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THE FIBRES OF CORTI.

A POPULAR SCIENTIFIC LECTURE.[1]

BY PROF. ERNST MACH.

Whoever has roamed through a beautiful country knows that the tourist's delights increase with his progress. How pretty that wooded dell must look from yonder hill! Whither does that clear brook flow, that hides itself in yonder sedge? If I only knew how the landscape looked behind that mountain! Thus even the child thinks in his first rambles. It is also true of the natural philosopher.

The first questions are forced upon the attention of the inquirer by practical considerations; the subsequent ones are not. An irresistible attraction draws him to these; a nobler interest which far transcends the mere needs of life. Let us look at a special case.

For a long time the structure of the organ of hearing has actively engaged the attention of anatomists. A considerable number of brilliant discoveries has been brought to light by their labors, and a splendid array of facts and truths established. But with these facts a host of new enigmas has been presented.

Whilst in the theory of the organisation and functions of the eye comparative clearness has been attained; whilst, hand in hand with this, ophthalmology has reached a degree of perfection which the preceding century could hardly have dreamed of, and by the help of the ophthalmoscope the observing physician penetrates into the profoundest recesses of the eye, the theory of the ear is still much shrouded in mysterious darkness, full of attraction for the investigator.

Look at this model of the ear. Even at that familiar part by whose extent we measure the quantity of people's intelligence, even at the external ear, the problems begin. You see here a succession of helixes or spiral windings, at times very pretty, whose significance we cannot accurately state, yet for which there must certainly be some reason.

The shell or concha of the ear, *a* in the annexed diagram, conducts the sound into the curved auditory passage *b*, which is terminated by a thin membrane, the so-called tympanic membrane, *c*. This membrane is set in motion by the sound, and in its turn sets in motion a series of little bones of very peculiar formation, *c*. At the end of all is the labyrinth *d*. The labyrinth consists of a group of cavities filled with a liquid, in which the innumerable fibres of the nerve of hearing are imbedded. By the vibration of the chain of bones *c*, the liquid of the labyrinth is shaken, and the auditory nerve excited. Here the process of hearing begins. So much is certain. But the details of the process are one and all unanswered questions.

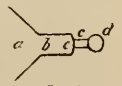

Fig. 1.

To these old puzzles, the Marchese Corti, as late as 1851, added a new enigma. And, strange to say, it is this last enigma, which, perhaps, has first received its correct solution. This will be the subject of our remarks to-day.

Corti found in the cochlea, or snail-shell of the labyrinth, a large number of microscopic fibres placed side by side in geometrically graduated order. According to Kölliker their number is three thousand. They were also the subject of investigation at the hands of Max Schultze and Deiters.

A description of the details of this organ would only weary you, besides not rendering the matter much clearer. I prefer, therefore, to state briefly what in the opinion of prominent investigators like Helmholtz and Fechner is the peculiar function of Corti's fibres. The cochlea, it seems, contains a large number of elastic fibres of graduated lengths (Fig. 2), to which the branches of the auditory nerve are attached. These fibres, called the fibres, pillars, or rods of Corti, being of unequal length, must also be of unequal elasticity, and, consequently, pitched to different notes. The cochlea, therefore, is a species of pianoforte.


Fig. 2.

What, now, may be the office of this structure, which is found in no other organ of sense? May it not be connected with some special property of the ear? It is quite probable; for the ear possesses a very similar power. You know that it is possible to follow the individual voices of a symphony. Indeed, the feat is possible even in a fugue of Bach, where it is certainly no inconsiderable achievement. The ear can

[1] Graz, 1865. Translated by μκρκ.

pick out the single constituent tonal parts, not only of a harmony, but of the wildest clash of music imaginable. The musical ear analyses every agglomeration of tones.

The eye does not possess this ability. Who, for example, could tell from the mere sight of white, without a previous experimental knowledge of the fact, that white is composed of a mixture of other colors? Could it be, now, that these two facts, the property of the ear just mentioned, and the structure discovered by Corti, are really connected? It is very probable. The enigma is solved if we assume that every note of definite pitch has its special string in this pianoforte of Corti, and, therefore, its special branch of the auditory nerve attached to that string. But before I can make this point perfectly plain to you, I must ask you to follow me a few steps into the dry domain of physics.

Look at this pendulum. Forced from its position of equilibrium by an impulse, it begins to swing with a definite time of oscillation, dependent upon its length. Longer pendulums swing more slowly, shorter ones more quickly. We will suppose our pendulum to execute one to-and-fro movement in a second.

This pendulum, now, can be thrown into violent vibration in two ways; either by a *single* heavy impulse, or by a *number* of properly communicated slight impulses. For example, we impart to the pendulum, while at rest in its position of equilibrium, a very slight impulse. It will execute a very small vibration. As it passes a third time its position of equilibrium, a second having elapsed, we impart to it again a slight shock, in the same direction with the first. Again after the lapse of a second, on its fifth passage through the position of equilibrium, we strike it again in the same manner; and so continue. You see, by this process the shocks imparted augment continually the motion of the pendulum. After each slight impulse, the pendulum reaches out a little further in its swing, and finally acquires a considerable motion.[1]

But this is not the case under all circumstances. It is possible only when the impulses imparted synchronise with the swings of the pendulum. If we should communicate the second impulse at the end of half a second and in the same direction with the first impulse, its effects would counteract the motion of the pendulum. It is easily seen that our little impulses help the motion of the pendulum more and more, according as their time accords with the time of the pendulum. If we strike the pendulum in any other time than in that of its vibration, in some instances, it is true, we shall augment its vibration, but in others again, we shall impede it. Our impulses will be less effective the more the motion of our own hand departs from the motion of the pendulum.

[1] This experiment with its associated reflexions is due to Galileo.

What is true of the pendulum holds true of every vibrating body. A tuning fork when it sounds, also vibrates. It vibrates more rapidly when its sound is higher; more slowly when it is deeper. The standard *A* of our musical scale is produced by about four hundred and fifty vibrations in a second.

I place by the side of each other on this table two tuning-forks, exactly alike, resting on resonant cases. I strike the first one a sharp blow, so that it emits a loud note, and immediately grasp it again with my hand to quench its note. Nevertheless, you still hear the note distinctly sounded, and by feeling it you may convince yourselves that the other fork which was not struck now vibrates.

I now attach a small bit of wax to one of the forks. It is thrown thus out of tune; its note is made a little deeper. I now repeat the same experiment with the two forks, now of unequal pitch, by striking one of them and again grasping it with my hand; but in the present case the note ceases the very instant I touch the fork.

What has happened here in these two experiments? Simply this. The vibrating fork imparts to the air and to the table four hundred and fifty shocks a second, which are carried over to the other fork. If the other fork is pitched to the same note, that is to say, if it vibrates when struck in the same time with the first, then the shocks first emitted, no matter how slight they may be, are sufficient to throw the second fork into rapid sympathetic vibration. But when the time of vibration of the two forks is slightly different, this does not take place. We may strike as many forks as we will, the fork tuned to *A* is perfectly indifferent to their notes; is deaf, in fact, to all except its own; and if you strike three, or four, or five, or any number whatsoever, of forks all at the same time, so as to make the shocks which come from them ever so great, the *A* fork will not join in with their vibrations unless another fork *A* is found in the collection struck. It picks out, in other words, from all the notes sounded, that which accords with it.

The same is true of all bodies which can yield notes. Tumblers resound when a piano is played, on the striking of certain notes, and so do window panes. Nor is the phenomenon without analogy in other provinces. Take a dog that answers to the name "Nero." He lies under your table. You speak of Domitian, Vespasian, and Marcus Aurelius Antoninus, you call upon all the names of the Roman Emperors that occur to you, but the dog does not stir, although a slight tremor of his ear tells you of a slight response of his consciousness. But the moment you call "Nero" he jumps joyfully towards you. The tuning-fork is like your dog. It answers to the name *A*.

You smile, ladies. You shake your heads. The

simile does not catch your fancy. But I have another, which is very near to you: and for punishment you shall hear it. You, too, are like tuning-forks. Many are the hearts that throb with ardor for you, of which you take no notice, but are cold. Yet what does it profit you! Soon the heart will come that beats in just the proper rhythm, and then your knell, too, has struck. Then your heart, too, will beat in unison, whether you will or no.

The law of sympathetic vibration, here propounded for sounding bodies, suffers some modification for bodies incompetent to yield notes. Bodies of this kind vibrate to almost every note. A high silk hat, we know, will not sound; but if you will hold your hat in your hand when attending your next concert you will not only hear the pieces played, but also feel them with your fingers. It is exactly so with men. People who are themselves able to give tone to their surroundings, bother little about the prattle of others. But the person without character tarries everywhere: in the temperance hall, and at the bar of the public-house—everywhere where a committee is formed. The high silk hat is among bells what the weakling is among men of conviction.

A sonorous body, therefore, always sounds when its special note, either alone or in company with others, is struck. We may now go a step further. What will be the behaviour of a group of sonorous bodies which in the pitch of their notes form a scale? Let us picture to ourselves, for example (Fig. 3), a series of rods or strings pitched to the notes *c d e f g*. . . . . On a musical instrument the accord *c e g* is struck. Every one of the rods of Fig. 3 will see if its special note is contained in the accord, and if it finds it, it will respond. The rod *c* will give at once the note *c*, the rod *e* the note *e*, the rod *g* the note *g*. All the other rods will remain at rest, will not sound.


c d e f g a b c d e f
Fig. 3.

We need not look about us long for such an instrument. Every piano is an instrument of this kind, with which the experiment mentioned may be executed with splendid success. Two pianos stand here by the side of each other, both tuned alike. We will employ the first for exciting the notes, while we will allow the second to respond; after having first pressed upon the loud pedal, and thus rendered the strings capable of motion.

Every harmony struck with vigor on the first piano is distinctly repeated on the second. To prove that it is the same strings that are sounded in both pianos, we repeat the experiment in a slightly changed form. We let go the loud pedal of the second piano and pressing on the keys *c e g* of that instrument vigorously strike the harmony *c e g* on the first piano. The harmony *c e g* is now also sounded on the second piano. But if we press only on one key *g* of one piano, while we strike *c e g* on the other, only *g* will be sounded on the second. It is thus always the like strings of the two pianos that excite each other.

The piano can reproduce any sound that is composed of its musical notes. It will reproduce, for example, very distinctly, a vowel sound that is sung into it. And in truth physics has proved that the vowels may be regarded as composed of simple musical notes.

You see that by the exciting of definite tones in the air quite definite motions are set up with mechanical necessity in the piano. The idea might be made use of for the performance of some pretty pieces of wizardry. Imagine a box in which is a stretched string of definite pitch. This is thrown into motion as often as its note is sung or whistled. Now it would not be a very difficult task for a skilful mechanic to so construct the box that the vibrating cord would close a galvanic circuit and open the lock. And it would not be a much more difficult task to construct a box which would open at the whistling of a certain melody. Sesame! and the bolts fall. Truly, we should have here a veritable puzzle-lock. Still another fragment rescued from that old kingdom of fables, of which our day has realised so much, that world of fairy-stories to which the latest contributions are Casselli's telegraph, by which one can write at a distance in one's own hand, and Prof. Elisha Gray's telautograph. What would the good old Herodotus have said to these things who even in Egypt shook his head at much that he saw? ἐμοὶ μὲν οὐ πιστά, just as simple-heartedly as then, when he heard of the circumnavigation of Africa.

A new puzzle-lock! But why invent one? Are not we human beings ourselves puzzle-locks? Think of the wonderful groups of thoughts, feelings, and emotions that can be aroused in us by a word! Are there not moments in all our lives when a mere name drives the blood to our hearts? Who that has attended a large mass-meeting has not experienced what tremendous quantities of energy and motion can be evolved by the innocent words, "Liberty, Equality, Fraternity."

But let us return to the subject-proper of our discourse. Let us look again at our piano, or what will do just as well, at some other contrivance of the same character. What does this instrument do? Plainly, it decomposes, it analyses every agglomeration of sounds set up in the air into its individual component parts, each tone being taken up by a different string; it performs a real spectral analysis of sound. A person completely deaf, with the help of a piano, simply by touching the strings or examining their vibrations with a microscope, might investigate the sonorous motion of the air, and pick out the separate tones excited in it.

The ear has the same capacity as this piano. The ear performs for the mind what the piano performs for a person who is deaf. The mind without the ear is deaf. But a deaf person, with the piano, does hear after a fashion, though much less vividly, and more clumsily, than with the ear. The ear, thus, also decomposes sound into its component tonal parts. I shall now not be deceived, I think, if I assume that you already have a presentiment of what the function of Corti's fibres is. We can make the matter very plain to ourselves. We will use the one piano for exciting the sounds, and we shall imagine the second one in the ear of the observer in the place of Corti's fibres, which is a model of such an instrument. To every string of the piano in the ear we will suppose a special fibre of the auditory nerve attached, so that this fibre and this alone, is irritated when the string is thrown into vibration. If we strike now an accord on the external piano, for every tone of that accord a definite string of the internal piano will sound and as many different nervous fibres will be irritated as there are notes in the accord. The simultaneous sense-impressions due to different notes can thus be preserved unmingled and be separated by the attention. It is the same as with the five fingers of the hand. With each finger I can touch something different. Now the ear has three thousand such fingers, and each one is designed for the touching of a different tone.[1] Our ear is a puzzle-lock of the kind mentioned. It opens at the magic melody of a sound. But it is a stupendously ingenious lock. Not only one tone, but every tone makes it open; but each one differently. To each tone it replies with a different sensation.

* * *

More than once it has happened in the history of science that a phenomenon predicted by theory, has not been brought within the range of actual observation until long afterwards. Leverrier predicted the existence and the place of the planet Neptune, but it was not until sometime later that Gall actually found the planet at the predicted spot. Hamilton unfolded theoretically the phenomenon of the so-called conical refraction of light, but it was reserved for Lloyd some time subsequently to observe the fact. The fortunes of Helmholtz's theory of Corti's fibres have been somewhat similar. This theory, too, received its substantial confirmation from the subsequent observations of V. Hensen. On the free surface of the bodies of Crustacea, connected with the auditory nerves, rows of little hairy filaments of varying lengths and thicknesses are found, which to some extent are the analogues of Corti's fibres. Hensen saw these hairs vibrate when sounds were excited, and when different notes were struck different hairs were set in vibration.

I have compared the work of the physical inquirer to the journey of the tourist. When the tourist ascends a new hill he obtains of the whole district a different view. When the inquirer has found the solution of one enigma, the solution of a host of others falls into his hands.

Surely you have often felt the strange impression experienced when in singing through the scale the octave is reached, and nearly the same sensation is produced as by the fundamental tone. The phenomenon finds its explanation in the view here laid down of the ear. And not only this phenomenon but all the laws of the theory of harmony may be grasped and verified from this point of view with a clearness before undreamt of. Unfortunately, I must content myself to-day with the simple indication of these beautiful prospects. Their consideration would lead us too far aside into the fields of other sciences.

The searcher of nature, too, must restrain himself in his path. He also is drawn along from one beauty to another as the tourist from dale to dale, and as circumstances generally draw men from one condition of life into others. It is not he so much that makes the quests, as that the quests are made of him. Yet let him profit by his time, and let not his glance rove aimlessly hither and thither. For soon the evening sun will shine, and ere he has caught a full glimpse of the wonders close by, a mighty hand will seize him and lead him away into a different world of puzzles.

Respected hearers, science once stood in a different relation to poetry than at present. The old Hindu mathematicians wrote their theorems in verses, and lotus-flowers, roses, and lilies, beautiful sceneries, lakes, and mountains figured in their problems.

"Thou goest forth on this lake in a boat. A lily juts forth, one palm above the water. A breeze bends it downwards, and it vanishes two palms from its previous spot beneath the surface. Quick, mathematician, tell me how deep is the lake!"

Thus spoke an ancient Hindu scholar. This poetry, and rightly, has disappeared from science, but from its dry leaves another poetry is borne aloft which cannot be described to him who has never felt it. Whoever will fully enjoy this poetry must lay his hand to the plough, must himself investigate. Therefore, enough of this! I shall reckon myself fortunate if you will not repent of this little excursion into the flowery dale of physiology, and if you take with yourselves the belief that we can say of science what we say of poetry,

"Who the song would understand,
Needs must seek the song's own land;
Who the minstrel understand
Needs must seek the minstrel's land."

[1] A development of the theory of musical audition differing in many points from the theory of Helmholtz here expounded, will be found in my treatise *Beiträge zur Analyse der Empfindungen*, 1886.

THOMAS PAINE IN ENGLAND, 1787-92.

BY MONCURE D. CONWAY.

ALTHOUGH my fresh information relates chiefly to Paine's residence in Paris, I have several new items concerning his sojourn in England, where he arrived early in September, 1787. He stopped at the White Bear, Piccadilly, only long enough to place with a publisher a pamphlet he had written in Paris, then went to his native town, Thetford, for a long visit to his widowed mother, then in her ninety-first year, on whom he settled an annuity. After a brief visit to Paris in 1788, to secure the patent of his iron bridge, he returned to England in the spring, and passed most of the summer at Rotherham, Yorkshire, where a workshop was fitted up in the iron works of Messrs. Walker. The bridge-model, two hundred feet long, was set up on Paddington Green in June, 1790, and exhibited at a shilling admission. Most of the above items are in my "Life of Paine," but I now add a note written by him to Jefferson, February 16, 1789, which reveals a picture of Paine in his Yorkshire workshop worthy the attention of an artist.

"Having found a straight wall suited to my purpose, I set off a centre and five feet for the height of the arch, and forty-five feet each way for the extent; then suspended a cord and left it to stretch itself for a day; then took off the ordinate at every foot (for one-half the arch only). Having already calculated the ordinate of an arch of a circle of the same extent I compared them together and found scarcely any certain distinguishable difference. The reason of this is that, however considerable the difference may be when the segment is a semi-circle, that difference is contained between the first and sixtieth or seventieth degree, reckoning from the bases of the arch. And above that the catenary appears to me to unite with the arch of the circle, or exceedingly nearly thereto. So that I conclude that the treatise on catenarian arches applies to the semi-circle, or a very large portion of it. I annex a sketch to help out my meaning.

"Having taken my measurements I transferred them to the working-floor. (1) I set off half the cord divided into feet; (2) the ordinates upon it; (3) drove nails at the extremity of every ordinate; (4) bent a bar of wood over them corresponding to the swinging cord on the wall. Above this first bar, and at the distance the blocks would occupy, I set off all the other bars, and struck the radii through the whole number; which marked the places where the holes were to be, and consequently the wooden bars became patterns for the iron bars.

"I had calculated on drilling the holes for 8d each, but found that I could punch a square or oblong square hole for 1d or 1¼ each. This was gratifying to me not only because it was under my estimation, but because it took away less of the bar in breadth than a round hole, and made the work stronger. I was apprehensive of difficulty in getting the work together owing to diverging of the bolts, but this I think I have completely got over by putting the work together with wood bolts and then driving them out with the iron ones."

The chief investor in Paine's bridge-enterprise was Peter Whiteside, an American merchant in London. Towards the close of 1790 Whiteside became bankrupt, and in 1791 his assignees demanded of Paine payment of six hundred and twenty pounds found on his books in connection with the bridge. I now find a note written from London by Paine's friend, John Hall, April 20, 1792, which suggests that this annoyance, and the unjust claim (which Paine paid), were due to political animosity arising from his reply to Burke.

"Mr. Paine was arrested as the papers mention in that public manner by the manœuvres of his opponents, on the settlements of a bankruptcy from whom he had some time past had money on a mechanical scheme. He directly gave bail and was released. He speaks with confidence on carrying his political scheme by many societies arising at Manchester, Sheffield, and different parts of the country. He is now out of town and will be some little time longer composing what I expect may be deemed B——s [Burke's] funeral sermon, and pointing out the further measures proper for the people to proceed on. The first and second part of 'The Rights of Man' are now printing and will be sold 1s 6d for both. He printed ten thousand of the second part which are nearly gone off. The Government papers execrate him to the highest degree; he says that they feel pinched and hurt, that makes them squeak so. There is now another society arose that seems to be a go-between on the reforming plan by stimulating the people to petition Parliament for a reform in representation. I deem it they may as well ask them to cut their throats, for the few interested in the slave-trade show you what interest will do in its support—and what can we expect when the whole phalanx of Government are so interested from the k—g [king] to the tidewaiter. But betwixt one and the other a reform of some kind will take place, I believe there is no doubt."

I have recently discovered the house in which Paine finished Part II. of his "Rights of Man," for which he was prosecuted and outlawed. He began writing this second part in Paris early in 1791, soon after the publication of Part I. (March 13, 1791), and it was published in London, February 17, 1792. The "Burke's funeral sermon" to which John Hall alludes was one of the various public letters written by Paine about that time,—probably "Address to the Addressers," in

which he charges Burke with being a masked pensioner. Part I. of the "Rights of Man" was begun early in November, 1790, at the Angel Inn, Islington, and completed in Harding Street,—the house undiscoverable, but not far from Newton Hall, where the positivists gather to hear Frederic Harrison and other leaders. As to Part II. I was long puzzled about the place where it was written, because I had taken seriously the words of the indictment that "with force and arms at London aforesaid, to wit, in the parish of St. Mary le Bow, in the Ward of Cheap, he, the said Thomas, wickedly, maliciously, and seditiously, did write and publish, etc." On consulting some old lawyers, however, I learned that this reference to the city parish was a mere formula, a legal fiction, meant to certify the jurisdiction of the Guildhall Court. It did not at all imply that Paine really resided in that parish. Having got off this false scent, I discovered that Paine resided, during the year 1792, until he left for France in September, at the house of Thomas Rickman, a publisher and bookseller. The house was then and is now No. 7 Upper Marylebone Street. It is now a bookbinding establishment, and the present occupant tells me that to his own knowledge it has been a "bookbindery" for over seventy years. There is little doubt that it has been such since Rickman's time. The front shop has the same old bookshelves, and otherwise has been little changed. It is a fairly comfortable house of three stories. In this house the London radicals gathered around Paine up to the time when the government became cruel. Among them Romney, who painted his portrait (now lost), Sharp, who engraved it, Mary Wollstonecraft, Horne Tooke, Sampson Perry, Dr. Priestley, Col. Oswald, Joel Barlow.

I have a diary kept by Paine's friend John Hall, then in London (1792), which contains some suggestive entries. Hall used to attend the popular debating societies or clubs, some, those of mechanics, held in the public houses. The reader will note the boldness of these societies, and their handling of large public questions, in April and May, as contrasted with the last, May 21, when the intimidated men could only venture to discuss whether accomplishments, beauty, or fortune should be sought for in marriage! Such was the panic caused by Paine's prosecution. About that time the societies were suppressed, though it is said one of them survives in "The Codgers," who meet in a Fleet Street public-house. The Codgers are those who, when they could no longer debate, could silently "cogitate." John Hall's entries, so far as they report such events, are as follows:

"April 5, 1792. Coachmakers' Hall. The question about putting confidence in government—whether Ins or Outs, Whigs or Tories. The proposer stated, from historic facts, that there was no dependence to be placed in them, but that the people at large should begin to act for themselves. It went against him by a small majority. Returned at eleven.

"April 9. King's Arms. Lotteries improper, and Pitt was responsible for continuing them.

"April 14. Mr. Paine and Mr. Henry had called when out.

"April 16. King's Arms debate. Whether the people in general were in favor of a direct abolition of the Slave Trade. Carried in the affirmative by a great majority.

"April 20. Met Mr. Paine; he goes out of town to-morrow to compose what I call Burke's funeral sermon. He went with me to an acquaintance where he had just dined, near the bridge foot, to desire him to introduce me to Dr. Priestley for advice on what I intended to pursue; which he very readily agreed to, and, being a philosopher himself, he will give me any information, and show me his philosophical apparatus, which he says is capital. He gave me a card of his address, and I am to go up with him to Hackney whenever I please to call. Parted with Mr. Paine at Fleet Market. [Hall was a scientific engineer and electrician.]

"April 23. King's Arms Debate. On a political and commercial alliance with France. Carried in favor. Much good sense urged by one person on the trade of war.

"April 26. Coachmakers' Hall Debate. On the propriety of Sheffield and Manchester addressing Paine and Tooke. Carried in favor by a small majority.

"May 3. Found Mr. Paine is returned to town; had called on me; left an advertisement of a fresh association. [Associations for propagating the principles of Paine's 'Rights of Man' were springing up throughout the country.] Coachmakers' Hall Debate: Praise or censure on the new Society for Reform, from men not principles. *Noes* seem to prevail; *pro* much broke by a man answering.

"May —. Freemasons' Arms Society. Much said in favor of Mr. Paine and 'Rights of Man,' and nothing unmanly against him.

"May 11. Carpenters' Hall House. Noisy meeting. The question, Are societies good, etc.

"May 15. To Johnson's [Paine's first publisher, who lost courage]. Asked him on Mr. P—e. He said it might be feared, but he was yet safe. [The indictment of Paine is referred to. For the first time his friend Hall enters his name with a blank.]

"May 21. King's Arms. Question, Accomplishments, beauty, or fortune be first married? Did not stay finishing."

This, the last debate mentioned by John Hall, was on the day of Paine's indictment.

"July 27. To Johnson's, St. Paul's. My countryman [Paine] out of town; his trial does not come on until winter.

"August 5. Mr. Paine called on me between 2 and 3, looking well and in high spirits.

"August 15. Bad news from France; riots.

"August 16. Mr. Paine has just called on me.

"September 1. To Johnson's; saw Barlow, the American author of 'Advice to Privileged Orders.'

"September 3. A walk up to Newgate to see the Lord Mayor, as he passed by, drink his cold tankard with the Keeper, as he was going to Smithfield to proclaim Bartholomew Fair.

"September 6. Mr. Paine called in a short time. Does not seem to talk much, rather on a reserve, of the prospect in political affairs. He had a letter from G. Washington and Jefferson by the ambassador [Pinckney, who had just arrived in London]."

Paine left England on September 14, 1792, and never set foot on it again. His English adherents were scattered abroad, and as for the debating societies, John Hall's last entry concerning them is: "November 26. To Change, but could not find where debating society met." The royal proclamation, at the end of May, against seditious utterances, virtually suppressed the societies. But it will be seen by some of the above entries that Paine had not carried the London masses with anything like unanimity in favor of his new gospel of rights. Only a small majority of one society approves the addresses of Sheffield and Manchester to Paine; in another (May 3) it is doubtful whether a majority does not favor a reform society which was formed really to oppose Paine's appeal to first principles.

I close this paper by translating a letter (unpublished) written from London by the French Minister, Chauvelin, referring to the reform society. It is dated May 23, 1792, two days after the indictment of Paine, to whom the writer was not friendly. ("French State Archives." Angleterre. Vol. 581, fol. 48.)

"An association has been formed . . . . including some eminent members of the commons and a few peers. The writings of Mr. Paine, which preceded a little this association, have done it infinite harm. It is suspected of concealing under a veil of reform long demanded by reason and justice the intention of destroying a constitution equally cherished by the peers whose privileges it consecrates, the wealthy whom it protects, and the nation to which it assures all the liberty desired by a people methodical and slow, and who, constantly occupied with commercial interests, do not wish to be continually agitated with public affairs. In vain have the friends of reform protested their attachment to the constitution. Vainly have they declared that they wish to obtain nothing save by legal ways. People persist in disbelieving them. They see only *Paine* in all their projects; and this writer has not, like Mackintosh, rendered imposing his refutation of Mr. Burke's work. The members of the association, although of opinions very different, find themselves enveloped in the disgrace, now almost general, of Paine. Such are the prejudices that they dare not do a good thing because it is advocated by a man whom they fear. Paine is mixed up in all the questions which trouble the comfortable class which values above everything a quiet life. Thus, up to this time, the members of the new association have obtained little hold on the people, except in some towns of Scotland whose interests they have defended."

A LOVER OF TRUTH.

Mr. William Rough, a real-estate agent, was a gentleman without any affectation, blunt in his speech, and not without coarseness in his manners. It cannot be said that he was much liked among his acquaintances, and those who had business with him preferred to deal with one of his two clerks; but he prided himself on the cause of his unpopularity, which he unhesitatingly attributed to his love of truth. In his eyes, all men were miserable sinners; all the poor were thriftless vagabonds; all the wealthy were robbers who had grown fat on the fleecings of the poor; all politicians, the President included, hungry office-seekers; all labor-agitators demagogues; all lawyers frauds; all physicians quacks; all clergymen hypocrites; and all, without exception, save himself, were liars. It was his favorite pastime to discourse on truth, and he used to contend that, for an ordinary mortal, it was impossible to live and prosper without telling lies. It is true that he "boomed" his real estate when he wanted to sell, and undervalued that of his neighbors when he wanted to buy. Truth-loving as he pretended to be in his private conversation, he was shrewd enough in his business.

During the summer season, when his business was light, he used to travel, and one of his main enjoyments was to shock strangers with his peculiar views whenever there was an opportunity at the hotels or on the trains.

Once, in a Pullman sleeping-car, he met an elderly gentleman, dignified and obliging, who was quietly reading his papers. Curious to know with whom he had the pleasure of sharing the compartment, Mr. Rough intruded himself repeatedly on his fellow-traveller's notice, but without success, for his partner was not less polite than reserved. "What method of lying," Mr. Rough thought to himself, "may his specialty be? He is apparently no clergyman, no physician, and no business man. Perhaps he is a professor."

At length Mr. Rough took occasion to launch the conversation, carried on mainly by himself alone, into the subject of truth and falsehood, and he paraded his hobby with his wonted vigor. "All men are liars," he said, "and they hate to hear the truth. I know it from experience, for I am much disliked at home for telling the truth squarely and unreservedly. Society is built upon falsehood; success is possible only by trampling truth underfoot; religion is hypocrisy; charities are merely given to evade justice; they are shams. In brief, all human intercourse is a great public lie."

The stranger looked up at Mr. Rough. "I suppose," he said, "there is much lying done in the world by people who cannot appreciate the worth of truth. Yet business succeeds in the long run only when conducted with honesty. The tenets of our churches are undoubtedly full of errors, but there is a spirit stirring in the souls of men that seeks for the truth. He who errs is not a liar. Truthful is he who obeys the truth as he best understands it. Lies go a little way, but the truth abides. Our public life is of a mixed nature: there is truth and error, and, I am sorry to add, also much conscious lying. But if truth were altogether absent, society would soon cease to be, for truthfulness is the sole basis of healthy conditions in our social intercourse."

"There I have you," interrupted Mr. Rough; "the truth is not only absent, but it is directly offensive and therefore injurious. Is there any one who even for a single day could tell the truth, the whole truth, and nothing but the truth?"

"My dear sir," replied the stranger, "you are by no means requested to tell the truth, the whole truth, and nothing but the truth to everybody whom you meet. I do not ask you to tell me that my face is homely, nor do I myself bore others with the truth—let alone the whole truth—of my private affairs, whether I smoke, or drink, or chew, or am a total abstainer. All that is requested of you and of me and of everybody else is to tell the truth where it is our business and duty to tell the truth; and it is not sufficient, nor the right thing, to tell the truth squarely; we must tell the truth with discretion. The physician who shocks a sick man by bluntly telling him, 'your disease is fatal,' may be guilty of a criminal offence in so far as he hastens the dissolution of his patient. He must be on his guard and break the truth to him in an appropriate way, as the occasion requires. Due reserve is not lying, and bluntness is not love of truth. Consider the consequences of your words, and choose such expressions as will bring about the result at which you truthfully aim."

The train was approaching the next station, and the stranger rose, taking his valise. "But I maintain," said Mr. Rough, "that we cannot reach our aims without telling lies, and that is the reason why all men are frauds and all life is a great social lie."

"You are mistaken," said the stranger, "and I advise you to subject your opinion to a thorough and searching revision. I do not know your special predicament, but there must be an unhealthy spot somewhere, either in your heart or your logic, or in both. Excuse my frankness. But if you cannot pursue your aims without telling lies, your aims are perhaps not good."

"I beg your pardon," cried Mr. Rough.

"I repeat," continued the stranger, quietly, "I do not know your case, and it is not my business to cure the diseases of your errors; but the greatest probability is that while you are faithfully telling the truth to everybody, you carefully hide the truth from yourself. Honestly, did you ever make up your mind to tell yourself the truth about yourself squarely and bluntly? Did you never make your vanities appear in your eyes as virtues; and did you never palliate your most obvious vices? They are perhaps known to every one who meets you, while they remain hidden to yourself. Remember,

> "This above all: to thine own self be true,
> And it must follow as the night the day
> Thou canst not then be false to any man."

The train stopped. "This is my station," said the stranger; "I am sorry that we disagree on the most important question of life; but don't give up your love of truth, even though you erroneously regard truth as a nuisance. I hope that you will understand the problem better as soon as you begin with your truthfulness at home, for there it is most sorely wanted. Good-by."

The stranger left the train, and Mr. Rough was at leisure to think over the lesson which he had just received.

P. C.

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