



JULES VERNE'S TOMBSTONE AT AMIENS
PORTRAYING HIS IMMORTALITY

AMAZING STORIES

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In Our Next Issue:

THE UNIVERSE WRECKERS, by Edmond Hamilton. (A serial in 3 parts) Part I. We are inclined to take everything for granted—particularly the courses of Nature. There is, after all, no absolute assurance that the sun, for instance, should continue indefinitely to turn at its present speed. What would be the final result of the centrifugal force if the sun started to turn more and more rapidly? What would happen to the planets which rotate around this great luminary? Mr. Hamilton needs no introduction, but we do want to say that this surpasses the best interplanetary story by him that we have yet published. Read the first instalment in the May issue.

MADNESS OF THE DUST, by R. F. Starzl. Although this story was written some time ago, an extract taken from "The New York Times" of December 21, 1929, gives almost word for word a similar description of an operation performed by a ship's Captain, following radio instructions from a physician. How then, can we say anything is impossible? But this is only an incident in an unusual story, excellently told, and which contains a good bit of science.

THE IVY WAR, by David H. Keller, M.D. Here is a new story by Dr. Keller, based on the always interesting subject of botany, dealing with a subject that is little known as yet. The "Ivy War" goes on in the good old Keller manner, which some of our readers seemed to have missed recently. It is absorbingly interesting and plausible, without.

SYNTHETIC, by Charles Cloukey. By this time, Mr. Cloukey has become a familiar and well-liked author in *AMAZING STORIES*. In this story, he offers us an exceedingly clever, swift-moving aviation exploit of the future that shows good imagination and excellent knowledge of his subject. (Crowded out of the last issue.)

THE NON-GRAVITATIONAL VORTEX, by A. Hyatt Verrill. Here is another of Mr. Verrill's extraordinary scientific tales, based on the local annihilation of gravitation.

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Our Cover

this issue depicts a scene from the story entitled, "The Conquest of the Earth," by Isaac R. Nathanson, in which the representative of the strange intelligent beings from the nebula of Andromeda is pointing out to the unsuspecting earth people, on a screened easel-like stand, on which it has a picture of the nebula, just where they come from.

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Remote Control

By Walter Kateley

Author of "The Fourteenth Earth," "Steam Heat," etc.

Illustrated by
WESSO

A MASSIVE steel basket, much resembling a greatly enlarged freight container of a gondola railway car, pulled up beside the dock. It halted directly before where my friend, Mr. Kingston, and I were standing. Instinctively I looked for a tow line, supposing that the load was carried by a barge, which on account of its great burden was submerged. I could see no tow line, and no tug was in sight. My companion saw my bewilderment.

"You will be interested in our new method of transportation," he said, leading the way to the edge of the wharf.

I peered over into the water. What was my surprise when, instead of a submerged barge I saw a great blue whale.

"Is he real?" I asked with a gasp of astonishment.

"Real? Of course he is real," said my friend, with a quiet laugh. "What is the good of knowing the great secrets of Nature if we can't make use of them?"

"These whales and the sharks," he went on, "are carrying the better part of our heavy stuff; the cement and the building stone, for instance. Without them we would be in a frightful mess of congestion. We should have the whole channel full of freight boats, tugs and barges. There wouldn't be room for the craft to get around. These servants of ours need only room enough to slide through. They handle more material in one day than a whole harbor full of boats could handle in a week. Besides, it costs money to buy or build boats and barges. And this old sulphur-bottom is nearly ninety feet long; and we have sharks that are about fifty feet.

"The unloaders are coming now. I shall have the pleasure of showing you some real efficiency."

At that moment there issued from one of the avenues between the great piles of materials the most motley gang of dock wallpers that it had ever been my privilege to see.

First came some half dozen lively little apes, closely followed by as many huge and fearsome visaged African gorillas. These gorillas were flanked by two pow-

THE empire of the ants is generally and universally conceded to be the most perfect functioning organization known. What makes it possible for them to carry on their work without any apparent leadership or supervision? Mr. Kateley develops an original idea in a very ingenious manner—namely, the control of intellects of animals and insects from a center of dissemination. Basing our assumptions on present-day findings, we can hardly say that the conception of "Remote Control" is impossible. We recommend this as an exceedingly interesting story, well worth your careful reading.

erful lumbering elephants.

Without a moment's hesitation the monkeys swarmed agilely over the newly arrived cargo, and with movements of incredible swiftness untied and rolled up the tarpaulins that covered the freight. It proved to be a cargo of sacks of cement.

By now the more powerful but less agile gorillas were on the load. They picked up the huge bundles of tarred canvas and tossed them easily to the dock. Then they laid down net slings, and began filling them with bags of cement; picking up and tossing the hundred pound sacks as easily as a man would so many bricks.

"One of them is as strong as ten or a dozen men," remarked Kingston as the first sling was filled. "Now watch the big

boys do their stuff. Give them your careful attention."

The two elephants stepped to the edge of the dock, and extending their trunks, passed them through the loops at the ends of the slings, which were held in readiness by a couple of the little monkeys.

They swung it aloft, dumped the sacks on the platform with a heavy thud, and returned the empty sling with a swiftness and precision that was astonishing.

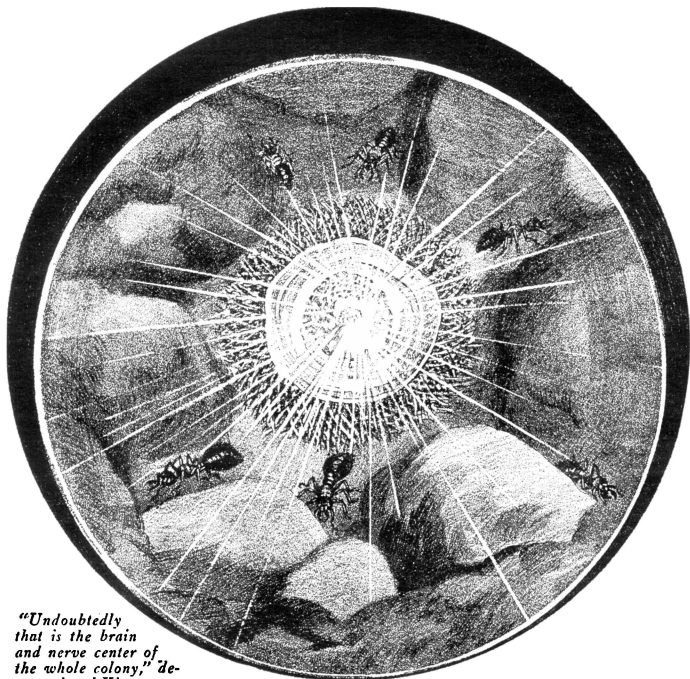
Almost before I had time to realize what was going on, the first load of perhaps a hundred tons was unloaded, and another load was pulled in; the great whale sliding swiftly away and giving place to another nearly as large.

I stood looking at the whole performance, overcome with amazement.

"I can't believe it," I said at length. "There just ain't no such thing!"

"Go to the ant, thou sluggard. Consider his ways and be wise," quoted Kingston.

At that moment something under water a little way out from the docks caught my eye. Soon I was able to make out a long procession of whales and giant sharks. Although they were quite submerged, I was able to see that each was carrying a large container on his back loaded with stone. Some had but a single block, while other loads were made up of smaller pieces.



"Undoubtedly that is the brain and nerve center of the whole colony," declared Kingston.

"We are using these rocks for masonry coffer dams," said Kingston. "You see, we are sinking several shafts, in order to build the tunnel in sections. In this way we are able to employ more of the large excavating machines; and it is much easier to dispose of the debris out in the Channel than it would be if it were all brought up at the two coastlines.

"You see, we are very fortunately located here for the securing of building materials. The Cornish coast, just up the Channel, affords an inexhaustible supply of the best granite rock; and the cement works, just over yonder at Portland, furnish the best grade of cement right at tidewater. The stone can be transported under water with a minimum of effort; for its weight when submerged is considerably reduced.

"Then again, these carriers can place a rock in a submerged position, exactly where it is wanted, without the work of an additional handling. The method is proving both swift and economical."

I HAD thought that I knew Kingston and his work; but all this had me floundering beyond my depth. Midway between incredulity and amazed curiosity, I managed to ask:

"But—but where are the bosses for the monkeys and the supervisors for the whales?"

"Oh, we have established offices in London," he explained. "This is all carried on through a system of television, and of remote control.

"You see, there were no buildings in Dover or anywhere along the English Channel large enough to house our office force and necessary equipment.

"You must know that this England-to-France tube is by far the largest engineering feat ever undertaken. It requires very many clerical and other workers.

"The only people we have here are the material checkers. They take care of receiving and reshipping such stuff as you see here on the wharf. Come, I will show you one of their booths."

So saying, he led me to a little glassed-in office. Here we found two men seated at desks, but apparently idle, but in reality their attention was fixed on a number of typing and computing machines on the opposite side of the room.

The machines were being operated at lightning speed, not by lady typists, as one might expect, but by bushy-tailed gray squirrels!

"Did you ever see a squirrel operating a revolving wheel in a cage?" asked Kingston. "Well, that's where I got my idea that they would make good stenographers. I believe they can move at least twenty times more quickly than a human being."

I could readily believe that such was the case; for one of the little creatures was mounted on the keyboard of a comptometer, operating the keys with all four feet. He was working with a frenzy of almost imperceptibly quick movements, so that one could scarcely believe there was any intelligent system to his performance.

Another was operating a quivering typewriter with equal swiftness.

"Do you mean to tell me that these squirrels know what keys they are stepping on?" I asked.

"Well, no; they don't exactly know what they are doing, any more than your hands know what they are doing when they comb your hair. Their little minds—such as they are—are crowded aside by the will of the director.

"This state of efficiency, however, is arrived at only after a great deal of practice. The director must educate the muscles of his squirrel, just as a human operator must educate the muscles of his hands.

"I don't suppose they will ever know that they are doing their part in building a thousand-foot tunnel, nearly twenty miles long. And they may see you, but they will probably never know that you are the discoverer of the great principle that has rendered all this possible." And he slapped me affectionately on the back.

"What I have done is nothing compared with what you are accomplishing," I replied.

"And even that little was only an accident," I continued resentfully.

And indeed such was the case.

What he had in mind had all happened some four years before.

I had been employed for a number of years—in fact I still am—in the Patent Office in Washington.

I had known Kingston more or less intimately for some time. In fact I had accompanied him only the year before on a most extraordinary expedition—an expedition that had led to some extremely interesting and important discoveries.

At that time he was an amateur scientist; employed as a designer of excavating machinery in a large manufacturing plant. To say he was an amateur in science is probably doing him something of an injustice; for I fully believe that even then he had a deeper insight into the physical properties of all matter than any other man I have ever been privileged to meet.

He had already perfected some experiments pertaining to atomic densities, that were destined to have almost revolutionary effects in the realm of physics.

His was a personality such as made one instinctively feel that he was in the presence of a great mind; and in addition I had found him to be a most companionable and genial spirit.

I HAVE long been something of an amateur scientist myself; not that I have any great store of scientific knowledge, or have ever accomplished much of a scientific nature; but I have always been keenly interested in the unseen forces that rule the everyday world. In fact, my interest in scientific matters has always far outrun my ability to investigate.

I have a month's vacation every year, and I usually spend the major portion of it rustivating on the old farm in Minnesota where I was born. Here I have quiet and leisure for studying any phenomenon of Nature that for the moment has enlisted my attention. For a few weeks I am a geologist, a zoologist, or perhaps an entomologist; browsing among the secrets of nature.

The old homestead has a small creek with a good fish pond. The pond and the riffles are teeming in summer with all manner of interesting aquatic life. Here too is a large gravel pit, replete with fossilized remains of prehistoric formations. And the old grove and fields abound with a wealth of insect life.

So with my books of reference, my microscope and a few other pieces of paraphernalia, I usually put in my time enjoyably and not altogether unprofitably.

At the time of which I write, I was especially interested in ants; their anatomy, building habits, social customs and what not. I had even gone so far as to establish a colony of the little creatures in a glassed-in formicary in the library-living room of my town lodgings, where I could have them under daily observation. This year I was looking forward to my month at the old homestead with pleasant anticipation, for I felt sure opportunities for ant study would be abundant.

Shortly before vacation time, however, I received a letter from Kingston; saying among other things that he was going to have a long vacation while his company were remodeling and installing new machinery in some of the buildings of the plant. I lost no time in inviting him to join me at the old farm, where we could fish and rest, or together chase our favorite phantoms and I mentioned in my letter that I intended to give considerable time to the ants.

He replied promptly, saying he would take great pleasure in helping me catch my favorite ant; and asking permission to bring with him a few articles of laboratory equipment, in order to carry out some experiments which he had in mind.

A fortnight later we were sitting on the bank of the old fish pond in the bend of the creek; fishing for young pickerel and scanning the water with a pair of short range binoculars in quest of strange forms of aquatic life. Behind us was the old gravel pit, where we had spent a part of the morning examining some ancient sea shells that evidently had been preserved in the sand since pre-glacial times, when this particular area must have been submerged beneath salt water.

"How about your ants?" asked Kingston. "I hope you are not forgetting them in your zeal to entertain me."

"Oh, no," I replied. "I shall not forget them; in fact I brought these glasses all the way from Washington for the express purpose of studying the creatures.

"I plan to go up on the hill back of the sand pit to look for a formicary this afternoon. There used to be several of them there in the edge of the little grove. You know they like to build on high, sandy soil. I plan to arm my forces with a spade, the high-power microscope and these binoculars and march upon the formicidæ."

"Yes," rejoined my friend very gravely, "Cæsar said that conquests were more often won by the spade than by the sword."

"But to me the matter of impedimenta seems of equal importance. You know Napoleon said, 'an army travels on its belly.' Or was it stomach? Well, anyway I believe leading strategists are agreed that no one ought to risk an engagement with any of the tribes of Hymenoptera without a copious supply of lacteal fluid, rich in casein and lactic acid."

So saying he took the thermos bottle from the basket and drank generously. He was a great buttermilk hound. And now, while he was on the farm where all dairy products were plentiful, he was making the most of his opportunities.

"A valuable suggestion," I agreed. "No doubt the boys will be back from the creamery when we go down to the house for lunch, and we will load the old demijohn with a fresh, cool supply."

AND so that afternoon we took our basket, loaded with the glasses, a few smaller instruments, a bottle of cedar oil for the oil-immersion lens, together with Kingston's beloved buttermilk bottle, and hopefully climbed the little hill that flanked the gravel-pit. Here, as I had expected, we found a couple of very populous fornicaries, and chose one close to the shade of a small maple tree for our investigations. This nest seemed to be very newly, if not quite, on the spot where I had known one to be fully twenty years before, when I was a small boy.

I am inclined to believe that the colony had occupied the same quarters for at least two decades, and possibly much longer. The mound was about two feet in diameter and perhaps ten or twelve inches high. It was made up largely of small twigs and straws, pebbles, etc. The ants were quite large, with red thorax and dark, almost black, abdomen. The female or working ants varied quite extensively as to size and strength of mandibles.

We identified the tenants of this domain as belonging to the group *Lasius Niger*, variety *Americanus*.

Upon examination we found the workers busy at their multifarious occupations. They were carrying in fragments of insects and other articles of food; bringing out rubbish and carrying their little aphids—ants' cows—to and from the pasture grounds. The nurse ants were bringing their charges, the grubs and larvæ, out for an afternoon airing.

In fact all was orderly commotion.

While we watched, a group of workers appeared at the edge of the mound, bringing in a twig several inches long. There were more than a dozen of them at this job, and their performance revealed perfect teamwork.

We were anxious to see something of the substructure of the fornicary, so we decided to start an excavation, by digging a hole some five feet deep, at a distance of several feet from the mound.

This we lengthened in the direction of the ants' habitation, in order to reveal a vertical section of the works without too greatly disturbing the inhabitants or injuring their home. As we approached the vicinity of the substructure, carefully shaving the soil away in vertical slices, we came upon the quarters of a colony of minute red ants, whom we at once recognized as robbers. The little creatures were no doubt preying on their much larger neighbors, and living largely off stolen food.

We soon found that the rooms and galleries of the red ants were connected by tiny tunnels with those of the larger fornicary, and that these tunnels were too small for the larger ants to enter through. Such an arrangement rendered it possible for the little marauders to slip into their victims' quarters and snatch anything small enough to carry away and duck back to safety with it.

At length we came upon the rooms and galleries of the large ants, and found them busy with their household duties.

Some were taking care of the eggs and young. Many were engaged in carefully cleaning themselves and one another; busily brushing and licking every part of their bodies. Some were at work excavating new chambers and galleries; while others carried the loose soil away. Here again we witnessed perfect teamwork and cooperation.

We found that their workings extended even below the bottom of our five-foot excavation. Owing to the fact that it was a very warm afternoon, we soon lost enthusiasm for digging any deeper, and lay down in the shade to discuss what we had seen.

"They are very clever little creatures, aren't they?" remarked my companion.

"I hardly know whether they have intelligence or not," I replied.

"Some naturalists claim that all that they do is accomplished by instinct alone: that every movement is a reaction to some sensory stimulus; and that their behavior is controlled by something more deeply seated than intelligence. This something is inseparable from the fundamental life processes."

I took out *The Field Book of Insects*, by my favorite authority, Frank E. Lutz, Ph.D., and read as follows from his discussion of the anatomy of insects:

"The central nervous system is a double longitudinal series, connected one with another by cords.

There is no brain, strictly speaking; for the ganglia in the thorax seem to be about as important as those in the head. Nerves run from each ganglion to near by parts of the body."

"Now if there is no brain," I argued, "how could there be any intelligence?"

"I can't say anything about the brain part," Kingston countered, "but you must admit there are evidences of intelligence. You saw how they all lifted at the same time on that long twig? You see how workmanlike they are in their excavating—each doing his part and doing it correctly. We know that their arrangements of passages and galleries are not haphazard, for each variety has its own characteristic plan of home architecture. The different groups are as easily identified by their building methods as by their physical characteristics."

"It certainly requires intelligence to build such a complicated system of compartments and tunnels, all according to a preconceived plan; especially since they have no blueprints to go by."

"On the contrary," I persisted, "the fact that they always follow a general plan, and that each seems to take little or no notice of what his fellows are doing, only goes to convince me that they are not intelligent."

IN the first place, the worker ant only lives a few months; passing all her life in a single fornicary. We have no reason to believe that she ever studies the inside of any other establishment. Then how could she,

no matter how intelligent, learn the plan and details of a home? She is able to do her part in building as soon as she is fully developed.

"Then again, in all the public works, in all the engineering projects carried on, no one has ever been able to discover anything remotely resembling supervision. There is no master builder, planning and coordinating the work. Now suppose a group of men were about to erect a building. Would it be possible for each one to do as he individually saw fit, without regard to orders from anybody? There would naturally be too many doing one thing, and nobody doing another. There would be too much studding and not enough rafters, or *vice versa*. No one would think of determining where the doors and windows should be, and in fact, with no one to direct and coordinate the work, it is obvious that however intelligent the individual workmen might be, no appreciable progress could be made. All would be confusion, as it was at the Tower of Babel.

"Yet among the ants, all is orderly and efficient."

"Surely you would not say that ants have intelligence superior to that of human beings, or that individual humans could not exercise as much judgment as individual ants could!" I countered.

"Well," said Kingston, "if they have no leader, how do they know who is to go for food, who is to make tunnels, and who is to care for the young, or the hundred and one other things that ants do? You say there are no foremen and no directors; but how do you know that?"

"Now look at these workers bringing this twig. Here is a large one struggling along on this side near the front. Let us suppose that she may be the forelady. We might easily imagine her giving directions as she works.

"Gladly, you are a little too far back. Come forward a couple of paces, and catch hold just behind Mary Jane. Now lift the front end over that stone. Right up high with it!

"And you on the back, let your end down, so it will slide along on the top of the stone.

"Now Sarah and Elizabeth, come here and give me a lift. Remember, when we come to that weed stalk, you girls up there in front want to go to the right side of it, not to the left!

"Now we will let it rest a moment until Evelyn's gang get out of the way with that old log. That gang makes me sick. They dodge around that timber like a bunch of old maid grasshoppers and then when they do get home with one piece, it usually takes them all the rest of the afternoon to manure their antennae!"

"Highly amusing," I laughed, "but hardly scientific."

"Of course you know," he went on, "we can't hope to hear all this; for our great flapping ears are not attuned to the wave lengths that serve to carry their little voices. But I strongly suspect that if we had sufficiently strong magnifiers we could hear their communications, although of course we would not be able to understand their language."

He lit his pipe and went on: "Hearing and sight are very peculiar things; things that as yet we know little about.

"We have made some progress in these matters in recent years. progress in the way of X-rays, telescopes, microscopes and radio; in fact, we have gone just far enough to reveal how great is the field, and how little of it we know. I suspect that we are merely on the borderland of the possibilities still beyond. And then it is just

possible that ants and other insects have an additional sense, apart from the five that we possess. It might be somewhat akin to hearing, to sight or to the sense of touch. But since we do not have it, we cannot name it, neither can we have any conception of its nature.

"If all people were blind, and had always been blind, no one could possibly know anything about sight. There would be no name for such an experience, and no one would be able to discover it in the animals.

"Sight is such a marvelous, such a complicated thing, that no stretch of the imagination could have conjured up such a faculty, had it not been known in human experience.

"It may be that throughout their entire bodies insects are sensitive to certain vibrations: vibrations associated with wave lengths we know nothing of.

"We know that light, sound, heat and other natural phenomena have characteristic wave lengths. We know that some of these waves are very long, some very short, and some are of intermediate length. We have been able to segregate a little group of them here and there for purposes of identification, and some of them we can measure very accurately. We know the length of those we sense as color, and those which we utilize in radio, etc. But there are wide gaps between the known groups; presumably filled with waves the uses of which we have yet to discover.

"I might illustrate the thought in this way. Suppose we draw a line through San Francisco, Chicago, Cleveland and New York. It so happens that they are exactly in a straight line; and suppose that only those parts of the line within the narrow limits of the four cities was known, and the long stretches between were unexplored wilderness. This would be a fair representation of our knowledge of vibrations and wave lengths.

"In all probability there are many longer waves—far longer than the longest we know; perhaps hundreds or thousands of times as long. In fact their limits may be circumscribed only by the inconceivable reaches of space itself. And at the end of the scale beyond the short wave lengths there may be countless gradations of shorter and shorter lengths.

"There is, of course, a limit to the shortness of a space that the human mind can conceive of, but there is perhaps no limit to the shortness of a space that Nature can divide. And the possibilities of different forces at work, employing different wave lengths, are absolutely boundless.

"So I say it is quite conceivable that an insect might have a hundred distinct senses, instead of only two or three, or five, as we have. And I believe I am justified in thinking that the mere fact that we cannot see an ant acting as foreman and directing the work, is no sign that such directing is not being done."

"Yes," I admitted, "that is a possible explanation. But I have a somewhat different theory; although as yet it is only a theory. My conception is that a single ant is not an entire individual. In other words, these units that we see are not the entire entity, but only parts of a larger animal, other parts of which escape our notice.

"PERHAPS I can explain by using the following illustration. Suppose in the case of a hundred-legged worm, the common centipede, that we were able to see only the legs and the feet and the body were completely invisible. We would then have two rows of feet and legs

going along, all nearly alike and all keeping in line, all marching at the same speed and at uniform distances apart. If one line should turn, the other would turn also. There would appear to be perfect cooperation and teamwork.

"Because we could see no connection between them, we might suppose that each was a complete animal, and that each was intelligent and highly efficient as a marcher; and we would naturally wonder how the general movements of the whole group were directed. Or, to put it in another light. Suppose there were a race of beings so constituted that they could not see our bodies, but only our hands.

"They would be interested in watching our hands doing all manner of things; writing, using tools, operating machines and so on. They would naturally suppose that our hands were possessed of intelligence; yet upon examination, no brain could be found. Then suppose we had a dozen hands; a hundred; or even as many as an ant hill has ants. All these hands might be at work with seeming intelligence, and no particular hand would appear to be directing the others as to what to do, or how to do it.

"Of course I know you might find objections to this analogy, as applied to the ants. You may say that each ant has its own organs, such as digestive apparatus, sight and smell. And I might answer: so does every part of an amoeba have its own organs, or rather the functions of organs. Each part digests the food with which it comes in contact. The parts move and react to stimuli, although there is no brain and no nerves or sense organs, as we know them.

"Then again, our own hands have certain sense organs, such as the sense of touch, sensitiveness to heat and cold, etc. I see no reason, therefore, why Nature could not add other senses, such as sight and taste; in fact, all the senses we know and others that we know not. So perhaps these ants that we see are only a great many operating parts of one animal. As we have hands, fish have fins; an octopus has tentacles; and so this thing has ants."

"Yes, yes, go on," said Kingston whimsically. "You are making my world larger every moment. Let me see the rest of your strange beastie."

"Well, I hardly know if I can do that," I admitted. "You know vision has its limitations. There may be nerves, or substitutes for nerves, right before your eyes, passing from each ant to some central location; but you cannot see them. Let us consider a nerve. It is a little string of white, fatty substance, extending from the brain as a ganglion to some portion of the body. When a message passes along this substance, we do not know what is really happening. Apparently there is no movement of the nerve substance, and no change in its composition. So we are led to believe that the nerve itself has no intelligence nor mechanical energy; and that it only acts as a passive medium on which the message travels.

"WE do not know what a nerve message really is. To our senses it has no tangible form or substance; but our reason dictates that it is a movement of some kind of energy, perhaps a series of vibrations of some sort; possibly akin to light, heat or electricity. And the human brain, knowing far more than we know, is able to interpret these vibrations in terms of sight, smell, touch, etc. Or, if the vibrations originate in the brain,

some organs in the muscles—organs which we have yet to discover—have power to translate them in terms of motion. I think that so far my hypothesis is altogether reasonable, is it not?" I asked.

"Yes, I can agree to all that," my friend rejoined; "go on."

"Well," I continued, "sometimes we send messages—such as telephone messages—on a wire; and sometimes we dispense with the wire. We just give the words a little impulse by the help of some electrical apparatus, and let them find their own conductor. And they go all right. We cannot see them as they travel on; but when they arrive at their destination, perhaps thousands of miles away, they reveal themselves to human consciousness fully as well as when sent by wire.

"In fact we are already commencing to think of writing as a somewhat superannuated and archaic method of communication.

"It is within the province of reason to suppose that while Nature can and does send messages over nerves, as we send them over wire, she can also dispense with that little line of fatty matter as readily as we can dispense with the copper wire, and send messages as we send them over or through or by some medium that is imperceptible to human senses.

"We often hear of some instance that would tend to justify this belief.

"I remember when I was a small boy I heard my uncle tell how he met with an accident while operating a well-drilling machine. Something sharp struck his right hand with such force that it passed through his leather glove and completely severed his little finger at the second joint.

"Realizing that his hand was badly injured, he immediately started for the doctor's house. (It so happened that the doctor lived close by.)

"He removed the remains of his tattered glove as he went, and in so doing let the severed portion of his finger fall to the ground. Paying no attention to this incident, he hurried on to the doctor who dressed the wound.

"This happened in the winter; and soon my uncle commenced to experience the feeling that the missing finger was cold. But since there was really no finger there to get cold, he tried to ignore the feeling.

Presently the weather became more severe and the pain increased. At length he decided to find the severed member, and put it in a warm place. This he was able to do after a somewhat prolonged search, and promptly the distress was relieved.

"I might relate a number of similar instances, and maybe you know of some yourself.

"But the point is that our nervous system may not have to use a continuous, tangible nerve to register feeling."

"Let's take a drink," said Kingston. He turned to the basket for his bottle.

"What happened here?" he exclaimed. "The cork is out of the thermos, and the little oil bottle is broken. Everything is in a mess!"

"I hope your buttermilk isn't all wasted," I said. "I suppose I must have hit the basket with the spade when I was digging."

"Oh, I guess there is not much gone," he replied, examining the bottle and taking a drink.

I HASTENED to take the microscope and binoculars out of the mixture of cedar oil and buttermilk in the bottom of the basket.

I laid the glasses aside, meaning to wipe them dry after attending to the basket. But we fell into further discussion, and I forgot them.

Half an hour later, perhaps, I had occasion to use the binoculars to examine some detail of the formicary. As the lenses came into proper focus, I noticed a small blotch of slight cloudiness on one of the glasses. I at once thought of the spilt oil and buttermilk, and was on the point of interrupting my observations to wipe the instrument, when something quite unusual caught my eye.

It was a tiny gleam of brilliant color, which lay just beside a medium-sized worker ant. As the ant moved along, the particles of color moved with it.

My first thought was that she was carrying something that reflected the sunlight. Yet this seemed impossible; for the bright spot appeared to be about midway along the thorax. As the worker mounted a little rise, the area lengthened and became a thin thread of silvery, shimmering blue. Then this thread lengthened and shortened as she moved on. Another ant moved into the clouded area; and immediately I discovered that she also was accompanied by a similar fragment of color.

By this time my curiosity was thoroughly aroused. I focused on other ants, and found them all accompanied by the same phenomenon. And to my ever-increasing surprise, I found that in some cases this line of brilliance was very long. In one instance, where a small worker was mounted on a twig, the strange glimmer was fully two inches long. It was like a ray of some peculiar kind of light.

I now noted that from all the workers within my observation the color line extended in approximately the same direction; that is, toward the center of the formicary, regardless of which way the ant was facing.

As I was puzzling over this, Kingston's voice broke in on my consciousness. He had noticed how intent I was on the spectacle, and had no doubt detected a look of astonishment on my face.

"What is it?" he said. "Are you seeing a ghost?"

"I hardly know what it is," I replied in my bewilderment.

I handed him the glasses. "Look at the ants through the clouded spot in the right lens," I directed.

He held the glasses to his eyes. I watched him with interest.

For a moment the binoculars were stationary. Then I saw that he was moving his line of vision from place to place. Evidently he was transferring his attention from ant to ant, just as I had done.

"What do you make of it, Watson?" I asked.

He did not answer. Very soon he focused the glasses on the opposite side of the ant-hill for a few moments. Then he picked up a twig from the top of the mound and held it before him. He noted that several of the inhabitants clung to the twig. At length he lowered the glasses and turned on me.

"What can it be?" I said, hoping that he might have some explanation.

He stared at me as if unable to comprehend my question.

"Why, my God, man, what do you suppose it is?" he asked as if entirely out of patience with my density. "What were you just talking about?"

And then with an abrupt change of manner, he extended his hand.

"My dear fellow," he said. "I want to congratulate you on having made the greatest discovery in zoology of the twentieth century! It is, beyond question, the nerve system of the ant colony!"

"But why," I said incredulously, "has no one ever seen it before?"

My companion was examining the spot on the lens.

"I suppose," he replied, "that no naturalist has ever before had the good fortune to spill just the exactly correct mixture of cedar oil and buttermilk on his lens. We must preserve this dried film with the utmost care."

AGAIN we took up the examination. We found a worker several feet from the mound, and had no trouble in discovering the bright line and tracing it from her all the way to the side of the ant hill.

Then we thrust the point of the spade into the formicary, and took up a mass of the building material covered and filled with ants.

Holding this above the mound and focusing the glasses on a point below it, we beheld innumerable lines of brilliance extending to the formicary.

It resembled a wonderfully illuminated waterfall.

"I have no doubt that the queen ant is the center of this marvelous system," I announced. "We ought to continue our excavations until we find her."

"It might be quite a long job," said my friend. "The sun is getting low, and that bank of clouds will soon obscure it. So maybe we had better wait until morning."

"I am afraid to put it off," I replied with some impatience, "because it may be that, when this film on the glasses dries a little more, it will lose this marvelous quality. And then we might never know the origin of the lines. We might never be able to hit upon just the right combination."

"Yes, you may be right about that," he admitted; "and in that case we had better go on as far as we can tonight."

So I hastily started digging again; shaving the vertical layers of the formicary, stopping every now and then while Kingston examined the direction of the lines.

But very soon the sun's rays commenced to lose their brilliance; the lines became increasingly hard to detect and follow.

So we decided to call it a day and go home. That evening we determined to treat some panes of glass with cedar oil and buttermilk, to see if by any chance they would give the same effect as the lens. We cleaned a dozen or more photographic dry-plates, and covered them with a thin film of cedar oil and buttermilk mixed in varying proportions.

These we set aside to dry. Then we treated the other lens of the binoculars with a mixture that we hoped would be effective.

The next day proved to be rainy; but during the day there occurred several short periods of sunshine between showers. We took advantage of these short periods to test our treated glasses.

We soon found that none of the plates gave any results. Neither did the newly covered lens; but we were gratified to find that the original clouded one still retained its magic quality. It was evident that we had not hit upon the proper proportion of oil and buttermilk. The lens seemed to be too opaque. This was presumably due to too great a proportion of buttermilk.

We hastily prepared a more attenuated mixture, and replaced the old coating. During a later period of sunshine, we found that this new film gave perceptible results, but was far from satisfactory.

After several trials, with varying proportions, we finally arrived at one containing only a trace of butter-milk.

By this time the sun was so low that we had no further opportunity to test our work, and so were obliged to postpone further experiment until the following day.

Fortunately the morning was clear and light. We were at the formicary bright and early. To our great delight we found that our newly treated lens was a success. In fact it was quite as clear as the old one, and of course afforded a much larger field of vision, so that now we were able to observe a large group of ants at one time. When a large number were lifted from the formicary *en masse*, it gave a very beautiful effect. The brilliant lines were so close together that in some cases the eye could not separate them; but they never seemed to cross.

By manipulating several groups in the air at one time, we provided some very striking effects. We were so entranced with the brilliance and beauty of the spectacle that it was only with the greatest reluctance that we at length forced ourselves to go to work.

We now continued our excavation, one watching the direction of the lines from near by ants, while the other removed the soil and deposits of the formicary.

Upon arriving at a point near the center of the mound, and two or three inches above the surrounding surface soil, we came upon a locality where all lines seemed to converge. But to our surprise there was no queen ant present. In fact there seemed to be only a deposit of ant eggs in an exceptionally large cell. Using the low power lens of the microscope, we discovered that there was indeed a very minute basket-like arrangement, apparently composed of silken fibre such as that from which the ant grubs spin their cocoons.

Switching to the 444 lens, we were able to make out that the little container was filled with an almost transparent liquid.

ALTHOUGH we investigated carefully, we could see nothing further, and upon segregating the tiny basket-like object and moving it about, we discovered that the convergence of the bright lines moved with it, following it from place to place.

Apparently there was nothing to do but try the oil immersion lens. Yet we hesitated, because we feared that the oil to be used might prove fatal to the animal matter, in case there really was a living creature present.

After some discussion, we decided to carry on. I brought a large flat stone, on which we carefully mounted our microscope and an auxiliary light condenser. Then with the tiny basket mounted on a crystal slide, we commenced our examination. I knew that Kingston was a very accomplished microscopist, and I permitted him to take charge of the work.

For some time his efforts were unsuccessful. But at length he announced, "I believe I have it."

A moment later he affirmed emphatically, "Yes, here it is, sure enough. And it's alive," he added presently. Needless to say I was all agog, and impatient to have a look; and my companion soon gave his place to me.

Immediately there appeared before my vision a very minute but quite distinct object. It resembled an imperfectly formed brain. It was palpitating slightly; and as I gazed spellbound, it moved perceptibly with an amoeba-like motion.

Apparently it was suspended somewhat below the surface of the crystal-clear liquid in which it was immersed.

"Undoubtedly that is the brain and nerve center of the whole colony," declared Kingston. "I have no doubt that it is hatched from a special kind of egg; and that it draws its nourishment from this bath in which it is immersed, after the manner of an amoeba."

"Probably the ants deposit predigested food substances in the bath. There regurgitated foods may be prepared and concentrated in the digestive tracts of especially adapted workers. Or it may be that the queen herself performs this as a royal duty."

"I doubt very much if it comes from an egg," went on Kingston. "I think it is more likely in the nature of an amoeba. That is to say, its method of reproduction is by division, and like an amoeba, its life is eternal, except in case of destruction from outward sources. Perhaps after a subdivision of the organism the superfluous brain is carried away by a young queen, about to institute another colony; in the same manner as a young queen often flies away with a number of small wingless workers, or a fragment of fungus culture with which to start a new establishment."

"Be that as it may," I replied, "I think we can safely say that this is the animal itself, possessed of brain power and intelligence; and that what we call ants are only its multitudinous appendages; the queen being in reality only its reproductive organ."

"The various parts of its anatomy are not connected one with another by organic tissues. But they are connected and coordinated into one complete entity by this marvelous and beautiful system of nerves; this network of lines of force."

"This is indeed a great discovery," said Kingston impressively. "And I foresee that it is sure to have far-reaching results."

After a moment he went on. "If we could only discover what this nerve energy is, and determine the wave length of its vibrations, we could apply the force to all animals. We could revolutionize all industry!"

I will not dwell on the account of our further investigations. Suffice it to say that we returned to our respective employments after vacation; and I spent my spare time in preparing a report to submit to the entomological society. I prepared it with much care and elaboration; for I was convinced that it would create a furor when it came to the notice of the scientific world.

MEANWHILE, as his letters revealed, my colleague was busy in his little home laboratory, trying to analyze this peculiar nerve force that could travel through space.

One day I received a letter full of jubilation.

"I find," he wrote, "that it is not far different from light; its wave length is not a great deal shorter than those at the violet end of the spectrum."

He went on to say that he was trying to produce an apparatus that would generate this force. He also suggested that we give a name to this new found entity, in order to distinguish it from light, electricity, etc., and aptly suggested the name "Formicidary Rays."

'A still later letter advised me that he had succeeded in producing a generator that was something like a cross between a dry battery and an X-ray machine, and that he was now able to produce visible lines of formicidary rays at will.

I asked for a few days' leave of absence and took a hurried trip to his home, where I found him hard at work in his laboratory.

"I have asked the company for three months off," he explained, "and they have retaliated by electing me to the position of third vice-president. As yet, the third vice-president has no duties prescribed, so I am at leisure and entirely at your service."

He showed me his new apparatus, and proceeded to demonstrate it.

"For this work, I have been able to expose one of my nerves," he explained as he unwrapped a finger that I had noticed was banded. He displayed an incision in the flesh that revealed a small silvery white line, easily discernible with the pocket lens.

He immersed his finger in a transparent bath contained in his apparatus.

"I know this is a very crude method of connecting up," he observed; "but I have no doubt I shall be able to get away from it when I have had time to perfect the details."

"Here, you see, is my subject," whereupon he picked up a small glass box containing an ant; at the same time he operated a number of controls of his mechanism.

"Now, take the glass and watch for the nerve line," he directed.

I did so; and immediately saw that the line was established, extending from the ant toward the operator.

"You see, I am using my own brain for sending," he explained. "You will perceive that my subject is eating a bit of honey. Such reflex actions can be carried on without intelligent direction. But now watch what she does. I am going to direct her to go and get that straw."

A small fragment of straw was lying some distance behind the ant. At once the ant ceased eating, and abruptly turning round, picked up the straw and made off with it.

"That will do, Sarah," said Kingston with a chuckle. The ant dropped the straw and went back to the honey. "What do you think of that?" asked my host.

"I think you are a wizard," I replied hastily.

"No, I am not," he said; "I am only an amateur scientist. Next time you come I will have a guinea pig perform for you."

"I'm willing to believe anything now," I said. "I am fully prepared to see anything happen. But tell me; why do you think you can apply this to animals also?"

"I have reason to believe," he answered, "that a like force actuates the nervous system of all animals. The only difference between the ants and the others is that the ants have a specialized sending apparatus—broadcasting mechanism if you will—that causes the message to travel on nerves where there are nerve fibres, and in

space where the nerves are lacking; whereas the others are possessed of an apparatus that sends over nerve fibres only.

"Now if we can find a way to convey messages to the nerve centers and ganglia of an animal in such a way that they will come in stronger than those from the animals' own brain, we can control the actions of the animals' body.

"Suppose a dog is standing with one foot raised off the ground. There will be messages coming from the motive part of the brain to the ganglion and nerve center through which the nerves pass governing that foot; saying in substance, 'Keep that foot up'.

"But if we can send a stronger, more impressive message saying 'Put that foot down,' the foot will go down; and Mr. Dog can like it or not."

"I wish you would go a little easy on that buttermilk," I said with mock gravity. "I am really afraid it is affecting your mind."

In spite of my little joke I was conscious—perhaps more strikingly than ever before—of being in the presence of a superior mind.

I was convinced that a great realm, which to me was dark and full of the deep secrets of life, was to him an open book.

And now some years had passed. Mr. Kingston's company, of which he was still a vice-president, had undertaken to construct the long-projected tube from England to France. And my old-time friend was in charge of operations, under the title of chief engineer, which brings us back to the afternoon when my story opened.

This extraordinary scientist mused a few moments over my declaration that my part in the early discovery had been a mere accident.

"Yes," he said, "there was an element of chance involved, to be sure; but almost all discoveries have been to some extent due to chance; look at the way the Chinese discovered roast pig. This is cleverly told by Charles Lamb in his 'Essays of Elia.'

"But usually the accident doesn't mean anything, unless one has a theory first. You had a theory; and the accident only served to verify it."

"The important part of the accident was that you happened to be there to see it," I rejoined. "Had it not been so, the most that could have come of it would have been a rather carefully worded report to the entomological society."

"Well," Kingston said, "the good old tube is more than half done now.

"It is ten times as large as the old engineers dared to propose. And in all the departments of the undertaking except where heavy machinery is indispensable, the work has been done by very efficient animals of more than forty kinds."

"And when the thing is finished, something seems to tell me that we shall see your picture in all the leading newspapers and magazines of the world," I said in answer to his modest statements.