## JOHN SCOTT RUSSELL.

The decease of this eminent engineer was recently announced in the SCIENTIFIC AMERICAN. We now give a portrait from the *Illustrated London News*. He died in June last, at Ventnor, in the Isle of Wight, in the seventy-fifth year of his age. He was born in the Vale of Clyde in the year 1808. On the death of Sir John Leslie, Professor of Natural Philosophy in Edinburgh, in 1832, Scott Russell, though then only twenty-four years of age, was elected to fill the vacancy temporarily. About this time he commenced his famous researches into the nature of waves, with the view to improving the forms of vessels. His first paper on this subject was read before the British Association in 1835. He discovered during these researches the existence of the wave of translation, and developed the wave line system of construction of ships, in connection with which his name is now so widely known.

The first vessel on the wave system was called the Wave, and was built in 1835. He succeeded in having his system employed in the construction of the new fleet of the West India Royal Mail Company, and four of the largest and fastest of these vessels—viz., the Teviot, the Tay, the Clyde, and the Tweed—were built and designed by himself.

Mr. Russell was for many years known as a shipbuilder on the Thames. The most important work he ever constructed was the Great Eastern steamship, which he contracted to build for a company of which the late Mr. Brunel was the engineer. The Great Eastern, whatever may have been her commercial failings, was undoubtedly a triumph of technical skill. She was built on the wave line system of shape, and was constructed on the longitudinal double skin principle, which also was invented by Mr. Russell. It is not necessary now to refer to this ship in any detail. In spite of the recent advances made in the size of vessels, the Great Eastern, which was built more than a quarter of a century ago, remains much the largest ship in existence, as also one of the strongest and lightest built in proportion to tonnage. The paddle engines and boilers of this vessel were also made and designed by Mr. Russell. He was one of the earliest and most active advocates of ironclad men-of-war.

In early life he took a great interest in steam locomotion on ordinary roads, and while at Greenock he constructed a steam coach which ran for some time successfully between Greenock and Paisley. The springs of this steam carriage, and the manner in which the machinery adapted itself to the inequalities of the road, were triumphs of ingenuity.

His greatest engineering work was without doubt the vast dome of the Vienna Exhibition of 1873. This dome is, among roofs, what the Great Eastern is to ships, its clear span of 360 feet being by far the largest in the world. It will be probably the most enduring monument of its designer's fame and ability.

JOHN SCOTT RUSSELL.

## MICROSCOPICAL EXAMINATION OF ICE.

BY EPHRAIM CUTTER, NEW YORK, MEMBER PHILOSOPHICAL SOCIETY GREAT BRITAIN, ETC., ETC.

PRELUDE.

This paper is a report of an examination of the forms found in the water derived from the melting of ice used in domestic consumption. The subject is one that is interesting, because ice is an article of commerce, and is extensively consumed in this country.

Again, it is interesting as the notion prevails that water is purified by freezing, and hence can be used freely, even though it may come from ponds or lakes whose waters are impure. How far this notion is sustained by chemical examination is seen in the following extract:

"The notion that ice purifies itself by the process of freezing is not based upon trustworthy scientific observation. On the contrary, it is utterly wrong in principle to take the ice for consumption, from any pond the water of which is so fouled as to be unfit for drinking purposes."*

Again, how far the notion of ice purifying itself by freezing is sustained by a morphological (*morphos*, form, *logos*, account) examination may be gathered somewhat from what follows. I say "somewhat" advisedly, since the report simply relates to the specimens examined, and may be modified by subsequent examinations. So far as the results are positive, they are final as to the specimens examined, but not as to specimens not examined. Those must be judged by themselves. The examinations reported here are microscopical, and relate to objects not recognized by the unaided vision, which for distinction is now termed *macroscopic* (*macros*, large, and *scopein*, to view); this includes ordinary vision. Should any doubt, it is easy to test the statements by taking domestic ice sufficient to fill an ordinary ice pitcher which is clean. Melt and filter the water resulting through a bag made of fine twilled cotton, say three inches by one and one-half, and when the water is filtered down to the capacity of the bag, inverting the bag into a clean tumbler or goblet, then sopping it in the water in the goblet, and finally twisting the bag longitudinally.

The filtrate thus obtained will give to the naked eye an idea of the amount of dirt found; and if the quantity of dirt is like that obtained in the preparations for the following observations, some surprise will be excited and evidence afforded to sustain those who are accustomed to filter drinking water into jars or bottles, and to cool it indirectly by placing said jars of water into a refrigerator. Indeed, Dr. Cuzner, the artist, will testify that ice enough to fill a goblet has, when melted, produced foreign substances in quantities incontestably evident before the microscopical examination. Still, as will be seen in ice examined at Amherst, Mass., I found hardly any sediment. Hence, all ice is not to be pronounced impure, but rather the ground is to be taken that if some ice is quite free from dirt, the great ice companies should take pains to furnish only such ice for drinking purposes.*

There is no doubt that ice exposed to the air after it has been taken from the water, especially in summer time, attracts dirt. This is seen in the refrigerating apparatus of Mr. A. J. Chace, of Boston, who cools and purifies air by ice aspiration. Last summer the writer placed at Weehawken, N. J., near 42d Street pier ferry, a simple apparatus made of a common wooden water pail, with four half-inch holes bored in sides, two inches above the bottom; one inch higher was a shelf of oil cloth loosely fitted; on this was placed ice. The top was loosely covered with oil cloth. The rationale was that the ice as it melted cooled the air, which was displaced through the side holes; then warm air would enter the crevices at the top, and thus a current would be formed, which, carrying with it the bodies found in the air, would then lodge on the ice by its stickiness during melting.

In an exposure from 8 P.M. to 7 A.M. next day, the mass of ice nearly melted, and what was left was covered black with dirt; and the water from the melting was so loaded with sand and dirt, that I was unable to obtain the object of the aspiration, to wit, the detection of the so-called ague plants of the district. So it seems that ice conveyed in open carts on highways must attract more or less dirt that floats in the atmosphere, and may explain the superabundance of dirt in urban as compared with suburban ice.

It will be my aim to show what forms may have come from the water, and what from the air. When large cakes of ice are black with interstitial dirt frozen into its substance (as seen this summer on 8th Avenue), it needs no expert to point out presence. This report is intended to show something of the field for exploration that here is open to the student of food stuffs. It is not intended for alarm, nor for discredit of ice companies, for there is no doubt they use care and judgment in their business. Nor does it aim to exclude ice from use. It would simply try to regulate use by knowledge, so that exposure to filth may be avoided as much as possible.

FIRST EXAMINATION.

Ice said to be from Maine, from a New York ice company. It was soft, cloudy, spongy, light, opaque. Mode of examination: A clean bag, one half inch by four inches, made of cotton cloth, was tied to the escape pipe of a refrigerator—zinc lined, shelf at top—that had been washed and cleansed with filtered water. The filtrate of from thirty to forty pounds of ice was collected by inverting the detached bag into a clean goblet, then sopping the inverted bag in the filtrate, and wringing the bag also. Power of microscope, one-fifth inch objective. Eye piece, one inch and half inch, 350 diameters.

Fig. 1, drawn by Mr. Hotchkiss, from specimens: 1, Yeast; 2, bacteria; 3, pelomyxa; 4, difflugia; 5, yeast vegetating filaments; 6, mycelial filaments of red water fungus; 7, dark red organic unknown body; 8, trachelomonas; 9, astrionella formosa; 10, bast fibers; 11, ascus; 12, wool; 13, spherotheca fungus; 14, decaying leaf; 15, difflugia unusual; 16, monad; 17, silica; 18, carbon; 19, feather barb; 20, difflugia globosa; 21, epithelia; 22, starch of corn, wheat, and potato; 23, egg of bryozoa; 24, dirt, debris, etc.; 25, abundant mycelial filaments; 26, actinophrys sol; 27, aneurœa monostylus; 28, bacillaria diatom.; 29, chitin; 30, closterium; 31, cotton fiber; 32, diatoma vulgaris; 33, other diatomaceæ; 34, dinobryina sertularia; 35, eggs of entomostraca; 36, epidermis of wheat; 37, euglenia viridis; 38, gemiasma verdans; 39, hair of plants; 40, leaves of moss; 41, liber fibers; 42, lyngbya; 43, oscillatoria; 44, pediastrum boryanum; 45, other pelomyxas; 46, peridinium cinctum; 47, pitted ducts; 48, potato starch; 49, protococcus; 50, rotifer; 51, scenedesmus quad.; 52, skeleton of leaves; 53, silk; 54, spiral tissues of leaf; 55, transverse woody fiber. Thirty-three of these objects belong to fresh water, and twenty-two to air as a medium of communication. At my request, Dr. G. B. Harriman, of Boston, examined this filtrate, and found about two-thirds of the forms found in Boston ice by him, and reported farther on.


Fig. 1.—MICROSCOPICAL EXAMINATION OF ICE.

DESCRIPTION OF CUT. (FIG. 1.)

1. Yeast. This is the alcohol yeast of the yeast pot, torula cerevisiæ, the spores of which are everywhere present, ready to germinate if they have the opportunity. Its presence in ice is interesting.

2. Bacteria. These are minute self-moving protoplasmic bodies. Some regard them as ultimate forms of life; others that they are but the embryonal forms, seeds, or babies (as it were) of a vegetation, yet capable of immense reproduction by division, arranging themselves into masses, chains, etc., at will. In order to know what plants they belong to, culture is necessary. It is possible that those in the cut may be the spores or seeds of the yeast plants, but it cannot be said with certainty.

3. Pelomyxa. This means "mud mucus." It is an animal classed with the rhizopod or root-footed protoplasmic animals. They are very greedy, and eat much mud or dirt. The color in this case is dark amber, and may be mistaken for decaying vegetable matter. The writer regards them with suspicion, as contributing when dead and decaying to cause the "cucumber" and fish oil taste that sometimes occurs in hydrant drinking waters, notably the Cochituate.

4. These are portions of difflugia (Latin, *diffluo*, to flow); these are like number 3, only they have the property of building over themselves a covering made of particles of sand glued together so as to protect their structural proto

* Seventh annual report, Massachusetts State Board of Health, 1876. Prof. A. H. Nichols, chemist, Massachusetts Institute Technology, Boston.

* Another very practical way to get information of this character is to inspect the bottom of an ice pitcher inside, after it has been used freely for drink.