed itself on flattery and selfishness, and the life not pay the fearful penalty at the end. The mere wasting of a muscle, the breaking of the walls of an artery, the tiring of a nerve,—so simple a thing,—has saved the world from many a pitiful spectacle, and many a man from sleeping in an unenviable grave. Lear's madness is only an exaggeration of his every-day propensities. It is not that any barriers have been broken down; but that his natural inclinations break over the barriers which have hitherto sufficed to contain them, stimulated thereto by the opposition which his disregard for

the personal rights of others and his imperious will have kept in forcible restraint. He has paltered with himself so long, that he sees nothing in its true light; he has deceived others so long, that now he fails to understand himself. When he first comes under our notice after he has broken with Kent and Cordelia, he is in Albany's palace,—he "and his hundred knights,"—shrieking to an attendant, "Let me not stay a job for dinner; go, get it ready." When Goneril's servant comes into sight, he calls out, „You, you sirrah, where is my daughter?" He is one of the innocents abroad, incapable of feeling that there has been any change in the atmosphere which he breathes. Goneril appears and speaks to him language that sounds like the language of mathematics, cold and without any feeling, in the severity of its truthfulness. He stares at her and asks, "Are you our daughter?" She again speaks, and her words are harsh only because they are so true. He replies:

"Does any here know me? This is not Lear.
Does Lear walk thus? Speak thus? where are his eyes?
Who is it that can tell me who I am?"

And so it goes on. Disillusion after disillusion breaks upon him, but it always comes as a surprise,—he had not expected it. One by one the harbors which he had marked upon his chart, and into which he had hoped to sail and find quiet waters, prove but illusions, or are closed against him, and he dashes upon the reefs. Yet he learns nothing. He has never entered port, save to exchange some commodity in the market-place; never made a landing save to conquer or to bribe some foe; and now he knows no way to deal with his daughter but to threaten her. "Thou shalt find that I'll resume the shape which thou dost think I have cast off forever." When he would appeal to Regan's "tender-hefted" nature, he can say only, "Thy half of the kingdom hast thou not forgot, wherein I thee endowed." And when at last her ingratitude drives him from her door, he has no words but "I gave you all."

Thus strand after strand of the straw cables which he has been twisting part, as storm after storm strikes him. But he is still Lear. Each blast that "gallows the very wanderers of the dark," each stroke of "quick, cross lightning," he answers from the storm-shaken world within, till it seems that the very demons of discord, in the two worlds of sense and spirit, have met as in high carnival upon some field of the Cloth of Gold. Nor does the inner storm ever seem to expend itself. Its dreadful crash dies away into mutterings more dreadful; but we know that it is only because the field which made it sensible has been withered and burned up by its fury. For a moment our attention is turned away from it to trivial sights and sounds. There are armies. We see their banners and spears, and hear their drums and the measured beat of their steps. But we turn our eyes back to the stricken field. The ashes are there, cold and gray. As we look in sadness and gloom, what a marvel amid the dead ashes. The companies of the Gods are indeed rising from the ground. Lear lies slumbering peacefully upon a couch; there is low, sweet music; his child, whom he had sent away "dowered with his curse," is bending over him, uttering words that might be spoken by the lips of an angel. He wakes, and she speaks to him. He sits tottering on the edge of the couch; he moves his hands vacant-

ly, as his eyes wander from one object to another. At last he speaks :

"You do me wrong, to take me out o' the grave;
Thou art a soul in bliss ; but I am bound
Upon a wheel of fire, that mine own tears
Do scald like molten lead."

She asks him to hold his hands in benediction o'er her, and he begins to glide from the couch and kneel to her. Then, after a long, silent look, he says, "Do not laugh at me, for as I am a man, I think this lady to be my child Cordelia," and she cries, "and so I am, I am." But the scene must not be quoted, it must be read. It is the most beautiful thing in literature. Lear has found his lost self; but not in the old world of scheming and lying, of buying and selling, of cursing and hating. The love which he could not buy with his kingdom nor command with his curses, is his in the new world of realities into which he has "awakened from the dream of life."

A great deal has been written about Shakespeare's fatalism and the gloom which he hangs, like a pall, around all his greatest work. Why does he allow the good to suffer as he does ; why does he give such a fearful potency of evil to the vile, that it can engulf the innocent in such irremediable ruin? Why must such a man as the Fool wear the garb of a jester ; why must we hear his words almost a life-time before we realize what a piercing brain it is that lies under his harlequin's cap, and what a faithful, affectionate heart it is that beats under his harlequin's coat? Why must we see him go out into the darkness with the hectic fever of excessive, but utterly fruitless toil, and utterly broken hopes, burning in his eyes and upon his cheeks ; why must the last words we hear from his lips, as he passes into the silence, be only the inexpressibly pathetic, "and I'll go to bed at noon"? Why must such a life as Cordelia's go out ignominiously in prison, extinguished under the orders of such a man as Edmund, given while he was still reeking with the slime of those demon women's jealous infatuation for him ? Why could not the old king, after the artificial deformities, which his public life fed like a fungus growth, had been burned away as by lightning, and the native nobility and human-heartedness, which his public life stifled so long, had been called into new life by the ministries of Cordelia,—why could he not have a year, a month, a day of the real life with his heavenly child? Would he not have appreciated it? Had the poison of his unreal, unhuman life of flattery and self-deception so deadened his soul, that he could not comprehend the possibilities of the life opening like the vistas of paradise before him? Hear him talk with her as they are taken away to prison. Cordelia says :

"For *thee* oppressed king am I cast down ;
Myself could else outfrown false Fortune's frown."

Lear answers :

"No, no, no, no, let's away to prison :
"We two alone will sing like birds in the cage :
"When thou dost ask me blessing, I'll kneel down
"And ask of thee forgiveness. So we'll live,
"And pray, and sing, and tell old tales, and laugh
"At gilded butterflies, and hear poor rogues
"Talk of court-news; and we'll talk with them, too,
"Who loses, and who wins; who's in, who's out,
"And take upon us the mystery of things,
"As if we were God's spies ; and we'll wear out
"In a walled prison, packs and sects of great ones,
"That ebb and flow by the moon."

There are no wiser words than these in all the sayings of the philosophers; and yet in a few hours Lear is bending over her crying, as the death-mists gather before his own eyes :

"Why should a horse, a dog, a rat have life,
"And thou no breath at all? Thou'llt come no more,
"Never, never, never, never, never."

When we remember that the old chroniclers who tell the story, and Spencer in the Faerie Queen, all make the ending a happy one, Lear and Cordelia triumphant, we can scarcely wonder that Shakespeare's treatment should be noticed. Ruskin compares it with the usage of the great Greek writers, and says: "Sorrow is much more definitely connected with *sin* by the Greek tragedians than by Shakespeare. Often his victims are entirely innocent; whereas with the Greek, the victim is resolutely entangled with crime and destroyed by it. The victory over sin and death is, therefore, with the Greek tragedians more complete than with Shakespeare. At the close of the Shakespearean tragedy nothing remains but a dead-march and clothes of burial. At the close of a Greek tragedy there are far-off sounds of a divine triumph and a glory as of resurrection."

These are eloquent words, yet I cannot help thinking that the great critic is far less wise and human than the great poet. He has been taking on himself the mystery of things, as if he were one of God's spies. While he is speaking in the interest of Christian morality and art, his conceptions of sin and a triumph are essentially pagan, and point backward to the time when nature was "red in tooth and claw," and when it was thought that Heaven was surrounded with battlements, a fortress manned by savages against savage foes. I hear no dead-march and see no clothes of burial at the end of the Lear; and I look for no resurrection, either, for I have seen no coffin and heard no falling clods.

There is a theory, propounded, so far as I know, by Gervinus, and repeated in our own country by one or two critics, that Cordelia's death is a punishment, the penalty of her crime in leading a hostile army upon English soil, and insulting the majesty of the state. But the criticism seems to me only one of those attempts, as Lowell says, "to gauge like an ale-firkin abysses that mock the plummet." The explanation springs, so it seems to me, from an utter misapprehension of the point of view which Shakespeare designed us to take. Lear is the mechanical center of the action, since it was his doings that set the machinery in motion; but the artistic center is Cordelia with Kent and the Fool as different embodiments of the spiritual principle which first found expression in her. That principle is the absolute sacredness of self,—a thing which cannot be bought nor sold, nor given through fear of any pain or disgrace, which must stand for itself against the demands and bribes of all the world, but may give itself out of its own behoof, which is Love.

If this is the right view of the drama, the death of Cordelia has nothing to do with punishment,—indeed, punishment is utterly inconsequent in her case. She had done all that Shakespeare meant her to do. She had shown us that she could not be bought by the glitter of a coronet, nor driven by a father's authority, coming from the State's seat of authority, and under the sanctions of the State's sovereignty as witnessed by the crown, and robes, and scepter of royalty. When she had once done that, and then shown us how she could give herself at her own command, and what a healing for her "child-changed father" was in the gift, there was no more

for her to do,—she was immortal. And Lear, too, must have a chance to show us what her gift was to him. And how could he show that so well as by dying when her breath would no longer "stain the stone," dying by a broken heart, that heart which not all the wolfish ingratitude of his other daughters, nor his own fearful cursing, nor the storm and thunder, could break. All his other woes, the filial ingratitude, the thwarting of all his purposes, the pitiless pelting of the storm, seemed but to give him a new lease of life for hating and cursing, or for the pitying oblivion of insanity, in which the specters that had maddened him were transfigured and he stood over them "every inch a king," making them quake at his staring, as in the old days when he wore the bauble crown, and the phantom knights flattered him like a dog, and told him he had "white hairs in his beard ere the black ones were there." But the taking away of the love which he could neither buy nor command, and which no one since his days has either bought or commanded, and which was yet given him freely,—that was what killed, and was what Kent saw and expressed in the words:

"He hates him, that would upon the rack of this tough world, stretch him out longer." What has punishment to do with all this? And what is the state which, at such a time, comes in and exacts a penalty, blood-money, for its insulted dignity? The state is but an arrangement whereby such characters as Cordelia are made possible, and its majesty consists solely in the perfectness with which it meets this end. But the thing called Britain, the throne, the orders political and social, from the duke to the lackey, have produced as their legitimate fruits only Goneril, and Regan, and Cornwall, and Edmund, and Oswald. Under its fostering, Albany has grown into a "milk-livered man," "a moral fool," who sits still and cries, "alack, why does he so?" Kent, the Fool, Cordelia, Edgar, Albany at last, are what they are only through revolt and disobedience of the state's constituted authorities. And why should we expect it to be different and look for another ending? What other end is possible for such a character as Kent, or Cordelia? The greatest man that ever walked the streets of imperial Rome, who saved it at the only time when it was ever threatened by a power that a mighty nation need have feared, when he was charged with dereliction in office, tore up his accounts in the face of his accusers, and ascended the rostrum before the tribunal appointed to try him, saying, "this day, I conquered Hannibal. Let us go to the Capitol and thank the gods." And the people followed him, leaving the tribunes alone in their judicial seats. Yet he died in voluntary exile, refusing to allow his body to be buried at the Rome which he had saved and made mistress of the nations. And have we forgotten how, eighteen hundred years ago, there lived in Palestine a journeyman carpenter, who worked at his trade not as a contractor to win a fortune, but as a member of the community who must earn a living. His spare time he spent in making the wretched more comfortable, and persuading the poor that the kingdom of Heaven was not in office or station, not in fortune or position, but was within themselves; was not a kingdom of crowns and scepters, nor of gold and lands, but of thoughts and feelings. He gave all due respect to office and station, he rendered unto Caesar all things that were

Caesar's, but he kept the integrity of his own thoughts and feelings as something with which neither priest nor Caesar had any thing whatever to do. And the end was an afternoon of agony, and infamy, and death, and a pauper's burial. It is always so; and, humanly speaking, the cross and Calvary were no more the necessary end of the life of self-respect and self-sacrifice which Jesus lived, than were the prison and halter of the life of self-respect and self-sacrifice which Cordelia lived. And why should we wish it otherwise, why change the drama, as has been done, to give it a quieter ending? Does any one believe that any stain rests upon the name of Cordelia? No amount of critical stupidity can make it so. The state may be a very important sort of thing, but it never rises to the shining hights upon which the best of its citizens live. Edmund had no thought of vindicating justice and the majesty of the state, when he gave the commission to put Lear and Cordelia to death. His purpose was the same as it was when he schemed and lied against his brother and his father, and when he fed the consuming jealousy of the sister-gorgons. He must have lands, and with him, "all's meet, that he can fashion it."

But could not the issues of the play have been ordered differently? The question will repeat itself; the heart will feel that such loyalty as Kent's should have some reward, and such gentleness as Cordelia's some opportunity of exhibiting its beauty before a self-exploiting world. And yet, do we really wish it? Do we realize how mortal is the antagonism between such characters as theirs and those with whom they had come into conflict? It may be held in abeyance by silence and oblivion of self, as Albany held his so many years; but let it once express itself, and the old ways are impossible forevermore. Thenceforth, every hour must be a conflict; there is no peace but in a fortress, no rest, but in the grave. And do we not in our desire to have the issues other than the poet made them, really assign to life and what life brings, a value altogether too high? It is always those who have made the lowest uses of life, that leave it with the most reluctance; and those who have made it but a mockery, that gasp for the last breath of the air which they poison. What honors could the world of politics, with its lying and scheming, with its scaly, crawling, slimy snakes, that wriggle their way under feet which would be glad to crush them,—what honors could it bring to Kent and the new-born Lear? Who does not know that the Angel of Death would have come as an Angel of Blessing to the old hero who now sleeps on the banks of the Hudson, had it only come in the old days before the politician's fever and the *auri sacra fames* had poisoned the fountains of his grandly simple soul? And the social world, with its bickering jealousies, its hollow pretenses, which deceive no one but a fool, its chattering frivolities and sweaty courtesies, its show and parade, noise and bluster, all reminiscent of its early savage life,—do we really desire to see Cordelia shine in such a world as that? What happiness could it bring to her who was unhappy, because she could not "heave her heart into her mouth," and because she wanted "the glib and oily art, to speak and purpose not"?

No, no; as usual Shakespeare has been wiser than we, and kinder than we to ourselves. He has let us see those we love, let us see what they are and

what they can do. He has shown us that the ideal life which our hearts long for and which our judgments approve, is a very simple one, and one with which place and titles have nothing to do. The disguising clothes and unmeaning name of the servant Caius have nothing to do with Kent. It is the great, sturdy soul, hating all pretense, not tempted by fortune, not frightened by calamity, and the warm, child-like heart, these are what we love in him. The cap and bells, the base menial office of the poor jester, neither make nor mar our estimate of the man. We stand with dry eyes when the blood of Caesar dashes out upon the stones of the Capitol; but when the Fool goes away helping Kent bear the body of his master, we feel that we are losing a brother and no common man. When Cornwall orders the nameless servant, whom he and Regan together had succeeding in killing, to be thrown upon the dung-hill, we say: "thank you, but I would rather share his grave than yours." And as Lear comes bearing the body of his child into our presence, and cries to us as the feather seems to move before her lips, "She lives; if it be so, it is a chance which does redeem all sorrows that ever I have felt," our hearts go out in a mighty tide of sympathy to the old man. But we look again, and see that she wears the fillets of Apollo; and we know that no mortal crown would now become her brow consecrated with an immortal crown of perfect life and duty; and turning to the great master, we lay our hands upon our hearts, and whisper, it is well.

BAD AIR AND BAD HEALTH.

(*In two parts. Part I.*)

HAROLD WAGER AND AUBERON HERBERT.

THE air which we breathe is made up of two gases, one active, one indifferent. The active gas, oxygen, on which life depends, is in the proportion of about one-fifth (21 per cent.) of the whole; the indifferent gas, nitrogen, which tempers and dilutes its active partner, is in the proportion of four-fifths (79 per cent.), and with these two gases is found a small quantity—varying according to the purity of the air—of carbonic acid, about three to four parts in 10,000 parts, or .04 per cent., and in addition a minute quantity of a peculiarly active form of oxygen, called ozone, which is rarely found in the air of towns. Of this gas-mixture (which we call air) we breathe enormous quantities. Of it we breathe in the twenty-four hours, over 2600 gallons, that is about 425 cubic feet; and as it returns from our lungs the proportions of the mixture are changed, the oxygen being reduced, and the carbonic acid increased.† But in all ordinary cases the quantity of oxygen in a room in which people are meet-

† It must be remembered that the act of breathing consists in bringing the blood of the system in contact with air, through a delicate membrane in the lungs. Here an exchange takes place—oxygen being yielded up from the air to the blood, and carbonic acid from the blood to the air.

ing is only slightly decreased, whilst the increase of the carbonic acid is not sufficient to cause bad effects. How, then, arises the mischief?

The truth is that in taking air into the lungs and breathing it out again, we breathe out with it certain organic poisons. About the existence and presence of these poisons there can be no doubt, though very little is known about their nature. Of them Dr. Foster writes that they may be formed in the lungs, or may be products of putrefactive decompositions allied to a class of poisons known as ptomaines, which are found in the system. Dr. A. Ransome says:

"The aqueous vapor arising from the breath, and from the general surface of the body, contains a minute proportion of animal refuse matter, which has been proved, by actual experiment, to be a deadly poison..... It is this substance that gives the peculiar, close, unpleasant smell which is perceived on leaving the fresh air and entering a confined space occupied by human beings or other animals,..... and air thus charged has been fully proved to be the great cause of scrofulous or tubercular diseases, and it is the home and nourisher of those subtle microscopic forms of life that have lately become so well known under the title of germs of disease, or microzyms. It is probably the source of a large part of that increase of mortality that seems inevitably to follow the crowding together of the inhabitants of towns."

Now let us take the case of a person who sits in a closely shut up room, ten feet high, ten feet broad, and fifteen feet long, for five hours. At the end of that time he is breathing air which contains 1.2 per cent. less oxygen than it ought to contain, but, what is far more serious, he is breathing some air which has already passed through his lungs, and which is charged with this special poison. Here is the great secret of the fatal mischief. Nature has got rid of the poison, thrown it out of the system, but the perverse occupant of the room insists on thwarting Nature, and, by means of his closed doors and windows, breathes in again, it may be a second time or a third time, the poison that has once been safely got rid of. Say that in twenty-four hours 500 cubic feet have passed once through the lungs, then in six hours our friend will have vitiated one quarter of that quantity, or 125 cubic feet—*i. e.*, one-twelfth of the whole air in the room (1500 cubic feet). If he still goes on sitting in his study, at the end of nine hours he will have vitiated 187.5 cubic feet, or one-eighth of the whole; or if he has been unfortunate enough to have had a friend sitting with him, then in six hours they will have tainted one-sixth of the air; and of every mouthful of air they breathe after that time, one-sixth of it must be supposed to be charged with poisons that have been already once got rid of, but are now being retaken into the system. Of course this proportion of one-sixth will not remain constant. Each breath expired will make the matter worse.

We know that we are constantly building up new tissue of different kinds, and that this building up makes it necessary that the old tissues should be got rid of. The larger part of our food measures this change which is going on. If we take our daily food, liquid and solid, for twenty-four hours, as weighing about 5 lb. 8 oz.—a large proportion being water—we may look upon about 5 lb. 3 oz. of this quantity as used for the making of new tissue, the other 5 oz. forming what is spoken of as exhausted ferments, and which, passing along the alimentary canal, is eventually rejected. Now, all the suitable part of the food, after undergoing various changes, which are necessary to prepare it for its passage

from dead food into living tissue, finds its way into the blood; and when by means of the larger blood-vessels it reaches the very minute blood-vessels, called capillaries, it pours a part of itself out through the permeable walls of these minute vessels, bathing and feeding the whole surrounding tissue. Thus, the whole of the new and living body is in solution in this wonderful food-stream of the blood, which, by a very subtle mechanism of nerves, distributes its good gifts in proportion to the needs of each separate part. But the blood is not simply a food-stream, it is also a sewage stream, and it is as such that we are specially interested in it. Where no growth or storing of flesh material of any kind is taking place in the system, it is evident that that part of the daily food which is turned into tissue measures not only the daily construction that is taking place within us, but also the daily destruction or waste. In fact we —if we may so speak of the particles of which we are composed—are forever living and dying within ourselves—making a new self, and getting rid of an old self; and just as the new living body is in solution in the blood, so also is the old dead body, that has done its work and has to be got rid of. Now, of this dead body a large part has to escape through our lungs and through our skin.

About this process of waste very little is known. We know, whilst certain temporary forms of waste are found in muscle, such as kreatin (Gr. kreas, flesh) which, whether again made use of or not, is supposed to be eventually changed in some complex manner into urea in the liver, and an acid called sarcolactic which is also supposed to be decomposed in the liver into carbonic acid and water, that all our dead tissue is—with a certain slight but most important exception—got rid of safely at last, as urea, carbonic acid, and water.* These are the final forms which the waste that passes from the tissue into the blood takes—the urea being separated from the blood and got rid of by the kidneys, the carbonic acid both by the skin and the lungs, and the water by all three channels of separation.

But we said that urea, carbonic acid, and water did not account for quite all the waste tissue; and amongst the part not so accounted for are the very hurtful poisons which escape from lungs and skin. What are these poisons? Have they a connection with, or a resemblance to, the poisons which, as we know, exist at all times within the system on a large scale? Dead or waste tissue probably passes through many forms before it reaches the safe final forms of carbonic acid and water, and we must conclude that some of these forms are highly poisonous. We see this by what happens to a man when he is drowned. A drowned man is in reality a poisoned man. The waste which is going on everywhere and at every moment in his tissues is producing a poison of so deadly a character that when it cannot be oxidized by receiving oxygen from the blood (as it does under ordinary circumstances by means of the two gallons of air he breathes in a minute) death ensues in a few minutes. In this case, the poison produced all over the system has been no longer rendered harmless by oxygen, and goes as poison to the brain. Now, this poisoning does not appear to be primarily or necessarily due to an excess of carbonic

* We are not taking into account certain other substances discharged from the skin in small quantities.

acid, which also accumulates in the blood when a man is drowned. As Dr. Foster shows, even where carbonic acid is got rid of, and no oxygen available, the same result follows. Thus we have a pretty clear indication that the poisoning which results is the non-oxidization of certain active poisons. Other indications point to the same conclusion. When a man faints from loss of blood, he probably faints because the diminished stream of blood does not carry a sufficient quantity of oxygen with it to neutralize the poisons which reach the brain. It is also noticeable that in both these cases convulsions occur; that is, oxygen being denied, the poisons (which retain all their virulence, from being non-oxidized) act as a very powerful stimulant on a part of the nervous centre, which, in turn acting through the nerves, throws one set of muscles after another (connected with the respiratory system) into action, in order to obtain the oxygen that is absent; ending at last in that general violent movement which is called convulsions. After a short time the poisons overpower the nerve centres and death ensues.

Both fevers and violent exercise seem also to illustrate the same thing. In fever, the tissue rapidly wastes, and great quantities of waste-poisons are poured into the blood. These poisons affect the nerves, and are the cause of quickened respiration, and often of quickened circulation, which are necessary in order to get the excess of poison oxidized; when therefore unconsciousness supervenes, we may say pretty confidently that the rapid circulation and the rapid breathing have not been sufficient to oxidize and neutralize the mass of poison which is being carried to the brain. So again, in pneumonia, the quickened breathing shows both the effort of Nature to make up for the loss of that part of the lung which is ineffective, and also the stimulus, which the increased waste-poison in the blood (increased owing to diminished lung capacity, and therefore diminished oxygen) exerts upon the respiratory machinery. So again, when less blood is carried to the lungs, owing to the artery which leads from the heart to the lungs being partially blocked with a clot, the same effect is produced. Probably a somewhat similar condition arises after hard work, either in old age or in a feeble state of health. The tissue, not being in the firm condition of the tissue of a vigorous person accustomed to daily work, breaks down in large quantities, whilst at the same time the circulatory and respiratory machineries are no longer at their best, and therefore the oxidation is imperfect. On the next day the infirm man is poisoned by the unusual quantity of waste in the system, and feels discomfort in many parts of his body or limbs. So also the discomfort acutely felt by some persons during east winds probably arises from the poison that ought to have been got rid of by the skin, but, owing to the closing of the pores, has been thrown back into the system. So also with ordinary violent exercise. When we take violent exercise an unusual quantity of waste is thrown into the blood, requiring an unusual quantity of oxidation. Here also the waste stimulates the nerve centres, increasing action of heart, and of respiratory muscles, so that the blood charged with waste and the air may come into quicker contact. The successful athlete is therefore, first, the good oxidizer, the person who has good lung capacity, and especially a powerful heart

to drive the blood swiftly; and, secondly, the person who trains well, whose tissue is healthy and firm and does not break down rapidly into waste—waste in his case not outstripping the powers of oxidation, and thus causing distress. On the other hand, the untrained man, who breaks down in the race with every symptom of distress, is the poisoned man—the man who formed waste quicker than he could oxidize it.

Reviewing, then, what we have said, we seem to see three things: first, that so long as we have a sufficiency of oxygen, we get rid of a large amount of daily waste in safe and harmless forms; secondly, that when oxygen is withheld from us there are poisons in every part of our tissue of so deadly a character (either abnormally formed because oxygen is absent, or under ordinary circumstances neutralized by the supplies of oxygen present) as to take life in a few minutes; thirdly, that even when all is well, and our system is functioning under healthy conditions, we are still always breathing out from ourselves, through lung and through skin, certain dangerous poisons, which poisons, when we are living in bad air, we perpetually reabsorb into ourselves, to our own great hurt.

Nothing, however, that we have said satisfactorily explains the presence of these poisons which escape from the lungs and the skin. It seems hard to explain why, when Nature so successfully breaks down the great mass of waste into harmless products, there should be this comparatively slight residue left over—reminding one of a lawless fraction of people in an orderly State—which cannot be got rid of on the same easy terms. As we have seen, we have about 5 lb. 3 oz. of daily waste that is safely got rid of as urea, carbonic acid, and water, by means of kidneys, skin, and lungs; but accompanying this safe discharge we have a few grains of poison—a sort of surplus of evil—which in some way or other seems to resist the oxidation to which all the other mass of waste has been subject. What, then, is this poison? How far is it the same, how far does it differ from, the normal poisons of the tissues, which, as we see, in a few minutes destroy life when oxygen is withheld? Where and how is it formed? Are we to look upon it as a putrefactive poison formed at the surface of the lungs and the skin, when waste of some kind is escaping through these channels? Dr. Klein tells us that septic bacteria (the authors of putrefactive change) are to be found in those parts of the body into which air penetrates, as the mouth, the air-passages, the whole alimentary tract; but it seems difficult not to believe, whatever changes take place as these poisons reach the air, that they must at all events have existed as chemical poisons when still in the tissues. Are we, then, to look upon these poisons as derived from putrefactive decompositions taking place in certain parts of the body; or as poisons derived from the tissues; or as in turn possessing both characters? At present, both within and without the body, their nature is surrounded with mystery, and many are the interesting questions that remain to be solved about them. When they have passed outside the body, are they the food of any of the bacteria which are found so plentifully in foul air? If so, are the ordinary bacteria (excluding the case of certain bacteria producing disease) our friends or our enemies; do they render the poison itself harmless; or do they themselves

produce an excretion which is of a poisonous character; or should they be looked on as neutral, destroying one poison and producing another; are the poisons themselves simply removed by currents of air, or are they oxidized in the air; if so, are they oxidized only when ozone is present; and if in the air, why not in the blood, after we have rebreathed them and surrounded them with oxygen, in loose combination with hæmoglobin?

Another light is thrown upon the waste-poisons of the tissues by the statement that they exhaust the power of muscle to contract. Muscle taken from a freshly killed animal, if fed with arterial blood, or blood supplied with oxygen, may retain for some time its power of contraction. But if venous blood (blood that has lost its oxygen and is charged with waste-poisons) be injected into it, the power of contraction is lost quicker than if no blood be supplied to it. In the same way the power of the muscle is soon exhausted if a solution containing substances which can be extracted from muscle (such as kreatin, lactic acid, &c.) be injected into it. These facts help us to see the local mischief which must often arise from these poisons, as well as their effects on the nerve centres. Many an ache and pain are probably due to local effects of the waste-poisons, whether they are the normal waste-poisons of the system, which under unhealthy conditions of life we are not properly getting rid of, or the special waste-poisons of skin and lungs that we have rebreathed into the system.

Contemporary Review.

JANKO.

HENRYK SIENKIEWICZ.

WEAK and frail came he into the world. The neighbors, assembled round the bedside, shook their heads over mother and child. The blacksmith's wife, the most experienced amongst them, began to comfort the sick woman after her fashion.

"You just lie quiet," she said, "and I will light a blessed candle. Its all up with you, poor dear, you must make your preparations for another world. Some one had better run for the priest to give you the last Sacraments."

"And the youngster must be baptized at once," said another. "I tell you he won't live till the priest comes, and it will be some comfort not to have an unbaptized ghost spooking about."

As she spoke, she lit a blessed candle, took the baby, sprinkled it with holy water, till it winked it eyes, and at the same time pronounced the words:

"I baptize thee in the name of the Father, and of the Son, and of the Holy Ghost, and give thee the name of Jan," adding immediately (with a vague recollection of the form of prayer used for the dying): "And now depart, O Christian Soul, out of this world, and return to the place you came from. Amen."

The Christian soul, however, had not the least intention of departing out of this world. It began, on the contrary, to kick with the legs of the body as hard as ever it could, and to cry, but in a

fashion so feeble and whimpering, that it sounded to the women like the mewing of a kitten.

The priest was sent for, discharged his sacred office, and retired; but, instead of dying, the mother recovered, and, after a week, went back to work.

The life of the baby hung on a thread; he scarcely seemed to breathe, but, when he was four years of age, the cuckoo cried three times over the cottage roof —a good omen, according to Polish superstition—and after that matters mended so that he somehow attained his tenth year. To be sure, he was always thin and delicate, with a slouching body and hollow cheeks. His hay-colored hair fell over his clear, prominent eyes, that had a far-away look in them, as if he saw things hidden from others.

In winter the child crouched behind the stove and wept softly from cold, and not unfrequently from hunger if "Mammy" had nothing in the cupboard or in the pot. In summer he ran about in a little white blouse, tied round the waist with a handkerchief, and wore an old straw hat on his head. His flaxen hair poked its way through the holes, and his eager glance darted hither and thither like a bird's. His mother, poor creature, who lived from hand to mouth, and lodged under a strange roof like a swallow, loved him, no doubt, after a fashion, yet she gave him many a cuff, and generally called him a "changeling." At eight years of age he began life on his own account, now driving a flock of sheep, now making his way deep into the forest to look for mushrooms when there was nothing to eat at home. He had Providence only to thank that the wolves did not devour him on one of these expeditions. He was not a particularly precocious boy, and, like all village children, had the habit of sticking his finger into his mouth when addressed. The neighbors prophesied that he would not live long, or that, if he did live, he would not be much of a comfort to his mother, for he would never be strong enough for hard work.

One distinguishing characteristic he had. Who can say why the gift was bestowed in so unlikely a quarter? But music he loved, and his love was a passion. He heard music in everything; he listened to every sound, and the bigger he grew the more he thought of melody and of harmony. If he tended the cattle, or went with a playfellow to gather berries in the forest, he would return empty-handed, and lisp, "O mammy, there was such beautiful music! It was playing like this—la, la, la!"

"I'll soon play you a different tune, you good-for-nothing monkey!" his mother would cry angrily, and rap him with the ladle.

The youngster might shriek, and promise not to listen to the music again, but he thought all the more of how beautiful the forest was, and how full of voices that sang and rang. Who or what sang and rang he could not well have told; the pine-trees, the beeches, the birch-trees, the thrushes, all sang; the whole forest sang, and the echo sang too...in the meadows the blades of grass sang; in the garden behind the cottage the sparrows twittered, the cherry-trees rustled and trilled. In the evening he heard all imaginable voices, such as are audible only in the country, and he thought to himself that the whole village resounded with melody. His companions could only wonder at him; they heard none of these beautiful things. When he was set to work to toss out hay he fancied he heard the

wind playing through the prongs of his pitchfork. The overseer, who saw him standing idly, his hair thrown back from his forehead, listening intently to the wind's music on the fork, seized a strap, and gave the dreamer a few cuts to bring him to his senses, but it was of no avail. The neighbors, at last, nicknamed him "Janko the Musician."

At night, when the frogs croaked, the corncrakes cried across the meadows, the bitterns boomed in the marsh, and the cocks crowed behind the fences, the child could not sleep, he could but listen with delight, and heaven only knows what harmonies he heard in all these mingled sounds. His mother dared not bring him with her to church, for when the organ murmured or pealed, the eyes of the boy grew dim and moist or else brightened and gleamed as if the light of another world illumined them.

The watchman, who nightly patrolled the village and counted the stars, or carried on a low-toned conversation with the dogs in order to keep himself awake, more than once saw Janko's little white blouse scudding through the gloom to the alehouse. The child did not enter the tavern, but crouched close up to the wall and listened. Within, couples revolved merrily to lively music, and now and then a fellow would cry "Hooray!" One could hear the stamping of feet and the affected voices of the girls. The fiddles murmured softly, the big 'cello's deep notes thundered, the windows streamed with light, every plank in the taproom seemed to creak, to sing, to play, and Janko listened to it all. What would he not have given to have a fiddle that would give forth such sounds, a bit of board that would make such music! Alas, where was *he* to get it; how could he make it? If they would only allow him just to take one in his hand! . . . But no! all he could do was to listen, and so he listened till the voice of the watchman would call to him out of the darkness—

"Off to bed with you, you imp!"

Then the little bare feet would patter away to the cabin, and the voices of the violins would follow him as he ran through the night.

It was a great occasion for him when at harvest time or at a wedding he heard the fiddlers play. At such times he would creep behind the stove, and for days would not speak a single word, looking straight before him with great glowing eyes, like those of a cat at night.

At last he made himself a fiddle out of a shingle, and strung it with horsehair, but it did not sound as beautifully as those in the alehouse; the strings tinkled softly, ever so softly, they hummed like flies or midges. All the same, he played on them from morning until night, though many a kick and cuff he got till he was black and blue. He could not help himself, it was in his nature.

The child grew thinner and thinner; his shock of hair became thicker, his eyes grew more staring and swam with tears, and his cheeks and chest became hollower. He had never resembled other children, he was more like his own poor little fiddle that one could scarcely hear. Moreover, before harvest time he was almost starving, living as he did chiefly on raw turnips, and on his longing, his intense longing, to own a violin. Alas! this desire bore evil fruit.

Up at the Castle the the footman had a fiddle that he sometimes played in the evening to please his pretty sweetheart

and his fellow-servants. Janko often crept amongst the climbing plants to the very door of the servant's hall to hear the music, or, at least, to catch a glimpse of the fiddle. It generally hung on the wall, exactly opposite the door, and the youngster's whole soul was in his eyes as he gazed at it, an unattainable treasure that he was unworthy to possess, though he held it to be the most precious thing on earth. A dumb longing took possession of him to touch it just once with his very own hand—or, at any rate, to see it closer. . . . At the thought the poor little childish heart leaped with delight. One evening there was no one in the servant's hall. The family had for a long time lived abroad, the house was empty, and the footman, with his sweetheart, was elsewhere. Janko, hidden amongst the creepers, had already been looking for many minutes through the half-open door at the goal of his desires.

The moon, at her full, swam high in the heavens; her beams threw a shaft of light across the room, and fell on the opposite wall. Gradually they moved towards where the violin hung, and streamed full upon it. To the child in the darkness a silvery halo seemed to shine around the instrument, illumining it so brightly that Janko was almost dazzled; the strings, the neck, the sides were plainly visible, the pegs shone like glow-worms, and the bow like a silver wand. . . . How beautiful it was; almost magical! Janko gazed with hungry eyes. Crouching amidst the ivy, his elbows supported on his little bony knees, he gazed open-mouthed and motionless at this one object. Now fear held him fast, the next moment an unappeasable longing urged him forward. Was it magic, or was it not? The violin, with its rays of glory, absolutely appeared to draw near to him, to hover over his head.

For a moment the glory darkened, only to shine again more brilliantly. Magic, it really was magic! Meantime, the wind murmured, the trees rustled, the creepers whispered softly, and to the child they seemed to say, "Go on, Janko, there is not a soul there. . . . . Go on, Janko."

The night was clear and bright. By the pond in the garden a nightingale began to sing—now softly, now loudly. Her song said, "Go on; have courage; touch it." An honest raven flew softly over the child's head and croaked, "No, Janko, no." The raven flew away, but the nightingale remained, and the creepers cried more plainly than ever, "There's no one there."

The fiddle still hung in the track of the moonbeams. The little crouching figure crept softly and cautiously nearer, and the nightingale sang, "Go on—on—on—take it."

The white blouse glimmered nearer the doorway. Soon it was no longer hidden by the dark creepers. On the threshold one could hear the quick, panting breath of the delicate child. A moment more and the little white blouse had disappeared, only one tiny bare foot still stood upon the steps. In vain the friendly raven flew by once more, and cawed "No, no,"—Janko had already entered.

The frogs in the pond began suddenly to croak as if something had frightened them, and as suddenly were silent. The nightingale ceased to sing, the climbing plants to whisper. In the interval Janko had edged nearer and nearer to his treasure, but fear seized him. In the shadow of the creepers he felt

at home, like a wild creature in a thicket, now he quivered like a wild creature in a snare. His movements were hasty, his breath came short.

The pulsing summer lightning that glanced from east to west illumined the apartment for an instant, and showed poor trembling Janko almost on his hands and knees, his head stretched out, cowering before the violin, but the summer lightning ceased, a cloud passed before the moon, and there was nothing to be seen nor heard.

Then, after a pause, there sounded through the darkness a low wailing note, as if some one had accidently touched a string, and all at once a rough, sleepy voice broke from a corner of the room, asking angrily,—

"Who's there?"

A match cracked against the wall. Then there was a little spurt of flame, and then—great heaven!—then were to be heard curses, blows, the crying of a child, appeals, "Oh, for God's sake!" barking of dogs, people running with lights before the windows, uproar in the whole house.

Two days later poor Janko stood before the magistrates. Should he be prosecuted as a thief? Of course.

The justice and the landlord looked at the culprit as he stood in the dock, his finger in his mouth, with staring, terrified eyes, small, emaciated, dirty, beaten, unable to tell why or wherefore he found himself there, or what they were about to do to him. How, thought the justice, could any one try a wretched little object like that, only ten years of age, and barely able to stand on its legs? Was he to be sent to prison, or what? One must not be too severe with children. Would it not be well if a watchman took him and gave him a few strokes with a cane, so that he might not steal a second time, and so end the matter?

"Just so. A very good idea!"

Stach, the watchman, was called.

"Take him, and give him a caning as a warning."

Stach nodded his stupid, bull head, took Janko under his arm like a kitten, and carried him off to the barn.

Either the youngster did not understand what it was all about, or he was too terrified to speak; in either case he uttered not a word, and looked round him like a little frightened bird. How did he know what they wanted with him. It was only when Stach seized him, laid him on the barn floor, and, holding him fast with one hand, turned up his little shirt with the cane, that poor Janko shrieked "Mammy!" and after every blow he cried "Mammy, mammy!" but lower and weaker each time, until after a certain number of strokes, the child was silent, and called for his mother no more. . . .

The poor broken fiddle!

You clumsy, wicked Stach! Who ever flogged a child in such a fashion? The poor, tiny fellow was always thin and weakly, and scarcely had breath in his body!

At last the mother came and took the child with her, but she had to carry him home. Next day Janko did not rise. On the next day he breathed out his soul in peace, on the hard bed covered by the horse-cloth. . . .

As he lay dying, the swallows twittered in the cherry-tree that grew before the window, a sunbeam peered through the pane, and flooded with glory the child's rough hair and his bloodless face. The beam seemed like a

track for the little fellow's soul to ascend to heaven.

Well for him was it that at least at the hour of death he mounted a broad and sunny path, for thorny would have been his road in life. The wasted chest still heaved softly, and the child seemed still conscious of the echoes of the outer world that entered through the open window. It was evening; the peasant girls returning from hay-making passed by and sang as they went; the brook purled close at hand.

Janko listened for the last time to the musical echoes of the village. Beside him, on the horse-cloth, lay the fiddle he had made from a shingle. Suddenly the dying child's face lit up, and his white lips whispered—

"Mammy!"

"What is it, dearie?" asked the mother, her voice stifled with sobs.

"Mammy, God will give me a real fiddle in heaven."

"Yes, darling, yes," replied the mother. She could speak no more, for from her heart the pent-up sorrow burst suddenly forth. She only murmured "Jesus, my Jesus!" and laying her head on the table, wept as those weep from whom death robs their dearest treasure.

And so it was. When she raised her head and looked at the child, the eyes of the little musician were open but fixed, the countenance was grave, solemn, and rigid. The sunbeam had disappeared.

"May you rest in peace, little Janko!"

* * * *

Next day the Baron and his family returned from Italy to the Castle. The daughter of the house and her suitor were there amongst the rest.

"What a delightful country Italy is!" remarked the gentleman.

"Yes, and the people! They are a nation of artists! It is a pleasure to note and encourage their talent." answered the young lady.

* * * *

The larches rustled over Janko's grave!

The Strand.

PSYCHOLOGY—SPECIAL SENSATIONS.

H. N. Carver.

IT is almost impossible to obtain any very clear ideas of sensation without some practical knowledge of the nervous system, especially the nerve-centers. Teachers may get a knowledge that will be better than none by taking the brain of almost any animal, and dissecting it with the help of some work upon anatomy. The institutes that hold sessions a week in length, could hardly do better than make some provision for work of this kind. Almost any town can furnish some intelligent physician who would spend an hour a day in directing the work, and make the charges very reasonable. Young teachers will always find the Medical profession willing to help in any proper way, and the writer is glad to express his own obligations to friends in that profession as among his most valued teachers.

The general sensations, already referred to, are vague in their character, and furnish very few of the raw materials which the mind afterwards builds up into that great body of scientific knowl-

edge which is the means of the guidance and enjoyment of life. No more than a mere outline can be attempted here; the details must be obtained from the works on physiology and psychology.

The fundamental sense is, probably, the muscular sense, that sensation of strain, or tension, which is always felt when the muscles of any part of the body are allowed to remain unchanged for a moment, and the attention is directed to them. The characteristic property of muscular function is contractility, and every muscle is more or less contracted at all times. This contractility is usually dependent upon innervation, or the constant discharge of nerve-energy into the fibers of the muscles; and the sensation is very likely nothing more than a reflex action of the nerves, localized by the attention when directed to any given set of muscles. The same thing may be said of the sensation felt, when a weight is lifted, or some object is pushed, and the entire series of sensations may be called the sensation of resistance. In the case of touch proper, the sensation is only a modified form of the other. The resistance is slight, mere contact, and is much more definitely localized within limited areas. Here, perhaps, some general terms, applicable in a general way to all the senses, may be explained. The external cause of a sensation, the object resisting, or making contact, the light striking the eye, etc., is called the stimulus. The intensity of the stimulus, as the degree of resistance, the brightness of a light, etc., gives rise to important differences in the quality of a sensation. A tuning-fork making 256 vibrations in a second, and moving through an arc of, say, one-eighth of an inch, gives to the ear a note of a certain pitch, and applied to the skin causes a tingling sensation of touch. Could the same fork be made to vibrate through an arc of 25 or 50 feet in the same time, the vibrations would destroy the organs of hearing, and the fork applied to the skin would destroy the tissues. Again, every stimulus must reach a certain degree of intensity, or have a certain quantity of energy, before any sensation is felt. This is called the threshold, or liminal, value of intensity. In the case of touch, this threshold value, is said to be about .03 grains for the back of the hand and 15 grains for the heel. In the case of sight, it is said to be one three-hundredths of the light of the full moon reflected from white paper. These amounts must be taken as only averages, though they *point* to a law and an undoubted truth. Still further, after the threshold has been once reached, a certain increment of stimulus is necessary to cause any change in the sensation, that is, to cause a new sensation. If the hand is supported by a rest, so that muscular sensation may be excluded and only contact sensation felt, and a weight of three pounds be placed upon it, no change is felt from the addition of a weight less than one pound; that is, the increment in case of pure contact sensation is $\frac{1}{3}$. When the muscular sense is added to the contact sense, as in lifting a weight, the increment is $\frac{1}{16}$. This law of increments is known as Weber's law, or Fechner's, and holds, in different ratios, for all the senses. It is an important law, and plays a prominent part in all theories of the connection between mind and body.

There has been a great deal of discussion in regard to the exact kind of knowledge given by the different senses; as, for example, how does the mind get

its knowledge of space and time. These and other interesting questions may be deferred until the subject of perception is taken up in the next article. One question often asked may be noticed here, and with it this article may close, —would there be any sound, if there were no ear to hear it? The answer must depend upon what is meant by sound. When I hear a sound there are three things to be considered,—first, the waves of air; second, the changes set up within the nerves; third, the sensation, which is entirely within the mind. If the term sound is made to include all three, there certainly will be no sound unless there is an ear. The word is like many others, ambiguous in its import. In physics, it does not include so much as in psychology. With the meaning attached to it in the former science, there may certainly be sound where there is no ear to hear it. It might be desirable to have two words, one for the objective side, and another for the subjective; yet no confusion need ever result, if the speaker and the hearer will each keep his own thoughts clear.

We are now at the point where most of the matters come up, which the teacher will find useful at examination, and which are supposed to be fruitful in the pedagogic fields. The writer will do his best to make the discussion as little disappointing as posssble.

THE CURFEW BELL.

J. C. HADDEN.

"Solemnly, mournfully dealing its dole,
The curfew bell is beginning to toll;
Cover the embers, and put out the light,
Toil comes with the morning, and rest with the night."

THUS Longfellow; and the beautiful little stanza tells us more regarding the primitive uses of the curfew than we may at a first reading observe. For the significance of the bell in modern times we need go no further than Gray's "Elegy"; it is simply intended to "toll the knell of parting day"—to sound, as Longfellow again has it, "the requiem of the dying day." Away far back in the centuries, however, the custom had other and more practical uses. We suspect it would be nothing less than heretical to question the popular tradition that the curfew came in with William the conqueror. There are, however, good grounds for questioning this tradition, as we shall presently see; but meantime we may allow it to pass.

We are, at any rate, bound to admit that the Norman monarch was the first to *enforce* the curfew in England generally. It was he who ordained, under severe penalties, that when the bell rang at eight o'clock in the evening, all lights and fires should be extinguished. Thus we can understand now, if we did not understand before, the meaning of Longfellow's words quoted above. To us the regulation of the Conqueror might seem an altogether arbitrary one; but it was indeed most useful in those early days, when houses were built mainly of wood, and when the fireplace was a mere hole in the middle of the floor, under an opening in the roof to allow the smoke to escape. When a family retir-

ed for the night, the fire was extinguished by simply covering up the opening in the floor; hence the term *couvre-feu*, or curfew. In those far-away times the danger of fire was so constant that extraordinary safeguards were enjoined against it. The old city of London ordinances show us that between Whitsuntide and St. Bartholomew, when a scarcity of water might be expected, every householder was required to keep a supply in front of his door in readiness for emergencies. Other expedients were resorted to for the same purpose, but none of these had the sweet simplicity of the curfew law.

It has been unkindly suggested that the severity exhibited by William in enforcing obedience to the curfew was more particularly designed to prevent the English from assembling together in order to plan schemes of rebellion against their Norman lords. This they are said to have done mostly in the Saxon beer-clubs, and thus we have Thomson writing :—

"The shiv'ring wretches, at the curfew sound,
Dejected, sink into their sordid beds."

But the "cover-fire bell" was certainly known in France, Spain, Italy, Scotland, and probably in other countries of Europe, at this same period, and in some places even before William's time. Alfred the Great, for example, is known to have ordained that all the inhabitants at Oxford should, at the ringing of the curfew at Carfax, cover up their fires and go to bed: which custom, it is stated in Peshall's "History of Oxford," "is observed to this day, and the bell as certainly rings at eight as Great Tom tolls at nine." The curfew again is mentioned to a late period as a common and approved regulation, which would hardly have been the case had it been originally imposed as a badge of servitude. In 1590 the magistrates of Dundee, where Norman influence could never have obtained, allowed the curfew ringer "to levie eight pennies" yearly upon all who had "ane fire-house [*i.e.*, a house with fireplace] in the burgh;" and as late as 1657 the Town Council of Perth passed "an Act requiring obedience to the ringing of the bell for putting out fires." We even find the ringing of the curfew provided for by bequests of tracts of land and other property, although this ringing was but the relic of the custom.

The absolute prohibition of fires and lights after the ringing of the curfew was abolished by Henry I., in the year 1100; but the practice of tolling a bell at a fixed hour in the evening was continued; and this, which is still extant in many places, is a survival of the curfew of mediæval times. At first the common hour was seven o'clock; then it was gradually advanced to eight, and in some places to nine o'clock; in Scotland, ten o'clock was not an unusual hour; at Dundee we believe that hour is observed to this day. At Durham, where it is tolled at nine o'clock, the curfew heralds the closing of the college gates; at Newcastle it used to be the signal for shutting the shops; and in some Cheshire and Yorkshire villages it has for several centuries warned farmers to lock up their cattle for the night. In the low fen districts about Ely and the Cambridge flats it is even now most useful to the traveller as he trudges through the marshy mists, which, while obscuring the lights of the distant city, act as favorable conductors, according to Professor Tyndall, to the sound of bells. In this connection it is interesting to note that at Waltham-

in-the-Woods a grateful farmer, who was lost in the snow, and found his way home by the sound of the curfew, left a field to endow a five o'clock bell for all time.

In many parts of Scotland, as well as of England, the custom has kept its hold of the popular sympathies. In Perth, where the bell is still rung every evening, there is a "Curfew Row," in a house in which is yet to be seen a niche in the wall where, it is said, the bell once hung, thus giving the street its name. This same old city by the Tay affords an instance of the morning curfew—a curious variation of the ancient custom. In the records of one of the town's churches for the year 1586 we read that "the Session ordains Nicol Balmain to ring the curfew and workman bell in the morning and evening the space of ane quarter of an hour," the times appointed being 4 a. m. and 8 p. m. At Stow, the bell is, or was lately, also rung as early as four o'clock in the morning, and at Tamworth at the more reasonable hour of six o'clock. In the Yorkshire city of Ripon there still exists a pleasant variation of the old practice, for every night at nine o'clock the curfew horn is blown in the market-place by a man dressed in a uniform that recalls a very distant past.

It would be tedious to mention the names of places where the curfew bell still continues to be rung. Mr. Syre Cuming, in a paper read before the British Archæological Society, gives a list of nearly forty towns and villages in which the custom survives, and to this number writers in *Notes and Queries* have added some fifty more places. One of the most recent revivals was at Stratford-on-Avon, where the same bell is now used that was tolled at Shakespeare's funeral. In some corners of the country the practice is dying out; and it may be that ere long the soothing tones of the curfew, spreading their charm over the happiness of the quiet English home, will be heard no more in the land. Meantime, it is pleasant to have had this short chat about a custom of such distant origin, and one which is even now perpetuated all over the kingdom. *The Quiver.*

LIFE AT THE U. S. NAVAL ACADEMY. I.

GEO. L. FERMIER.

THE United States Naval Academy was founded in 1845 by Hon. George Bancroft, Secretary of the Navy, during the administration of President James K. Polk. With Commander Franklin Buchanan as Superintendent, this institution was formally opened as the Naval School, on the tenth day of October of the same year.

At that date the Naval School was placed on the land, given by the War Department, the same it now occupies, the site of old Fort Severn, on the south bank of the Severn river, and facing the Chesapeake bay.

When first opened, the course of instruction at the Naval School was fixed at five years, the first and last years being spent at study, and the intervening three years at sea. This was subject to variance according to the exigencies of the service.

After five years the school was reorganized and the course changed to seven years, the sea service, the three intervening years, remaining the same. This change lasted but one year, when the sea service was entirely eliminated, and an annual three months' cruise substituted.

In May, 1861, at the breaking out of the war, the school was removed to Newport, R. I., where it remained until Sept., 1865, when it was removed to Annapolis and went by the name of Naval Academy. In 1873 the course was changed to six years, the first four being spent at Annapolis, the fifth and sixth years being spent at sea. There has been no change in the period of instruction since that date; and the various stages, method of becoming a cadet, and the instruction are:—

"The students of the Naval Academy shall be styled Naval Cadets." (Rev. Stat. § 1512.)

There shall be allowed at the Naval Academy one cadet for each Congressional District, or member of the House of Representatives; one for the District of Columbia, and ten from "at large." The ten from "at large" to be appointed by the President of the United States. Whenever there shall be fewer than ten cadets, appointed from "at large," at the Academy, the President shall fill such vacancy.

After cadets have completed the prescribed six years' course, appointments will be made to fill the vacancies that have occurred in the lower grades of the Line and Engineer Corps of the Navy and of the Marine Corps. These appointments will be made in the order of merit of graduation, determined by the Academic Board of the Naval Academy. In case no vacancies exist, at least ten appointments from the graduates will be made, and the surplus graduates not receiving appointments or commissions, to be given an honorable discharge and one year's sea pay ($1,000) in advance.

A cadet completes the course at the Naval Academy in six years, unless he be unable to keep up with his class and is dropped from the school. There then exists a vacancy to the Academy in the Congressional District from which he was appointed.

As soon as possible after the 5th of March of each year, the Secretary of the Navy informs, in writing, each member of Congress of any vacancy that may exist in his district. The Representative then uses his own discretion as to the manner of choosing a candidate. Some Representatives appoint, while others choose by a competitive examination. The choice of the Representative, or the successful one in the competitive examination, is recommended by the Representative; and such recommendation must be made by the first day of July. If no recommendation is made by July first, the Secretary of the Navy makes the appointment to fill the vacancy.

All candidates must be actual residents of the districts or territories from which they are nominated, and all candidates must be, at the time of their examination for admission, between the ages of 17 and 20 years, and physically sound, well formed and of robust constitution.

Should the candidate receive his nomination sufficiently early to enable him to reach the Naval Academy by the 15th of May, he will receive permission to present himself, on that date, to the Superintendent of the Naval Academy,

for examination for admission ; if, however, he receives the nomination too late for May 15th, he will present himself for examination by the first day of the following September.

It very often happens that a candidate succeeds with the mental examination, yet he fails on the physical. It would be advisable for the candidate to have some physician examine him before he proceeds on his journey to Annapolis only to return, physically disqualified.

Feeling able to pass the physical ordeal, the candidate proceeds to Annapolis to undergo his examinations for admission ; the first of which is the mental examination in the following subjects :—

Reading, writing, orthography, arithmetic, algebra, grammar, geography, history.

In reading the candidate must show by example his ability to read understandingly, and at the same time give proper accent and emphasis.

In writing and orthography the candidate must write, from dictation, sentences from standard pieces of English literature, in sufficient numbers to test his qualifications in handwriting and orthography.

In arithmetic the candidate will be required to show perfect knowledge of decimal and mixed numbers, acquaintance with different tables of money, weights, and measures, and ability to use them ; to be able to state the difference and relation between a Troy and Avoirdupois pound, difference of time, and difference of Longitude and vice versa; to solve square and cube root, simple and compound proportion, simple and compound interest, and exchange, and in other ways be able to show himself able to proceed with higher mathematics without further study of arithmetic.

The candidate must be well acquainted with the first one hundred and eleven pages of Ray's Higher Algebra.

In grammar the candidate must show himself familiar with all parts of speech and rules governing them. He must be able to parse any ordinary sentence, and must understand the subjects comprehended under the heads of Orthography, Etymology and Syntax.

The examination in geography is very thorough, and covers both physical and descriptive geography. The candidate must be able to define, latitude, longitude, zone, the grand divisions of land and water, give a description of any coast, as regards its contour, the bodies of water touching the same, to name the rivers emptying at the coast, coast cities, etc. He must be able to give the names of, and bound, the divisions of any country. His knowledge of the geography of the United States cannot be too good.

The examination in history will be much like the following :

Name the early European settlements within the present limits of the United States, and fix their positions ; when and by whom were these settlements made ?

Explain the three forms of government in the colonies, (Royal, Proprietary and Charter), name the colonies that originally existed within the present limits of Mass., of Conn. When were these colonies united? What did the colony of Penna. include.

Give a sketch of Queen Anne's war.

Explain the Stamp Act, Navigation Act, writs of assistance, and Monroe Doctrine. Name an important battle

in the United States (any war), and give the names of the commanding officers. Why was this battle important? Name the Presidents of the United States in order and give the leading events in each administration.

This will cover the mental examination and should the candidate be successful he has the physical ordeal to go through after which he deservingly can call himself a Naval Cadet, ready to enjoy the pleasures of cadet life to follow.

THE TEACHER.

OUR SCHOOLS AND THEIR RESPONSIBILITIES.

J. L. PICKARD.

THE child who has been taught to utter tersely and with clearness his own thoughts, who has acquired the habits of close and critical observation of the common things about him, who can control his muscular movements within the lines of their highest efficiency, who realizes as he climbs the hill of knowledge that his horizon rapidly recedes and is by reason of this made more humble—the child so taught and trained can never be educated *out of* his sphere in life, but will on the other hand be educated *for* it. Enough has been said to indicate the fundamental topics in a proper course of study. They should be such as to call into exercise the faculties of sight, speech and manual skill.

The old time apprenticeships are no more, the home industries are so largely carried on by machinery, that "the chores" which kept youth busy and out of mischief occupy but little time. If the child can use his spare time in the handling of simple tools and bring out little articles of use or of ornament for the home he will be freed from temptations to idleness and to vicious indulgences, and will be saved from crime. The articles of adornment of my home which I prize most highly are the product of child labor, they are not expensive articles but I can see in them the saving of expense to parents as their children grow into manhood and womanhood. While at work with needle and scissors and scroll-saw and lathe and plane and pencil, the enemy of mankind can find no resting place in their young minds. Something by way of encouragement to manual labor may be found in every school, more in the higher grades of city schools. If the school encouragement find home alliances there will be less tendency to juvenile crime.

The incidental helps toward the formation of a virtuous character just hinted at in what has been written are after all only preparatory to the time of seed sowing.

They are but the plow and the harrow which make the soil ready for the seed. Their work is essential but it may be fruitless. If continued till the proper time for harvest they do no more than keep down the weeds. In the human soil spontaneous germination of good seed rarely occurs.

No amount of *incidental* instruction or influence can take the place of *positive precept.* Goodish talks about the "*impoliteness*" of profanity, the "*meanness*" of lying, the "*injury*" done the victim of lust, the "*filthiness*" of tobacco chewing, the "*policy*" of honesty, the "*inconvenience*" to which the sufferer by a broken promise is subjected, the "*shame*" attached to a discovered thief, the thousand platitudes awakening only a momentary purpose which yields to the first temptation—such talks, good in themselves, fail to reach the root of wrong-doing. Fruit depends more upon the condition of the root than upon the form or the foliage of the tree. He who knows what is in man and how best to develop a true character has said "*Thou shalt not.*"

Until this right to command is recognized, and His commands are heeded, we may look in vain for a check upon juvenile crime.

The church has as its special mission the presentation of divine truth, the home is the fittest place for the lodgment of the truth, the best adapted to hide the leaven. But the church reaches only a limited number, who come voluntarily within its precincts; the home by perversion, by indifference, by ignorance, by lack of time, has turned its children over to the influences of the school, or it may be of the street.

Unless the school be permitted to emphasize the power of a religious life under the sanction of God's authority, and in the use of precepts drawn from God's word without the intermixture of human interpretation, it must fail to reach its purpose as a means of safety and perpetuity to the Republic.

Education.

AROUSING A LOVE OF GOOD READING.

LET it be remembered that the teacher is responsible that the child knows how to read. A little consideration will lead us to conclude that the teacher must instruct the pupil as to what he shall read. There are a vast number of bad books, books that do so much damage that it were almost better the child had never learned to read. And then, the best books are not lying around usually; they have to be sought for. So that the teacher must steadily labor to teach the pupil which the best books are, and to give him a desire to read them.

1. The first step will be to tell the pupil stories of the right kind. These must create an appetite, must excite interest for reading and for investigation. The great mine of classical stories has been worked for a thousand years, and is not yet exhausted. The story of the destruction of Troy and of the wanderings of Ulysses and of Æneas were told over and over beside the hearthstones of old Greece and Rome. They are just as delightful to-day. The recasting of these by Hawthorne in his "Wonder Book" brings them within range of every teacher.

Then there are historical stories, such as those recast by Jacob Abbot, and which gave him his fame as a writer. The stories of Cyrus, of Alexander, of

Alfred the Great, of Washington, of Lincoln, of Grant and Garfield, will never be without interest.

Then there are stories of inventions that are quite as attractive. The story of Thomas A. Edison is now, while he is alive, a wonderful thing. There are stories of those who discovered and applied the power of steam ; of spinning, and of weaving, of manufacturing iron and steel, of those who invented the steamboat and the locomotive, and of printing machines. The field is a large one.

Stories of travel and adventure are innumerable. The stories of Stanley and Livingstone, of Chinese Gordon and Sir John Franklin, have a tremendous power to-day.

Now the point made is that these stories should be the teacher's property; they should be at her tongue's end, as it were. A lady lately wrote : "When at school we often staid after hours to get our teacher to tell us a story." The true way to rouse a love of good literature is for the teacher to be imbued with it. It is not enough to say, "That is a bad book ; you must not read it." Nor is it enough to say, "That is a good book ; read that." The teacher must give the pupils glimpses of the bright fields of literature.

It is a good plan for the teacher to have the older pupils assist in this "story telling." Let her assign one to tell the story of Alexander, for example, another that of Alfred the Great, and so on. In the course of a school year the names of a hundred actors in the world's history can be made familiar to the pupils. They will want to know more about them.

2. There will be a good deal of reading, and the question will come up continually before the teacher, "What are my pupils reading?" The question should be often put to them personally, and in time they will ask, "What had I better read ?" One teacher reports that she has each pupil have a little blank book in which she records the works she reads. Another teacher has a report made *viva voce* each week. "I am reading 'Ivanhoe.'" "I am reading 'Outre Mer,'" and so on. Then she comments and asks opinions. "Jennie, you had 'The Heart of Midlothian' last week ; how did you like it?" The pupil is encouraged to have an opinion, and utter it.

Another teacher puts up a list of books for her Fourth Reader class to read, and encourages them in reading them. In these cases there is access to town or city libraries.

A caution must be observed here ; some teachers define good books as those that discuss religion or morals ; they think only of those that might belong in Sunday-schools. Twenty-five years ago it would have been impossible to have found Irving's "Rip Van Winkle" in a Sunday-school library, but it has got into a good many now. "Good reading" means rightly all that class of reading that awakens thought, and tends to give it a broader scope, puts the individual into a more complete understanding of his surroundings. Some of this may have a direct moral influence, some may act so only remotely. The play of Hamlet must be classed as good reading—it is exciting, but it does not degrade. Hence the teacher must not mark off romances and works of the imagination from his list of good reading.

3. Then the teacher should aim to encourage the owning of a few books by

each pupil. A teacher relates: "A stranger came to my school and asked the girls, 'What books do you own for your very own? I do not mean the Bible. I suppose you each have one. But what book do you treasure and take down and read when you want to have a very nice time?'

Then followed a discussion, and the result was that in the course of a few weeks several of the girls had bought Longfellow's poems."

Nothing will be accomplished unless the teacher makes a business of reading herself, and of getting her pupils to read. A list of books (for pupils over twelve) should be put up in the schoolroom, and then questions asked. "'Who have read 'Robinson Crusoe'?" "'Who have read 'Ivanhoe'?" etc. The teacher who pursues some such course as is outlined above will surely arouse a love for good reading.

School Journal.

LESSONS IN ELEMENTARY ASTRONOMY. I.

H. V. HIBBARD.

"THE stars are the land-marks of the universe; amidst the endless and complicated fluctuations of our system, seem placed by its Creator as guides and records, not merely to elevate our minds by contemplation of what is vast, but to teach us to direct our actions by reference to what is immutable in His works."

SIR JOHN HERSCHEL.

THE object of this paper and of others that may follow is to give to any one interested such explicit directions that he may learn by observation the planets and stars as they appear from night to night as the seasons pass.

Upon a clear night, when the moon is not in the sky, choose as a standpoint for observation an open place, a plain, or the summit of a hill where there is a wide low horizon.

The most obvious classification of the heavenly bodies that we can make with the naked eye is that of the sun, moon and stars. Let us turn our attention now to the stars and discover, if we can, the differences between them and the planets. A planet is a body like the earth or moon, shining by reflected light. A star is a body like the sun, shining by its own light. The sun is a star near the earth. The stars are suns far away. The vast number of bodies we have termed stars do not shine with a steady light, but undergo incessant and rapid changes of brightness and variations of color. This is called scintillation and is said to be due to difference in velocity of rays of light coming to us through media of different refractive powers. The planets scintillate but little or none at all.

Another marked distinction would be noticeable if we should continue our watch from night to night: The greater number of the stars preserve the same relative distances from each other on the celestial sphere. Their positions with reference to each other have been so constant throughout the centuries that astronomers have separated them into *Groups* or *Constellations* and called them the *Fixed Stars*. Our purpose is to learn the names and places of the most interesting of these *constellations*.

There are five other heavenly bodies visible to the naked eye that change

their positions relatively to each other, and to the fixed stars. They are the "Wandering Stars," the planets, (from the Greek word *planasthai*, to wander.) Their names are Mercury, Venus, Mars, Jupiter and Saturn. These too we can learn to recognize for they differ from each other in appearance, motions and places.

While the fixed stars overspread the vault of the sky and appear in every direction the planets may be found only in the constellations of the zodiac near the ecliptic.

Now let us learn from the sky itself, before we go farther, what the zodiac and the ecliptic are. We must, however, supplement direct observation with imagination. Let us imagine ourselves and our observatory, the open plain, transported to the *equator*. Suppose the earth beneath our feet to be perfectly transparent so that we can see through it to the sky on the opposite side and see the stars there as well as those above our heads. Let us suppose the sun, for we could see it now since our earth is transparent, to diminish in size until it is only just a little larger than the stars. We want it smaller than it is so that it will not outshine and obscure the other stars, and a little larger in order that we may readily distinguish it from them. Let us continue our observations throughout a year. We will see our diminutive sun rise and set just as it used to do; we will see it move from its point of setting in the western horizon, around the convex of the sky beneath our feet to the eastern horizon and then across our day-sky to its place of setting in the west, and *the other stars will have moved along with it.* For the first twenty-four hours of our observation the heavenly bodies, sun and all, have swept around the sky, with apparently equal pace and with our observatory as a center. We will not have watched long before we will see that our sun is being beaten in the race. In other words the sun is moving slowly along among the fixed stars and in a year will have returned to the position whence he started when we began our observations. This path which the sun describes among the stars in its annual revolution is the *Ecliptic.* A belt of the heavens extending about 8° on each side of the ecliptic is the *Zodiac.* Now we may take our station at any convenient place for we know where the zodiac is and we will always find the planets somewhere within it.

If we had taken our observatory to the sun instead of the equator we should have seen the earth to have taken the very same path among the stars that the sun appeared to take. The other planets would also have been seen moving on the same course in the belt of the zodiac. The annual motion of the sun then is only apparent. The sun is fixed like the other stars and the planets revolve around it near the plane of the ecliptic.

We are unconscious of our motion, being carried along with the earth in its revolution about the sun, the appearance to us being as if the sun were in motion and the earth at rest.

SALT.

An Object Lesson.

(Given in the Training Class in the N. I. N. School.)

MANTIE E. BALDWIN.

THE lesson was presented to the class as it would have been given to children. It was given to cultivate the observing powers, and to stimulate thought. The students in the class did much more of the work than appears in this article. The teacher should ask questions and let the pupils answer as well as they can. No attempt was made to do the work in a scientific sense. No technical terms were used.

A substance was handed to the class. They were told to observe it closely. A second substance was handed to the class.

Teacher.—I want each of you to dip his finger into this substance, and taste it. I want each one to taste it, look at it carefully, and pass it on rapidly. How many know what it is?

Class.—It is salt.

T.—Is it salt? How many think so? How do you know?

C.—It tastes as salt does.

T.—Would not granulated sugar look very near the same? Can you tell salt by the way it looks? How many can tell salt from sugar?

In teaching a class of children, it would be well to prepare some sugar as well as salt, and see if they can tell the difference. Get the two nearly the same degree of fineness.

T.—We will now begin on the real object lesson. I have here, on the board, the points I wish to bring out this morning. The topics are not named as I would have them named, if I were giving a scientific lesson. I have put general names where I would put scientific names, were I giving a scientific lesson.

1. To what kingdom does salt belong?
2. To what branch of that kingdom?
3. What kind of mineral is it?
4. What kind of food?
5. Tell the kinds of salt.
6. Tell how these kinds of salt are formed, or produced.
7. Appearance.
8. Characteristics or peculiarities.
9. Abundance.
10. Value.
11. Uses.
12. Other points of interest concerning salt.

What is this? Class,—Salt. T.—To what kingdom does it belong? C.—To the mineral kingdom. T.—How many kingdoms are there? C.—Three: animal, vegetable and mineral. T.—How do you know this belongs to the mineral kingdom? C.—Because it may be mined. T.—Yes, who can think of another reason why it belongs to the mineral kingdom? C.—It is an inorganic substance. T.—Does it grow? C.—No. T.—Does it increase? C.—Yes. T.—What do you mean by growing? C.—Having the power within itself of increasing. T.–What does increase mean? C.—Enlargement by addition from the

outside. T.—To what branch of the mineral kingdom does it belong? We have minerals that are simply soil, in which plants are grown. There are minerals for building purposes; such as stone, marble, slate, &c. We have minerals that are valuable for fuel; minerals used as medicine; minerals used as ornaments, such as diamonds, rubies, gold, silver, &c; minerals used as money; and minerals used as food. To which class does salt belong?

C.—Salt is used as food. T.—Yes, salt is a food mineral. What kind of food is this? Is it food in itself, or is it used in food?

C.—It is used in food. T.—We eat sugar by itself and very many other things by themselves; do we eat salt in that way? C.—No. T.—No, we would not make a meal upon salt alone. Do you know of anything that does? C.—Sheep, horses, cattle, and pigs do. T.—It is not food by itself for man, and it is not meant to be for animals. What kind of food is it?

C.—Inorganic food. T.—I do not mean that exactly. We say bread is the staff of life; how about salt? C.—We could not eat a meal without salt in some way. T.—What do we call it? What do we call pepper? C.—A condiment. T.—What is a condiment? some of you look the word up and report at our next recitation. Is there more than one kind of salt? I mean the kind that is used for food.

C.—We say rock salt and table salt, but it is all the same kind, only formed differently. T.—When we go to buy salt, do we buy rock salt or table salt? C.—We buy table salt to use for ourselves, and rock salt for animals. T.—Why do we have table salt? C.—it is finer. T.—Does it taste any better than the other? C.—Yes: it is not so strong.

T.—I wonder what rock salt is? Who can tell how it is formed? (Children would not be able to tell. The teacher would have to explain the process.) C.—It is formed by additions on the outside. T.—Is it? There must be something else before we can have any salt. We find salt in great masses of rock: what was there in the first place? C.—Water. T.—You mean that where salt is now found in masses, there must have once been water? That is a wonderful thing, isn't it? What are salt mines? C.—It is where we find great rocks of salt. T.—But we obtain salt from something else. C.—It is obtained from water. T.—What kind of water? C.—Sea-water. T.—Not necessarily sea-water, but salt water. We have learned that salt is obtained in two different ways; or, rather, that it is found in two different forms; in rocks and in water. If we were to have a bucket of water from the well, and should let it stand in the room three or four days, what would become of the water? C.—It would evaporate. T.—What is evaporation? C.—It is the air taking the water up. T.—The air is like a great sponge. Little particles of water pass into the air as they would into a sponge. That process is called evaporation. Now, in this bucket will there be anything left, if the water was pure? C.—No, nothing after the water was evaporated.

T.—Suppose we fill the bucket from a spring in which there is sulphur, or alum? How about that when the water is evaporated? C.—There would be dregs of sulphur or alum left in the bucket. T.—What if we take the water from the ocean or a salt spring? C.—There would be salt left. T.—The

ocean water is very salt. We would not like to drink it. In every one hundred pounds of ocean water, there are three and one-half pounds of salt. That is the average proportion. Who can tell what salt looks like? C.—It is white and glittering. T.—How can you tell the difference between salt and pepper? C.—By the color. T.—How can you tell the difference between salt and sugar? C.—By the taste. T.—What else do you notice? C.—It is in crystals. T.—This lump shows that it is beautifully crystallized. Is it always in crystals when formed? C.—Yes, and it is somewhat transparent. T.—The glittering little particles of this that has been crushed show crystallization also. Of what shape are the crystals? C.—They seem to be perfect cubes. T.—Yes, they are perfect cubes; but they are so mingled here that it is difficult for you to tell that by the appearance. It is white; it is in crystals; it glitters; it is semi-transparent; all these things we can tell about it. How does it taste? C.—Like mineral. T.—I think you could not tell by the taste that it is mineral. What would children say? C.—They would say it tastes salty. T—Yes, that is what they would probably answer. Those of you who have studied chemistry know that it has certain peculiarities, but we would not mention them in this kind of a lesson. What else do you know about salt? C.—It is heavy. T.—Would a lump of cotton of that size be as heavy? C.—No. T.—What else can you tell? C.—It is hard. T.—What else? Suppose I try to break it, would it break regularly, in perfect cleavage, as slate or mica? C.—It would break irregularly. T.—If you could examine a piece of crystallized salt like this, could you tell something more about it? When we break it, does it part easily or does it cling together? C.—It is brittle and the particles cling together. T.—Now suppose we drop some into a cup of water. C.—It would disappear, or melt. T.—What other word can you use for that? C.—It would dissolve. T.—If we try a lump of ice in water, could we tell any difference after it had melted? C.—No. T.—But if I dissolve a lump of salt in water, could you tell the difference? C.—Not by the appearance; but we could by the taste. T.—It is soluble in water. How about putting it into molasses or vinegar? C.—It will dissolve there also. T.—What else can you tell about it? We have learned that it is hard, brittle, and soluble. If I leave this piece lying on the table, what do you think would become of it? C.—It would crumble and probably dissolve. T.—Why? C.—Because the atmosphere is so full of moisture to-day. T.—When we dissolve this in water, it disappears. Suppose I let the cup remain here a few days? What would happen? C.—The water would evaporate and the salt would remain. T.—In what form? C.—In crystals. T.—Yes, and if there were a twig in the water, the crystals would collect about that, just as they did about this twig which was hanging in the edge of Great Salt Lake in Utah. This lump came from there. Is salt plentiful or scarce? C.—Plentiful. T.—How plentiful? C.—The amount of salt in the world is inexhaustible. T.—Where may we find it? C.—In New York, West Michigan and other places. T.—In what other places? C.—In all sea-water, and in salt lakes. T.—I would like to know where the salt in the ocean came from in the first place? was it put there? How did it get there?

C.—It was washed into the ocean by

rivers that flowed from the land. The salt is all through the land and rivers and springs wash it out. T.—Yes, if you take a handful of earth out here in the street, there is likely to be some salt in it. And in the earth that is thrown out of that cellar where the men are digging, there is also some salt. It comes bubbling up through springs; it is carried and deposited in the lakes and oceans. The whole earth is a system of salt works on a grand scale. In the beginning of the world, the water washed all around it. Each particle of water carried a tiny particle of salt and deposited it somewhere. The water finally evaporated in many places, the salt became harder and harder, forming massive salt beds. Now in digging down into the earth, men find these massive beds of rock salt. Salt is very abundant. In one sense, it is the most abundant thing in the mineral kingdom, because it is distributed everywhere. Plenty of salt! I wonder if that is a good thing. C.—Yes, for it is necessary to all animal life. T.—I wonder how it ever got all through the earth? Who put it there? C.—The Creator. T.—Yes, he planned that it should be that way. It is a very great blessing and we, his children, should love him for giving it.

T.—What is salt worth? Is it costly or is it cheap? C.—It does not cost more than half a cent a pound, in this country. T.—Isn't that a good thing? The things that are necessary to life, we can have almost without money. Sunshine, sweet air, water, all cost nothing. Salt costs very little and is so necessary for man to use in his food. What are some of the uses of salt? C.—It is used for food. T.—Yes, what else? C.—It is good to produce chlorine. T.—Yes, but that is a chemical sense and does not belong to this lesson. What else is salt good for? C.—It is good in freezing ice cream. T.—How is it used in freezing ice cream? C.—It is put on the ice to make it melt and the melting freezes the cream. T.—What else is salt good for? C.—It preserves food, and it is used as a fertilizer to the ground. T.—Would anything grow in a bed of salt? C.—No, it would be too strong.

T.—Many other interesting things could be told concerning this apparently commonplace subject. Short accounts of great salt lakes and of the most wonderful salt mines could be given to the children, but time forbids our saying more in the class to-day. Perhaps enough has been given to aid you in presenting a lesson of this nature. Try to bring out the important points and to stimulate the pupils to be observant, and to learn for themselves about the things which are seen and used every day.

ARITHMETIC. VI.

The Least Common Multiple.

H. B. BROWN.

AS in the preceding subjects, so in this, a *preliminary* drill would be necessary. This drill would suggest the following:—

1. *Definition.*—The Least Common Multiple of any set of numbers is the *least* number that will contain each of the given numbers integrally.

2. *Principle.*—No number will contain another number integrally unless it contains all the prime factors of that number.

Both the definition and principle may be further illustrated by the following problem.

Find the L. C. M. of 15, 18, 21, 25, 26.

From the definition the L. C. M. must contain each of these numbers integrally. For convenience we begin with the number expressing the greatest value, since the L. C. M. can not be less than the greatest number. Of course it will be necessary for the teacher to show that the same results may be obtained by commencing with any one of the numbers. But to proceed with the problem. Something like the following questions and answers would be brought out.

Teacher.—Why do you take the greatest number first?

Class.—Because it is more convenient. Since the L. C. M. must contain each number *integrally* it can not be less than the greatest number.

T.—Are there any prime factors in 25 not found in 26?

C.—Yes, 5 and 5.

T.—What shall be done with these?

C.—Place them as factors of the L. C. M.

T.—Why?

C.—Because from the principle above stated, no number will contain another number integrally unless it contains all the prime factors of that number.

T.—Are there any prime factors in 21 not found in 25 or 26?

C.—3 and 7.

T.—What shall be done with these?

C.—Place them as factors of the L. C. M.

T.—Why?

C.—Because of the principle just given.

T.—Are there any prime factors found in 18 not found in the preceding numbers?

C.—One factor, 3.

T.—But the prime factors of 18 are 2, 3, 3. Why not use all of these?

C.—Because 2 is found in 26, and 3 is found in 21, and these factors have already been used; and according to the principle it is only necessary to have such prime factors in which may be collected the prime factors of each of the given numbers.

T.—Are there any prime factors in 15 not already used?

C.—There are none.

T.—What then are the prime factors of the L. C. M.?

C.—2, 13, 5, 5, 3, 7, 3. The product is 40950, the L. C. M. of 15,18,21, 25, 26.

Other problems of a similar nature may be given until the pupils are able to reason, then give some practical questions.

In finding the L. C. M. of decimal fractions, it is best to reduce them to whole numbers, then factor. Thus:—

Find the L. C. M. of .25, .035, .0045.

These must first be of the same denomination. And since the one having the least value can not be changed to a greater, the greater number may be changed to the same denomination as the lower.

.25=.2500=.0001, 2, 2, 5, 5, 5, 5

.035=.0350=.0001, 2, 5, 5, 7

.0045=.0045=.0001, 3, 3, 5

The prime factors of the L. C. M. of

these numbers are 2, 2, 5, 5, 5, 5, 7, 3, 3. The product is 157,500. This however is the L. C. M. of numbers 10000 times too great, hence to find the L. C. M. we divide by 10000, which gives 15 .7500 the L.C. M. of .25, .035, .0045.

Though the subject of common fractions has not yet been discussed, yet it might be well in this article to call attention to it.

Find the L. C. M. of ½, ¾, ⅝, ⅞.

The L. C. M. of the denominators is 24.

½ = 12/24
¾ = 18/24
⅝ = 20/24
⅞ = 21/24

The L. C. M. of the numerators is 1260.

It is evident, however, that we have found the L. C. M. of numbers 24 times too great, hence 1260 is 24 times too great. 1260÷24=52½, the L. C. M. of ½, ¾, ⅝, ⅞.

It is seen however, that this results in the same as though we find the L. C. M. of the numerators of the fractions and divide it by the G. C. D. of the denominators.

The L. C. M. of 1, 3, 5, 7, =105

The G. C. D. of 2, 4, 6, 8, =2

105÷2=52½

Hence the general rule for finding the L. C. M. of common fractions.

Find the L. C. M. of the numerators and divide by the G. C. D. of the denominators.

NATURAL SPELLING.

Wm. C. Talcott.

In compliance with an invitation by the editor to write an article in advocacy of reform in spelling to be published in The Student, at the N. I. Normal School, the writer sees no better order in which to lay out the work than to consider 1st, wherein is present spelling wrong and how it needs correction; 2d, what its correction would be worth to English-speaking people; 3d, how easily a will would find a way for all to spell by rule.

The error of our present spelling is that though in theory it recognizes as correct the rule that every single sound in English words should have a proper letter always representing that one sound and that alone, in practice very few words now are spelt without a violation of this rule.

To spell words by this rule we need at least 16 more letters. We have now but 23 of any use—c, q and x are only needless and annoying substitutes for k, s, g and z. But sounds requiring to be represented are not less than 39, and many think not less than 44. This defect disables following the rule.

While this accounts for much irregularity, still more is owing to a frequent needless use of letters interchangeably, and quite as often with no sound at all.

For instance, at the outset of instruction in the art of spelling, children are required to spell b-a and call it bay, and then transposing, spell a-b, which reasonably must spell abe, but they are taught to call it ab. This violence to reason is applied to every vowel in the alphabet, by way of introduction to the art.

Each vowel also serves, alone or in disorderly connection with some other letter or a number of them, to denote a multitude of other sounds than that one indicated by its name. Thus a is used diversely in ate, any, art, at, all, what; e, in eat, been, eight, ell, her, there; i, in

pine, pin, pique, bird; o, in oat, son, groat, got; u, in tune, rude, full, but; y, in my, myrrh, hymn.

Another error is that every vowel sound is represented in so many various ways. Thus a, ail, ale, veil, eight, great, grey, slay; be, bee, flea, thief, receive, pique; alibi, die, sigh, height, by, dye; go, doe, flow, oat, beau, court, yeoman, dough; duly, due, few, view, lieu.

Beside the 5 long vowel-sounds, a, e, i, o and u, we have 3 more in art, ought, ooze, and 1 diphthongal sound in out so close as to be spoken always in 1 syllable with single utterance, and hence require a single letter no less than the vowels. These also have their various present ways of being represented. As, art, aunt, laugh, all, haul, bawl, ought, caught, groat, do, too, true, through, our, bower.

Thus every vowel sound is represented by a variety of letters and each vowel letter represents a great variety of sounds.

A number of the consonants are just as interchangeable. The letter c is used in cost and cyst, the letter s in ease and cease, the letter g in get and gem, the letter x for wax and exist. The sound of k is heard in kite, quite, cot, chaos; that of z in size, wise, sacrifice. These may suffice for specimens.

As if all this were not enough disorder, many letters we employ have no sound at all; in utterance they are utterly ignored. Of all the letters used in present spelling, 1-5th are not only useless as not being uttered, but annoying and intolerably so to learners. When n-a spells na, why spell it n-a-y, or n-e-i-g-h?

Such is a substantial though imperfect statement of the gross defect of letters in our present alphabet and of their almost lawless use in our chaotic spelling.

Much improvement may be made by dropping silent letters which are not a partial guide to utterance, as e from any word like give, or a from one like dead, or any other obviously at the first glance worse than useless. But the only thoro' remedy is first to supplement the alphabet and furnish every single utterance a letter. Then, disusing these mere substitutes c, q and x, and using all our present letters in their most accustomed way, we must adapt the new ones to the single sounds yet letterless.

The vowels a, e, i, o, u, are now used chiefly in their short sounds as in at, ebb, it, of, full, and so the long sounds indicated by the names these letters now have need some mark or difference of shape in order to distinguish them as long, as in the words, ate, eat, ire, oat, tune; and vowel sounds in art, all, out, up, ooze, need also like distinction.

For each sound now represented by the digraphs th, ch, sh, zh and ng, a single letter is demanded to denote their sounds respectively in thin, then, chin, sing, shin, fuzhun.

The name of every vowel ought to be its sound. The names of consonants would be much easier learned and used if all formed uniformly as the first are now; thus be, pe, de, te, ve, fe, ze, se, ge, ke, ðe, þe, ʒe, ʃe, je, ɋe ne, ŋe, me, he, le, re, we, ye. The names of w, h and y, —why! they not only fail to represent the uses of these letters but do really indicate entirely different uses. That of h denotes the sound of ch, that of y the sound of w, and that of w—let any one tell what. Their names, especially, sho'd be made he, we, ye.

Adopting such new letters as the writer deems the fittest yet prepared, the following words show just the proper sound of every vowel and of every new or doubtful consonant and hence are a sufficient key to the VIDETTE'S phonetic print:

If we spel plen—and art triz nɤ on el wurdz sɷ tu dш—nų metodz ðarbį briŋ muɋ ʃortr mezr.

Now what would the accomplishment of such reform be worth?

By disuse of silent letters 1-5th of the present labor and material for writing, printing, telegraphing and the like, is evidently saved. Such cost in this county probably is $20,000 every year.

Call it half that. Reckon Porter county just 1-100th of the state, the state 1-50th of the nation and the nation half the English-speaking world. The yearly cost would be $10,000 to the county, $1,000,000 to the state, $50,000,000 to the nation and $100,000,000 to the English-speaking world, 1-5th of which is wasted every year on silent letters.

The saving to all learners of the art of spelling is immensely more. The time consumed on an average in learning quite imperfectly to spell, is 2 years, which, but for the need of learning how to read would be as well employed in learning other needful arts of life. Now, learning how to spell and read by rule, it's thought, need cost the learner nothing bnt a little play with letter blocks upon the floor or table. Thus the learner is 2 years ahead in progress, which is worth of course the time, board, clothing and tuition of the child 2 years. because the child will reach the same capacity for useful service 2 years earlier. A very low rate for such cost would be $100 yearly or $200 for the 2 years saved for every child.

Another saving must be made in sane sense of the pupils, worth much more than all the time and money. How can it be otherwise than that the training of the infant intellect to such absurd ideas of how letters should be used in spelling words, must paralyze their reasoning faculties and fit them to expect no reason why in school instruction but accept whatever they are taught by books or teachers as unquestionable, whether seeming probable or otherwise, as nothing could be more improbable in reason than that letters should be so applied in spelling as to have no rule reliable but make it requisite to memorize the spelling of each word, as if a rule for spelling were impossible and not to be proposed?

Is such reform of spelling practicable? It is in this respect like any other labor-saving proposition little understood and little thought of—it is not now in demand because its value and importance are so unfamiliar even to the literary people. It is now the spelling of the short-hand style of writing, which may soon become a branch of public-school instruction. This would give it public prominence, and this is all it needs to bring it into early prevalence. The difficulty is the most with present spellers, who have so much crazy spelling to unlearn. The printers will not find much difficulty in a change. A case can be transformed for 50c. New styles of type are daily being made and books in schools and ready-printed matter in the country papers may be agencies for rectifying this incipient work of education. When some influential journal of the nation leads the way the multitude will follow probably like sheep and this reform be brought in with a rush. Before the war the writer had no hope of seeing slavery done away. He dare not promise in his present 76th year to live long enough to see orthography just what the word implies, but he will do his best in this direction.

A PLEA FOR GOOD ENGLISH.

LIVY S. RICHARD.

ONE great educational problem of the day is to teach English speaking pupils the proper use of their vernacular. Upon it assuredly depends the answer to that oft-repeated question :

"Are we to have an American literature?" And it follows that correctness in this direction will stimulate correct methods in kindred directions, will lead to clearer thinking, greater assurance of belief and, if I may coin the phrase, intellectual probity. For it is quite be-

yond probability that one who is content to be slovenly in the manner of his talk and writing cannot be otherwise in his other mental relations.

The indifference of the average American toward his mother-tongue would be amusing, were it not so frequently cruel. It pervades all classes. In the schoolboy it is expected and may be partly excused—for does he not have the extenuating plea that he but reflects the instruction he receives? What shall be said, though, when we perceive it in the college president, the erudite professor or the professional writer of English.

Within the compass of two pages of a recent issue of *Harper's Magazine*, in the very entertaining and no doubt accurate portrayal which Mr. Theodore Child gives us of "The Argentine Capital" may be detected two errors in grammar. One is the use of a plural subject with a singular verb, in the sentence: "This pride and self-congratulation *is* largely justified"; a few paragraphs further on, whilst speaking of Argentine street cars, he falls into the inaccuracy of using an adverb where an adjective was meant. "They smell disagreeably." Now, no one will maintain that so able and experienced a writer as Mr. Child did this in ignorance. He certainly knew better. But he grew careless: as Mr. Howells might say, the "hurry and bustle incidental to monthly journalism" temporarily disturbed that calm equilibrium which, in the opinion of the gifted oracle of the Study, is necessary to a literary style.

At a concert I was recently handed a program which stated that one performer was "an eminent cornetist." This information was to be classed with that proverbially "important if true." But it was not true, for the reason that no such thing as a cornetist exists with the sanction of either the revised Webster or the new Century dictionary. To be sure, there is the cornist, who plays the cornet; but as for "cornetist," I challenge it to show its passport.

It was but lately that I read from the pen of a pretentious polemic that his adversary had argued "illy", whereas had he written "welly" the result would have been disastrous. Yet the author was a man who, if named, would at once be recognized to be one of the foremost scholars of the day.

These are little errors casually noted. They are not attributable to ignorance, but rather to the haste of an age which often cannot spare the time to be right before going ahead. Placed before the school children, though, as models of diction, they assume dangerous proportions. And a great share of modern instruction in English is made up of models not less imperfect.

In these days when the literary ferment is upon us, when of ten persons more than five aspire to authorship in one direction or another, it certainly behooves us to pay attention to little things. The editors of the land have not the time to pardon inaccuracies in the manner of their manuscripts; it is difficult enough for them to weed out the inaccuracies of the matter.

So if I may speak to teachers it will be to urge upon them the necessity of being exact in their own writing and to require exactness from those under their charge. How this may best be done is for the pedagogues to determine.

SOME LESSONS IN DRAWING. IV.

Perspective Drawing.

G. W. FERGUSON.

PERSPECTIVE drawing is the art of representing on a plane surface objects as they appear, relatively, to the eye, in nature.

It will be necessary first that you understand the construction of the eye and the laws of vision.

If we can truly see things, we can easily represent them.

We may have our hand ever so finely disciplined, so as to draw a straight line or circular curve with a remarkable degree of accuracy, or produce the finest of touches with the pencil, yet it all avails nothing when we undertake to make a sketch from nature, if our eye has not been disciplined so as to see correctly. Because we have eyes and have them open, is no indication that we can see the true appearance of an object.

The telegraphic instrument may be ticking ever so rapidly, but to little purpose if there be no intelligence ready and willing to receive the information it may be presenting.

Of the five senses, or gateways of knowledge—seeing and hearing, feeling, tasting and smelling,—two, seeing and hearing, belong to the intellectual part of our natures, whilst the other three chiefly supply our animal wants. The sense of seeing is at once the most active, the most comprehensive and the most intellectual of them all. It is the servant of the soul, and through it the mind receives the richest variety of images or ideas. F. W. Robertson says that "the highest pleasure of sensation comes through the eye. She ranks above all the other senses in dignity. He whose eye is so refined by discipline that he can repose with pleasure upon the serene outline of beautiful form, has reached the purest of the sensational raptures."

When the eye has been disciplined by close observation, such as is necessary in drawing, and the owner of that eye can truly say that he dwells in the Lord and the Lord in him, then he can, with the aid of that inner eye, see things as he never saw them before.

When an object is placed before the eye, the light from it passes through the crystalline lens, and an image is formed on the retina, from whence the consciousness of it is conveyed by the optic nerve to the brain.

If a person were to travel from Chicago to New York City and hold a looking-glass so as to have all of the objects reflected in it as they were passed, on arriving in New York City, there would be nothing left on the glass but the last image, perhaps the station; all the other thousands of objects would be gone. It is just so, in a lesser degree, with many persons who have not learned to use their eyes; whilst others are more like a sensitized plate in a camera, not only receiving images, but photographing and fixing them by observation.

We should not learn drawing for drawing's sake only, but rather that it may help us in many ways.

Considering the eye merely as an organ, it is a compound lens, consisting of three principal parts, the aqueous humor, the crystalline lens, and the vitreous humor. The aqueous humor is held in front of the eye by the cornea, a transparent, horny capsule, something like a watch crystal in shape. Behind the aqueous humor, and immediately in front of the crystalline lens is the iris, which surrounds the pupil. Then follow the lens and the vitreous humor. Behind this is a black pigment, upon which the delicate network of nerves, called the retina, is spread. It is this delicate screen, the retina, that receives the images of things with such marvelous rapidity, and conveys them through the optic nerve to the brain. By means of the iris the size of the pupil may be caused to vary. When the light is feeble the pupil expands, and when it is intense the pupil contracts, thus, the quantity of light entering the eye is to some extent regulated.

The pupil also diminishes when the eye is fixed upon a near object, because fewer rays of light are necessary for a distinct vision. The pupil expands when fixed upon a distant object, because the rays of light are faint and it is necessary to catch all of them we can in order that we may see the object. Light objects reflect more rays of light than dark ones and hence can be seen at a greater distance.

The eye posseses a power of adjustment for different distances, chiefly by a change in the curvature of the crystalline lens. Two objects at different distances from the eye cannot be clearly defined at the same moment; the adjustment of the eye for seeing one distinctly, will cause the other to become indistinct.

The image of any object thrown on the retina of one eye differs from that thrown on the retina of the other, because the object is viewed from two separate points. If these two pictures, thrown upon the two retinas, were combined, we should have the full impression of solidity. This is what takes place in the stereoscope, in which the two pictures always slightly differ. Both eyes, therefore, are necessary to give the idea of solidity and space satisfactorily.

A very young child at first sees things not as they really are, but as they appear: for instance, on the fourth of July while passing along Main street in our city, our little girl, who is a trifle over three years and a half old, exclaimed, "Oh papa, look at the little men and lady dolls!" and on looking in the direction she was pointing, I saw several life size figures in front of a store which was on the opposite side of the street. To her they appeared only as little dolls; she knew nothing of the real size, and she was right, for they really did not appear as tall as the length of a man's head. Yet an adult would see them only as life size figures, because he would see them as he knew they were, and not as they appeared.

As a child grows and gradually learns the true or actual shapes of things, and if, whilst very young he does not draw things, he will lose what is called the innocence of the eye; so that when he is older, and attempts to draw things from nature, he will have considerable difficulty in seeing retiring forms correctly, and will have to make use of the rules of perspective.

There are many intelligent persons who cannot draw the top of a bucket, or table correctly. In this case the mind,

with its knowledge of actual shapes, interferes with the image on the retina. It is a fact that, supposing a young child could hold and guide the pencil sufficiently well, he would draw solid forms in perspective more correctly than most adults who had not studied drawing, for the reason, that he sees more truly.

By careful practice, as in drawing, the eye becomes very accurate as a measuring instrument.

Art only recognizes one point of vision.

If we wish to see correctly the contour of a near object, only one eye should be used, so as to avoid a parallax of vision. Hold a pencil at a little distance in front of you and you will understand what is meant by a parallax of vision. Close one eye and observe what object or part of the scene it obscures from your view. Now, without moving the head or pencil, close the other eye and open the one just used and you will notice that the pencil screens a different part of the scene. But if we desire to determine how far an object is away from us, both eyes must be used, so as to see, as it were, from two places, for with one eye alone we have little idea of space.

Some artists, while sketching, will place before themselves a piece of stiff paper or tin with a hole through it; this is fastened to one end of a rod, the other end of which is inserted in the ground. The artist places his eye to the hole in the paper every time he views the scene or object, so he will see it from exactly the same point every time.

Step to the window of your room, and with a piece of crayon, or by means of a small brush and some paint or whiting, trace on the window pane the outline of two trees or two fence posts at different distances from you; be sure to close one eye. Stand in the middle of the street and hold a piece of glass before you in one hand and on it trace the receding sides or edges of the street from foreground to distance, and the lines will almost run together as your pencil runs along the distant edges of the street, because the visual angle is smaller. Suppose you have two poles, each twenty feet long, and you place them in an upright position, one at ten feet and the other at twenty feet from you, and imagine lines drawn from the extremities of each to the eye, and it will be found that the angle formed by the lines from the nearer pole will be larger than that formed by the lines from the farther pole; so the further an object is from you, the smaller it will appear because the visual angle is smaller. Look down a long hall-way or a tunnel, the farther end of which appears no larger than the nail on your little finger, and the nearer end three or five times your height to its arch. Go to the railway where you can look for some distance down the track and examine the rails as you did the street, then watch the approaching train. The locomotive will appear to swell, like a balloon when it is inflated with hot air. It will swell all the way from a tiny speck in the distance to a gigantic monster, and when it has passed by, look at the train of cars tapering off in the distance like a snake's tail, then when all have passed by, watch them as they disappear in the distance.

SIGMA PI MATHEMATICAL ASSOCIATION.

THE SQUARING OF THE CIRCLE.

THE MONIST.

BEFORE we proceed to consider the promotive influence which the invention of the differential and the integral calculus had upon our problem, we shall enumerate a few at least of that never-ending line of mistaken quadrators who delighted the world by the fruits of their ingenuity from the time of Newton to the present period; and out of a pious and sincere consideration for the contemporary world, we shall entirely omit in this to speak of the circle-squarers of our own time.

First to be mentioned is the celebrated English philosopher Hobbes. In his book "De Problematis Physicis," in which he chiefly proposes to explain the phenomena of gravity and of ocean tides, he also takes up the quadrature of the circle and gives a very trivial construction that in his opinion definitively solved the problem, making $pi = 3\frac{1}{5}$. In view of Hobbes's importance as a philosopher, two mathematicians, Huygens and Wallis, thought it proper to refute Hobbes at length. But Hobbes defended his position in a special treatise, in which to sustain at least the appearance of being right, he disputed the fundamental principles of geometry and the theorem of Pythagoras; so that mathematicians could pass on from him to the order of the day.

In the last century France especially was rich in circle-squarers. We will mention: Oliver de Serres, who by means of a pair of scales determined that a circle weighed as much as the square upon the side of the equilateral triangle inscribed in it, that therefore they must have the same area, an experiment in which $pi = 3$; Mathulon, who offered in legal form a reward of a thousand dollars to the person who would point out an error in his solution of the problem, and who was actually compelled by the courts to pay the money; Basselin, who believed that his quadrature must be right because it agreed with the approximate value of Archimedes, and who anathematized his ungrateful contemporaries, in the confidence that he would be recognized by posterity; Liger, who proved that a part is greater than the whole and to whom therefore the quadrature of the circle was child's play; Clerget, who based his solution upon the principle that a circle is a polygon of a definite number of sides, and who calculated, also, among other things, how large the point is at which two circles touch.

Germany and Poland also furnish their contingent to the army of circle-squarers. Lieutenant-Colonel Corsonich produced a quadrature in which pi equalled $3\frac{1}{8}$, and promised fifty ducats to the person that could prove that it was incorrect. Hesse of Berlin wrote an arithmetic in 1776, in which a true quadrature was also "made known," pi being exactly equal to $3\frac{14}{99}$. About the

same time Professor Bischoff of Stettin defended a quadrature previously published by Captain Leistner, Preacher Merkel, and Schoolmaster Bohm, which made *pi implicite* equal to the square of $\frac{6}{5}\frac{2}{5}$, not even attaining the approximation of Archimedes.

From attempts of this character are to be clearly distinguished constructions of approximation in which the inventor is aware that he has not found a mathematically exact construction but only an approximate one. The value of such a construction will depend upon two things—first, upon the degree of exactness with which it is numerically expressed, and secondly on the fact whether the construction can be more or less easily made with ruler and compasses. Constructions of this kind, simple in form and yet sufficiently exact for practical purposes, have for centuries been furnished us in great numbers. The great mathematician Euler, who died in 1783, did not think it out of place to attempt an approximate construction of this kind. A very simple construction for the rectification of the circle and one which has passed into many geometrical text books, is that published by Kochansky in 1685 in the *Leipziger Berichte.* It is as follows: "Erect upon the diameter of a circle at its extremities perpendiculars; with the centre as vertex, mark off upon the diameter an angle of 30°; find the point of intersection with the perpendicular of the line last drawn, and join this point of intersection with that point upon the other perpendicular which is at a distance of three radii from the base of the perpendicular. The line of junction thus obtained is then very approximately equal to one-half of the circumference of the given circle." Calculation shows that the difference between the true length of the circumference and the line thus constructed is less than $\frac{3}{1000}$ of the diameter.

Although such constructions of approximation are very interesting in themselves, they nevertheless play but a subordinate role in the history of the squaring of the circle; for on the one hand they can never furnish greater exactness for circle-computation than the thirty-five decimal places which Ludolf found, and on the other hand they are not adapted to advance in any way the question whether the exact quadrature of the circle with ruler and compasses is possible.

The numerical side of the problem, however, was considerably advanced by the new mathematical methods perfected by Newton and Leibnitz, commonly called the differential and the integral calculus. And about the middle of the seventeenth century, some time before Newton and Leibnitz represented *pi* by series of powers, the English mathematicians Wallis and Lord Brouncker, Newton's predecessors in a certain sense, succeeded in representing *pi* by an infinite series of figures combined by the first four rules of arithmetic. A new method of computation was thus opened. Wallis found that the fourth part of *pi* is represented more exactly by the regularly formed product

$$\frac{2}{3}\times\frac{4}{3}\times\frac{4}{5}\times\frac{6}{5}\times\frac{6}{7}\times\frac{8}{7}\times\frac{8}{9}\times \text{ etc.}$$

the farther the multiplication is continued, and that the result always comes out too small if we stop at a proper fraction but too large if we stop at an improper fraction. Lord Brouncker, on the other hand, represents the value in question by a continued fraction in which all the denominators are equal to 2 and the numerators are odd square

numbers. Wallis, to whom Brouncker had communicated his elegant result without proof, demonstrated the same in his "Arithmetic of Infinites."

The computation of *pi* could hardly be farther advanced by these results than Ludolf and others had carried it, though of course in a more laborious way. However, the series of powers derived by the assistance of the differential calculus of Newton and Leibnitz furnished a means of computing *pi* to hundreds of decimal places.

(*Continued next month.*)

QUERIES.

20. A horse is tied to a stake by a rope 100 ft. long; there is a circular fence around the stake with a radius of 75 ft., and a gap 20 ft. across, so the horse can graze over all the inside and as far as he can reach on the outside of the fence. Find the area over which he can graze.

P. A. M.

ANSWERS.

16. 1. Let x=the number.

Then according to the statement of the problem

2. $\sqrt{x+\sqrt{x}}-\sqrt{x-\sqrt{x}}=\frac{3}{2}\sqrt{\frac{x}{x+\sqrt{x}}}$.

3. $x+\sqrt{x}-\sqrt{x^2-x}=\frac{3}{2}\sqrt{x}$.

4. $-\sqrt{x^2-x}=\sqrt{\frac{x}{2}}-x$.

5. $x^2-x=\left(\sqrt{\frac{x}{2}}-x\right)^2$.

6. $x^2-x=\frac{x}{4}-x\sqrt{x}+x^2$.

7. $-4x=x-4x\sqrt{x}$.

8. $4\sqrt{x}=5$.

9. $x=\frac{25}{16}$. Ans. J. DONOVAN.

17. 1. If D won ⅙ of E's money and E had $7.50 left, then $7.50=⅚ of E's money:

If ⅚ of E's money =$7.50, ⅙=⅕ of $7.50, or $1.50 and ⅙=6×$1.50, or $9.

∴ E had $9 at first.

2. Since C won ¼ of D's money, D had ¾ of his money left and ¾ of D's money + ⅙ of E's money =$7.50; but E's money =$9 and ⅙ of E's money =⅙ of $9, or $1.50.

∴ ¾ of D's money + ⅙ of E's money =¾ of D's money +$1.50=$7.50.

∴ ¾ of D's money =$7.50—$1.50=$6.

∴ Since ¾ of D's money =$6, D's money =$8.

∴ D had $8 at first.

3. Since B won ⅓ of C's money, C had ⅔ of his money left; and since what C had left +¼ of D's money = $7.50.

∴ ⅔ of C's money+¼ of D's money=$7.50, but since D's money=$8, ¼ of D's money =$2.

∴ ⅔ of C's money+$2=$7.50; hence ⅔ of C's money=$7.50—$2=$5.50.

∴ Since ⅔ of C's money=$5.50, C's money =$8.25.

∴ C had $8.25 at first.

4. Since A won ½ of B's money B had ½ of his money left, and since what money B had left+⅓ of C's money=$7.50.

∴ ½ of B's money+⅓ of C's money=$7.50; but since C's money=$8.25, ⅓ of C's money= $2.75.

∴ ½ of B's money+$2.75=$7.50. Hence ½ of B's money =$7.50—$2.75=$4.75.

∴ Since ½ of B's money=$4.75, B's money =2×$4 75=$9.50.

∴ B had $9.50 at first.

5. Since A won ½ of B's money and then had $7.50, A's money+½ of B's money=$7.50, B's money=$9.50.

∴ ½ of B's money=$4.75, and since A's money+½ of B's money=$7.50, then A's money+$4.75=$7.50.

∴ A's money=$7.50—$4.75=$2.75.

∴ A had $2.75 at first. J. S. WELCH.

18. 1. After 4th drawing there remained $\frac{81}{256}$ of original quantity of pure wine.

2. ∴ $\frac{81}{256}$ is the 4th power of fractional quantity after first drawing.

3. $\sqrt[4]{\frac{81}{256}}=\frac{3}{4}$ or amount left.

4. ¾ of 256 gal.=192 gal. amount left after first drawing.

5. 256—192=64 gal. amt. drawn 1st time.

6. 256 : 192 : : 64 : 48 gal. " 2nd "

7. 256 : 144 : : 64 : 36 " " 3rd "

8. 256 : 108 : : 64 : 27 " " 4th "

9. ∴ 64, 48, 36, 27 gals. are the quantities drawn each time respectively.

ANDREW MARTIN.

THE EDITOR.

Don't fail to read our advertising pages. We can vouch for the honesty of every advertiser we have.

* * *

On another page, Mr. Kelly announces his annual excursion to Niagara Falls. Every body should see the Falls sometime, and Mr Kelly offers excellent opportunities and accommodations at very low rates.

His excursions heretofore have been very popular and his management has given the best of satisfaction.

* * *

A special feature this year will be the geological party under the direction of H. V. Hibbard. Mr. Hibbard has made quite an exhaustive study of the geological formations in the neighborhood of Niagara, and there is a treat in store for those who join his party.

* * *

Camp Meetings and Sunday School Conventions

at Vermillion, O. The Nickel Plate will sell Excursion tickets to Vermillion from July 28th to August 24th at half rates. Do not fail to improve this opportunity as a very attractive program has been prepared.

* * *

Every body knows that the G. A. R. encampment is held in Detroit, Mich., Aug. 3d, but if you want rates and routes, ask the Nickel Plate Agents.

SCHOOL AND CITY.

It is announced that the Commencement exercises will not be allowed to interfere with the regular school work, this year. The regular sessions of the classes will be held up to six o'clock Thursday evening Aug. 13.

* * *

The following are the programs for Commencement week :

THURSDAY EVENING AUG. 6.

ENTERTAINMENT by the ELOCUTION CLASS.

Recitation, The Station Master's Story, C. C. Rogers
Recitation, The Spinning Wheel Song, Clara C. Allen
Recitation, The Chariot Race, O. W. Storer
Recitation, Music on the Rappahannock, Dollie M. Bishop
Recitation, "Juberlo Tom," A. L. Moore
Medley, Florence M. Dale
Dumb Bell Exercise, Misses Dale, Gloe, Allen and Bishop
Attitudes and Gestures, Class

FRIDAY EVENING.

CRESCENT LITERARY SOCIETY.

Piano Solo, *Balade* Prof. Ruifrok
Essay, "*Will it wash*?" Minnie Chambers
Recitation, *A New Cure for Rheumatism*, W. T. Howe
Vocal Solo, Grace Groth
Oration, *Tendency of Thought*, Andrew Heltman
Essay, *Monuments Imperishable*, Elma Davis
Violin Solo, Maggie White
Recitation, *Mary's Night Ride* E. P. Harmon
Oration, *Luck—Its Origin and Influence*, H. Ruring
Duett, Minnie Roessler and Prof. Heritage

SATURDAY EVENING.

STAR LITERARY SOCIETY.

Oration, Monuments, M. J. Searle
Essay, Time is the Mask of Eternity, Nellie Moreau
Solo, Prof. Heritage
Recitation, The Whistling Regiment, Ida Wirt

Oration, The Spirit of Politics To-day, J. B. Dicus
Essay, Godward, the Spirit of True Manhood, May Tinsley
Piano Solo, Lizzie Ball
Recitation, The Catholic Psalm, Bertha Stockman

MONDAY EVENING.

ALUMNI ASSOCIATION.

Piano Solo, *Finale Sonata*, Henri Ruifrok
Address, *Vanity of Reformers*, W. F. McKnight
Vocal Solo, *The Wolf*, R. A. Heritage

Toasts will be responded to, in the banquet hall, by Andrew Heltman, Miss Sarah Ream, J. W. Stratton, D. L. Markle, H. W. Blachley, Jennie Osborn Haan and H. M. Evans.

TUESDAY EVENING.

MUSIC CLASS.

Scene and Aria from Semiramide, Miss Louise Stilwell
Piano Solo, Violin and 'Cello, Accompaniment Miss Eva McCree
Scene and Prayer from Der "Freychutz," Miss Ada Reese
Rondo Capuccioso—Piano and Orchestra, Miss Minnie Wirt

WEDNESDAY EVENING.

SCIENTIFIC CLASS.

Salutatory, Sarah C. Ream
Address, Col. Henry Watterson
Vocal Solo, Jennie Thatcher
Valedictory, *Simon Says*, '*Thumbs Up!*' Ross H. Gregory
Violin Solo, Maggie White

THURSDAY EVENING.

CLASSIC CLASS.

Ideals, A. M. Otwell
Oedipus, Cumie Hunter
Relation of Literature to Truth, C. M. Jansky
Harmony of the Material and the Spiritual, W. H. Plymire
The Constant in Human Nature, Mrs. Norviel
Evolution of Language, U. S. Conn

The Music to be furnished by a Chicago quartette.

* * *

The out-going Scientific class numbers 96 members. These represent 13 different states, as follows :—Ind., 31, Ill., 16, Iowa, 10, Ohio, 9, Mich., 7, Wis., 7, Mo., 6, Penna., 4, Minn., 2, Kan., 1, Ky., 1, N. Dak., 1, Neb., 1.

79 of the members have taught school. The average time taught by the 79 is 19$\frac{31}{32}$ mo.

* * *

Nickel Plate Excursion, August 17th. Ninth Annual Niagara Falls Outing. Chautauqua Free. Toronto, $1.00 Extra. Liberal limits. Stop over to visit friends granted on return trip at Brocton or points west. Enquire of Nickel Plate Agents.

* * *

Mr. Carver expresses himself as being well pleased with the work of the Classic class—the largest ever graduated from our school—of this year. The indications are that there will be a much larger class enroll for next year.

* * *

Take the Nickel Plate to G. A. R. Encampment at Detroit, Mich., Aug. 3d. All stop over privileges guaranteed.

WHAT THEY ARE DOING.

Oliver Kline, of Huntington co., Ind., was recently married to Miss Mary E. Harper of the city of Huntington. Mr. Kline, after completing the Scientific course in '85, taught successfully in Huntington and Wabash counties until '87, when he was elected county superintendent of the schools of the former county, which position he has held until the present. He was elected to the third term last spring.

Oscar Hale, Scientific of '86 and principal of the high school of Holton, Kansas, for three years, has recently been elected superintendent of the same, at a salary of $1,000 a year. He is a successful and rising teacher.

A. H. Barber has been recalled to

Walkerton, Ind., at an increased salary and will superintend the schools of that town next year.

W. M. Greenwood is doing good work in one of the Ford co., Ill., schools, and Lizzie Welsch is teaching in the same county. Jacob Welsch, a Scientific of '89, is also doing excellent work in Ford co.

M. W. Ward, a Scientific of '80, is the principal of the Sierra Normal College, Auburn, California, and is doing well.

We make the following extract from a kind letter from Charles W. Jones:

I was elected to the position of professor of natural science in the Des Moines high school in December of '89, and have succeeded in so developing that department, and giving such satisfaction, as to be honored by re-election, receiving a unanimous vote from the board of education, for my third year, to begin in Sep. '91. Besides this, I was tendered the principalship of the Fremont, Neb., high school, at a salary of $1,000 a year of nine months, but declined to accept it, preferring to remain at least one more year in my present position.

Geo. H. Mullin, Classic of '86, has been teaching in Louisa co., Iowa, ever since leaving school. He will superintend the Columbus Junction schools next year at a salary of $1100.

D. S. Robbins, who taught at Volga, Iowa, last year, has been appointed one of the teachers of the Chillicothe Normal School for next year.

Mr. Robbins is an experienced and successful teacher.

Dr. D. D. Rose, who was connected with our school for a number of years, is now a successful physician in Dodge City, Kansas.

David Swineheart, also a student some years ago in our school, is the county superintendent of schools of Ford co., Kansas.

E. B. Smith, a Scientific of '76, has charge of the Great Bend, Kan., schools.

E. E. Barker, also of '76, is superintendent of the schools of Florence, Kan.

T. C. Smith and D. H. Wever, both Scientifics of '76, are in the subscription book business, with headquarters at Chicago.

Andrew Martin, Scientific of '89, has just closed, and very successfully, his work as principal of the Akron, Ind., school.

Students of ten or twelve years ago will be likely to remember "Colonel" Oller and his various experiences and lectures. It may be of interest, to those who knew him then, to know that he now is one of the most successful lawyers in Southern Ill.

His home is at Litchfield, where he has just finished an elegant new house. He has recently disposed of $18,000 worth of land adjoining East St. Louis, and his practice is very large and lucrative.

J. T. Wilson, who was here in '89 and '90, is a successful real estate agent in Chicago.

Mrs. S. M. Dille (*nee* Eliza S. Osborn) is teaching with good success in Colorado. Mr. Dille was in school in '79.

Ira Long, who took the Teachers' course in '84, is a very successful real estate dealer in Astoria, Oregon; he is reported to THE STUDENT as making a great deal of money. J. W. Gray, also of '84, is teaching in the city schools of Oregon City, Oregon. He has been retained for next year at an advance in salary of $25 per month.

Eugene O'Riordan has made a specialty of mathematics during the year, and will also finish the Elocution course. M. J. Searle has been here since March last, and will remain all next year for mathematics and German. John Lowe, who taught in the Woods Male and Female Academy last year, is here and will remain next year, a member of the Law department. W. R. Blackwelder and F. F. Phillips are here for the summer. They both return to their positions of last year with an increase of salary, the former to Cissna Park, Ill., the latter to Pickens, Mississippi. N. P. Hull, who taught at Long Prairie, Wis., in a school of five departments, holds the same position next year with an increased salary. W. H. Bittner, who taught at Louisville, Colo., has had the same position offered him for another year.

J. F. Fortney is teaching an excellent school at Bismark, Mich. He has recently published a circular letter to the patrons of the school, which is practical and full of good sense. He is doing well.

The friends and acquaintances of Frank Lean will be grieved to learn of his death, which occurred recently in Chicago.

A. C. Jones who attended school here about eight years ago, has recently been elected president of the Olympia, Washington, Collegiate Institute. Mrs. Jones, a graduate of our Department of Oratory, has charge of the elocution.

Prof. and Mrs. Jones have many friends among our people who will be glad to learn of their success.

Bendix Holdahl is in the fur business in Northern Minnesota. He says,

The hunting season is now over and I am soon going to Winnipeg with my stock of furs, consisting mostly of beaver, otter and muskrat. Last year we sold several specimens; among others, a fox, to the State University of Kansas, for $85. I am succeeding with my business beyond my expectations, so that I probably ought not to feel sorry because I was obliged to leave my school work, but I have regretted it very much.

We make the following clipping from the *Tulare Register*, Tulare, California,

Yesterday closed the term of the Tulare public schools and to day began the summer vacation. The term just ended has been one of the most profitable and satisfactory of any in the history of the school. Prof. Faber has been untiring in furthering the interests of the school, and there is to-day more intense interest and personal concern in the school than has ever before been manifested.

Prof. Faber has been retained for next year at a salary of $150 per month.

The second commencement of the Idaho Springs high school occurred Friday evening, May 29. W. A. Haggott is the principal.

B. F. Nihart, formerly instructor in penmanship in our school, has been for a number of years superintendent of the Herington, Kansas, public schools. He has been very successful.

The Columbia City, Ind., *Commercial*, in the concluding lines of a column article reviewing the work of Superintendent Alex. Knisely, who has just concluded his third term as county superintendent of schools, says,—

It is not saying too much to credit Mr. Knisely with having performed a work that has never been equalled in this or any other county in the state. As a superintendent of county schools he is without a peer.

From the very beginning he has been a model officer. He to-day claims a friendship among the people of this county that is invaluable to him. He enjoys their confidence and respect to a flattering extent, and his friends are numbered by the thousands.

Mr. Knisely sacrificed both health and money for his work, so that his only compensation is the consciousness of having done his duty. In retiring from the field, he goes forth with the hearty approval of the people who with one voice are ready to say to him "Well done, thou good and faithful servant."

Mr. Knisely is a Scientific of '80, and we are proud of him.

AMONG THE MAGAZINES.

Among the contributors to the August FORUM are Dr. F. H. Geffcken, Baron de Hersch, Pres. F. A. Walker, Ex. Gov. L. A. Sheldon and Gen. A. W. Greely.

The principal topics are the Russian persecution of the Jews, the struggle for popular liberty in Chili and Nansen's proposed expedition to the North Pole. $5.00 a year. Forum Pub. Co., New York.

A good and timely table of contents, especially adapted to midsummer reading, is presented by the NEW ENGLAND MAGAZINE for August. Colonel Albert Clarke, the secretary of the Home Market Club of Boston, opens the number with a bright and instructive account of the State of Vermont, past and present, giving pen pictures of all the leading men of the State. It is attractively illustrated, and its information is imparted in a light and easily digestible form. *The Birthplace of Hannibal Hamlin* is a little descriptive sketch of Paris, Me., especially interesting at this time, when the recent death of the old statesman is so fresh in the memory of the people. It is by Charles E. Waterman, a fellow-townsman of Hamlin's. William Howe Downes contributes a finely illustrated paper on *The Literature of the White Mountains*. W. D. McCrackan furnishes a very interesting and valuable paper on *the Rise of the Swiss Confederation*, which is also timely in view of the coming celebration in Switzerland. N. H. Chamberlain contributes an interesting paper called *In the Footprints of Burgoyne's Army*. W. Blackburn Harte chats pleasantly in a department called "About Books," and several poems and sketches complete a very entertaining number.

$3.00 a year. New England Magazine, Boston.

The ATLANTIC MONTHLY for August has two notable features besides the serial stories by Mrs. Catherwood and Mr. Stockton. Henry James contributes an admirable short story entitled *The Marriages*, which will delight his army of admirers; and Mr. John C. Ropes, who is peculiarly strong in writing on military subjects, has an excellent paper on General Sherman, awarding him great but not undiscriminating praise. Miss Harriet Waters Preston and Miss Louise Dodge, who, over their initials, have before this printed many delightful papers in the ATLANTIC, now, under the title of *A Disputed Correspondence*, discuss wisely and delightfully the letters which are said to have passed between Seneca and the Apostle Paul; Wendell P. Garrison has a political article of real value on the Reform of the United States Senate; Agnes Repplier contributes a bright paper on *The Oppression of Notes* which will touch a responsive chord in readers who have struggled with foot-notes far too copious and obtrusive. There are excellent reviews of the Life of Browning and the Memoir of John Murray, with poems, notes on new books, and the Contributors' Club. $4.00 a year. Houghton, Mifflin & Co., Boston.

Poultney Bigelow, who was a schoolmate of the German Emperor, contributes an article to the Midsummer (August) Number of THE CENTURY on the first three years of the emperor's reign —the third anniversary of his ascent to the throne having taken place on the 15th of June. Mr. Bigelow believes that "since Frederick the Great no king of Prussia has understood his business like this emperor," and in this article he gives what he considers the secret of the power of William II. with his people, and incidentally contributes many facts regarding his life.

This number of THE CENTURY is especially rich in illustrated articles and complete stories, and the illustrations of Mr. Bigelow's paper include a number of views of the palaces at Berlin and Potsdam, and engraved portraits of the Emperor and Empress form a

double frontispiece. $4.00 a year. Century Co., New York.

One of the literary events of the summer in the United States is the publication in the COSMOPOLITAN of a short novel by Amelie Rives, which she calls *According to St. John.*

During her two years' residence abroad, Mrs. Chanler has written nothing else for the public, and this product of her matured mind may be expected to register with something like exactness, this author's position in the world of letters. $2.40 a year. Cosmopolitan Magazine, New York.

Do You Want

to know how to spend August? Go to Vermillion, O., and attend the Camp Meetings and Sunday School Conventions at Linwood Park. The Nickel Plate will sell excursion tickets at half rates from July 28th to August 24th.

Among the good things in the August number of WIDE AWAKE are the three poems—the ballad by Harriet Prescott Spofford, *Pope's Mother at Twickenham*, the *Rain Song*, by Eli Shepperd, and *The Burglar Bee*, by Richard Burton; the three stories—*Peg's Little Chair*, by Sarah Orne Jewett, *The Bride's Bouquet*, by Grace W. Soper, and *The Silent Lie*, by Francis E. Leupp; the three articles—*How the Cossacks Play Polo*, by Madame de Meissner, *An Odd Set*, by Eleanor Lewis, and *Mr. Brown's Playfellow*, by J. Loxley Rhees; the Margaret-Patty Letter, by Mrs. William Claflin; *An Unanimous Opinion*, by Helen Sweet; the three serials by Margaret Sidney, Elizabeth Cumings and Marietta Ambrosi, and the four pages of original anecdotes in *Men and Things*, $2.40 a year. D. Lothrop Co., Boston.

Unlike the PETERSON of old days, which consisted entirely of stories, the new PETERSON offers numerous bright attractive features, which appeal to the entire family circle. It is profusely and handsomely illustrated, and got up in a manner that makes it rank well with the more expensive magazines. Its stories and poems are from the pens of many of our leading authors and its illustrated articles and miscellaneous papers are both interesting and varied. Everybody should read the illustrated paper *Spoons and Spoon Cases*; it is exceedingly entertaining and full of useful information, and the photogravures of souvenir and historical spoons are admirable. The August number is a good specimen of this magazine,

$2.00 a year. Peterson's Magazine, Philadelphia.

Dr. Kellogg's GOOD HEALTH magazine for July contains a great deal of wholesome advice for people of all ages and conditions of life. The editorial department is especially valuable.

$1.00 a year. Good Health, Battle Creek, Mich.

Among the 40 or more who contribute to the August number of THE LADIES' HOME JOURNAL are Lady Mcdonald, Mrs. A. D. T. Whitney, Dr. Andrew Graydon, DeWitt Talmage, Hezekiah Butterworth, Robert J. Burdette and Eben E. Rexford. The contents of this unusually fine issue are too varied, and the articles too numerous for us to even give a sketch of them. They will be read with pleasure by hundreds of thousands. $1.00 a year. Curtis Pub. Co., Philadelphia.

Chautauqua Excursion Free, Toronto Excursion $1.00 Extra, Lewiston Excursion $.25 extra.

These side trips are arranged for the Nickel Plate Ninth Annual Niagara Falls Excursion of August 17th.

Enquire of Nickel Plate Agents.

Those of our readers who are interested in Phonography would be pleased with the PHONOGRAPHIC MAGAZINE.

It is a beautifully printed and carefully edited monthly, devoted to shorthand writing, and is the foremost journal of its class in the country.

$1.50 a year. Phonographic Institute, Cincinnati, O.

JUNE EXAMINATION QUESTIONS FOR INDIANA.

CONDUCTED BY O. P. McAULEY.

READING.

"Unwarmed by any sunset light
The gray day darkened into night—
A night made hoary with the swarm
And whirl-dance of the blinding storm,
As zigzag wavering to and fro,
Crossed and recrossed the winged snow."

—*From "Snow Bound" by John Greenleaf Whittier.*

1. Ask five questions on the above suitable to bring out the meaning.

5 points, 10 each.

2. All exercises in oral reading to be marked From 1 to 50.

ANSWERS.

1. What do the first and second lines mean by saying the gray day was unwarmed by any sunset light?
2. Why is it called the gray day?
3. Why does he speak of the "whirl-dance of the blinding storm"?
4. Express the meaning of third and fourth lines in your own language.
5. Why does he call the snow, winged?

WRITING AND SPELLING.

The penmanship shown in the manuscripts of the entire examination will be graded on a scale of 100, with reference to *legibility* (50), *regularity of form* (30), and *neatness* (20). The handwriting of each applicant will be considered in itself, rather than with reference to the standard models.

The orthography of the entire examination will be graded on a scale of 100, and 1 will be deducted for each word incorrectly written.

Or, the County Superintendent may conduct the examination in these subjects in any manner he may desire.

ARITHMETIC.

1. Find the difference between the product and quotient of 3.125 by .64.
2. What are the prime factors of 6480? of 42600? of 112?
3. Simplify $\frac{3\frac{5}{8}+2\frac{5}{12}-1\frac{5}{24}}{5\frac{4}{5}+2\frac{9}{10}-1\frac{9}{20}}$
4. Reduce 1 day 7 hours to the decimal of 31 days.
5. Find the bank discount on $1,504.50 due 90 days hence at 4 per cent.
6. If by selling a house for $4,000 I gain 25 per cent. on my outlay, what should I gain per cent. by selling it for $3,360.
7. How many feet of boards, each 1 inch thick, will it take to inclose a yard 5 rods long and 4 rods wide with a fence 5 feet high, the spaces between the boards being equal to ⅓ the width of the boards?
8. If a room is 40 feet long, 32 feet wide, and 18 feet high, how far is it from one of the lower corners to the upper corner diagonally opposite?
9. What will it cost to carpet the above mentioned room with carpet 27 inches wide at $2.50 per yard?
10. Write a full analysis of the following example: ⅔ of A's money equals ¼ of B's, and the difference of their money is $126. How much has each?

ANSWERS.

1. $3.125 \div .64 = 4.8828125$.
   $3.125 \times 64 = 2$
   $4.8828125 - 2 = 2.882125$, ans.
2. $6480 = 2.2.2.2.5.3.3.3.3.$
   $42600 = 2.2\ 5\ 5.2.3\ 71.$
   $112 = 2.2\ 2\ 2\ 7.$
3. $\frac{3\frac{5}{8}+2\frac{5}{12}-1\frac{5}{24}}{5\frac{4}{5}+2\frac{9}{10}-1\frac{9}{20}} = \frac{\frac{87}{24}+\frac{58}{24}-\frac{29}{24}}{\frac{116}{20}+\frac{58}{20}-\frac{29}{20}} = \frac{\frac{116}{24}}{\frac{145}{20}} = \frac{2}{3}$.
4. 1 da. 7 hrs. = 31 hrs.
   31 da. = 744 hrs.
   31 hrs. ÷ 744 hrs. = .04⅙.
5. Int. on $1504.50 for 93 da. at 4% = $15.55.
6. Let 100% = cost.
   125% = $4000.
   1% = $32.
   100% = $3280 cost.
   $3360 − $3200 = $160 gain.
   $3200 = 100%.
   $1 = $\frac{1}{32}$%.
   $160 = 160 \times \frac{1}{32}\% = 5\%$, ans.
7. The distance around the yard is 18 rds. = 297 ft. Since the space between the boards is

⅓ the width of the boards it occupies ¼ of the entire space. Therefore ¾ of 297 ft.= 222.75 ft. 5 ft. by 222.75 ft.=1113.75 sq. ft., ans.

8. $\sqrt{40\times40+32\times32+18\times18}$=54.2 ft., ans.

9. It depends upon which way the strips run. To put the strips on crosswise gives the following solution:

40 ft.=$\frac{40}{3}$ yds. wide.
¾ yds.=width of strips.
$\frac{40}{3}$ yds.=width of $17\frac{7}{9}$ strips=18 strips.
32 ft.=$\frac{32}{3}$ yds. length of strips.
1 strip=$\frac{32}{3}$ yds.
18 strips=$18\times\frac{32}{3}$ yds.=192 yds.
1 yd.=$2.50.
192 yds.=192×$2.50=$480 ans.

10. ¼ of B's=$\frac{2}{5}$ of A's.
$\frac{4}{4}$ of B's=$4\times\frac{2}{5}=\frac{8}{5}$ of A's.
∴ B's=$\frac{8}{5}$ and A's $\frac{5}{5}$.
$\frac{8}{5}-\frac{5}{5}=\frac{3}{5}$=$156.
$\frac{1}{5}=\frac{1}{3}$ of $126=$42.
$\frac{5}{5}=5\times$42=$210 A's.
$\frac{8}{5}=8\times$42=$336 B's.

GRAMMAR.

1. In using the pronouns who, which, and what, in questions about persons, what determines which one of these to use in any given case?

2. "The poorest education that teaches self-control is better than the best that neglects it."
—*Sterling*.
Re-write this sentence, filling out all ellipses.

3. I know how cruel he is.
Analyze and parse *how* and *cruel*.

4. Correct, if necessary, with reason:
a. I only recited once yesterday.
b. A butterfly, which thought himself an accomplished traveler, happened to alight on a bee-hive.
c. I expected to have come yesterday.

5. Illustrate in sentences the use of each of the following words, first as an adjective and second as an adverb: early, well, smooth, only.

6. Compare the following adjectives: Ill, far, forth, much, well.

7. Write sentences illustrating all the different substantive uses which a clause may perform in a sentence.

8. How many different meanings may the following ambiguous sentence have: The farmer told the merchant that his hogs were in his garden.

9. "Behold," said the streamlet, "to nourish this beauty is the end and aim of my life."
Analyze by some simple form of diagram.

10. What are the practical uses of declension?

ANSWERS.

1. Whether the noun is expressed or unexpressed.

2. The poorest education that teaches to us self-control is a better education than the best education that neglects to teach it.

3. "How" is an adverb of degree and modifies "cruel;" "cruel" is an adjective used in the predicate with "is" and belongs to the subject "he."

4. *a*. In one sense is correct, but a more elegant expression would be, "I recited only once, yesterday." *b*. Change *himself* to *itself* so that it will agree with the antecedent. *c*. I expected to come yesterday. The perfect tense of the infinitive is never used with the past tense of such verbs as *expected, etc.*

5. The early bird catches the worm. He rises early. He is a well man. He has studied the lesson well. That is a smooth surface. He is their only child. He is only poor in purse.

6. "Ill" uses these forms, worse, worst, though the word is really not compared. "Far," farther farthest; much, more, most. "Well" uses these forms, better, best, though the word is really not compared.

7. 1st, The subject of a verb: *That he is honest* is not denied. 2d, The predicate of a verb: The difficulty is *that he is not prepared for the work*. 3d, The object of a verb: He dreamed *that he was president*. 4th, In apposition: The statement *that he is dishonest* has been denied. 5th, The object of a preposition; There has been much discussion about *who wrote Shakespeare*. 6th, By pleonasm: *Think of the rich man*, how he suffers.

8. There are four distinct meanings. 1st, That the merchant's hogs were in the merchant's garden; 2d, That the merchant's hogs were in the farmer's garden; 3d, That the farmer's hogs were in the farmer's garden. 4th, That the farmer's hogs were in the merchant's garden.

9. streamlet | the
said | [you] | behold | [this | to nourish | beauty | is end (and) aim | the | of life | my

"You behold" and what follows, is a substantive clause, the object of "said." "To nourish this beauty, etc.," is also a substantive clause, the object of "behold."

10. To show the different forms and uses of words.

GEOGRAPHY.

1. Tell three ways by which the shape of the earth has been determined.

2. What are zones? Bound them by means of circles.

3. Explain the change of seasons as to a class.

4. Name the political divisions of North America in the order of their size.

5. Describe briefly the drainage of North America.

6. Bound Tennessee, and give the locations of four of its most important cities.
7. What do you think of, and tell where to find in each case, when Philadelphia, Niagara, Cumberland, Geyser, Ganges and Rhine are spoken of ?
8. What precious metals are found in South America in abundance ?
9. Bound Spain, and describe briefly its surface, soil productions and government.
10. What emphasis would you place upon an "Indiana Edition" of the geography for pupils ?

ANSWERS.

1. The shape has been determined by the circumnavigation, the eclipses of the moon, and the measurment of a degree of the meridian.
2. (a) The belts into which the earth's surface is divided by the Tropics and the Polar circles. (b) The Torrid is bounded by the Tropic of Cancer on the north and the Tropic of Capricorn on the south ; the North Temperate by the Arctic circle on the north and the Tropic of Cancer on the south ; the North Frigid by the Arctic circle; the South Frigid by the Antarctic circle and the South Temperate, on the north by the Tropic of Capricorn and on the south by the Antarctic circle.
3. With a globe, or some substitute, show that the inclination of the axis, the parallelism of the axis and the revolution round the sun will bring the same points on the surface into positions that will cause the same amount of heat and light to spread out and cover more space in winter than in summer.
4. United States, Dominion of Canada, Mexico, The Central American Republics, Newfoundland and Danish America.
5. The drainage is effected through the Yukon, the Mackenzie, the Hudson Bay, the St. Lawrence, the Atlantic Slope, the Mississippi, the gulf and the Pacific Slope system.
6. (a) Kentucky, Virginia, North Carolina, Georgia, Alabama, Mississippi, Arkansas and Missouri. (b) Nashville, north and west of the center on the Cumberland River ; Memphis on the Mississippi River, in the extreme south west corner of the state ; Chattanooga and Knoxville in east Tennessee both on the Tennessee River, the former on the south boundary line of the state and the latter north of the center of East Tennessee.
7. (a) A city in Pennsylvania situated on the Delaware River in the south-east part of the state. (b) The grandest waterfall in the world in the Niagara River. (c) A range of mountains between Virginia and Kentucky. (d) Yellow-stone Park. (e) A river in India. (f) A river in Germany.
8. Silver and gold.
9. (a) Bay of Biscay, France, Mediterranean Sea and the Atlantic Ocean. (b) A tableland with several mountain ranges tending east and west. (c) Not fertile. (d) Wheat corn, wool, cork, iron-ore, silver, coffee, wine and silk. (e) A limited monarchy.
10. Very little.

HISTORY.

1. Define local government.
2. Explain the government of a township in Indiana.
3. Define general government.
4. Which was stronger, the local or the general Government, as provided by the articles of confederation?
5. State three important differences between the general Government in the United States between 1781 and 1789 and that provided by the constitution.
6. Which section of the country had the best school system at the time of the Declaration of Independence ? Why ?
7. Compare the industrial life of the South with that of the North in 1822.
8. What was the principal object in the admission of Texas.
9. Write from twelve to twenty lines on the following subject : Should the general Government assist in the education of the children of the several States?
10. What is the relation between the Church and the State in the United States.

ANSWERS.

1. Local government is the government of the state, or government administered by local authorities.
2. The principal officers of a township in Indiana are the trustee, the assessor, the road supervisor, and the justice of the peace. The laws of the state so far as they pertain to the township are enforced by these officers.
3. General government is the government of a nation.
4. The local government.
5. *a*. There was no provision for a President.
   b. There was no Judiciary.
   c. There was but one house in Congress.
6. The New England states had the best school system. To secure better privileges was one of the reasons why most of these people came.
7. See any good text book.
8. To extend slavery.
10. Entirely separate, except as state and any other corporation. See any good text-book.

Note : I have used State as one of the political units of the nation.

PHYSIOLOGY.

1. Locate and briefly describe the following : The ulna, the patella, the tendon Achilles, the gall cyst, the crystalline lens.

2. Sketch a representation of the brain, and locate and name its principal parts.
3. Explain fully the process of respiration, stating what organs are used in filling the lungs with air, and how they act. State fully the effects of respiration.
4. Locate and describe the salivary glands, and state their use.
5. What is disease? How prevented? How cured.
6. In what part of the system does the blood give up its nutritive elements? In what part is it renewed?
7. Why should every effort be made to prevent pupils from breathing through the mouth?

ANSWERS.

(a) The inner bone of the forearm. It articulates at the elbow with the humerus forming a hinge joint, articulates at the wrist with the first row of bones of the carpus. It forms a gliding joint at the carpus.
(b) A flat, triangular bone at the anterior part of the knee joint. It is developed in the tendon of the quadriceps extensor muscle increasing the leverage of that muscle and protecting the front of the joint.
(c) It is the common tendon of the Gastrocnomius and Soleus muscles, is 6 inches in length and is inserted into lower part of the oscalcis. (d) A pear-shaped membranous sac, a reservoir for the bile. It is on the under surface of the right lobe of the liver, is 4 inches long and holds 10 drachms.
(e) One of the refracting media of the eye. It is transparent, double-convex, about ½ in. in transverse, and ¼ in. in anterio-posterior diameter. It forms the image on the retina.

2. Right and left hemispheres of the cerebrum form the upper part, *i. e.* the fore brain. The mid brain is the Corpora quadrigemina, and crura cerebri. The hind brain is the cerebellum, medulla oblongata, and pons varolli.
3. Respiration may be defined as the process of gas interchanging between the blood and the air, and between the tissues and the blood. There are therefore two kinds of *respiration*, viz: External or pulmonary and internal or tissue respiration. In filling the lungs with air, three changes in the dimensions of the thorax take place. 1st. its vertical diameter is increased by the descent of the lateral parts of the *diaphragm* the origin of which is fixed by the *quadratus* lumborum.
2nd and 3rd its lateral and anterio-posterior diameters are increased by the forward and slight upward movement of the sternum brought about by the *scaleni*, *levatores cortarum*, *intercostal* muscles approximate the ribs and widen the thorax from side to side.
Effects of respiration:
1st in the blood; It loses carbon dioxide, watery vapor and gains oxygen. 2nd in the air; It loses oxygen, gains carbon dioxide, watery vapor and organic gases.
4. The 3 pairs of salivary glands are, 1st, Parotid, in front of and below the external ear immediately beneath the skin; weight 1 oz. 2nd, the Submaxillary, below the jaw in anterior part of the submaxillary triangle of the neck; weight 2 drachms. 3rd, the Sublingual, beneath the mucous membrane of the floor of the mouth at the side of the fraenum lingual; weight 1 drachm.
5. (a) Disease is a struggle for existence between a micro-organism and the animal system.
(b) By keeping the micro-organism out of the tissues. (c) By killing him after he gets in, this latter sometimes results in the death of the patient but does not however, invalidate the rule
6. In the capillaries. In the lungs, along the digestive tract and in the excretory and blood elaboratory glands.
7. It is decidedly inelegant, besides the air by its more circuitous route through the nasal passages is warmed for its reception in the lungs.

SCIENCE OF EDUCATION.

1. What is meant by Socratic Method?
2. State anything you know of the teaching of Socrates.
3. Describe the objects and methods of education among the Greeks.
4. Illustrate what is meant by going from the concrete to the abstract.
5. What is a mental habit?
6. How are mental habits formed? How may bad mental habits be broken up?
7. What is the difference between common knowledge and scientific?
8. What is a law of mind?
9. What is the accepted doctrine as to the relation of mind efficiency to brain efficiency?
10. What is your conception of mind growth?

ANSWERS.

1. The method of getting a pupil to see a point by asking questions leading to the point.
2. He was self-taught and a master of his art.
3. Would take to long to describe many. One was, to develop the full nature of the pupil. The methods were all practical, unless, perhaps, the Sophist.
4. A child may form its own rule after he has been taught how to work a sufficient number of examples.
5. A mode of mental working in which attention is wholly, or largely, not present.
6. 1. The same as physical habits, by practice.
2. By ceasing to do the old things, and doing something else.
7. Common knowledge is imperfectly classified; scientific, relatively well classified.
8. A rule of the mind's acting.
9. They go together.
10. The mere increase of power and possessions without development.

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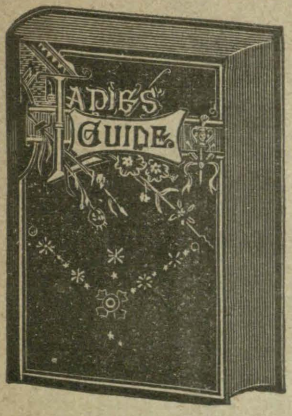

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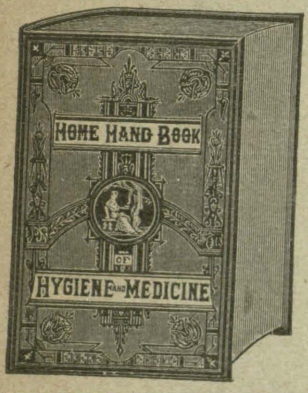

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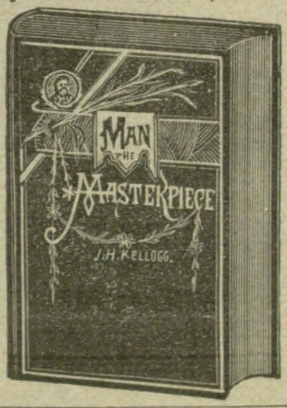

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