dress, and excitement, the strivings of earnestness misdirected in its aim ; and instead of trying to remedy the many evils which arise from this sad state of affairs, we call them "girls of the period," and condemn them for being "fast."

"All this would not be, were girls taught that there is something worth knowing besides accomplishments learned only to attract, and that the best years of a bright life may be spent in a nobler way than striving to get married. We are far indeed from saying that fitness for a wife should not be considered, but would a girl be less fit to make an earnest man's home bright and cheerful, because in her earlier years she had been taught to understand the great truth of science, and could come to him with a large heart and full mind, capable of understanding his hopes and triumphs, the labor of his life, and the work that he was striving hard to do so manfully in the world. Surely, there is nothing in knowledge that should or could make a girl hard, or a woman less a woman.—Does not literature and science only increase the sympathies and open the earth to seek out nobler things ? Why, then, are they kept from half the world, and what reason can we give for keeping up that foolish expression of "blue stocking," and always bringing forward those canting notions about "homely women ?"

The Science of Going up Stairs.

Every one knows that the ascent of a staircase is more fatiguing than ordinary walking ; but current ideas upon the subject, as upon most other familiar things, are loose and inaccurate, and therefore unsuited to regulate practice. Science gives us more precise information about it, which it is important for all to understand.

The planet on which we live, although itself an example of motion on a stupendous scale, seems to be unwilling that any thing else should stir. It puts forth an influence called gravity, which would hold every one of us fast in our places like a vice, if some other agency did not come to set us free. It is a star more than ninety millions of miles away that, liberating us from the chain of gravity, makes it possible to change places. To move a body upon the earth's surface, a counter-force must be exerted sufficient to overcome the pull of gravity, and this counter force is solar energy. In railway locomotion, as is well known, the sun's force, stored up in fuel, is set free by combustion, and converted into a rolling movement through the agency of cranks and wheels. The animal system works on the same general principle, but by different mechanical arrangements. In walking, the solar force stored up in food is liberated in the system and translated into mechanical movement through the agency of contractile muscles and bony levers.

In walking, progression is effected by a succession of lifts, inclinations, and swings. In starting, the body is lifted (for example) by the levers of the right foot, and is inclined forward. The left foot being then raised from the ground, the leg swings forward and is carried by its momentum beyond the right foot. The levers of the left foot now lift the body again, and the right leg swings forward, and so we oscillate along on a pair of pendulums. As walking thus takes place by the pendulous movement, its economy is involved in the law of oscillation. We walk with the least expenditure of power when the intervals of the steps are so timed that each leg swings by its own weight through its natural arc, and there is no extra effort either to quicken or retard the swinging movement. Short pendulums vibrate more quickly than long ones, and therefore short-legged people step quicker than long-legged people, though with no more sense of exertion.

In going up stairs, the mechanism of progression is, of course, the same ; but the lifting action, which is the real force-consuming part of the process, is now greatly increased. Instead of being just sufficient to admit of the free swing of the pendulous foot, it must be so great as to project the body up at each step a distance equal to the height of the stair. Whether a man of one hundred and forty pounds gets his weight upstairs by the levers that Nature gave him, or lifts it by a pulley, makes no difference ; one hundred and forty pounds are to be lifted through the height of the staircase, at any rate. In walking a distance of eighteen feet, at, say, six steps, and assuming that the centre of gravity of the body is raised an inch at each step, the total effort expended would be equal to raising the body through a height of six inches. But, in ascending a staircase eighteen feet high, the body has to be lifted through thirty-six times this space, with the expenditure of thirty-six times the amount of force ; the power expended would therefore be equal to a level walk of three hundred and twenty-four feet. We thus get a definite idea of the immensely greater consumption of force in ascending a staircase than in ordinary walking.

But the difference is still greater than here appears. We have said that each person has a natural time-rate of stepping, at which force is expended most economically. Two persons of unequal steps will move along together at equal speed, the short and frequent stepping of one being equal to the longer and slower stepping of the other. But, if they join arms, and undertake to "keep step," one or the other must violate the law of oscillation—that is, must swing his pendulums in the wrong time. He therefore walks at a mechanical disadvantage which involves extra exertions, and to that degree a waste of force. But in going up stairs this deviation from the natural movement and the consequent mechanical drawback are very much greater ; so that, besides the enormous draft of vital energy for simple lifting, there is a further loss in the disadvantageous way of doing it.

But there is another law of the case which is still more important. In moving a body from one point to another, it is not enough to know how much force is required to overcome weight and friction, but *the time in which it is to be done* must also be taken into account ; and, as regards the economy of force, this is by far the most serious thing. The dynamic formula is, not that the moving force must equal the weight of the mass moved, but it must equal the mass *multiplied into the velocity*. And how multiplied ? People generally would say that, if the speed be doubled, the force also must be doubled ; but this is far from the truth. You cannot double the speed by doubling the force ; to double the speed you must double the force *twice*. A duplicate increase of velocity requires a quadruple increase of force. If a railway-train is moving at ten miles an hour, to make it twenty miles an hour requires four times the driving power—hence the great economy of low speed. Physicists assure us that, in raising weights by pulleys or levers, the same principle holds. When, therefore, you run up-stairs in half the time that you would walk up, the draft upon the vital energy is multiplied *fourfold*. Quickening the speed lengthens the staircase ; and quickening it a little lengthens it a great deal. Running up in half the time is equivalent to walking up *four flights*.

Running up-stairs is thus an excessive strain upon the constitution ; but where does this strain fall ? The levers of motion are moved immediately by the muscles ; but the muscles cannot act of themselves. Their contractions and relaxations take place only under stimulus ; they are all connected by lines of force, called nerves, with the nervous centres, and these are the sources of muscular stimulation. Not that the nerve-force of the brain is converted into the mechanical movement of progression, but nerve-force is constantly drawn upon to maintain the action of the muscles, and this draft is always greatest where there is a sense of exertion. The feelings are muscular stimuli, and whenever excited they press for vent in muscular movement ; if much excited, for example, we cannot sit still. Under the influence of an intense emotion, as terror, for instance, men often put forth an amount of power which would be impossible under ordinary circumstances. In running up-stairs, therefore, it is not mere mechanical force that we are expending ; there is a wasteful exertion of the highest force of the organism. It takes place at the expense of nervous vitality and cerebral vigor. There is a limited fund of nervous power which is drawn upon by the stomach in digestion, by the heart in circulation, by the glands in secretion, by the muscles in work, and by the organ of mind in feeling and thinking. And this fund of force being limited, any over-draft in one direction takes place at the expense of the others. When bodily vigor is high, the evil result of running up-stairs may not be decidedly felt ; but where there is debility of any of the processes, this strain cannot fail to tell in some form or other with injurious effect.

The habit of running up-stairs implies bad calculation. The reason offered in nine cases out of ten will be, that it is to save time. But time must be very precious when we can afford to pay for it in vital energy at such an exhorbitant rate. It is better to be deliberate, to take time and economise vital power. It may answer for young people, in their exuberance of activity, to make the staircase a gymnasium ; but it is a wasteful folly in others, who, if time must be saved by accelerated motion, had better do it by adopting the trot as the regular pace of the parlor.

The bad practice is, however, in reality, due to incorrect thinking upon the subject. People suppose that, in going up-stairs, there is just so much to be done *at any rate*, and the quicker the task is over the better. But this is a fallacy, and when we undertake to reduce fallacies to practice, we always have to pay the penalty.—*Appletons' Journal.*