

THE MECHANISM OF SYMPATHY.

BY HENRY F. RULISON.

WHEN WE SEE a mother look for the last time upon the face of her dead child, when we see her tears and hear her sobs and cries, there wells up in our breasts a flood of emotion, we are filled with grief, sorrow overflows our hearts, and tears dim our eyes. We hear of the good fortune of some acquaintance and are at once filled with joy. We weep with those that weep and laugh with those that laugh.

These are familiar examples of the manifestations of sympathy. The common notion of sympathy is that it is a feeling corresponding to that which another feels, it is literally a *fellow-feeling* with others in their varied conditions of grief or joy. It is an agreement of affections or inclinations, or a sameness of natures, which makes persons pleased with one another or with the same subject of thought.

By most people sympathy is thought to be restricted to the hearts of the human family, and particularly to individuals of the same race. We hardly ever think that a bird feels sorry for its wounded mate, or that a fox that has caught a good fat hen is congratulated by his fellow-foxes. We never think, as did Pliny, that plants sympathise with one another. It is only the poet who can say that "the sympathies and affections of plants blossom into marriage; the petals of flowers are their wedding dresses, and their lovely hues and sweet odors are their gayeties and smiles and music." We never think of the ocean and the land as lovers, having that likeness of natures which makes them pleased with each other. It is only the poet that can say, as did Alexander Smith, "The sea is a bridegroom, the shore his wedded bride. In the fulness of his marriage joy he decorates her tawny brow with shells, retires a space to see how fair she looks, then proud, runs

up to kiss her." We never expect, as we enter the inorganic world, the world of coal, and iron, and rock, to see manifestations of sympathy. Yet the chemist finds here what appears to be warm sympathy and enduring affection. Many of the most pleasing experiments in chemistry and physics depend upon the apparent fact of sympathy. Dr. Mason Good says, "It exists between atom and atom, and the philosopher calls it attraction; it exists between iron and loadstone, and every one calls it magnetism." So that chemistry and physics are only a sportive, poetical way of telling the story of the human heart, its life, its intelligence, its emotions.

It is the object of this paper to show that only by the study of the so-called dead world around us can we really know what sympathy is, its exact nature, its process of action, and its development from unconscious sympathy in matter to conscious sympathy in mind. The field is an inviting one, full of surprises and pleasures, of instruction and philosophy, and to it the thoughtful attention of the reader is invited.

Let us go back to our childhood sports, to the old orchard and the old apple-tree, and see again the swing suspended from one of its branches. The mere mention of the swing sets our heart a-beating in sympathy with its motion. Did you ever carefully observe this motion and the process of swinging? A little girl sits in the swing, and a little boy stands just behind her to push. He gives a slight push and she swings away. She swings back, and he again gives a stronger push. She again swings away farther than before. And so, back and forth, she swings. Should he push before she gets fully back, he would stop the motion of the swing; should he push too slowly or too quickly, there would be an interference with the natural motion of the swing. He must push exactly at the moment the swing is ready to go away from him. In this way the swing has an even, steady motion, going away and coming back in equal intervals of time. It swings back and forth, say, thirty times a minute; the boy must therefore push fifteen times every minute. This swinging motion is called, in the language of science, a vibration.

A little way off is another swing, longer than the one just considered, and we notice that it takes longer for it to vibrate back and forth. This swing vibrates, say, twenty times a minute, and the pushes are ten a minute. Should the boy push eleven times a minute, or nine times a minute, he would stop the swinging. He must push exactly ten times a minute, no more, no less.

Anything which, when moved out of place, comes back again

to place, in equal intervals of time, vibrates. Examples of vibration are seen in the movement of the pendulum of a clock, the balance-wheel of a watch, the shuttle of a sewing-machine, the piston of a steam-engine, the waves upon the surface of water, etc.

Take a large tuning-fork and fasten it firmly by its handle to a table, so that its prongs shall stand upwards. Strike one of the prongs. See how it vibrates back and forth, so swiftly that the eye can scarcely follow its rapid motion. At the same time there is heard a musical tone of a certain pitch. Take a small piece of cork and suspend it by a fine thread. Hold the cork close to the vibrating prong. The prong pushes the cork and sends it flying away. The suspended cork is a swing, and the vibrating prong is the boy that pushes it. But the prong strikes out many times oftener than the cork can swing back and forth in a second. If the thread be shortened, that is, the swing be made shorter, a length may be found so that the vibrations of the prong and of the cork will be the same in number per second. In the case of the swing and the boy, the boy timed his pushes to agree with the vibrations of the swing; in the case of the fork and the cork, the vibrations of the cork are timed to agree with the pushes of the prong. In other words, the cork-swing is keyed up to the pitch of the fork.

Here are two tuning-forks of exactly the same pitch, that is, they vibrate the same number of times in a second. Each is fastened by means of a brass plate to the top of small boxes, open at the ends, and made of thin pieces of wood. The boxes are called sounding-boxes. When the forks are struck, they vibrate and force the top and sides of the boxes to vibrate with equal rapidity. The result is a very loud musical tone of the same pitch as the forks. Place one of the boxes on the table and hold the other in the hand. Strike the fork of the one held in the hand, and it emits a loud sound. While sounding, bring it near the silent fork attached to the box on the table, but not in contact with it. Allow them to continue in this position for a few seconds, and then stop the vibration of the fork in the hand—the tone is still heard. The fork on the table has taken up the vibrations of its neighbor and is now sounding in its turn, a faint, mellow tone. The vibrations of the fork in the hand have been transferred to the fork on the table. How is it done?

There is around us a substance capable of transmitting the motion of a tuning-fork, or of any vibrating body, to great distances with great rapidity. This substance is the atmosphere. The atmosphere is composed of very small particles placed very near

to one another, but not actually touching, so that each particle can swing back and forth with perfect freedom. Each particle is, in fact, a little swing. But they have this advantage over ordinary swings—they are not held in place by threads of different lengths, and so can vibrate just so rapidly, and no more, but are held near one another by the attractive power of the earth, and kept apart by a repulsive force which exists between them, an arrangement which permits them to swing slowly or rapidly. When the prong of the fork vibrates it strikes the particles of air next to it, which push other particles, which in turn push still other particles, and so on. Each particle swings a little ways, strikes its neighbor in front of it, springs back to be struck by the neighbor back of it, and so on. And in this way motion travels, like waves, through the air, outwards in all directions from the vibrating fork, and thus particles of air at a distance from the fork vibrate as rapidly as the prongs themselves. And when the air-waves made by the fork in the hand reach the fork on the table they strike its prongs and cause them to vibrate. "It is easy to understand this. The waves of air of the one fork can affect the other, because they are perfectly timed. A single wave causes the prongs of the silent fork to vibrate through a very small space. But just as it has completed this small vibration, another wave of air is ready to push it. Thus the small pushes add themselves together. The pushes, all delivered at the proper moment, all properly timed, give such strength to the vibrations of the fork on the table as to render it audible." One fork, then, can cause another at a distance to vibrate with the same form and speed of motion as itself has. This sameness of motion is called sympathetic vibration. Two bodies vibrate in sympathy, then, when the motion of one is similar to and as rapid as the motion of the other. Instead of a tuning-fork to set up motion among the particles of air, any vibrating body may be used, as piano-strings, harp-strings, the reeds of an organ, the tongue of a jew's-harp, a bell, etc.

All have heard of the harp of a thousand strings. Let us, in imagination, make one. Some of its strings shall be long, some short; some large, some small; some light, some heavy; some stretched tightly, some loosely; no two alike, but all capable of vibrating in different times and thus of giving out different tones, and all mounted upon a large sounding-box or sounding-board—a most wonderful musical instrument. Let us now place this harp of a thousand strings at one end of a room and place near it a young man who has good, sharp ears. At the other end of the room we

will place a piano, a violin, a flute, a cornet, a bugle, a whistle, a drum, and other instruments, each having a person to play upon it. The young lady at the piano strikes C, the young man at the harp hears C sounding in the harp. She strikes E on the piano, he hears E in the harp. She slowly plays "Home, Sweet Home," he hears "Home, Sweet Home" in the harp. And now a simple melody is played upon the flute; the young man hears the same melody in the harp. The drum is now struck, and the heavy, long strings of the harp give out the same sound. And so for the other instruments. As the strings of the piano vibrate, waves of motion pass through the air to the strings of the harp and cause some of them to vibrate. All strings of the harp so constructed and keyed-up as to vibrate the same number of times per second as those of the piano vibrate in sympathy with them, and give out the same tune as is played on the piano. Waves of air from the cornet pass over to the harp, certain strings of which vibrate in sympathy and give out the same tune as is played upon the cornet. In like manner all the musical instruments play upon the harp through this principle of sympathetic vibration. The harp is so constructed that it is in sympathy with all the instruments, and can reproduce all the tones and tunes they give forth.

This harp of ours is not altogether a creature of the imagination; England's great scientist, John Tyndall, says: "If you open a piano and sing into it a certain string will respond. Change the pitch of your voice; the first string ceases to vibrate, but another replies. Change again the pitch; the first two strings are silent, while another resounds. Now, in altering the pitch you simply change the form of the motion communicated by your vocal chords to the air, one string responding to one form and another to another."

Now, suppose this wonderful harp of ours were a conscious musical instrument, that it could feel its own tones or vibrations, and know its own tunes as they are caused in it by the other musical instruments. And suppose, further, that each of the other instruments were a conscious instrument, that it could feel its own tones or vibrations and know its own tunes, would not the harp sympathise literally with the piano, and the flute, and the cornet, and the drum?

That this wonderful harp is not wholly impossible of realisation is apparent when we come to think of the telephone. In fact, the telephone is a much more wonderful mechanism than our imaginary harp, wonderful in its simplicity and ability to respond sym-

pathetically to impressions made upon it by waves of air. The band may play, ducks may quack, dogs bark, cats mew, birds sing, and boys whistle, all at the same time, in the presence of one telephone, and the medley of sound will be transmitted miles distant, through the medium of a single small wire, to be exactly reproduced in another telephone. The two phones are constructed precisely alike, and what thrills one thrills the other in the same way, one vibrates in sympathy with the other. Now, if each phone were a conscious phone, capable of feeling and knowing its own vibrations, the feelings and emotions of each would be the same, there would be a literal sympathy between them. The joy of one would be the joy of the other, the grief of one would be the grief of the other, they would literally be "two souls with but a single thought, two hearts that beat as one."

This, then, is the philosophy of sympathy, that two objects constructed on the same plan, made of similar materials, keyed-up, so to speak, to the same degree of tension, subjected to the same forces, will vibrate in sympathy with each other. And if the two objects are conscious objects, an act of one accompanied by a feeling will arouse the like feeling and action in the other.

The sun is composed of various elements whose particles are vibrating with great rapidity. The earth has in and around it the same elements whose particles are capable of vibrating with the same rapidity. Between the sun and the earth, and filling all space, is a medium capable of transmitting waves of motion from the sun to the earth, and causing earth-particles to vibrate in sympathy with sun-particles. So that storms and other disturbances in the sun are accompanied by storms and electrical disturbances on the earth. And what is true of the sun and the earth is also true of all other heavenly bodies. Thus, as Tyndall says, "nature is not an aggregate of independent parts, but an organic whole." And thus throughout the universe there is a bond of sympathy which unites into one grand whole the myriads of worlds. It is no poet's dream that makes some lowly flower rejoice in the warmth of the sunlight, that makes the valleys laugh when kissed by the raindrops, that makes a little bird sing in some human breast when all nature smiles and is happy. Given a mechanism that can vibrate in unison with the varied motions of nature, and at the same time be conscious of these motions, and this mechanism is in literal sympathy with the thrills of the universe. And we have such a mechanism—it is a human being—man. Hear Tyndall again: "And thus is sentient man acted upon by nature, the optic, the auditory, and

other nerves of the human body being so many strings differently tuned and responsive to different forms of the universal power."

We are now prepared to study the phenomena of sympathetic vibrations accompanied by consciousness or feeling, as exemplified in ourselves and other animals.

The nervous system is the mechanism by means of which, and through which, sympathy is established between man and man, and between man and the world outside of man. It is a mechanism much more wonderful and complex than our harp of a thousand strings. The limits of this paper will not permit us to study its organisation in detail, nor to notice all the modes of its action. But enough will be presented to enable us to see that the principle of sympathetic vibration is the key which unlocks and opens up to us the apparent mystery of sympathy.

The nerves are of two kinds, nerve cells, and nerve fibres. The nerve cells are small, irregular masses of grayish color. They are so constructed that they can respond to the various motions that may come to them, as do the strings of a harp or the vibrating plate of a telephone, that is, they can vibrate in sympathy with other cells or motions. They can also originate motion, because in the process of waste and repair which accompanies their nutrition, molecular changes involve atomic and molecular vibratory motions. As each string of a piano, on account of its structure and tension, can vibrate only in one way and emit but one kind of pitch or note, so each cell, on account of its structure and quality of tissue, which it has by inheritance and education, can originate but one form of motion and vibrate to but one kind of impression. The nerve cells are connected with one another by white nerve threads or fibres. The nerve fibres do nothing but transmit motion from cell to cell. The cells may be thought of as telephones, and the fibres as wires connecting them.

There are millions of nerve-cells and millions of connecting nerve-fibres. The cells and fibres are found in every organ of the body; they are found clustered in large masses in the spinal cord and brain, which are called nerve-centres. If we think of the nerve-cells of the body as telephones, the nerve-fibres as telephonic wires, then the brain is a telephonic central office where connexions are made between the various telephones.

As one telephone vibrates in sympathy with another through the medium of the connecting wire, so the nerve-cells and centres vibrate in sympathy with one another through the medium of the connecting nerve-fibres. But unlike the sympathy between tele-

phones, there is a literal sympathy between the cells and nerve-centres of the body, for there is associated with the vibration of nerve-cells a most wonderful phenomenon, that of feeling and consciousness. The cells not only vibrate, but they know their own states of vibration. How it is that a certain mode of motion results in a certain feeling is a mystery no one has solved. But the fact is that there is a feeling, and that the feeling changes as the form of motion changes.

Motion gets into the brain from the outer world through the medium of certain special nerve-organs called the organs of sense. For example, the ear is such a special sense-organ. The cells and fibres of the internal ear are of many sizes and lengths, and many thousand in number, so that, no matter what kinds and qualities and rapidities of sound-waves may come to them, some are capable of absorbing the same motion, of vibrating in sympathy. But this motion does not end in the ear. The nerve-cells of the ear are connected with like ones in the brain. So that the motion of the fibres and cells of the ear are transmitted to the cells of the brain; and the cells of the brain vibrate in sympathy with those of the ear, and thus with the sounds in the world outside the brain. And the motion of the cells of the brain thus produced result in a state of consciousness we call a feeling, or sensation. We are conscious of noises and musical tones of different pitches, and qualities, and degrees of loudness. And this is hearing. Now, if the strings of a piano were conscious beings, if they could feel and know their own motions as they vibrate, the piano and the brain would literally sympathise with each other. Substitute for the piano a man. He feels like laughing, and he laughs. Waves of air from his vocal chords speed through the atmosphere and cause in the ear of another man corresponding vibrations. The motion goes on to the other man's brain, resulting in like vibrations in his brain, and he, too, feels like laughing, and laughs—laughs out of pure sympathy. And this sympathy is of the simplest kind; "it is a resonance, or unconscious reproduction or imitation of another's feeling."

Another example: At the back of the eye is a delicate substance called the retina. It is composed of nerve-cells and fibres in the form of rods and cones, of great complexity. The cells are of various shapes and sizes, the rods of different sizes and lengths. They are all connected by the optic nerve with the cells of the brain. Now, what is called light, or color, is thought to be only certain forms of wave-motion running through a medium called ether, which fills all space not occupied by other matter. In the

color called red as many as four hundred and thirty trillion waves of ether strike the retina every second. Violet sends out seven hundred trillion per second. The larger cells and the longer rods and cones of the retina are made to vibrate by the slower waves of light, and the smaller cells and shorter rods and cones are made to vibrate by the more rapid waves of light, just as a long swing is made to vibrate by slow pushes, and a short swing by fast pushes. Now, suppose there is placed before the eye a red rose, green grass, a yellow buttercup, the blue sky, and a modest violet. Red waves of light from the rose enter the eye and certain cells, rods, and cones of the retina are put into sympathetic vibration. Green waves from the green grass, in like manner, put other cells, rods, and cones into sympathetic vibration. In like manner other cells, rods, and cones of the retina are made to vibrate in sympathy with the waves of motion from the buttercup, the sky, and the violet. For every form of wave of light that enters the eye there is a corresponding form of motion in the retina. But the motions do not end in the retina, they are transmitted through the optic nerve to the cells of the brain, and corresponding motions are set up in them. So that the cells of the brain vibrate in sympathy with the roses, the grass, the sky, the buttercups, the violets, and with all the colors of nature. Still further, the motion of the cells of the brain are accompanied by consciousness, and there are as many forms of consciousness as there are forms of waves of light. Now, if the roses and the buttercups and the violets had feelings determined by their respective colors, we should feel as they feel, there would be a literal sympathy between us and them.

What is true of the ear and the eye as instruments for transmitting certain forms of motion to the brain and thus arousing certain feelings within us is true of the other nerves of the body. From the various organs of the body a multitude of vibrations are transmitted to the brain without intermittance, producing in us a continuous but ever-varying state of consciousness—our personality. So that our feelings of bodily comfort or pain, of hunger, thirst, muscular tension, etc., are but various forms of sympathetic vibration. So universally is this view entertained that it is common to say that the organs of the body sympathise with one another, through the medium of the sympathetic nervous system, and that our varying moods and emotions depend upon the varying conditions and actions of the bodily organs. So it is true, as said before, that the nerves of the human body are so many strings, differently tuned and responsive to different forms of motion. We thus get

feelings or ideas of odors, tastes, temperature, hardness, smoothness, colors, etc. The world close around us and the distant sun and moon and stars are continually sending into us waves of motion of different forms and qualities and degrees, causing us to tremble, to vibrate, to thrill in every nerve, producing in us an infinite number and variety of feelings; feelings as great as nature feels, full of joy if she be joyful, full of sadness if she be sad.

As we have seen, the nerve fibres from the eye are distributed to certain nerve cells of the brain, those from the ear to other cells of the brain, those from the nose to still other cells, etc., so that different receptive parts of the brain have different forms of vibration, attended by different forms of feeling. But this is not all. The various parts of the brain are themselves connected by nerve fibres. For example, the cells which vibrate under the impulses of waves of light are connected with the cells which are moved by waves of sound, so that the feelings accompanying a disturbance of the eye may be associated with feelings accompanying a disturbance of the ear. Thus, when we see a moving train of cars and hear the puffs of the engine, the two forms of feeling exist together, they are associated. In like manner other forms of feeling may be associated. Feelings produced by nerve disturbance in all parts of the body are thus made to blend into one compound feeling; it may be one we call bodily comfort, or unrest, or buoyancy of spirit. Compound feelings are the result of a blending of the vibratory motions of different nerve-cells through the medium of the connecting nerve-fibres, the form of vibration in one cell being superimposed upon that of another, as ripples upon larger waves or as overtone-vibrations of strings upon the fundamental. Another thing is made possible by this connexion of brain-cell with brain-cell. A disturbance of the cells connected with the ear may disturb the cells connected with the eye, even though the eyes themselves be not impressed. Thus, the music of a brass band will call up those feelings of sight we had when we saw the players. Though the players are out of sight, we can see them in the mind—their instruments, their dress, their orderly marching. Thus, feelings can revive other feelings with which they were once associated. A flash of lightning will revive the sound of thunder, and we seem to hear it even before it comes, that is, we anticipate the sound. And the sound of thunder leads us to think that it was preceded by lightning, though we did not see it. The first ten notes of "Old Hundred" will revive all the remaining notes, and we know the entire tune before it is sung. It is because the cells of the brain

are connected by "associative nerve-fibres, as Dalton calls them, that one idea revives another idea with which it was once associated. If an idea could not thus call up another idea, there would be no such train of ideas we call thought. Continuous, coherent thought is only possible when the cells of the brain are connected. Recollection and memory are made possible by this connexion, and impaired or destroyed by the degeneration or destruction of the connecting fibres.

" Lulled in the countless chambers of the brain,
Our thoughts are linked by many a hidden chain.
Awake but one, and lo! what myriads rise!
Each stamps its image as the other flies."

How wonderful is all this. The brain centres of the eye, the ear, and other organs of sense, at the base of the brain, are so many pipe-organs connected with the outer world, and played upon by it. Arranged on the surface of the cerebrum are the cells concerned in feeling and thinking, which are echo-organs connected with the pipe-organs below, and which are connected with one another by associative fibres. The organs at the base of the brain are played upon by pulses from the outer world, resulting in such harmonies as only the colors of the rainbow and the voices of angels can originate. The echo-organs reproduce the melodies in faint, mellow tones, with all the harmonic overtones. Even while the pipe-organs are silent, the outer world shut out, the echo-organs are sounding their sweet songs. Ideas, emotions, images, thoughts follow one another in an endless succession in the echo-organs. One melody in an echo-organ evokes another melody in another organ, one idea calls up another idea. And all so, because one part vibrates in sympathy with parts connected with it.

This view of the mechanism of associated feelings and thoughts is substantially that taught by modern psychology. Th. Ribot says: "If we take any adult person, in good health, and of average intelligence, the ordinary mechanism of his mental life will consist in a perpetual coming and going of inward events, in a marching by of sensations, feelings, ideas, and images, which associate with, or repel each other according to certain laws. Properly speaking, it is not, as frequently has been said, a chain, a series, but it is rather an irradiation in various directions, and through various strata; a mobile aggregate which is being incessantly formed, unformed, and reformed. Every one knows that this mechanism has been carefully studied in our day, and that the theory of association forms one of the solidest acquisitions of modern psychology."

But the half has not been told. The vibration of nerve cells results in a molecular decomposition of the cells themselves, accompanied by the liberation of energy. And this liberated energy manifests itself partly in heat and partly in the production of muscular contraction. Nerve-fibres, called motor nerves, run from the cells of the brain to all the muscles of the body. And the muscles are made to contract by the stimuli of this liberated energy carried to them by the motor nerves. So that every idea, every feeling, every thought is followed by some act, of some muscle, in some part of the body. All our movements and all the actions of the various organs of the body are thus produced by waves of energy which originate in, and proceed from, certain groups of cells in the brain, called motor cells. A disturbance in the motor cells of the brain is accompanied by a feeling or state of consciousness we call volition, or will. The motor cells are intimately connected with the feeling and thinking cells by nerve fibres, so that a disturbance in the feeling and thinking cells can be transmitted to the motor cells, and from thence to the muscles, causing bodily movements.

This fact of nerve structure makes it possible for us to understand how certain feelings are followed by certain definite actions; the feeling of hunger, for instance, followed by an act of eating; the feeling of pain followed by an act of crying-out; the feeling of joy followed by laughing or shouting. In every act there is not only the consciousness of the act itself, but an accompanying feeling which prompted the act. If a certain feeling finds expression in a certain action, and the feeling and the action are many times repeated, an association is established between the feeling and the motor cells, and a habit of acting in a definite way after certain feelings is formed. On the other hand, an action in another person will arouse in us the feelings that have always accompanied our acting in the same way, and having those feelings we are impelled to act as that person does. For example, we have a certain feeling and we yawn, and every time we have that feeling we yawn. We see a person yawn, and his act arouses in us the same feeling that has always accompanied our yawning, and we yawn. We unconsciously imitate that person's act because we feel as he feels—a case of the simplest form of sympathetic vibration. Again, we have a certain feeling and we weep. We hear a person weep, or see the tears flow down his cheeks, and his action and appearance arouses in us the same feeling and actions that have always accompanied our weeping, and we weep because we feel as he does, we weep out of sympathy with him.

Some amount of experience in the society of our fellow-men is needed to establish an association between the several feelings and their expression in action. But when the connexion is established a person automatically takes on the moods of hilarity, anxiety, or depression of those about him, and gives expression in acts of attitude, gesture, voice, etc. Says Sully: "A child suddenly placed in the midst of a group of merry children catches the prevailing tone of gladness. The spread of a feeling of indignation or of admiration, through a community, as a school or a nation, illustrates this tendency of a strongly manifested emotion to reflect itself in others. This fact is known as the contagion of feeling."

Contagious sympathy is well exemplified in some of the lower animals that associate in numbers. Herbert Spencer explains its mechanism in substance as follows: Members of a herd experience the attacks of an enemy. The emotion of fear aroused by the attack expresses itself in movements of escape, preceded and accompanied, it may be, by sounds of some kind. Each member of the herd sees the movements and hears the sounds of the rest of the herd, and the movements and sounds are more or less like his own movements and sounds, which are prompted by his own feelings of fear. Frequent repetition of attacks establishes an association between the feelings of fear and the signs of fear in himself and others, which signs, in time, become quite uniform as expressions of certain definite fears. After the association is established the movements and sounds cannot be perceived without there being aroused the feeling habitually joined with them when they were before perceived. Thus it is that the signs of fear may be excited in those to whom no fearful object is perceptible. And thus one member of a flock, himself alone and alarmed and making a sign of fear, seen and heard by the rest, excites in the rest the fear he is displaying, and the rest, prompted by their fear, begin to make like sounds and movements.

This explains how panics are brought about. A flock of birds towards which a man approaches will quietly watch for a while; but when one flies, those near it, excited by its movements of escape, fly also; and in a moment the rest are in the air. The same happens with sheep; when one runs, all run, and so strong is the sympathetic tendency among them that when one leaps over a stick held in his path, all leap at the same spot, though the stick be taken away. Dogs barking at night exemplify this tendency to sympathetic action. The panics in theatres, schools, and churches, upon the alarm of fire, are also examples of contagious sympathy.

By the inheritance of like body-structures and habits there must necessarily be aroused in progeny feelings and actions similar to those of progenitors, when subjected to the same environments and experiences. The association of certain feelings and corresponding actions becomes organic, and a quick, automatic, unconscious, and complete sympathy is established between the members of the same class or kind of animals. A drove of cattle, coming to a blood-stain in the road, one of their number smells it; whereupon he bellows and paws the ground. The others, seeing his actions and hearing his bellowing, begin to bellow and paw the ground. A brood of chickens under the care of the mother hen, hearing her cry of warning as some shadow flits over her head, will at once run under her protecting wings. And this they will do having never before heard the cry and being totally unconscious of danger. Having inherited a body-structure tuned in unison with the warning sound, the chickens respond as readily as does one tuning-fork to another. Says Sully: "That the child has a vague, intuitive knowledge of others' feelings seems shown by the fact that he responds to the smiles of his mother long before his own experience could have taught him to associate pleasurable feeling with this particular facial movement." The explanation of this "intuitive knowledge" seems to be that the child, having inherited the body mechanism of his mother, seeing her smile, responds in a definite action, and this action has been the action of the class to which he belongs for countless generations. Acts usually classed as instinctive find their explanation in the facts of heredity, and the possession of a mechanism which responds sympathetically to environments habitual to the race. Given a mechanism so constructed as to move in a definite way upon the application of a particular stimulus, when the appropriate stimulus comes along the mechanism responds accordingly. A windmill so constructed as to turn round a certain way when the wind blows will always turn round that same way when the wind blows.¹

But animals of unlike classes or kinds, constructed upon different plans, inheriting unlike mechanisms and experiences, are like two tuning-forks of different pitches of tone. They cannot vibrate in sympathy with each other. The acts of one cannot call out like acts in the other, either because the feelings are unlike or because like feelings have become associated with unlike acts of expression. The playing of a march will at once impel men who

¹In this connexion attention may be called to Mr. E. C. Hegeler's articles on the soul in *The Open Court*, Nos. 1, 15, and 127, which I have only seen after I had written the present article.

have marched to music to "fall in" and "keep step," but a cow will hear the same music and pass by with stolid indifference. No feelings of musical tones are invoked in her brain by the playing; her brain and the instruments do not vibrate in sympathy. The howling of a dog when he hears music clearly shows us that he and the music are in discord. The saying, "Birds of a feather flock together," is founded upon this fact of sympathetic vibration. It is only another way of saying that sympathy is found only between members of the same class or kind, because of similarity of structure.

In its well-developed form sympathy is more than a vibration in unison with the feelings of another, it is more than a resonance or imitative reproduction of manifested feeling. Says Sully: "It implies a distinct representation of another's pleasure or pain, and a disposition to make it our own, or to identify ourselves with the subject of it. It is a feeling for as well as with another." And Herbert Spencer says: "The degree and range of sympathy depends upon the clearness and extent of representation. So that there can be sympathy only in proportion as there is power of representation." Let us notice, briefly, the nature of representation upon which the higher forms of sympathy depend.

When a bell is struck it vibrates and emits a sound, and it continues to vibrate and emit a sound for some little time after the blow is struck which caused the vibration. When one looks at the sun for a few moments and then closes his eyes he still sees the sun, round and distinct. An image of the sun seems to be in his eyes. The retina continues to vibrate for some time after it is struck by the sun's waves of light. Not only is the retina set in vibration by the light of the sun, but the optic centres in the brain and the brain-cells associated with the optic centres are also made to vibrate, and the vibration of the brain-cells continues for some time after the retina ceases to vibrate. In other words, an image of the thing actually seen may be in consciousness for some time after the thing has disappeared. And multiplied experiences in seeing things, and thus causing the cells of the brain to vibrate, result in such a structural condition of the cells concerned in seeing that they acquire a habit of vibrating in a particular way. So that, though an object which has caused a vibration in the brain-cells is far distant, or utterly annihilated, the brain-cells, being now "keyed up" in unison with the motion of the annihilated object, still have the ability to vibrate as they did when under the stimulus of the object. And when they do thus vibrate, either

from molecular change in the process of nutrition or from stimuli from other cells associated with them, there is an image, more or less vivid, of the annihilated object. And this re-presentation of the image is called, in the language of psychology, representation. The brain is now able to act independently of external stimulation, having acquired a habit so to act through previous exercises under external stimulation. Beethoven was able to represent musical sounds after he had lost his hearing. Says Spencer: "A sympathetic feeling, in its higher form, is one that is not immediately excited by the natural cause of such a feeling, but one that is mediately excited by the presentation of signs habitually associated with such a feeling." Thus, though one may have nothing happening to himself to grieve about, when he sees signs of grief in another his own brain is excited, and a representation of his own grief when he manifested similar signs springs into being; he has a mental representation of another's inner experiences, he knows the other's condition of mind. And this image of another's grief may be strengthened and made vivid by the intuitions of grief he has inherited from a long line of ancestors who have had similar grief, and it may be strengthened and made vivid by the blendings of many of his own former griefs of a like form. Be that as it may, if the representation is vivid it takes firm hold on his mind, so that the suffering he witnesses is his own suffering, and he is prompted to make the same efforts to relieve the other's suffering as he would to relieve his own. He thus feels for as well as with another. And this complete identification of himself with another, this putting of himself in another's place, impels him to do toward and for that other as he would that other should do for him, similarly conditioned. "His feeling for another is a disinterested impulse which forms the foundation of a morally good and virtuous disposition of character."

Pleasure is experienced by us when we have representations of pleasure in others, and the feeling prompts us to generous actions. Pain is experienced by us when we have representations of pain in others, and the feeling prompts us to mitigate that pain.

The feeling of pity is a complex feeling experienced by us when we see in another a combination of misfortunes, as poverty coupled with helpless old age, the grief of parents over the criminal conduct of a son, an accident that cripples one for life, etc., though there exists no connexion, personal or social, with that other.

Sympathy with pain puts a check upon intentional infliction of

pain. Representations of pain and ignominy sufficiently vivid inhibits us from inflicting the penalty of death upon a convicted murderer. The corporal punishment of children is inhibited when sympathy is intense. Even the feelings of another are reluctantly wounded by unkind words when there is a high degree of representative power.

The limits of this paper will not permit an extended examination of all those altruistic sentiments having their basis and mode of manifestation in sympathy. The higher concepts and sentiments have their genesis in compound vibratory motions, the factors of which are found in the simpler forms of vibration of the brain-centres accompanied by elementary ideas and associated by connecting nerve-fibres. They may be likened (as is done by Mr. E. C. Hegeler) to the composite photographs of Galton, in which the blending of several different faces on the same photographic plate produces an ideal image which has no counterpart in actual life. The sentiments of liberty, of patriotism, of justice, and of mercy and duty, are but developed forms of these ideal images. And as intelligence and the representative power develops, the sympathetic sentiments that find their satisfaction in conduct that is regardful of others, and so conducive to harmonious co-operation, should become stronger, and the golden rule find its realisation in the actions of men. The sacredness of life, of liberty, of property, should be more vividly felt as civilisation advances. The disinterested love of right presupposes the capacity and habit of representing and realising the interests and claims of others.