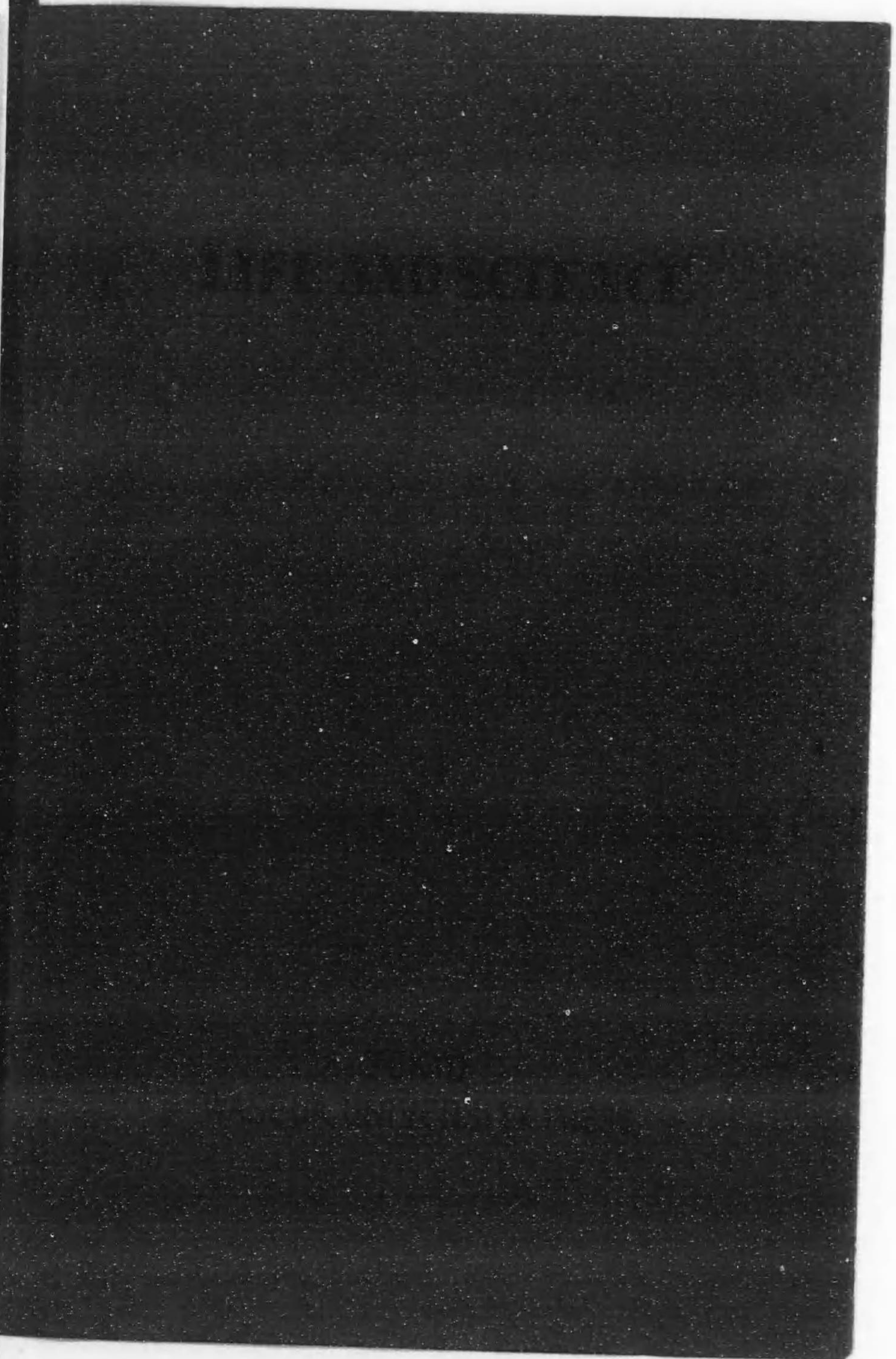




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LIFE AND SCIENCE

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LIFE AND SCIENCE

L. JACK FROST

You all know the word "rain." Perhaps you have not yet learnt the word "dew." Have you ever seen the tiny drops of water on the ground, or on the stems and leaves of plants, early on a summer morning? This water is called dew.

5

In winter, when dew forms at a temperature below the freezing-point of water (32° Fahrenheit or 0° Centigrade), it is called frost. The vapour in the air is frozen into very small ice crystals, or hoar-frost.

These crystals are very beautiful in shape. You ought to examine them through a microscope. When the crystals form on a very smooth surface, for example the glass pane of a window, they often do so in beautiful patterns, like strange leaves or flowers.

When English children wake up on a cold morning in winter and see the ground and plants covered with hoar-frost, they say that Jack Frost has been busy. They imagine a little man who goes about covering everything with this white powder.

Frost is very beautiful. The trees and bushes look charming in their white dress. Frost is useful, too. Farmers are glad to have frost in winter. They do not like frost if it comes late in spring because then it may kill the young

20

plants and injure the blossom on the fruit-trees.

How does frost help the farmer? It breaks up the soil for him. When soil freezes, it is not the earth itself which becomes hard. It is the water which is between the small
5 pieces (or particles) of soil.

When all this water freezes, it increases in size. 'So all the lumps of earth are pushed apart by the frozen water. Each lump is like an exploding bomb. The lumps are broken up into smaller pieces. The frost helps to break
10 up the soil.

Before winter comes the farmers plough their fields.

II. WATER

Turn the tap, and the water comes. The main-spring of the universe and source of all life, it is eternally restless. The rivers flow to the sea, the oceans heave with the tides and roar as they go to battle against the cliffs, the mighty glaciers creep irresistibly to the valley; all are for ever
5 moving and changing. There is no rest.

Can anything under the sun assume so many forms? It is as changeable as the colours reflected in the sea. Now it is lapping the Thames Embankment, or beating on our coasts, or foaming into our morning bath, or falling as the
10 gentle rain from heaven; and now it has ceased to flow and has become hard and brittle as glass. Rearing like shining walls within the Arctic Circle, it is jagged and sharp and cruel. In the shape of ice-bergs it tears open ships, as it tore open the proud Titanic the night she went
15 down.

It can become fine as powder, fluttering round us like white feathers, light and soft and beautiful. On hills and fields, on roofs and trees lies the pure snow. The dew sparkling on the lawn early in the morning; the shining
20 mirrors of the lakes; the ferns and leaves and strange shapes on the window-pane in winter; the frost silvering the bare hedges and gleaming on the fences, all these are water in its many disguises, all carrying on the life of the planet.

Nor are these all its forms. Like the fabled genii of old, it rises into the air as vapour and takes shape above our heads, furnishing the dome of heaven with clouds that are for ever changing. Shelley's clouds, bringing fresh showers
5 for thirsty flowers, were no more than water in its fairy dress.

There is water in almost everything. It is in every flower and tree, every blade of grass. It is in ourselves, for it is in the stuff of which we are made.

10 How much of the world's work this giant does. The great oceans carry our ships from port to port. The rivers and canals have long been highways of commerce. Water from the oceans rises as vapour, is blown to the mountains by the wind, falls as rain, is gathered into rivers, and
15 thunders over the Niagars Falls with immense power, man transforming it into heat and light and energy, and, long before great forces like this were harnessed, running water was serving man by turning the mill wheel and grinding corn. There came a day when man learnt how to use the
20 power of water when turned to steam, a power still driving our mills and serving us in a thousand ways.

III. CLOUDS

Ever since he could think man has wondered at the changing beauty of the clouds. He has been stirred by the shining mists of the dawn, the white clouds of a summer noon, the threatening thunder clouds with ragged edges bright with silver, and all the glowing splendour of a
5 brilliant sunset, when the clouds are like blazing gold or tongues of crimson flame.

Our poets have long been busy with the clouds. Some of their richest imagery has been born in the skies, and they have taught us to think of clouds as stately galleons
10 sailing a blue sea above the housetops, as plumes and towers and continents of mist, as sheep shepherded to new pastures by the invisible wind. Victor Hugo calls them the only birds that do not sleep.

How many kinds of clouds there are! Gathering over
15 the hills we may perhaps see what are known as cumulo-nimbus clouds. They are perhaps two miles deep, and we know them as thunder clouds which often come up with the wind in awful grandeur. A summer morning will bring the cumulus clouds like domes and pyramids; and among
20 the commonest of all cloud forms is the strato-cumulus, with its heavy dark masses usually about 7,000 feet up, sometimes extending across the whole sky. What is known as alto-cumulus clouds are like foaming waves; and the lovely cirro-cumulus---the dappled or mackerel sky---are
25

nearly always a sign of fine weather. The highest clouds of all are the cirrus clouds, thin wisps of ice crystals which rarely form lower than 30,000 feet.

The clouds give us not only a moving-picture show by day and night, but also the gentle rain, the snow in all its
5 purity, and all our rivers, streams, and lakes. Our friends, they make possible all the varied forms of life, for neither tree nor flower nor grass nor human beings could live without the rain from the clouds. True indeed are Shelley's words:

10 I bring fresh showers for the thirsting flowers,
From the seas and the streams;
I bear light shade for the leaves when laid
In their noonday dreams.
15 I wield the flail of the laughing hail,
And whiten the green plains under;
And then again I dissolve it in rain,
And laugh as I pass in thunder.

Of anyone who is day-creaming we say he has his head
20 in the clouds. A proverb reminds us that if there were no clouds we should not enjoy the sunshine; and Shakespeare says, "When clouds appear, wise men put on their cloaks." One of the oldest bits of good cheer is the expression, "There's a silver lining to every cloud."

IV. SKI-ING AND SKATING

During recent years ski-ing has become a very popular sport in Japan. There are several reasons for this. Ski-ing is a sport full of excitement and thrills. It is a health-giving sport because it takes us out into the pure mountain air and exercises our bodies. Further, Japan is a mountainous country and, in the northern and western districts,
5 there are numerous excellent ski-grounds.

Ski-ing was first practised in Scandinavia, especially in Norway. Two of the words which are used in this sport are names of places in Norway. They are Christiania,
10 the old name for the capital of Norway (now called Oslo), and Telemark, a province in the south of Norway. A Christiania turn is made on the inside edge of the ski, with the feet side by side, and a Telemark turn is made on the outside edge of the ski, with one foot in advance.
15

Ski-ing is full of thrills because it enables us to go over the snow at great speed. It is hard work to climb to the top of a high slope of snow. But when we have reached the top there is no excitement which equals the swift, rushing descent. Of course, only the expert skier can go
20 down a long, steep slope with safety. The learner must be careful to choose a gentle slope. He will have many falls and tumbles. He will find it difficult to pick himself up when he falls. His skis, if they are the right size, are greater in length than his own height. A man who is six
25

feet tall should have skis about seven feet four inches in length.

Ski-ing has proved very useful in time of war. We all remember how bravely the Finnish armies fought against the Soviet armies about one year ago. Their ski-troops, dressed in white (to make themselves invisible in the snow), were able to resist the Soviet troops for many months.

Let us then hope that this winter there will be plenty of snow and that all skiers in Japan will have good sport.

Skating is one of the most enjoyable of the winter sports. How exciting it is to move over the ice at a great speed! How proud we feel when we become really skilful! We have many falls and tumbles while we are learning, but when we have become experts we are well repaid for all our efforts to learn.

The best skating is obtained on large ponds and lakes or on canals. The Dutch are probably the best skaters in Europe. Their country, Holland, has canals everywhere. In winter the frozen canals are excellent for skating. The water in a canal freezes much more easily than the water in a river. This is because canal water does not flow fast.

Expert skaters can do much more than simply move over the ice. They can do quick and sudden turns, making for example, the figure 8. They can leap up into the air and come down gracefully. Figure-skating needs great skill and long practice.

Although skating on natural ice in winter is the best kind of skating, we can enjoy the sport at all times of the

year. Many big cities have rinks in which there is a big floor of artificial ice. Here we can be cool and enjoy skating even in the hottest part of the summer.

Roller-skating is another form of the sport which can be enjoyed at all times of the year. Instead of steel blades, we fasten to our shoes skates with small wheels. These wheels make it possible to move quickly over a polished floor.

In some cities we see boys roller-skating on the smooth concrete roads. This may be good fun, but it is very dangerous. Boys should not go roller-skating in and out of the traffic of busy streets. If they do, they will perhaps find themselves in hospital with a broken leg or arm!

V. VENTILATION AND FRESH AIR

The air in any room in which there are people is growing bad all the time. People breathing, lights burning, food cooking, and many other things cause the air to become unfit to breathe. The smaller the room or the more people
5 in it, the faster the air becomes bad. Of course, if the room is closed and has no fresh air coming in, the air is really poisonous.

Whenever you go into a room from outdoors, notice how the air smells. Even if the air does not smell bad, if all
10 the windows and outside doors are shut tight, the room needs a change of air, or ventilation.

In ventilating a room always remember that cold air is not always fresh air. Cold air from a hall or a cellar is not fresh air. Fresh air is air coming in directly from
15 outdoors. It may take a little care to keep the air in the house pure, and it may cost a little more to keep it warm enough, but both care and cost are repaid in better health for the people in the house.

A simple way to ventilate a room is to open two opposite
20 windows, or a door and a window, and let the air blow through the room for a few moments. Or another good way is to raise the windows a few inches at the bottom, and pull them down at the top.

When ventilating a room there is sometimes danger of
25 catching cold from the draft, or current of air. It is a

very simple matter for a person to move away from the draft, or leave the room for a few minutes.

Colds, however, are caught far more easily from other causes than a draft of fresh air. Bad air, clothing not suited to the season, going without rubbers or overshoes,
5 or wearing low shoes, or shoes with thin soles in winter—all these things cause colds and may lead to more serious diseases.

Perhaps there is no habit which helps more towards good health than the habit of deep-breathing. Breathing deeply
10 will improve the health of anyone and will do wonders towards curing the early stages of consumption or tuberculosis. If this habit of deep-breathing is faithfully kept up, in time the flattened and sunken chest will begin to round out and widen, as the lungs grow larger and stronger.
15 Hold the head erect, throw the shoulders back, and take a deep breath through the nose. Hold the air in the lungs a few seconds and then let it go slowly through the nose.

Practise this habit of taking a deep breath as often as you think of it. If you do it once in every three or four
20 minutes while walking outdoors, and as often as every half-hour while working indoors, you will in time notice the result in new strength and better health.

VI. THE ENGLISH COTTAGE

The English cottage is a favourite subject for artists. It is picturesque and attractive. It suggests peace, contentment and a simple life.

5 In the middle of an English village there is usually a large, open area of grass. This is the village green. Round it are the village shops and the cottages where the farm labourers live. In the centre of the village is the church.

10 Cottages are usually built of material from the district in which they are situated. In some places the cottages are made of stone from local quarries. In others they are built of red brick. In many places they are built of wood and plaster, as in Japan. The roofs are often made of thatch or covered with slate.

15 Every cottage has its garden. Round the house are flowerbeds in which many kinds of old-fashioned flowers are to be seen. There are snowdrops, daffodils, narcissi and tulips in spring, roses, pansies, sweet williams and many other flowers in summer. Roses and honeysuckle often grow on
20 the walls of the cottages, and climb up to the bedroom windows.

The kitchen garden is further from the house. Here the labourer and his wife grow vegetables such as potatoes, peas, beans, cabbages, carrots and parsnips. There are
25 probably some fruit-bushes, too, such as currants, goosebe-

ries and raspberries. In the corner of the garden there are probably a few fruit-trees. Apple, pear, and plum trees provide beautiful blossom in spring and sweet fruit in summer.

The pump is near the back of the house. Here the wife
5 comes for water. At the end of the garden, furthest from the house, the farm-labourer probably has a pig-sty. Waste food from the house and garden enables him to keep a few pigs. These provide him with ham and bacon for
10 most of the year. He probably has a hen-house, too. Eggs are always useful.

The farm labourer does not receive high wages. But the rent of his cottage is low; he has his pigs and his hens; he can grow most of the fruit and the vegetables that he needs. His life is pleasant and simple, not luxurious.
15 Today there are good bus services between the villages and towns. The cottagers are no longer cut off from city life. They can jump on a bus and easily go into town to do their shopping or visit a cinema.

VII. SIR ISAAC NEWTON

When the father of modern science, Galileo, died, he left a large legacy of unfinished work to the sons of science. When people had grown accustomed to the existence of the many new stars which Galileo had shown, and had turned their eyes to earth again, they noticed with curious interest that the great master was amusing himself by rolling a board! He would tip the board a little, then roll the ball down. This he repeated over and over, each time inclining the board a bit more, until it was vertical. Each time he calculated how long it took for the ball to reach ground. Faster and faster it went, he noticed, the farther it travelled. Again, Galileo would put two boards together in the shape of a V, start the ball down one side, and observe how high it rolled up on the other side.

"A ball rolls along a path; a planet goes round the sun," thought Galileo. "Why? How? That question we must settle: how things move." That was Galileo's greatest moment of genius. No one before had ever dreamed that there was a science of motion—dynamics, as it is called.

"Motion!" people exclaimed. "What is difficult about that? A thing moves because—well, because something else pushes it. Some force, you see, makes it move. It is so with the planets. Some force is continually shoving them round and round."

When Galileo finished his ball-playing, he retorted, "Once

a thing is moving, you don't need a force to keep it in motion. It will go on by itself for ever. On the contrary, you need a force to stop it."

"How can that be?" objected his bewildered students. "Even the brass ball you rolled along the board gradually came to a stop."

"That," replied Galileo, "was because there was a force stopping the ball—the friction of the board against it. But when there is no friction, as in the sky, the moving body moves for ever straight on."

His life over, the spirit of Galileo's genius seemed to follow his law of motion and move straight on, for in the year in which he died Isaac Newton was born in Woolsthorpe, a small village in England. During the next twenty-three years scientists tried to make Galileo's laws of motion explain the movements of the planets. "We can now understand," they agreed, "why a moving planet keeps moving. But why does it go in a circle round the sun, and not in a straight line?"

At Cambridge University Isaac Newton thought about it, too. "Our ignorance continues," he said to himself, "because we haven't the proper mathematical method." That conclusion spurred him on to invent the calculus. It was the most powerful tool placed in the hands of mathematicians of modern times, and was a work of genius all the more astounding because when he had entered the University four years previously, the young man was said by his professors to be a poor student in mathematics.

But then Isaac had always been a surprising lad. He was for ever inventing one thing or another. At Woolsthorpe the simple villagers still talked of that fearful sight in the sky one night—a comet with a glowing tail, riding over their heads. Finally the comet caught fire and revealed itself as one of Master Isaac's kites with a paper lantern tied to its tail.

When he was doing his spelling lesson, questions not in the book would pop into his mind and interfere with his learning. "How fast is the wind blowing?" the lad once wondered. "How can I measure the speed of the wind?" With his back to the wind, he jumped as far forward as he could. He marked the spot "with the wind." Then he faced the wind, and again jumped, "against the wind." After subtracting, the little scientist could tell the speed of the wind.

His lessons, of course, suffered so from such preoccupation that Isaac hovered somewhat nearer the tail than the head of his class. One day the stimulus to become a good scholar came to him in the shape of a kick in the stomach. The foot that kicked him belonged to a bright bully who was ahead of Isaac in the class. In retaliation, Isaac first beat his antagonist with his fist, then with his brain. Indeed the speed that Isaac gathered in his studies carried him to the very head of his class and perhaps beyond his teacher.

Mrs. Newton, who owned a farm, hoped that her son would become a farmer. Isaac was, therefore, taken out

of the grammar school and started on his career of a farmer. But instead of tending the cattle, he would sit in the shade of a hedge and solve problems in mathematics.

His mother, who saw this, sent the poor farmer back to school, and in time he went to Cambridge University, where the works of Galileo and Huygens absorbed him.

"Why do planets move in a circle round the sun?" "Why does an apple fall down and not up?" Those questions made Newton forget that he had not eaten dinner, or that he was going out without a shirt. "Gravitation," some called the force, but Newton thought this was a vague answer. "Well, how does it work?" he questioned.

"The moon goes round the earth, the apple falls to the earth.....The earth must be forcing both the apple and the moon. But the moon does not fall down. Maybe that is because the moon is so much farther away than the apple...The moon is trying to get past the earth, but the earth pulls upon it and, as it turns, pulls the moon round and round with it. In fact, the earth would pull the moon right down to it with a crash, as it does the apple, were not the moon, fortunately for us, too far away. The pulling force of the earth becomes weaker and weaker as the body it pulls is farther and farther away. Now how much weaker? The young scientist drew a few circles and made a few calculations.

"I see it! If the moon is four times as far away as the apple, then four times four—you square the distance, which is sixteen, and use the inverse of it, one-sixteenth—the

earth exerts only one-sixteenth of the force. But wait! Does not the moon or the apple play any part in the matter? Does not each return the pull? It must! Every body, even if it is a speck, draws every other body. The
5 moon and earth pull each other together. If they did not, the moon would fly away out into space."

"That is how gravity works," thought Newton. "Now for the test: the earth, the books say, is about twenty-one thousand miles in circumference. Then the distance of
10 the moon from the earth is... Well, according to my reckoning, it should take the moon about thirty-two days to go once round the earth," Newton figured. "But alas! It does not. It takes the moon about twenty-seven days..."

Newton felt the bitterness of defeat. All his eagerness
15 to discover how gravitation works seemed like an empty dream, and he laid away his papers. The sense of his failure lay upon him for sixteen years, until one day some one mentioned to him that a French scientist had discovered a mistake in the measurement of the earth. "It is really
20 twenty-five thousand miles around," Newton was told.

Home he rushed. Maybe he had been right after all. He must make his test again by the new measurement of the earth. When the answer came, it showed that his theory had been right, that he had discovered the true
5 law of gravitation sixteen years before.

Now was the time for Newton to shout, "I have discovered the reason why the earth turns round the sun." But he was so modest that he said nothing about it.

A few years went by. Then one day Newton had a visitor from London. It was Halley, the astronomer. "We cannot solve this problem," said Halley; "we need your help. If gravity works by the law of inverse squares, what is the path of a planet in going round the sun?" 5

"An ellipse," promptly answered Newton.

Halley was taken aback by Newton's readiness. "Why, how do you know?" he gasped.

"I've calculated it."

"Show me your papers." 10

Newton went to his desk, but was unable to find the papers. He was careless and so modest that he had thrown them away. But he reworked the figures for Halley, and in addition showed him all that he had written on science. Halley was lost in admiration. 15

"These are the greatest discoveries ever made," said he. "I shall get the Royal Society to publish them."

The Royal Society, however, had spent its last farthing on printing a book on fish, so that Halley had to publish Newton's book at his own expense. 20

Newton's laws have been our finest tool in solving the problem of nature. So many puzzles were made plain by them that scientists felt they had few more to learn; such puzzles as why there are tides, and how much matter there is in the stars. 25

When Newton peered through one of Galileo's telescopes, he thought about the blur in vision. Poor Galileo had probably lost his sight by straining through the murky

glass. "The trouble," Newton believed, "would be overcome if we knew more about light."

He had noticed the beautiful iridescent shades that play in a bubble of soap, or in the glass prisms of the chandelier, and he must have gazed long at a rainbow. He had a suspicion that ordinary white light was not a simple affair after all, and he began to experiment.

He made his room totally dark except for a tiny hole in the window shutter. Through that hole one beam of sunlight streamed into the darkened room and fell upon the opposite wall. Then, right in the way of the sunbeam, Newton put a glass prism so that the light went through it. A wonderful thing happened! There on the wall, instead of the round spot of white light, Newton saw a band of seven colours: red, orange, yellow, green, blue, indigo, and violet—the colours of the spectrum, as we now call it.

The secret of light was now as clear to Newton as light itself. "Sunlight is a combination of the seven colours of the spectrum," he said.

There is large meaning in this. When we say, for instance, that grass is green, the truth really is that the grass gives back the green light of the sun's rays. It absorbs six colours, but it reflects only the green.

Newton realized that the trouble with Galileo's telescope was that the lenses acted like prisms: they broke up the light and blurred the view. In the end he invented a new kind of telescope—one form of the reflecting telescope.

Isaac Newton was a mild, pleasant person. Most of his life he was very poor, because he gave away his money to whoever needed it more than he. This open-handed charity embarrassed him, for there was a time when he could not afford to pay his dues of one shilling to the Royal Society.

He was careless and absent-minded. He worked so steadily that he scarcely remembered to eat, and begrudged himself his four or five hours of sleep.

Once Newton invited a friend to dinner. The guest arrived: dinner was served. Newton was in his room working. The friend waited some time and then, partly from sheer annoyance, partly from a desire to be smart, ate all the dinner, Newton's share included. Presently the host entered, greeted his friend, and sat down at the table. He lifted the cover of the chief dish, stared awhile blankly at the bones, and at length said with a sigh: "I forget that we have already dined."

The world has never been able to restrain its admiration for sir Isaac Newton, the greatest genius that ever lived. But Newton himself was modest to the last. "I have been but as a child playing on the seashore," he said, "now and then finding a smoother pebble or a prettier shell than my companions, while the great ocean of truth lay all undiscovered before me."

VIII. BAMBOO WARE

The use of the bamboo in Japan is extraordinarily extensive. It is employed in making innumerable kinds of ornamental things, as well as for practical, domestic use. And perhaps fanciful bamboo ware will be some of the most peculiar souvenirs showing the simplicity in Japanese art. The bamboo grows everywhere in Japan and bamboo ware also is sure to attract the eye of tourists visiting this country.

People from abroad would scarcely realize how numerous bamboo products are, but, to mention some at random, there are flower baskets, cigarette holders, pen holders, walking sticks, angling rods, knives and forks, ash trays, lamp shades, sun blinds, and what not. Some of these articles are not only lovely ornaments in the home, but extremely useful as well; for example, flower baskets are exported in large quantities every year for that reason. Aside from practical use, tiny toys and dainty ornaments made of bamboo must be remembered as excellent souvenirs reflecting Japanese taste. These small articles are either bamboo twigs twisted, or pieces of the stem carved, into humorously fantastic figures of men, women, and animals such as monkeys, dogs, cats, as well as birds, lobsters and various other creatures. Their designs and ideas differ more or less from one another according to the place of origin, but those of Okayama, Hiroshima and

Nara are thought tasteful. Tokyo and Kyoto have a large stock of those tiny varieties of bamboo ware.

IX. NATIONAL PARKS OF JAPAN

The Government, which had long felt the need of establishing national parks similar to those in America, selected 12 zones as sites in 1932. They are Akan, Daisetsuzan, Towada, Nikko, Fuji-Hakone, the Japan Alps, Yoshino-Kumano, Daisen, the Inland Sea, Aso, Unzen, and Kirishima. In all, about 2,508,000 acres or 2.7 per cent of the whole area for the four main islands (Hokkaido, Honshu, Shikoku, and Kyushu), has been set apart to preserve and protect the natural beauty of those regions for the benefit of the public.

Akan National Park extends over the two provinces of Kushiro and Kitami. The park may be divided into two districts, Kutcharo and Akan, which are geologically of volcanic formation. The outstanding features of these districts are lofty mountains, primeval forests, and crater-lakes. In the Kutcharo district are the two lakes of Mashu and Kutcharo. Midway between these two lakes lies a volcanic mountain range, of which the most prominent peak is Mt. Atosa-nupuri, an active volcano. At the foot of the peak is the Kawayu Spa. At the southern extremity of Lake Kutcharo is the Wakoto Peninsula also dotted with a few hot springs. The Akan district is said to be richer in scenic attractions than the Kutcharo. Though the best time for visiting Akan is from June to September, winter is by no means a dead season in this

region, for the district affords excellent skating and skiing grounds.

Daisetsuzan National Park is the largest of all the national parks in Japan Proper. Extending over the two provinces of Ishikari and Tokachi, it embraces a few volcanic ranges which include Asahi-dake, the highest mountain in the Hokkaido, Kuro-dake, Hakuun-dake, Ryo-un-dake and others, all snow-capped. On the slopes of these mountains are extensive forests and rare alpine flora, known as the ohana-batake, "flower fields". Lake Shikaribetsu is the only lake this region boasts, but some large rivers such as the Ishikari, Tokachi, Chubetsu and Otofuke take their origin from these mountains, having many picturesque gorges and ravines on their upper reaches.

The Sounkyo on the River Ishikari, the Shosen-kyo (Tennin-kyo) on the River Chubetsu, and the Sensuikei on the River Otofuke are the most typical of these gorges. The Sounkyo is considered the grandest of its kind in this country. These gorges are generally blessed with hot-spring resorts.

Towada National Park, situated between Aomori and Akita prefectures, covers mountain and lake districts. Among the manifold attractions of the national park are Lake Towada, the largest mountain lake in Japan, the Oirase Valley and the Hakkoda volcanic range. Lake Towada is often compared with the famous Crater Lake in America. The best time to make a trip to Towada is

from May to October.

Nikko National Park includes the town of Nikko itself and the so-called Oku-Nikko (Inner Nikko) region which stretches over the four prefectures of Tochigi, Gumma, Fukushima and Niigata.

Here is magnificent mountain scenery, with rivers, cascades, water-falls, lakes, and ancient trees. Moreover, there can be seen the finest handiwork of man in the mausoleums erected over the tombs of Iyeyasu, the founder of the Tokugawa Shogunate, and over that of his grandson Iyemitsu. Many foreign visitors regard Nikko as by far the most awe-inspiring sight of Japan.

Nikko is also noted for its tinged foliage in autumn.

Nikko is the most popular of the 12 national parks of Japan Proper. Here is a region where tourists may spend their holidays, where religious devotees may visit shrines and temples. There students of nature or history may enjoy research in their respective fields, while urban dwellers may spend their summer vacations. In this great national park there is every facility for camping, mountain-climbing, sailing, angling, skiing, and skating. The park even possesses a number of splendid hot-spring resorts, noted for their recreational, recuperative, and curative advantages. Moreover, Nikko may be enjoyed throughout the year, for each of the four seasons has its attractions.

X. PAPER

There never was a time when paper was used more lavishly. We pay our bills in notes or as a cheque. If we go to a concert we handle a paper programme. If we jump on a bus we get a paper ticket. If we buy an article it is wrapped up in paper or put into a bag.

We take a photograph and the picture is printed on paper. When we write a letter we need note-paper to write on, a paper envelope, and a paper stamp to send it through the post. The artist needs paper for his pictures. The typist needs paper for her machine. The musician puts his melodies down on paper, and the writer can do nothing without paper. Poetry, plays, stories, news, all are committed to paper.

There is no end to the uses of paper. It comes into every part of life. A paper must be signed when we are born, another when we die. Wills are written on paper; marriages are recorded on paper. We can hardly imagine business transactions and legal affairs being carried on without paper. Shylock held his bond, and bonds to-day are printed on paper. The doctor writes his prescription on paper. Great ships and great blocks of buildings, even docks and irrigation schemes, begin on paper.

There are examination papers, carbon papers, squared papers and ruled papers we have blotting paper, India paper, Japanese vellum, straw-boards, and newspapers.

Every day hundreds of miles of paper pass through printing presses of our great cities, all telling the world the events of the hour. The telegraph, telephone, and tape machine, the journalist and editor and printer, all help to make our newspapers, but without paper they could not exist.

Paper, taking its name from the papyrus reed which still grows in Egypt, has superseded the parchments used long before. Examples of ancient papyri may be seen in the British Museum, many of them with writing almost as clear after thousands of years as when the ink was newly dried. The Romans perfected the manufacture of papyrus, but the industry languished, and the beginnings of paper-making as we know it are to be found in the methods brought westward from China by the Arabs, and said to have been introduced into Europe by the Moors. That would be in the 11th century.

In the old days paper was largely made of rags, but now most of it is manufactured from wood pulp. paper is everywhere. It not only hangs on our walls: paper clothes are now being manufactured. It was a scrap of paper which plunged the world into war for four years. It is on paper that peace treaties are drawn up.

XI. GLASS

Without glass life as we know it today would be impossible. Glass has led us on to knowledge and to power.

Glass has given us lenses which have enabled us to explore the depths of space or probe the mysteries of the infinitely small. With the lens the astronomer sweeps the heavens, turning his telescope to the myriad worlds in space, learning the size and weight and nature and number of the stars. In the microscope the lens enables us to discover the structure of minute organisms and track down disease, as Sir Ronald Ross hunted down the malaria germ.

There could have been no cinema and no camera without glass. Again the lens is everything, and all branches of photography (for snaps, for trade purposes, for the X-ray, and for the newspaper illustration) depend on glass.

In the last two centuries glass has played an increasingly important part in the manufacture of scientific instruments. The therm meter, the valve for electric rays and wireless waves, the photo-electric cell, these and scores of other instruments could never have been made without glass.

To glass we owe the prism by which Newton broke up light into its component colours, and the electric lamps which light our houses and streets. Even spectacles would be unknown if there were no glass.

Glass is everywhere. It is up in the air, where the pilot depends on instruments protected by glass; it is down in the sea where the submarine periscope reveals what is happening on the surface. Highly polished metal might
5 serve us very well, but there is nothing like glass for a clear reflection. The windows of our houses would be no more than holes in the wall were it not for glass, the astonishing material which keeps out the wind and rain and gives us a clear view of the stars.

10 Tumblers, bottles, showcases, and shop windows are of glass; and now we have glass pencils, silk made of finely drawn glass, and a promise of glass razor blade at 40 a penny. Old cut glass is something to treasure.

The first glass ever made probably came from Syria or
15 Phoenicia. Egyptian paintings of over 2,000 years before Christ show glass-blowers at work, and we know that houses in Pompei had glass in the windows. Over 20 centuries ago the Romans had brought the manufacture of glass to such a pitch that nothing finer has since been made.

20 After the Romans left Britain the art of glass-making was almost lost till French glass-workers were called in about the eighth century. After that the trade began to revive, and by the time Queen Elizabeth was on the throne the making of glass had become an important industry.

25 Fine glassware has been made ever since.

We keep in our everyday speech the old proverb: People who live in glass houses should not throw stones.

XII. OIL

Oil is one of the greatest factors in the shaping of our modern world. But for oil there could be no petrol engine. Until the end of last century the vast oil-fields remained untapped. Then, when science and invention
5 have advanced far enough for the making of a smaller engine than was used for developing steam power, mineral oil was discovered, and a way found of distilling it so that what is known as petrol could be used as the power in the car and the aeroplane.

This use of oil has brought a new age. It has made
10 possible our conquest of the air and our mastery of speed. It has linked the nations of the world together and has brought the ends of the earth within a day or two of each other. Planes carrying mails and passengers and goods along the world's skyways, and the millions of cars for
15 ever speeding along the great new roads, all these we owe to oil.

It has a thousand and one uses. Mineral oil, drawn from wells in the Old World and the New, drives many of our liners and warships. Every year sees the railways
20 building more oil locomotives. All round the world where gas and electricity are not readily available paraffin oil gives a clear white light, and in lonely spots are lighthouses burning paraffin vapour which becomes incandescent, throwing its powerful beams for miles across angry
25

seas.

Vaseline, the asphalt used for roofing, paraffin wax, these are some of the forms in which crude oil may appear. Soap, paints, varnishes, leather dressings; linole-
5 ums, all these we owe to another class of oils; and from whale oil and the oil of cotton seeds comes much of the margarine which in recent years has taken the place of butter.

But for oil our towns and cities would be full of
10 squeaking gates and doors. Next to petrol which drives its engine the most important thing about a car is the oil which enables the working parts to run smoothly and easily.

We take oil with our food; the Eskimos almost live on
15 it. With it the artist paints his pictures.

From time immemorial men have poured oil on troubled waters. Even as far back as the eighth century Bede tells us that St. Aidan gave a young priest a cruse of oil, and that afterwards when he was sailing in a ship and
20 a storm arose he poured the oil on the sea so that there was a great calm. Today the motor lifeboats round our coasts (deriving their power from oil) carry gallons of oil to enable them to rescue those in peril on the sea.

Truly oil is one of earth's best gifts. It is a driving
25 force. It throws a light on our path. It eases pain and cures disease. It is food and warmth. If today we do not burn the midnight oil we are using oil all the day long.

XIII. DAVID SWAN

We can be but partially acquainted even with the events which actually influence our course through life and our final destiny. There are other events, if such they may be called, which come close upon us, yet pass away without actual results, or even betraying their near approach, by
5 the reflection of any light or shadow across our minds. Could we know all the vicissitudes of our fortunes, life would be too full of hope and fear to afford us a single hour of true serenity. This idea may be illustrated by a page from the secret history of David Swan. 10

We have nothing to do with David until we find him, at the age of twenty, on the highroad from his native place to the city of Boston, where his uncle, a small dealer in the grocery line, was to take him behind the counter. Be
15 it enough to say that he was a native of New Hampshire, born of respectable parents, and had received an ordinary school education, with a classic finish by a year at Gil-
manton Academy.

After journeying on foot from sunrise till nearly noon of a summer's day, his weariness and the increasing heat
20 determined him to sit down in the first convenient shade and await the coming up of the stage-coach. As if planted on purpose for him, there soon appeared a little tuft of maples, with a delightful recess in the midst, and such a fresh bubbling spring that it seemed never to have
25

sparkled for any wayfarer but David Swan. He kissed it with his thirsty lips, and then flung himself along the brink, pillowing his head upon some shirts and a pair of pantaloons tied up in a striped cotton handkerchief.

5 The sunbeams could not reach him; the dust did not yet rise from the road, after the heavy rain of yesterday; and his grassy lair suited the young man better than a bed of down. The spring murmured drowsily beside him, the branches waved dreamily across the blue sky overhead; 10 and a deep sleep, perchance hiding dreams within its depths, fell upon David Swan. But we are to relate events which he did not dream of.

While he lay sound asleep in the shade, other people were wide awake and passed to and fro afoot, on horse- 15 back, and in all sorts of vehicles along the sunny road by his bedchamber. Some looked neither to the right hand nor the left, and knew not that he was there; some merely glanced that way, without admitting the slumberer among their busy thoughts; some laughed to see how 20 soundly he slept; and several, whose hearts were brimming full of scorn, ejected it on David Swan.

A middle-aged widow, when nobody else was near, thrust her head a little way into the recess, and vowed that the young fellow looked charming in his sleep. A temper- 25 ance lecturer saw him, and wrought poor David into the texture of his evening's discourse as an instance of dead drunkenness by the roadside. But censure, praise, merriment, scorn, and indifference were all one, or rather all

nothing, to David Swan.

He had slept only a few moments, when a brown carriage, drawn by a handsome pair of horses, bowled easily along, and was brought to a standstill nearly in front of David's resting-place. A linchpin had fallen out, and permitted 5 one of the wheels to slide off. The damage was slight, and occasioned merely a momentary alarm to an elderly merchant and his wife, who were returning to Boston in the carriage.

While the coachman and a servant were replacing the 10 wheel the lady and gentleman sheltered themselves beneath the maple-trees, and there espied the bubbling fountain and David Swan asleep beside it. Impressed with the awe which the humblest sleeper usually sheds around him, the merchant trod as lightly as the gout would allow; 15 and his spouse took good heed not to rustle her silk gown, lest David should start up all of a sudden.

"How soundly he sleeps!" whispered the old gentleman. "From what a depth he draws that easy breath! Such 20 sleep as that, brought on without an opiate, would be worth more to me than half my income; for it would suppose health and an untroubled mind."

"And youth besides," said the lady. "Healthy and quiet age does not sleep thus. Our slumber is no more like his 25 than our wakefulness."

The longer they looked the more did this elderly couple feel interested in the unknown youth to whom the wayside and the maple shade were as a secret chamber, with the

rich gloom of damask curtains brooding over him. Perceiving that a stray sunbeam glimmered down upon his face, the lady contrived to twist a branch aside so as to intercept it; and having done this little act of kindness, she began to feel like a mother to him.

"Providence seems to have laid him here," whispered she to her husband, "and to have brought us hither to find him, after our disappointment in our cousin's son. Methinks I can see a likeness to our departed Henry. Shall we waken him?"

"To what purpose?" said the merchant, hesitating. "We know nothing of the youth's character."

"That open countenance," replied his wife, in the same hushed voice, yet earnestly. "This innocent sleep!"

While these whispers were passing, the sleeper's heart did not throb, nor his breath become agitated, nor his features betray the least token of interest. Yet Fortune was bending over him, just ready to let fall a burden of gold. The old merchant had lost his only son, and had no heir to his wealth except a distant relative, with whose conduct he was dissatisfied. In such cases people sometimes do stranger things than to act the magician, and awaken a young man to splendour who fell asleep in poverty.

"Shall we not waken him?" repeated the lady persuasively.

"The coach is ready, sir," said the servant, behind.

The old couple started, reddened, and hurried away,

mutually wondering that they should ever have dreamed of doing anything so very ridiculous. The merchant threw himself back in the carriage, and occupied his mind with the plan of a magnificent asylum for unfortunate men of business. Meanwhile, David Swan enjoyed his nap.

The carriage could not have gone above a mile or two when a pretty young girl came along, with a tripping pace, which showed precisely how her little heart was dancing in her bosom. She turned aside into the shelter of the maple-trees, and there found a young man asleep by the spring! But there was peril near the sleeper. A monster of a bee had been wandering overhead---buzz, buzz, buzz---now among the leaves, now flashing through the strips of sunshine, and now lost in the dark shade, till finally he appeared to be settling in the eyelid of David Swan.

The sting of a bee is sometimes deadly. As free-hearted as she was innocent, the girl attacked the intruder with her handkerchief, brushed him soundly, and drove him from beneath the maple shade. How sweet a picture! This good deed accomplished, with quickened breath and a deep blush, she stole a glance at the youthful stranger for whom she had been battling with a dragon in the air.

"He is handsome!" thought she, and blushed redder yet.

How could it be that no dream of bliss grew so strong within him that, shattered by its very strength, it should part asunder and allow him to perceive the girl among its phantoms? Why, at least, did no smile of welcome brighten

upon his face?

"How sound he sleeps!" murmured the girl.

She departed, but did not trip along the road so lightly as when she came. Now, this girl's father was a thriving
5 country merchant in the neighbourhood, and happened, at that very time, to be looking out for just such a young man as David Swan. Had David formed a wayside acquaintance with the daughter, he would have become the father's clerk, and all else in natural succession. So here,
10 again had good Fortune---the best of fortunes---stolen so near that her garments brushed against him; and he knew nothing of the matter.

The girl was hardly out of sight when two men turned aside beneath the maple shade. Both had dark faces, set
15 off by cloth caps, which wore drawn down aslant over their brows. Their dresses were shabby, yet had a certain smartness. These were of couple of rascals, who got their living in whatever way they could, and now, in the interim of other business, had staked the joint profits
20 of their next piece of villainy on a game of cards, which was to have been decided here under the trees. But finding David asleep by the spring, one of the rogues whispered to his fellow:

"Hist! Do you see that bundle under his head?"

25 The other villain nodded, winked, and leered.

"I'll bet you a horn of brandy," said the first, "that the chap has either a pocket-book or a snug little hoard of small change stowed away among his hirt. And if not

there, we shall find it in his pocket."

"But how if he wakes?" said the other.

His companion thrust aside his waistcoat, pointed to the handle of a dirk, and nodded.

"So be it!" muttered the second villain. 5

They approached the unconscious David, and while one pointed the dagger towards his heart, the other began to search the bundle beneath his head. Their two faces, grim, wrinkled, and ghastly with guilt and fear, bent over their victim, looking horrible enough to be mistaken for fiends,
10 should he suddenly awake. Nay, had the villains glanced aside into the spring, even they would hardly have known themselves as reflected there. But David Swan had never worn a more tranquil aspect, even when asleep on his mother's breast. 15

"I must take away the bundle," whispered one.

"If he stirs I'll strike," muttered the other.

But at this moment a dog, scenting along the ground, came in beneath the maple-trees, and gazed alternately at each of these wicked men, and then at the quiet sleeper. 20 He then lapped out of the fountain.

"Pshaw," said one villain. "We can do nothing now. The dog's master must be close behind."

"Let's take a drink and be off," said the other.

The man with the dagger thrust back the weapon into
25 his bosom, and they left the spot, with so many jests, and such laughter at their unaccomplished wickedness, that they might be said to have gone on their way rejoicing.

In a few hours they had forgotten the whole affair, nor once imagined that the recording angel had written down the crime of murder against their souls in letters as durable as eternity. As for David Swan, he still slept quietly, 5 neither conscious of the shadow of death when it hung over him, nor of the glow of renewed life when that shadow was withdrawn.

He slept, but no longer so quietly as at first. An hour's repose had scatched from his elastic frame the weariness 10 with which many hours of toil had burdened it. Now he stirred--now moved his lips, without a sound--now talked in an inward tone, to the noonday spectres of his dream. But a noise of wheels came rattling louder and louder along the road, until it dashed through the dispersing 15 mist of David's slumber--and there was the stage-coach. He started up, with all his ideas about him.

"Halloo, driver! Take a passenger?" shouted he.

"Room on top!" answered the driver.

Up mounted David, and bowled away merrily towards 20 Boston, without so much as a parting glance at that fountain of dreamlike vicissitude. He knew not that a phantom of Wealth had thrown a golden hue upon its waters, nor that one of Love had sighed softly to their mummur, nor that one of Death had threatened to crimson them with 25 his blood--all in the brief hour since he lay down to sleep. Sleeping or waking, we hear not the fairy footsteps of the strange things that almost happen.

—N. Hawthorne.

XIV. ULTRA-VIOLET AND INFRA-RED RAYS

Everyone knows that the sun gives out light and heat. You can see the light, or rather you can see its effect upon your eyes when it strikes an object. Heat is also invisible, but the sensation produced can be felt. This is why we call the vibrations or rays which produce light 5 part of the "visible spectrum." Ordinary light, although it seems to be white, is composed of many aetherial oscillations of different length, which, when they combine, appear to be white. If you look at a ray of light through a prism, you will see it split up into component colours. 10 It is because white light is composed of many different rays that you see reds, greens, blues, and violets when the sun catches the bevelled edge of a mirror.

Interesting as visible light may be, it is "invisible light" 15 which has been attracting the attention of inventors during the last half century. Doctors discovered that one of the reasons why people returned from summer holidays feeling well and happy, was that they had been burned by the sun. In the towns, the sooty atmosphere absorbs many of the valuable life-giving rays before they can reach 20 your skin. The inventor asked: "Why should we not have sunlight in the dirtiest towns on a wet day?" He found that the penetrating rays of the sun, which turn your skin brown could be made artificially by passing an electric current through mercury vapour in a long quartz tube, one 25

end of which contains mercury ready to be volatilized. Another type of lamp is like an arc light, except that it uses tungsten in place of carbon. Ordinary carbons can be so treated as to produce the short-wave invisible light which, in the spectrum, is just beyond the violet. To-day, tungsten and mercury vapour lamps are common wonders of invention. Almost every large hospital in the world has installed them for the treatment of patients who are run down, and many people keep one in their bath-room so that they may be washed every day, not only by water, but by the health-giving rays of an artificial sun.

One of the curious things about ultra-violet rays, as this type of invisible light is called, is that they are turned back by almost any obstruction. Clothes prevent them reaching the skin, which is the reason why sun-bathers wear so little, even a film of grease absorbs them, so that patients usually have a water bath first! The usual kind of lead-containing glass which passes ordinary light cuts off these delicate rays so that most enclosed ultra-violet lamps use "quartz glass" in its place.

Ultra-violet rays have several interesting properties which have been turned to account by the inventor. I have said that ultra-violet rays are invisible, and so they are to the naked eye. But the camera can see many things which are invisible to human beings. Amongst others it can "see" the ultra-violet rays, which affect a sensitive plate. The photograph can be developed, and so, although we cannot see things which are bathed only in ultra-violet

rays, we can take photographs of them without difficulty.

When ultra-violet rays are used instead of ordinary light rays, a lens can be made even more powerful. If it were possible to look at a mouse through a lens under violet-rays, it would appear as big as the mountain of the proverb.

Inventors knew that there were certain germs so small that the ordinary microscope could not make them visible. Bearing this in mind, the inventor produced another wonder: a microscope that saw by ultra-violet rays. Of course, if you looked through it, you would see nothing, but the expert takes a photograph and the magic rays give a picture of germs so small that they will pass through a piece of porcelain! One of the greatest successes with this invention has been the discovery of the bacteria which are responsible for foot-and-mouth disease.

The rays separated by the chemist in his laboratory have also proved of great use to industry. Ultra-violet or allied light can be used to select between colours which appear similar in daylight, and to detect forgery. They can also be employed to save the makers of cloth thousands of pounds a year. The damage done to such materials by germs and mildew often cannot be detected until the process of manufacture is complete, so that until quite recently, thousands of yards of cloth had to be thrown away because it had been attacked by these two enemies of the weaver. Now the suspected cloth is placed in an ultra-violet ray cabinet which immediately shows if mildew or germs are present, so that the damage

can be rectified before it is too late.

Ultra-violet rays are not the only light which acts on the body. Another group of rays are called "infra-red" rays because they are a little shorter than the rays which
5 produce the sensation of redness on the retina or screen of the eye. Infra-red rays, although they are invisible, are sent out by gas fires, and a special form of clay has been invented with the object of making the fires emit as
10 make those who bathe in them feel brighter and happier, especially in winter time, but their action is milder than that of the ultra-violet.

The special lamps used for infra-red treatment do not emit any visible light at all and a small red bulb is usually
15 fitted to show when the lamp is working. It is used in a darkened room, so that the visible rays of light shall not interfere with the special treatment. The warm and penetrating infra-red rays usually give great relief to people who are in muscular pain, and they are also being used
20 as a substitute for the knife in certain operations. Many young people have to have their tonsils removed, and although it is done under an anaesthetic and they feel no pain, it is not very pleasant. Surgeons are now finding that they can apply infra-red rays, and that in a short time the
25 patient simply loses the unwanted part of the tonsils.

Infra-red rays are sent out in large quantities by the sun and they keep us warm. If the supply were cut off we should die, for all life originated in the sun. Like ultra-

violet rays, ray, infra-red rays will affect a special photographic plate, and by means of these rays it is possible to obtain pictures of objects which are invisible to the eye. High mountains are often shrouded in
5 mist, but with a special camera that largely cuts out ordinary light rays and only admits infra-red rays, it is possible to secure a picture showing peaks and valleys which are hidden from the photographer. Ordinary lenses are
10 sometimes replaced by reflectors of rock salt because glass may cut out most of the infra-red.

Infra-red rays are also responsible for one of the latest inventions, for it has been possible not only to make visible records in apparent darkness, but to photograph engines in such a manner that parts suffering from overheating
15 can be instantly detected.

The effect of both ultra-violet and infra-red rays on the human body is as yet not well understood. It is thought that certain vitamins may be supplied by their use, although it is not yet easy to understand the difference between
20 the effect of this process and that caused by the mere stimulation of the skin, such as is obtained by the application of a mustard plaster. Physical apparatus does not
25 "mind" whether oscillations in the aether happen to produce light on our eyes, heat on a thermopile, or invisible light in a sensitive electro-chemical cell.

The scientific progress which may eventually be made by a study of visible light can hardly be imagined at the present time. We have learnt that there are rays which

can penetrate fog and help in the guiding of ships at sea, or by means of which it is possible to transmit invisible messages which can only be read by those provided with the receiver which is sensitive to the rays. We have
 5 discovered that there are special rays which produce a cleansing effect upon the body, but we have still to find out how light of all kinds is transmitted, and how far this knowledge will ultimately assist the never-ending search for the truth as to the dependence of life itself
 10 upon light--both visible and invisible.

The discovery of new elements and even the knowledge already possessed by mankind as to the composition of the sun are part of the romance of the spectrum. Here is an illimitable field for the inventor, for light itself
 15 cannot be examined under any microscope. It is upon its effects and the resultant phenomena that so many theories of science and this universe are based.

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XV. SELF-RELIANCE

It is important to learn to rely upon yourself; for little has been done in the world by those who are always looking out for some one to help them.

We must be on our guard not to confound self-reliance with self-conceit, yet the difference between the two cannot
 5 easily be defined in words. The difference is something like that between bravery and foolhardiness.

The self-conceited person takes it for granted that he is superior to others. The self-conceited girl thinks that she is handsomer, more graceful, or more talented than
 10 other girls, that her work is nicer, or that her composition shows more genius. Whatever is to be done, she thinks that she can do it better than another, and that her way is always the best. The self-conceited boy looks upon himself and his exploits in the same way. It is hard to
 15 correct this, because all that such self-conceited persons do seems to them so nearly perfect that they are liable to grow more and more conceited.

It is one advantage of going to school that girls and boys are apt to have the conceit more or less taken out
 20 of them, because they are often thrown among others who are superior to them, and because their companions have little patience with such pretense.

Self-reliance is very different from this. The self-reliant person is often very modest. He does not say about any-
 25

thing that is to be done, "I am so strong and wise that I can do it." He says, "I will try, and if patience and hard work will do it, it shall be done."

One way in which a person may become self-reliant, is never to seek or accept help till he has fairly tried what can be done without it. Some scholars, if they come to a problem that seems hard, run at once to the teacher, or an older friend, or perhaps even to another scholar, who is brighter or more self-reliant than themselves, in order to be told how to do it. Always try it yourself. Even if it is nothing more important than a conundrum, do not wish somebody to tell you the answer till you have fairly tried to conquer it.

It is a pleasant feeling that comes from having done a difficult thing oneself, a feeling that those never have who are helped out of every hard place.

It is like the feeling that one has after having climbed a steep mountain. There is a healthy pride in having conquered the difficulty of the ascent. There is also the comfortable feeling that comes when the muscles have been used without being unduly strained. There is a similar pleasant sensation when the mind has been exerted successfully, in learning, for instance, a difficult task, or solving a hard problem.

One who has overcome one difficulty is ready to meet the next with confidence that too will yield to his attempt.

See how much such a person has gained. In later life, while others are hesitating what to do, or whether to do

anything, he goes forward and accomplishes what he undertakes.

Self-reliance is as important in thought as it is in action. Some people find it hard to make up their minds. They run to one and another to get advice. Perhaps it is in regard to nothing more important than the colour of a dress. Perhaps the bits of advice which they receive conflict with one another; then such people are worse off than they were before.

No person knows better the real value of advice than he who is self-reliant. He has measured his own powers so often that he knows where he needs help.

It is pleasant, and sometimes helpful, to talk over our plans with a friend; but we must remember that it is we ourselves who must make the decision.

XVI. AFTER TWENTY YEARS

The policeman on the beat moved up the avenue impressively. The impressiveness was habitual and was not for show, for spectators were few. The time was barely ten o'clock at night, but chily gusts of wind with a taste of rain in them had well nigh depeopled the streets.

Trying doors as he went, twirling his club, turning now and then to cast his watchful eye down the quiet street, the officer, with his stalwart form and slight swagger, made a fine picture of a guardian of the peace. The vicinity was one that kept early hours. Now and then you might see the lights of cigar store or an all-night lunch counter; but most of the doors belonged to business places that had long since been closed.

When about midway of a certain block the policeman suddenly slowed his walk. In the doorway of a darkened hardware store a man leaned, with an unlighted cigar in his mouth. As the policeman walked up to him the man spoke up quickly.

"It's all right, officer," he said, reassuringly, "I'm just waiting for a friend. It's an appointment made twenty years ago. Sounds a little funny to you, doesn't it? Well, I'll explain if you'd like to make certain it's all straight. About that long ago there used to be a restaurant where this store stands—'Big Joe' Brady's restaurant."

"Until five years ago," said the policeman. "It was

torn down then."

The man in the doorway struck a match and lit his cigar. The light showed a pale, square-jawed face with keen eyes, and a little white scar near his right eye-brow. His scarfpin was a large diamond, oddly set.

"Twenty years ago to-night," said the man, "I dined here at 'Big Joe' Brady's with Jimmy Wells, my best chum. He and I were brought up here in New York, just like two brothers, together. I was eighteen and Jimmy was twenty. The next morning I was to start for the West to make my fortune. You couldn't have dragged Jimmy out of New York; he thought it was the only place on earth. Well, we agreed that night that we would meet here again exactly twenty years from that date and time, no matter what our conditions might be or from what distance we might have to come. We thought that in twenty years each of us ought to have our destiny worked out and our fortunes made, whatever they were going to be."

"It sounds pretty interesting," said the policeman. "Rather a long time between meets, though, it seems to me. Haven't you heard from your friend since you left?"

"Well, yes, for a time we wrote to each other," said the other. "But after a year or two we lost track of each other. But I know Jimmy will meet me here if he's alive, for he always was the truest, staunchest old chap in the world. He'll never forget. I came a thousand miles to stand in this door to-night, and it's worth it if my old partner turns up."

The waiting man pulled out a handsome watch, the lids of it set with small diamonds.

"Three minutes to ten," he announced. "It was exactly ten o'clock when we parted here at the restaurant door."

5 "Did pretty well out West, didn't you?" asked the policeman.

"You bet! I hope Jimmy has done half as well. He was a kind of plodder, though, good fellow as he was. I've had to compete with some of the sharpest wits going
10 to get my pile. A man gets in a groove in New York. It takes the West to put a razor-edge on him."

The policeman twirled his club and took a step or two

"I'll be on my way. Hope your friend comes around all right. Going to call time on him sharp?"

15 "I should say not!" said the other. "I'll give him half an hour at least. If Jimmy is alive on earth he'll be here by that time. So long, officer."

"Good-night, sir," said the policeman, passing on along his beat, trying doors as he went.

20 There was a fine, cold drizzle now falling, and the wind had risen from its uncertain blow into a steady blow. The few foot passengers astir in that quarter hurried dimly and silently along with coat collars turned high and pocketed hands. And in the door of the hardware
25 store the man who had come a thousand miles to fill an appointment, uncertain almost to absurdity, with the friend of his youth, smoked his cigar and waited.

About twenty minutes he waited, and then a tall man

in a long overcoat, with collar turped up to his ears, hurried across from the opposite side of the street. He went directly to the waiting man.

"Is that you, Bob?" he asked doubtfully.

"Is that you, Jimmy Wells?" cried the man in the door. 5

"Bless my heart!" exclaimed the new arrival, grasping both the other's hands with his own. "It's Bob, sure as fate. I was certain I'd find you here if you were still in existence. Well, well, well!--twenty years is a long time. The old restaurant's gone, Bob; I wish it had lasted, so we could
10 have had another dinner here. How has the West treated you, old man?"

"Bully; it has given me everything I asked it for. You've changed lots, Jimmy. I never thought you were so tall
15 by two or three inches."

"Oh, I grew a bit after I was twenty."

"Doing well in New York, Jimmy?"

"Moderately. I have a position in one of the city departments. Come on, Bob; we'll go around to a place I know
20 of, and have a good long talk about old times."

The two men started up the street, arm in arm. The man from the West, his egotism enlarged by success, was beginning to outline the history of his career. The other, submerged in his overcoat, listened with interest.

At the corner stood a drugstore, brilliant with electric
25 lights. When they came into this glare each of them turned at the same time to gaze upon the other's face.

The man from the West stopped suddenly and released

his arm.

"You are not Jimmy Wells," he snapped. "Twenty years is a long time, but not long enough to change a man's nose from a Roman to a pug."

5 "It sometimes changes a good man into a bad one," said the tall man. "You've been under arrest for ten minutes, 'Silky' Bob. Chicago thinks you may have dropped over our way and wires us she wants to have a chat with you. Going quietly, are you? That's sensible. Now, before we
10 go on to the station here's a note I was asked to hand you. You may read it here at the window. It's from Patrolman Wells."

The man from the West unfolded the little piece of paper handed him. His hand was steady when he began to
15 read, but it trembled a little by the time he had finished. The note was rather short.

"Bob; I was at the appointed place on time. When you struck the match to light your cigar I saw it was the face of the man wanted in Chicago. Somehow I couldn't do it myself, so I went
20 around and got a plain-clothes man to do the job.

"Jimmy"

—O. Henry.

XVII. THE AMERICAN BOY

What we have a right to expect of the American boy is that he shall turn out to be a good American man. Now the chances are strong that he won't be much of a man unless he is a good deal of a boy. He must not be
5 a coward or a weakling, a bully, a shirk, or a prig. He must work hard and play hard. He must be clean-minded and clean-lived, and able to hold his own against all
10 comers. It is only on these conditions that he will grow into the kind of American man of whom America can be really proud.

No boy can afford to neglect his work, and, with a boy, work as a rule means study. A boy should work, and should work hard, at his lessons—in the first place, for the sake of what he will learn, and in the next place, for the sake of the effect upon his own character of resolute-
15 ly settling down to learn it. Shiftlessness, slackness, indifference in studying are almost certain to mean inability to get on in other walks of life. I do not believe in mischief-doing in school hours, or in the kind of animal spirits that results in making bad scholars; and I believe that
20 those boys who take part in rough, hard play outside of school will not find any need for horseplay in school. While they study they should study just as hard as they play football. It is wise to obey the homely old adage, "Work while you work; play while you play."
25

A boy needs both physical and moral courage. Neither can take the place of the other. A coward who will take a blow without returning it is a contemptible creature; but, after all, he is hardly as contemptible as the boy who
5 dares not stand up for what he deems right against the sneers of his companions who are themselves wrong.

There is no need to be a prig. There is no need for a boy to preach about his own conduct and virtue. If he does, he will make himself ridiculous. But there is need
10 that he should practise decency; that he should be clean and straight, honest and truthful, gentle and tender, as well as brave. The boy can best become a good man by being a good boy—not a goody-goody boy, but just a plain good boy. "Good," in the largest sense, should include
15 whatever is fine, straightforward, clean, brave, and manly. The best boys I know—the best men I know—are good at their studies or their business, fearless and stalwart, hated and feared by all that is wicked, incapable of submitting to wrong-doing, and equally incapable of
20 being aught but tender to the weak and helpless. A healthy-minded boy should feel hearty contempt for the coward, and even more hearty indignation for the boy who bullies girls or small boys, or tortures animals.

Of course the effect that a thoroughly manly, thoroughly
25 straight and upright boy can have upon the companions of his own age, and upon those who are younger, is incalculable. He cannot do good work if he is not strong and does not try with his whole heart and soul

to count in any contest; and his strength will be a curse to himself and to everyone else if he does not have thorough command over himself and over his own evil passions, and if he does not use his strength on the side of decency, justice, and fair dealing.

In short, in life, as in a football game, the principle to follow is: Hit the line hard; don't foul and don't shirk, but hit the line hard!

—Theodore Roosevelt.

XVIII. LANGUAGE

Let us talk to-day about a language that we never learn from a grammar or from a book of any kind—a language that we come by naturally, and use without thinking of it.

It is a universal language, and consequently needs no
5 interpreter. People of all lands and of all degrees of culture use it; even the brute animals in some measure understand it.

This Natural language is the language of cries, laughter, and tones; the language of the eyes, the nose, the mouth,
10 the whole face; the language of gestures and postures.

The child's cry tells of its wants; its sob, of grief; its scream, of pain; its laugh, of delight. The boy raises his eyebrows in surprise and his nose in disgust, leans forward in expectation, draws back in fear, makes a fist in anger,
15 and calls or drives away his dog simply by the tone in which he speaks.

But feelings and desires are not the only things we wish to communicate. Early in life we begin to acquire knowledge and learn to think, and then we feel the need of
20 a better language.

Suppose, for instance, you have formed an idea of a day; could you express this by a tone, a look, or a gesture?

If you wish to tell me the fact that yesterday was cloudy, or that the days are shorter in winter than in summer,
25 you find it wholly impossible to do this by means of

Natural language.

To communicate, then, your thoughts, or even the mental pictures we have called ideas, you need a language more nearly perfect.

This language is made up of words. 5

These words you learn from your mothers, and so Word language is your mother-tongue. You learn them, also, from your friends and teachers, your playmates and companions, and you learn them by reading; for words, as you know, may be written as well as spoken. 10

This Word language we may, from its superiority, call Language Proper.

Natural language, as was said, precedes this Word language, but gives way as Word language comes in and takes its place; yet Natural language may be used, and
15 always should be used, to assist and strengthen Word language. In earnest conversation we enforce what we say in words, by the tone in which we utter them, by the varying expression of the face, and by the movements of the different parts of the body. 20

The look or the gesture may even dart ahead of the word, or it may contradict it, and thus convict the speaker of ignorance or deception.

The happy union of the two kinds of language is the charm of all good reading and speaking. The teacher of
25 elocution is ever trying to recall the pupil to the tones, the facial expression, and the action, so natural to him in childhood and in animated conversation.

XIX. THINKING MAKES MAN

Thought, intelligence, is the dignity of a man, and I say every man is to be a student, thinker. But this does not mean that he is to shut himself within four walls, and bend body and mind over books. Men thought before
 5 books were written, and some of the greatest thinkers never entered what we call a study. Nature, Scripture, society, and life, present perpetual subjects for thought; and the man who collects, concentrates, employs his faculties on any of these subjects, for the purpose of getting the truth,
 10 is so far a student, a thinker, a philosopher, and is rising to the dignity of a man. It is time that we should cease to limit to professed scholars the title of thinkers, philosophers. Whoever seeks truth with an earnest mind, no matter when or how, belongs to the school of intellectual
 15 men.

In a loose sense of the word, all men may be said to think; that is, a succession of ideas, notions, passes through their minds from morning to night; but as far as this succession is passive, undirected, or governed only by
 20 accident and outward impulse, it has little more claim to dignity than the experience of the brute, who receives, with like passiveness, sensations from abroad through his waking hours. Such thought, if thought it may be called, having no aim, is as useless as the vision of an eye which
 25 rests on nothing, which flies without pause over earth and

sky, and in consequence receives no distinct image.

Thought, in its true sense, is an energy of intellect. In thought, the mind not only receives impressions or suggestions from without or within, but reacts upon them, collects
 its attention, concentrates its forces upon them, breaks
 5 them up and analyzes them like a living laboratory, and then combines them anew, traces their connections, and thus impresses itself on all the objects which engage it.

The universe in which we live was plainly meant to stir up such thought as has now been described. It is full of
 10 difficulty and mystery, and can only be penetrated and unravelled by the concentration of the intellect. Every object, even the simplest in nature and society, every event of life, is made up of various elements subtly bound
 15 together; so that to understand anything, we must reduce it from its complexity to its parts and principles, and examine their relations to one another.

Nor is this all. Everything which enters the mind, not only contains a depth of mystery in itself, but is connected by a thousand ties with all other things. The uni-
 20 verse is not a disorderly, disconnected heap, but a beautiful whole, stamped throughout with unity. Nothing stands alone. All things are knit together, each existing for all and all for each. Such a universe demands thought to be
 25 understood; and we are placed in it to think, to put forth the power within, to look beneath the surface of things, to look beyond particular facts and events to their causes and effects, to their reasons and ends, their mutual influ-

ences, their diversities and resemblances, their proportions and harmonies, and the general laws which bind them together. This is what I mean by thinking. You are all capable of thinking. You have all practised it in a
5 degree.

The child, who casts an inquiring eye on a new toy, and breaks it to pieces that he may discover the mysterious cause of its movements, has begun the work of which I speak, has begun to be a philosopher, has begun to penetrate the unknown, to seek consistency and harmony of
10 thought; and let him go on as he has begun, and make it one great business of life to inquire into the elements, connections, and reasons of whatever he witnesses in his own breast, or in society, or in outward nature, and, be
15 his condition what it may, he will rise by degrees to a freedom and force of thought, to a breadth and unity of views, which will be to him an inward revelation and promise of the intellectual greatness for which he was created.

—W. E. Channing.

XX. WITCHES' LOAVES

Miss Martha Meacham kept the little bakery on the corner (the one where you go up three steps, and the bell tinkles
5 when you open the door).

Miss Martha was forty, her bank-book showed a credit of two thousand dollars, and she possessed two false teeth and a sympathetic heart. Many people have married whose chances to do so were much inferior to Miss Martha's.
10

Two or three times a week a customer came in in whom she began to take an interest. He was a middle-aged man, wearing spectacles and a brown beard trimmed to a careful point. He spoke English with a strong German accent. His clothes were worn and darned in places, and wrinkled and
15 baggy in others. But he looked neat, and had very good manners.

He always bought two loaves of stale bread. Fresh bread was five cents a loaf. Stale ones were two for five. Never did he call for anything but stale bread.
20

Once Miss Martha saw a red and brown stain on his fingers. She was sure then that he was an artist and very poor. No doubt he lived in a garret, where he painted pictures and ate stale bread and thought of the good things to eat in Miss Martha's bakery.
25

Often when Miss Martha sat down to her chops and light rolls and jam and tea she would sigh, and wish that the gentle-mannered artist might share her tasty meal

instead of eating his dry crust in that draughty attic. Miss Martha's heart, as you have been told, was a sympathetic one.

In order to test her theory as to his occupation, she brought from her room one day a painting that she had bought at a sale, and set it against the shelves behind the bread counter.

It was a Venetian scene. A splendid marble palazzio (so it said on the picture) stood in the foreground—or rather forewater. For the rest there were gondolas (with the lady trailing her hand in the water), clouds, sky, and chiaro-curo in plenty. No artist could fail to notice it.

Two days afterward the customer came in.

"Two loafs of stale bread, if you please."

"You haf here a fine picture, madame," he said while she was wrapping up the bread.

"Yes?" says Miss Martha, revelling in her own cunning. "I do so admire art and" (no, it would not do to say "artists" thus early) "and paintings," she substituted.

"You think it is a good picture?"

"Der balace," said the customer, "is not in good drawing. Der bairspective of it is not true. Goot morning, madame."

He took his bread, bowod, and hurried out.

Yes, he must be an artist. Miss Martha took the picture back to her room.

How gentle and kindly his eyes shone behind his spectacles! What a broad brow he had! To be able to judge perspective at a glance—and to live on stale bread! But

genius often has to struggle before it is recognized.

What a thing it would be for art and perspective if genius were backed by two thousand dollars in the bank, a bakery, and a sympathetic heart to—But these were day-dreams, Miss Martha.

Often now when he came he would chat for a while across the showcase. He seemed to crave Miss Martha's cheerful words.

He kept on buying stale bread. Never a cake, never a pie, never one of her delicious Sally Lunn's.

She thought he began to look thinner and discouraged. Her heart ached to add something good to eat to his meagre purchase, but her courage failed at the act. She did not dare affront him. She knew the pride of artists.

Miss Martha took to wearing her blue-dotted silk waist behind the counter. In the back room she cooked a mysterious compound of quince seeds and borax. Ever so many people use it for the complexion.

One day the customer came in as usual, laid his nickel on the showcase, and called for stale loaves. While Miss Martha was reaching for them there was a great tooting and clanging, and a fire-engine came lumbering past.

The customer hurried to the door to look, as any one will. Suddenly inspired, Miss Martha seized the opportunity.

On the bottom shelf behind the counter was a pound of fresh butter that the dairyman had left ten minutes before. With a bread knife Miss Martha made a deep

slash in each of the stale loaves, inserted a generous quantity of butter, and pressed the loaves tight again.

When the customer turned once more she was tying the paper around them.

5 When he had gone, after an unusually pleasant little chat, Miss Martha smiled to herself, but not without a slight fluttering of the heart.

Had she been too bold? Would he take offence? But surely not. There was no language of edibles. Butter
10 was no emblem of unmaidenly forwardness.

For a long time that day her mind dwelt on the subject. She imagined the scene when he should discover her little deception.

He would lay down his brushes and palette. There would
15 stand his easel with the picture he was painting in which the perspective was beyond criticism.

He would prepare for his luncheon of dry bread and water. He would slice into a loaf—af!

Miss Martha blushed. Would he think of the hand
20 that placed it there as he ate? Would he—

The front door bell jangled viciously. Somebody was coming in, making a great deal of noise.

Miss Martha hurried to the front. Two men were there. One was a young man smoking a pipe—a man she had
25 never seen before. The other was her artist.

His face was very red, his hat was on the back of his head, his hair was wildly ruffled. He clinched his two fists and shook them ferociously at Miss Martha. *At Miss*

Martha. Dummkopf!" he shouted with extreme loudness; and then "*Tausseendonfer!*" or something like it in German.

The young man tried to draw him away.

"I will not go," he said angrily, "else I shall told her."

He made a bass drum of Miss Martha's counter. 5

"You haf shpoilt me," he cried, his blue eyes blazing behind his spectacles. "I vill tell you. You vas von *med-dingsome old cat!*"

Miss Martha leaned weakly against the shelves and laid one hand on her blue-dotted silk waist. The young man
10 took his companion by the collar.

"Come on," he said, "you've said enough." He dragged the angry one out at the door to the side-walk, and then came back.

"Guess you ought to be told, ma'am," he said, "what
15 the row is about. That's Blumberger. He's an architectural draftsman. I work in the same office with him.

"He's been working hard for three months drawing a plan for a new city hall. It was a prize competition. He finished inking the lines yesterday. You know, a drafts-
20 man always makes his drawing in pencil first. When it's done he rubs out the pencil lines with handfuls of stale breadcrumbs. That's better than India rubber.

"Blumberger's been buying the bread here. Well, to-day—well, you know, ma'am, that butter isn't—well, Blumberger's plan isn't good for anything now except to cut
25 up into railroad sandwiches."

Miss Martha went into the back room. She took off the

blue-dotted silk waist and put on the old brown serge she used to wear. Then she poured the quince seed and borax mixture out of the window into the ash can.

—O. Henry.

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