lotts and their Esterbrooks. Let us say, in every school and in every house, the child must not only learn to read and write, he must learn to draw. We cannot afford to let our young folks grow up without this power. A new French book is just now much talked about, with this droll title, "The Life of a Wise Man, by an Ignoramus." It is the story of the great Pasteur, whose discoveries in respect to life have made him world renowned. I turned to the book, eager to find out the key to such success, and I found the old story—"the child was father of the man." This philosopher, whose eye is so skilled in observing nature, and whose hand is so apt in experiments, is the boy grown up whose pictures were so good that the villagers thought him at thirteen an artist of rank.

Girls should learn the first lesson of hand-craft with the needle; boys may (and they will always prize the knowledge), but girls must. It is wise that our schools are going back to old fashioned ways, and saying that girls must be taught to sew.

Boys should practice their hands upon the knife. John Bull used to laugh at Brother Jonathan for whittling, and Mr. Punch always drew the Yankee with a blade in his fingers; but they found out long ago in Great Britain that whittling in this land led to something, a Boston notion, a wooden clock, a yacht America, a labor-saving machine, a cargo of woodenware, a shop full of knick-knacks, an age of inventions. Boys need not be kept back to the hand-craft of the knife. For in-doors there are the type case and printing press, the paint box, the tool box, the lathe; and for out doors, the trowel, the spade, the grafting knife. It matters not how many of the minor arts the youth acquires. The more the merrier. Let each one gain the most he can in all such ways; for arts like these bring no harm in their train; quite otherwise, they lure good fortune to their company.

Play, as well as work, may bring out hand-craft. The gun, the bat, the rein, the rod, the oar, all manly sports, are good training for the hand. Walking insures fresh air, but it does not train the body or mind like games and sports which are played out of doors. A man of great fame as an explorer and as a student of nature (he who discovered, in the West, bones of horses with two, three, and four toes, and who found the remains of birds with teeth) once told me that his success was largely due to the sports of his youth. His boyish love of fishing gave him his manly skill in exploration.

I speak as if hand-craft was to be learned by sport. So it may. It may also be learned by labor. Day by day for weeks I have been watching from my study window a stately inn rise from the cellar just across the road. A bricklayer has been there employed whose touch is like the stroke of an artist. He handled each brick as if it were porcelain, balanced it carefully in his hand, measured with his eye just the amount of mortar which it needed, and dropped the block into its bed, without staining its edge, without varying from the plumb line, by a stroke of hand-craft as true as the sculptor's. Toil gave him skill.

The second point I make is this: If you really value hand-craft, buy that which shows hand-craft, encourage those who are engaged in hand-craft, help on with your voice and with your pocket, those who bring taste and skill and art into the works of their hand. If your means are so small that you only buy what you need for your daily wants, you cannot have much choice, you must buy that which is cheapest; but hardly any one within the sound of my voice is so restricted as that; almost if not quite every one buys something every year for his pleasure, a curtain, a rug, a wall paper, a chair, or a table not certainly needed, a vase, a clock, a mantel ornament, a piece of jewelry, a portrait, an etching, a picture. Now whenever you make such a purchase, to please your taste, to make your parlor or your chamber more attractive, choose that which shows good handiwork. Such a choice will last. You will not tire of it as you will of that which has but a commonplace form or pattern.

I come now to a third point. That which has just been said applies chiefly to things whose price is fixed by beauty. But handiwork gives us many works not pleasing to the eye, yet of the highest skill—a Jacquard loom, a Corliss engine, a Hoe printing press, a Winchester rifle, an Edison dynamo, a Bell telephone. Ruskin may scout the work of machinery, and up to a certain point may take us with him. Let us allow that works of art marked by the artist's own touch—the gates of Paradise by Ghiberti, a shield by Cellini, a statue by Michael Angelo, are better than all reproductions and imitations, better than plaster casts by Eichler, electrotypes by Barbodienne, or chromos by Prang. But even Ruskin cannot suppress the fact that machinery brings to every thrifty cottage in New England comforts and adornments which, in the days of Queen Bess, were not known outside of the palace. Be mindful, then, that handiwork makes machines which are wonders of productive force—weaving tissues such as Penelope never saw, of woolen, cotton, linen, and silk, to carpet our floors, cover our tables, cushion our chairs, and clothe our bodies; machines of which Vulcan never dreamed, to point a needle, bore a rifle, cut a watch wheel, or rule a series of lines, measuring forty thousand to an inch, with sureness which the unaided hand can never equal. Machinery is a triumph of handiwork as truly as sculpture and architecture. The fingers which can plan and build a steamship or a suspension bridge, which can make the Quinebaug and the Blackstone turn spindles by the hundred thousand, which can turn a rag heap into spotless paper, and make myriads of useful and artful articles from rough metal, are fingers which this age alone has evolved. The craft which makes useful things cheap can make cheap things beautiful. The Japanese will teach us how to form and finish, if we do not first teach them how to slight and sham.

A fourth point is this. If hand-craft is of such worth, boys and girls must be trained in it. This, I am well aware is no new thought. Forty years ago schools of applied science were added to Harvard and Yale colleges; twenty years ago Congress gave enough land-scrip to aid in founding at least one such school in every State; men of wealth, like many whom you have known and whom you honor, have given large sums for like ends. Now the people at large are waking up. They see their needs; they have the means to supply what they want. Is there the will? Know they the way? Far and near the cry is heard for a different training from that now given in the public schools.

Many are trying to find it. Almost every large town has its experiment—and many smaller places have theirs. Nobody seems to know just what is best. Even the words which express the want are vague. Bright and thoughtful people differ as to what might, can, and should be done. A society has been formed in New York to bring together the needed data. The Slater trustees, charged with the care of a large fund for the training of freedmen, have said that manual training must be given in all the schools they aid. The town of Toledo in Ohio opened, some time since, a school of practical training for boys, which worked so well that another has lately been opened for girls. St. Louis is doing famously. Philadelphia has several experiments in progress. Baltimore has made a start. In New York there are many noteworthy movements—half a dozen at least full of life and hope. Boston was never behindhand in knowledge, and in the new education is very alert, the efforts of a single lady deserving praise of high degree. These are but signs of the times.

Some things may be set down as fixed; for example, most of those who have thought on this theme will agree on the points I am about to name, though they may or may not like the names which I venture to propose:

1. Kindergarten work should be taught in the nurseries and infant schools of rich and poor.
2. Drawing should be taught in schools of every grade, till the hand uses the pencil as readily as the pen.
3. Every girl at school if not at home should learn to sew.
4. Every boy should learn the use of tools, the gardener's or the carpenter's, or both.
5. Well planned exercises, fitted to strengthen the various bodily organs, arms, fingers, wrists, lungs, etc., are good. Driving, swimming, rowing, and other manly sports should be favored.

What precedes is at the basis of good work.

In addition:

6. With good teachers, quite young children may learn the minor decorative arts, carving, leather stamping, brass beating and the like, as is shown in the Leland classes of Philadelphia.
7. In towns, boys who begin to earn a living when they enter their teens may be taught in evening schools to practice the craft of carpentry, bricklaying, plastering, plumbing, gas fitting, etc., as is shown successfully in the Auchmuty schools of New York. Trade schools they are called; schools of practice for workmen would be a better name.
8. Boys who can carry their studies through the later teens may learn, while at the high school or technical school or college, to work in wood and metals with precision, as I have lately seen in the College of the City of New York, at Cornell University, and elsewhere—colleges or high schools with work-shops and practice classes. If they can take the time to fit themselves to be foremen and leaders in machine shops and factories, they may be trained in theoretical and practical mechanics, as in the Worcester Industrial Institute and in a score of other places; but the youth must have talent as well as time to win the race in these hard paths. These are schools for foremen, or, if we may use a foreign word like Kindergarten, they are Meister-schaft schools.
9. Youths who wish to enter the highest departments of engineering must follow advanced courses of mathematics and physics, and must learn to apply this knowledge. The better colleges and universities afford abundant opportunities for such training, but their scientific laboratories are fitted only for those who love long study as well as hard. These are schools for engineers.
10. Girls are most likely to excel in the lighter arts—to design (for furniture or fabrics), to embroider, to carve, to engrave, to etch, to model, to paint. Here also success depends largely upon that which was in-born, though girls of moderate talent in art, by patience, may become skilled in many kinds of art work. Schools for this instruction are schools of art (elementary, decorative, professional, etc.).

If there be those in this hall who think that hand-craft is adverse to rede-craft, let me ask them to study the lives of men of mark. Isaac Newton began his life as a farm-boy who carried truck to a market town; Spinoza, the philosopher of Amsterdam, ground lenses for his livelihood; Watt, the inventor of the steam engine, was mechanic to the University of Glasgow; Porson, the great professor of Greek, was trained as a weaver; George Washington was a land surveyor; Benjamin Franklin a printer.

Before I close let me draw a lesson from the history of our land. Some of you doubtless bear in mind that before the late war men used to say, "Cotton is king;" and why so? Because the trades which hung on this crop were so many and so strong that they ruled all others. The rise or fall of a penny in the price of cotton at Liverpool affected planters in the South, spinners in the North, seamen on the ocean, bankers and money-changers everywhere. Now wheat and petroleum share the sovereignty; but then cotton was king. Who enthroned this harmless plant? Two masters of hand-craft, one of whom was born a few miles east of this place in Westborough; the other was a native of England who spent most of his days a few miles south of this city. Within five years—not quite a century ago—these two men were putting in forms which could be seen, ideas which brought our countrymen large measures of both weal and woe. In 1790, Samuel Slater, once an apprentice to Strutt and Arkwright, built the mill at Pawtucket which taught Americans the art of cotton-spinning; and before 1795, Eli Whitney had invented the gin which easily cleansed the cotton boll of its seeds, and so made marketable the great crop we have spoken of. Many men have made more noise in the world than Slater and Whitney; few if any can be named whose peaceable hand-craft has done so much to give this country its front place in the markets of the globe.

Let me come nearer home, and as I take my seat let me name a son of this very town who loved hand-craft and rede-craft, and worthily aided both—Isaiah Thomas, the patriot printer, editor, and publisher, historian of the printer's craft in this land, and founder of the far famed antiquarian library, eldest in that group of institutions which gave to Worcester its rank in the world of letters, as its many products give it standing in the world of industry and art.

Mindful of three such worthies, it is not strange that Salisbury, Washburn, Boylston, and many more have built up this high school of handicraft; it will be no wonder if others like minded build on the foundations which have been so fitly laid.

MAKING SEA WATER POTABLE.*

By THOMAS KAY, President of the Stockport Natural History Society.

THE author called attention to the absence of research in this direction, and how man, endowed to overcome every physical disability which encompassed him on land, was powerless to live on the wide ocean, although it is teeming with life.

The water for experiment was taken from the English Channel, about fifty miles southwest of the Eddystone Lighthouse, and it was found to correspond closely with the analysis of the Atlantic published by Roscoe, viz.: Total solids 35.976, of which the total chlorides are 32.730, representing 19.863 of chlorine.

The waters of the Irish Sea and the English Channel nearer to the German Ocean, from their neighborhood to great rivers, are weaker than the above.

Schweitzer's analysis of the waters of the English Channel, near Brighton, was taken as representing the composition of the sea, and is here given:

Sodium chloride.....	27.059
Potassium ".....	0.766
Magnesium ".....	3.666
" bromide.....	0.029
" sulphate.....	2.296
Calcium ".....	1.406
" carbonate.....	0.033
Iodine and ammoniacal salts.....	traces
Water.....	964.795

1000.000

The chlorides in the—

Irish Sea are about.....	30 per mille.
English Channel are about.....	31 "
Beyond the Eddystone are.....	32 "

As the requirement for a potable sea water does not arise except in mid-ocean, the proportion of 32 per mille must be taken as the basis of calculation.

This represents as near 20 per mille of chlorine as possible.

From the analysis shown it will be perceived that the chlorides of sodium and magnesium are in great preponderance.

It is to the former of these that the baneful effects of sea water when drunk are to be ascribed, for chloride of sodium or common salt produces thirst probably by its styptic action on the salivary glands, and scurvy by its deleterious action on the blood when taken in excess.

Sodium chloride being the principal noxious element in sea water, and soda in combination with a vegetable or organic acid, such as citric acid, tartaric acid, or malic acid, being innocuous, the conclusion is that the element of evil to be avoided is chlorine.

After describing various experiments, and calling attention to the power of earthy matters in abstracting salts from solutions by which he hoped the process would be perfected, an imperial pint of water from beyond the Eddystone was shown mixed with 960 grains of citrate of silver and 4 grains of the free citric acid.

Each part of the chlorides requires three parts by weight of the silver citrate to throw down the chlorine, thus:

The silver chloride formed a dense insoluble precipitate, and the supernatant fluid was decanted and filtered through a rubber tube and handed round as a beverage.

It contained in each fluid ounce by calculation about:

18	grains of citrate of soda.
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with less than half a grain of undecomposed chlorides.

To analyze this liquid therapeutically, it may be broadly stated that salts of potash are diuretic, salts of magnesia aperient, and salts of soda neutral, except in excessive doses, or in combination with acids of varying medicinal action; thus, soda in nitric acid, nitrate of soda, is a diuretic, following the law of nitrates as nitrate of potash, a most powerful diuretic, nitrous ether, etc.; while soda in combination with sulphuric acid as sulphate of soda is aperient, following the law of sulphates, which increase aperient action, as in sulphate of magnesia, etc.

Thus it would seem that soda holds the scales evenly between potash and magnesia in this medicinal sense, and that it is weighed, so to speak, on either side by the kind of mineral acid with which it may be combined.

With non-poisonous vegetable acids, and these slightly in excess, there is not such an effect produced.

Sodium is an important constituent of the human body, and citric acid, from its carbon, almost a food. Although no one would advocate saline drinks in excess, yet, under especial circumstances, the solution of it in the form of citrate can hardly be hurtful when used to moisten the throat and tongue, for it will never be used under circumstances where it can be taken in large quantities.

In the converted sea water the bulk of the solids is composed of inert citrate of soda. There is a little citrate of potash, which is a feeble diuretic; a little citrate and sulphate of magnesia, a slight aperient, corrected, however, by the constipatory half grain of sulphate of lime; so that the whole practically is inoperative.

The combination of these salts in nature's proportions would seem to indicate that they must be the best for administration in those ailments to which their use would be beneficial.

Citrate of silver is an almost insoluble salt, and requires to be kept from the light, air, and organic matter, it being very easily decomposed.

A stoppered bottle covered with India-rubber was exhibited as indicating a suitable preserver of the salt,

* Read lately before the Manchester Literary and Philosophical Society

as it affords protection against light, air, and breakage. As one ounce of silver citrate will convert half a pint of sea water into a drinkable fluid, and a man can keep alive upon it a day, then seven ounces of it will keep him a week, and so on, it may not unreasonably be hoped, in proportion.

It is proposed to pack the silver citrate in hermetically sealed rubber covered bottles or tubes, to be inserted under the canisters or thwarts of the life-boats in ocean-going vessels, and this can be done at a simple interest on the first outlay, without any loss by depreciation, as it will always be worth its cost, and be invaluable in case of need.

THE ACIDS OF WOOL OIL.

ALL wools contain a certain amount of animal oil or grease, which permeates every portion of the fleece. The proportion of oil varies with the breed of sheep. A difference in climate and soil materially affects the yield of oil. This is shown by analyses made of different kinds of wool, both foreign and domestic. Spanish wool was found to have but eight per cent. grease; Australian wool fifteen per cent.; while in some fleeces of Pennsylvania wool as high as forty per cent. was obtained. To extract the oil from the wool, a fleece was put in a tall cylinder and naphtha poured on it. The naphtha on being allowed to drain through slowly dissolved out the grease. This naphtha solution was distilled; the naphtha passing off while grease remained—a dark oil having high specific gravity and remaining nearly solid at the ordinary temperature. I am indebted to Mrs. Richards for this method of extracting the oil. The process is quick and inexpensive, and is applicable to the treatment of large quantities of wool.

The object of these experiments was to find the readiest method of separating wool oil into its bases and acids, and further to identify the various fatty acids. A solution of the oil in naphtha was cooled to 150° C. This caused a separation of the oil into two portions: a white solid fat and a fluid dark oil. The first on examination proved to be a mixture of palmitic and stearic acids existing uncombined in the wool oil. The original wool oil was saponified by boiling with alcoholic potash.

The soap formed was separated into two portions by shaking with ether and water. On standing, the solution separated into two layers, the upper or mural solution containing the bases, the lower or aqueous solution containing the acids. This method of separation is very slow. In one case it worked very well, but as a rule appeared to be almost impracticable. Benzol and naphtha were tried instead of ether, but the results were less satisfactory. On suggestion of Prof. Ordway, potassium chloride was added to the soap solution partially separated by ether and water. This caused an immediate and complete separation. By the use of potassium chloride it was found possible to effect a separation with benzol and water, also with naphtha and water.

Another means of separation was tried by precipitating the calcium salts, from a solution of the potash soap. From the portion of the calcium salts insoluble in alcohol, a fatty acid was obtained with a melting point and composition almost identical with the melting point and composition of palmitic acid. The aqueous portion of the separation effected by water and ether was examined for the fatty acid. The lead salts of the fatty acids were digested with ether, which dissolved out the lead oleate. From this oleic acid was obtained. This was further purified by forming the Boreum salt of oleic acid. The lead salts not soluble in ether were decomposed by acid. The fatty acids set free were saponified by carbonate of potassium. A fractional precipitation was effected by adding lead acetate in successive portions; each portion sufficient to precipitate one-fourth of all the acids present.

The acid obtained from the first fractionation had the melting point at 75°–76°, indicating an acid either in carbon then stearic or palmitic acids.

The acids obtained from the third fractionation had a melting point of 53°–54° C. This acid in composition and general properties was very similar to that obtained by freezing the naphtha solution of the oil, and is probably a mixture of stearic and palmitic acids. These acids, being in combination with the bases of the oil, would be set free only on saponifying the oil and subsequently decomposing with acid.

In conclusion, I should say that but a small proportion of the fatty acids exist in the wool oil uncombined; that the proportion of oleic acid is small, and can only be obtained in an oxidized condition; that the main portion of the fatty acids is composed of stearic and palmitic acids in nearly equal proportions; that the existence of a fatty acid, containing a higher per cent. of carbon than those mentioned, is not fully established.—N. W. Shedd, M. I. T.

A NEW ABSORBENT FOR OXYGEN.

OTTO, BARON V. D. PFORDTEN.—The author makes use of a solution of chromous chloride, which he prepares as follows:

He first heats chromic acid with concentrated hydrochloric acid, so as to obtain a strong green solution of chromic chloride free from chlorine. This is then reduced with zinc and hydrochloric acid. The blue chromous chloride solution thus obtained is poured into a saturated solution of sodium acetate in an atmosphere of carbonic acid. A red precipitate of chromous acetate is formed, which is washed by decantation in water containing carbonic acid. This salt is relatively stable, and can be preserved for an indefinite time in a moist condition in stoppered bottles filled with carbonic acid.

In this process the following precautions are to be observed:

Spongy flocks always separate from the zinc used in the reduction, which float about in the acid liquid for a long time and give off minute gas bubbles. If poured into the solution of sodium acetate, they would contaminate the precipitate; and when dissolved in hydrochloric acid, would occasion a slight escape of hydrogen. The solution of chromous chloride must therefore be freed from the zinc by filtration in the absence of air. For this purpose the reduction is carried on in a flask fitted up like a washing bottle. The long tube is bent down outside the flask, and is here provided with a small bulb tube containing glass wool or asbestos. The

hydrogen gas liberated during reduction is at first let escape through this tube; afterward its outer end is closed, and it is pressed down into the liquid. The hydrogen must now pass through the shorter tube (the mouthpiece of the washing bottle), which has an India rubber valve. When the reduction is complete, the blue liquid is driven up in the long tube by introducing carbonic acid through the short tube, so that it filters through the asbestos into the solution of sodium acetate into which the reopened end of the long tube dips. When washing out the red precipitate, at first a little acetic acid is added to dissolve any basic zinc carbonate which has been deposited. In this manner a chromous acetate is obtained perfectly free from zinc.

For the absorption of oxygen the compound just described is decomposed with hydrochloric acid in the following simple washing apparatus: Upon a shelf there are fixed side by side two ordinary preparation glasses, closed with caoutchouc stoppers, each having three perforations. Each two apertures receive the glass tubes used in gas washing bottles, while the third holds a dropping funnel. It is filled with dilute hydrochloric acid, and after the expulsion of the air by a current of gas, plentiful quantities of chromous acetate are passed into the bottles. When the current of gas has been passed in for some time, the hydrochloric acid is let enter, which dissolves the chromous acetate, and thus, in the absence of air, produces a solution of blue chromous chloride. It is advisable to use an excess of chromous acetate or an insufficient quantity of hydrochloric acid, so that there may be no free hydrochloric acid in the liquid. To keep back any free acetic acid which might be swept over by the current of gas, there is introduced after the washing apparatus another washing bottle with sodium carbonate. Also solid potassium carbonate may be used instead of calcium chloride for drying the gas. If the two apertures of the washing apparatus are fitted with small pinch cocks, it is ready for use, and merely requires to be connected with the gas apparatus in action in order to free the gas generated from oxygen. As but little chromous salt is decomposed by the oxygen such a washing apparatus may serve for many experiments.

GAIFFE'S NEW MEDICAL GALVANOMETER.

In this apparatus, which contains but one needle, and has no directing magnet, proportionability between the intensities and deflections is obtained by means of a special form given the frame upon which the wire is wound.

We give herewith a figure of the curve that Mr. Gaiffe has fixed upon after numerous experiments. Upon examination it will be seen that the needle approaches the current in measure as the directing action of the earth increases; and experiment proves

that the two actions counterbalance each other, and render the deflections very sensibly proportional to the intensities up to an angle of from 65 to 75 degrees.

Another important fact has likewise been ascertained, and that is that, under such circumstances, the magnetic intensity of the needle may change without the indications ceasing to have the same exactness up to 65 degrees. As well known, Mr. Desains has demonstrated that this occurs likewise in sinus or tangent galvanometers; but these have helices that are very large in proportion to the needle. In medical galvanometers the proportions are no longer the same, and the needle is always very near the directing helix. If this latter is square, or even elliptical, it is found that, beyond an angle of 15 degrees, there are differences of 4 or 5 degrees in the indications given with the same intensity of current by the same needle, according to the latter's intensity of magnetism. This inconvenience is quite grave, for it often happens that a needle changes magnetic intensity, either under the influence of too strong currents sent into the apparatus, or of other magnets in its vicinity, or as a consequence of the bad quality of the steel, etc. It was therefore urgently required that this should be remedied, and from this point of view the new mode of winding the wire is an important improvement introduced into medical galvanometers.—*La Lumière Electrique*.

THE SUSPENSION OF LIFE.

EVERY one knows that life exists in a latent state in the seeds of plants, and may be preserved therein, so to speak, indefinitely. In 1853, Ridolfi deposited in the Egyptian Museum of Florence a sheaf of wheat that he had obtained from seeds found in a mummy case dating back about 3,000 years. This aptitude of revivification is found to a high degree in animalcules of low order. The air which we breathe is loaded with impalpable dust that awaits, for ages perhaps, proper conditions of heat and moisture to give it an ephemeral life that it will lose and acquire by turns.

In 1707, Spallanzani found it possible, eleven times in succession, to suspend the life of rotifers submitted to desiccation, and to call it back again by moistening this organic dust with water. A few years ago Doyere brought to life some tardigrades that had been dried at a temperature of 150° and kept four weeks in a vacuum. If we ascend the scale of beings, we find analogous phenomena produced by diverse causes. Flies that have been imported in casks of Madeira have been resuscitated in Europe, and chrysalids have been kept in this state for years. Cockchafer drowned, and then dried in the sun, have been revived after a lapse of twenty-four hours, two days, and even five days, after submersion. Frogs, salamanders, and spiders poisoned by curare or nicotine, have returned to life after several days of apparent death.

Cold produces some extraordinary effects. Spallanzani kept several frogs in the center of a lump of ice for two years, and although they became dry, rigid, almost friable, and gave no external appearance of being alive, it was only necessary to expose them to a gradual

and moderate heat to put an end to the lethargic state in which they lay.

Pikes and salamanders have at different epochs been revived before the eyes of Maupertuis and Constant Dumeril (members of the Academy of Sciences) after being frozen stiff. Auguste Dumeril, son of Constant, and who was the reporter of the committee relative to the Blois toad in 1851, published a curious memoir the following year in which he narrates how he interrupted life through congelation of the liquids and solids of the organism. Some frogs, whose internal temperature had been reduced to -2° in an atmosphere of -12°, returned to life before his eyes, and he observed their tissues regain their usual elasticity and their heart pass from absolute immobility to its normal motion.

There is therefore no reason for doubting the assertions of travelers who tell us that the inhabitants of North America and Russia transport fish that are frozen stiff, and bring them to life again by dipping them into water of ordinary temperature ten or fifteen days afterward. But I think too much reliance should not be put in the process devised by the great English physiologist, Hunter, for prolonging the life of man indefinitely by successive freezings. It has been allowed to no one but a romancer, Mr. Edmond About, to be present at this curious operation.

Among the mammifera we find appearances of death in their winter sleep; but these are incomplete, since the temperature of hibernating animals remains greater by one degree than that of the surrounding air, and the motions of the heart and respiration are simply retarded. Dr. Preyer has observed that a hamster sometimes goes five minutes without breathing appreciably after a fortnight's sleep.

In man himself a suspension of life, or at least phenomena that seem inseparable therefrom, has been observed many times. In the *Journal des Savants* for 1741 we read that a Col. Russel, having witnessed the death of his wife, whom he tenderly loved, did not wish her buried, and threatened to kill any one who should attempt to remove the body before he witnessed its decomposition himself. Eight days passed by without the woman giving the slightest sign of life, "when, at a moment when he was holding her hand and shedding tears over her, the church bell began to ring, and, to his indescribable surprise, his wife sat up and said, 'It is the last stroke, we shall be too late.' She recovered."

At a session of the Academy of Sciences, Oct. 17, 1864, Mr. Blandet communicated a report upon a young woman of thirty summers who, being subject to nervous attacks, fell, after her crises, into a sort of lethargic sleep which lasted several weeks and sometimes several months. One of her sleeps, especially, lasted from the beginning of the year 1862 until March, 1863.

Dr. Paul Levasseur relates that, in a certain English family, lethargy seemed to have become hereditary. The first case was exhibited in an old lady who remained for fifteen days in an immovable and insensible state, and who afterward, on regaining her consciousness, lived for quite a long time. Warned by this fact, the family preserved a young man for several weeks who appeared to be dead, but who came to life again.

Dr. Pfendler, in an inaugural thesis (Paris, 1833), minutely describes a case of apparent death of which he himself was a witness. A young girl of Vienna at the age of 15 was attacked by a nervous affection that brought on violent crises followed by lethargic states which lasted three or four days. After a time she became so exhausted that the first physicians of the city declared that there was no more hope. It was not long, in fact, before she was observed to rise in her bed and fall back as if struck with death. "For four hours she appeared to me," says Dr. Pfendler, "completely inanimate. With Messrs. Franck and Schaeffer, I made every possible effort to rekindle the spark of life. Neither mirror, nor burned feather, nor ammonia, nor pricking succeeded in giving us a sign of sensibility. Galvanism was tried without the patient showing any contractility. Mr. Franck believed her to be dead, but nevertheless advised me to leave her on the bed. For twenty-eight hours no change supervened, although it was thought that a little putrefaction was observed. The death bell was sounded, the friends of the girl had dressed her in white and had crowned her with flowers, and all was arranged for her burial. Desiring to convince myself of the course of the putrefaction, I visited the body again, and found that no further advance had been made than before. What was my astonishment when I believed that I saw a slight respiratory motion. I looked again, and saw that I was not mistaken. I at once used friction and irritants, and in an hour and a half the respiration increased. The patient opened her eyes, and, struck with the funeral paraphernalia around her, returned to consciousness, and said, 'I am too young to die.' All this was followed by a ten hours' sleep. Convalescence proceeded rapidly, and the girl became free from all her nervous troubles. During her crisis she heard everything. She quoted some Latin words that Mr. Franck had used. Her most fearful agony had been to hear the preparations for her burial without being able to get rid of her torpor. Medical dictionaries are full of anecdotes of this nature, but I shall cite but two more.

On the 10th of November, 1812, during the fatal retreat from Russia, Commandant Tascher, desiring to bring back to France the body of his general, who had been killed by a bullet, and who had been buried since the day before, disinterred him, and, upon putting him into a landau, and noticing that he was still breathing, brought him to life again by dint of care. A long time afterward this same general was one of the pall bearers at the funeral obsequies of the aide-de-camp who had buried him. In 1826 a young priest returned to life at the moment the bishop of the diocese was pronouncing the *De Profundis* over his body. Forty years afterward, this priest, who had become Cardinal Donnet, preached a feeling sermon upon the danger of premature burial.

I trust I have now sufficiently prepared the mind of the reader for an examination of the phenomena of the voluntary suspension of life that I shall now treat of.

The body of an animal may be compared to a machine that converts the food that it receives into motion. It it receives nothing, it will produce nothing; but there is no reason why it should get out of order if it is not deteriorated by external agents. The legendary rustic who wanted to accustom his ass to go without food was therefore theoretically wrong only because he