Greeley colonists, we were on the boundless prairie. Now and then horsemen passed us, and we met three waggons with white tilts. Except where the prairie dogs have honeycombed the ground, you can drive almost anywhere, and the passage of a few waggons over the same track makes a road. We forded the river, whose course is marked the whole way by a fringe of small cotton woods and aspens, and travelled hour after hour with nothing to see except some dog towns, with their quaint little sentinels, but the view in front was glorious. The Alps, from the Lombard plains, are the finest mountain panorama I ever saw, but not equal to this, for not only do five high-peaked giants, each nearly the height of Mont Blanc, lift their dazzling summits above the lower ranges, but the expanse of mountains is so vast, and the whole lie in a transparent medium of the richest blue, not haze—something peculiar to the region. The lack of foreground is a great artistic fault, and the absence of greenery is melancholy, and makes me recall sadly the entrancing detail of the Hawaiian Islands. Once only, the second time we forded the river, the cotton woods formed a foreground, and then the loveliness was heavenly. We stopped at a log house and got a rough dinner of beef and potatoes, and I was amused at the five men who shared it with us for apologising to me for being without their coats, as if coats would not be an enormity on the Plains.

It is the election day for the territory, and men were galloping over the prairie to register their votes. The three in the waggon talked politics the whole time. They spoke openly and shamelessly of the prices given for votes; and apparently there was not a politician on either side who was not accused of degrading corruption. We saw a convoy of 5,000 head of Texan cattle travelling from Southern Texas to Iowa. They had been nine months on the way! They were under the charge of twenty mounted *vaccheros*, heavily armed, and a light waggon accompanied them, full of extra rifles and ammunition, not unnecessary, for the Indians are raiding in all directions, maddened by the reckless and useless slaughter of the buffalo, which is their chief subsistence. On the plains are herds of wild horses, buffalo, deer, and antelope; and in the mountains, bears, wolves, deer, elk, mountain lions, bison, and mountain sheep. You see a rifle in every waggon, as people always hope to fall in with game.

By the time we reached Fort Collins I was sick and dizzy with the heat of the sun, and not disposed to be pleased with a most unpleasing place. It was a military post, but at present consists of a few frame houses put down recently on the bare and burning plain. The settlers have "great expectations," but of what? The mountains look hardly nearer than from Greeley; one only realises their vicinity by the loss of their higher peaks. This house is freer from bugs than the one at Greeley, but full of flies. These new settlements are altogether revolting, entirely utilitarian, given up to talk of dollars as well as to making them, with coarse speech, coarse food, coarse everything, nothing wherewith to satisfy the higher cravings if they exist, nothing on which the eye can rest with pleasure. The lower floor of this inn swarms with locusts in addition to thousands of black flies. The latter cover the ground and rise buzzing from it as you walk.

NATURAL MAGIC.

BY JOHN NEVIL MASKELYNE.

III.—CHEMICAL WONDERS.

WHILST the professed conjuror of our day has eclipsed the pagan impostors in optical illusions, he has also outstripped them in other directions, and chemistry has furnished not the least attractive objects in his budget of marvels.

This science has given him the power to astonish the unlearned and interest the more favourably circumstanced among his patrons; and in experiments with combustion, heat, the transmutation of colours, or of liquids into solids, etc., he has been able to present an endless variety of instructive, wonderful, or amusing phenomena; while the light-heeled quicksilver (a very juggler by nature) performs for his human prototype as readily in trickery as it renders useful service to the world, giving forewarnings from the "weather office," when—

> "In tubes of glass mercurial columns rise,
> Or sink obedient to the incumbent skies."

It is "Natural Magic" that has eked out the s'ender bill of fare presented to us by the fire-eaters and those who wash their hands in molten metals, from time immemorial. When the *sensitive* "spirit-medium" shows, as evidence of his supernatural power, that he can handle hot substances ("live coals" for instance), he only emulates a very old trick performed by many other showmen in the past. The cuticle of the hands may be rendered almost callous to heat by repeatedly washing with dilute sulphuric acid, which renders it horny and insensible. The hands may also be habituated to a high temperature, and by rubbing them with hard soap, and covering this with a layer of powdered sugar, great immunity from the effects of heat are obtained.

A man named Richardson, about the year 1672, amongst other "accomplishments," vaunted his ability to pour molten lead into the palm of his hand or upon his tongue. This feat is accounted for by the crafty conjuror's possession of greater chemical knowledge than his audience had arrived at, for he deceived them by using the fusible metal of Darcet—a compound of mercury, tin, and bismuth—which is leaden in colour, melts at a low temperature, and may be poured into the hand without ill effects by those accustomed to "play with fire," which is, withal, at the best, a dangerous game. A common domestic form of this trick is to have a teaspoon of this fusible metal, the melting of which in stirring the tea in a cup causes surprise and wonder.

Early in the present century Miss Roggers, an American performer, was said to wash her hands in boiling oil, and then have aquafortis poured over them; but this was a more barefaced swindle than Richardson's, for water was placed in the pan *beneath the oil*, with which it would not mix, and when it was heated air came bubbling to the top, and gave the oil an appearance of boiling, whereas its real temperature was much below that point.

After her hands had been saturated with the oil they were in no danger from the aquafortis bath they were afterwards subjected to. In another trick by this lady juggler she had real lead heated to boiling-point before the audience. From the molten contents of the ladle she apparently took a spoonful, placed it in her mouth, and afterwards produced it in a solid piece. This was managed by pretending to take lead into the spoon, but really substituting quicksilver, which ran out of a cavity in the handle to the bowl. By a dexterous turn of the wrist the mercury was again relegated to the place from whence it came, while the innocent Miss Roggers appeared to place it in her mouth, whence a lump of lead—previously secreted, like the sailor's 'bacca, in her cheek—was presently hooked out before the curious but baffled lookers-on.

This performance, though not by any means elevating, was far preferable to the cruel exhibition of the French "Fire Queen," Josephine Girardelli, who went into an oven with live dogs, cats, and rabbits, and remained there until the more helpless, if not lower, animals died in convulsions. Doubtless she carried poison with her to "speed the parting" of the tortured creatures and so hasten her own exit from the oven.

If there be any good in such tests beyond gratifying a morbid appetite (which is *very* doubtful), M. Chabert, "the human salamander," as he was called, came much nearer our ideal than did the "Fire Queen." He boasted that he could swallow phosphorus, and wash it down with arsenic and oxalic acid. These were to be supplied by the spectators, but as few go prepared with life-destroying compounds, we may naturally suspect those who handed the articles to him of being confederates, who gave some substance and liquids resembling the above. No one would venture to test their genuineness by tasting, we may be certain!

Chabert appeared at the White Conduit Gardens in June, 1826, and on the 8th of that month a notice of his performance was inserted in the "Times," headed—

"Hot! Hot! All Hot!"

Upon this occasion, it seems, the juggler, besides other feats, entered an oven that had been heated for an hour and a half with faggots. "Oh, for the muse of fire," continues the narrative, "to describe what followed. Monsieur Chabert, who seems to be a piece of living asbestos, entered this stove, accompanied by a rump-steak and a leg of lamb, when the heat was about 220°. He remained there for ten minutes, until the steak was properly done, conversing all the time with the company through a tin tube, placed in an orifice in the sheet-iron door of the oven. Then, having swallowed a cup of tea, and having seen that the company had done justice to the meat he had already cooked, he returned to his fiery den, and continued there until the lamb was properly done. This joint was devoured with such avidity by the spectators, as leads us to believe that had Monsieur Chabert himself been properly baked, they would have proceeded to a cannibal banquet. If Monsieur Chabert will attach himself to any of the insurance companies, he will, we have no doubt, save more goods out of the fire than ever 'Nimming Ned' did."

A writer in the "Morning Chronicle" of the same date says that the juggler wore a loose black linen robe, which was rendered as fireproof as asbestos by a chemical solution.* A thermometer which Chabert had taken in with him at 60°, was up to 590° when he came out, but "it bore unmistakable signs of having been thrust into the dying embers" (a clumsy oversight of the conjuror's, this!), where, doubtless, the leg of lamb had been cooked! Notwithstanding the little trick the "Chronicle's" chronicler had discovered, he yet looked upon the performance as extraordinary, and concluded that a man so impervious to fire "might make *assurance* doubly sure, and take a bond of Fate."

It appears that Chabert really stood where the thermometer rose to 220° for "full twenty minutes," which is wonderful, but natural. Dr. George Fordyce, in 1774, proved that the human body has the power of apparently destroying heat. He made experiments in a room measuring fourteen feet by twelve, and eleven feet high. A stove was placed in the centre of the apartment, and a tube passed from this through the wall to carry off the smoke. When the temperature stood at 210° degrees he entered, accompanied by the Hon. Captain Phipps, Mr. (afterwards Sir Joseph) Banks, and Dr. Solander. They found that the thermometer rapidly sank when all were in the room together, so that afterwards only one went in at a time, when the same effect was observed, but in a lesser degree. The air at the temperature named was unpleasantly hot, but quite bearable. They wore their clothes, but the heat of the body was only one degree above its ordinary state, and their breath sank the thermometer several degrees when blown upon it.

No doubt in these cases the clothes and boots were a protection from the heat, and had the miserable dogs, cats, and rabbits—done to death by Josephine Girardelli—been similarly clad to the "Fire Queen," they might have run her a race for life—possibly turning her into a "subject," indeed!—but for the little blue bottle with which she accelerated their tendency towards "convulsions."

But the naked hands and other parts of the body are capable of bearing great heat, as those who have seen glass-working and smelting furnaces will readily understand. Beckman, in his "History of Inventions," says: "In the month of August, 1765, when I visited the works at Awestad, one of the workmen, for a little drink-money, took some of the melted copper in his hand, and, after showing it to us, threw it against the wall;" and we are assured that an artisan at Chatham Dockyard was able to place his hand in boiling tar (which reaches that point at 220°); and Mr. Davenport, who makes the statement, says that he himself stirred the tar with his finger, and it was some time before the heat became unbearable. He ascribes this to the volatile vapour "carrying off rapidly the caloric in a latent state, and intervening between the tar and the skin, so as to prevent the more rapid communication of heat."

Wetting his fingers in ammonia, a Polytechnic professor afterwards dipped them in molten lead, and let it run off into water; but whether these "bullets were made of lead," or only Darcet's mixture already mentioned, I am unable to say. The foregoing facts, moreover, will be sufficient to show that many marvellous stories of old time relative to walking upon, and handling, hot iron, etc., might easily be accounted for, if we were in full possession of all the facts. That

* Quite right: a strong solution of alum. When will those of the fair sex who wear gauzy dresses, take the hint? Solution of tungstate of soda is even a better defence than alum.

they owed nothing to the supernatural is certain, and perhaps they depended more upon the conjuror's sleight than upon natural magic even.

The efforts of charlatans in this direction seem at last to have led scientific men to an examination of the subject; but not until the beginning of the nineteenth century did their experiments produce any result, nor have they yet been able to put the knowledge gained to any practical use. But that we *can* be fortified against the ravages of fire to an extent undreamt of, even in the days when impostors laid claim to such powers, is an undoubted fact. The first fire-resisting dresses were the invention of Chevalier Aldini, of Milan. This incombustible attire was made of cloth saturated in a solution of alum, and covered in parts with armour. The gloves and shoes were of cloth of asbestos, as likewise was the cap, which covered the head and neck, and had openings in it for the eyes, nostrils, and mouth. Over this *casque* an iron-wire gauze mask was placed, which (after the principle of Sir Humphrey Davy's safety-lamp) intercepted the heat. A shield of wire gauze and boots of the same material completed the equipment. Thus fortified, the firemen could hold their heads within the flames of a lighted brazier, and pass between walls of fire built of straw and brushwood, and which the spectators could not approach within several yards. The flames rose ten feet in the air, and through these a child was carried, in a basket covered with the gauze, upon the back of one of the firemen. This latter dangerous and unnecessary feat was performed also in 1829 at the barracks of St. Gervais, where the tests submitted to seem to have been more severe.

Subsequently the "Fire King," Signor "Buono-Cuore," exhibited his salamandrine powers at Cremorne Gardens, and in the August of 1876 Captain Ahlstrom, a Swede, performed some very remarkable feats in a fire-proof dress, the invention of Mr. J. W. Ostberg, of Stockholm, at the Alexandra Palace. The garb—which we cannot but think the most perfect yet devised for resisting fire—consisted of two suits worn over the captain's ordinary clothes, and much resembling a diver's in appearance. The outer dress was of moleskin, the inner one of india-rubber, and both were made in two parts—one for the legs, arms, and body; the other for the head and neck—and joined at the shoulders. The upper portion, or helmet, had a breast-piece connected with it which hung down to the waist. Air was conveyed to the fireman by means of a spiral india-rubber tube passed through a hose—also attached to his dress—and fed by large bellows. Through the hose a continuous stream of water was forced by a pumping-engine, and this, falling over the helmet and other parts of the dress, kept it constantly cool, while the air, passing out of apertures in the head-dress, prevented the too great generation of steam. Thus equipped, and with a hatchet in his hand, the adventurous Swede entered a structure specially prepared, consisting of uprights and cross-beams interlaced with highly combustible material, and its inflammability added to by copious streams of petroleum. This was supposed to represent a house, and when set on fire burned as houses seldom do, thus affording a capital test of the efficiency of the invention.

Captain Ahlstrom entered when the flames were at their highest, not passing rapidly through, but proceeding in a business-like manner to pick up any supposed valuables that came in his way, or to rescue a lay figure—that might just as easily have been a lay-brother—or to clear obstructions and handle red-hot beams as though they were as harmless as the sugar cigars which children place, burning-end first, into their mouths.

After all this exertion and the—to others—unbearable heat, the temperature of Captain Ahlstrom's body was not greatly raised, though at times he had stayed so long as ten minutes in this blazing structure—some eight or nine feet high and covering a surface of about nine square yards. Indeed the performer seemed more at ease than the spectators, and he behaved with the greatest *nonchalance*, upon one occasion carrying a burning chair out of the fire, sitting down upon it, and cooly smoking a cigar!

This chemical knowledge that enabled the Chevalier Aldini and others to resist fire has not yet, as I have said, been greatly utilised, but we must not the less admire the "magical" arts that allow man to accomplish apparently impossible achievements.

It is chemistry, too, that has added to the wonders of the world (I wonder how many there are now above the old fashioned seven!) in the utilisation of the tremendous electrical forces of nature; that has given us ether to assuage pain, gunpowder with which to blow each other's brains out, or "laughing gas" to render us insensible to the follies of the world while we display our own; and it teaches, too, how all is vanity, for the flashing diamond upon one's finger analysed by its unfailing tests is but a brilliant bit of crystallised charcoal after all.

The wonders of the *camera obscura* had delighted mankind for many years, but it remained for chemistry to *fix* the pictures; and though photography cannot yet, and perhaps never may, reproduce the colours of nature in all their marvellous variety and gradations, yet a stride has even been made in that direction. When M. Daguerre first fixed the "positive" image upon a metallic plate by means of iodine and mercurial vapour, he could scarcely hope his beautiful invention would lead to the exquisite, if "negative," results obtained by such artists as Mr. Vernon Heath, whose pictures are real drawings from "the pencil of Nature."

Chemistry gives us other means of fixing landscapes, or faces, for our delight or amusement. Let us draw a winter scene, using instead of ink bromide of copper. Where the foliage of the now naked boughs of trees will come in spring, and over the now snow-clad ground, lay a solution of muriate of cobalt (which will dry invisible), and upon the sky and water acetate of cobalt. This held to the fire will become a *chameleon picture*, the sky changing to blue, the trees green, the wintery landscape, indeed, gradually putting on the freshness of the young spring-time. Again you may make your drawing upon clean polished glass in hydro-fluoric acid, and it will be perfectly invisible until breathed upon. These are called *vapourgraphic glasses*. The young artist can pursue his studies in this direction, also, by engraving in relief upon the thick, well-washed and dried shell of an egg. Sketch with a new quill pen, using fat in place of ink, and when this is firm place the egg in white-wine vinegar for some three or four hours until that part of the shell free from the drawing is eaten away by the action of the acid, and your design appears in relief.

All the student has to do is to avoid following the example of the German chemist, and experimenting by *tasting* his compounds. This man, being desirous

of writing a work upon *Toxicology*, tried the effects of small doses of poison upon himself. He left a record of his researches, indicating the poison he had used; adding, "The potion is mortal, and the proof of it is—I am dying!"

Bearing this in mind, our young friends can themselves verify the truth of those twin paradoxes,—causing water to boil through the agency of cold, or making it cease to do so by the application of heat. You will prove this very simply by half filling a Florence flask and letting it remain over a lamp to boil for several minutes, then cork, and tie a piece of moist bladder over the top. Now remove the flask from over the lamp, and when it ceases boiling you can bring it back to that state by applying a cloth wetted in cold water to the empty part of the flask, or again lower the temperature by putting a hot bandage round it. This is singular, but not so strange as freezing water in a red-hot vessel. Let this latter be of platinum, and when heated pour a small quantity of water into it, and, after, liquid sulphurous acid. A sudden evaporation then takes place, and the cup being quickly turned over, a piece of *ice* rolls out!

What has been called a *Chemical Miracle* is the conversion of two fluids into a solid. This is done by pouring a solution of sulphate of magnesia (Epsom salts) into a solution of caustic potass, or soda.

The Mineral Chameleon of the old chymists is a magical change of colour effected thus:—Take two wine-glasses and place a few grains of alcalized oxide of manganese in each. Into one glass pour clear *cold* water, and it will change rapidly to green, purple, and red; while *warm* water poured into the other glass produces beautiful violet and crimson tints. Another and similar effect is got by taking two glass tumblers, and placing a couple of table-spoonfuls of tincture of cabbage (which is dark blue) in each. A drop of sulphuric acid in one will change the blue to crimson; while liquid ammonia, or solution of potash, in the other will transform it to a bright green; into this latter roll carefully down the side of the glass one drop of sulphuric acid, when the fluid will appear crimson at the bottom, purple in the middle, and green at top. It does not require much chemistry to work "miracles" more wonderful than liquefying the blood of St. Januarius, or to strike a light at the Holy Sepulchre!

If you place phosphuret of lime of the size of a pea into a wine-glass half full of water, it takes fire with a snapping noise, and as the gas-bubbles rise to the surface of the water and come into contact with the air they explode, when horizontal rings of white smoke sail, with an undulatory motion, up to the ceiling.

Sir Humphrey Davy (whose labours made him so well-known, that a letter from Italy, addressed SRUMFREDEVE, LONDRA, went straight to its destination without a visit to the Dead Letter Office) discovered a strange quality in the metal potassium on contact with cold water, and he exhibited his experiments before delighted crowds at the Royal Institute. A minute piece dropped into a basin will ignite and burn vividly, darting to and fro upon the surface of the water until the potassium is dissolved. Who shall say that it is impossible to set the Thames on fire, after this! A pretty effect of liquid combustion may also be seen by saturating a lump of sugar with phosphorised ether and placing it in a glass of warm water. Waft your hands gently over this in the dark, and it will ripple in luminous and varied hues; or you may produce combustion *beneath* the water by putting a little oxymuriate of potass and a small piece of phosphorus into the bottom of a tumbler, and pouring water in carefully so as not to displace the salt, then dip a glass tube into sulphuric acid, place your finger on the top of the tube and convey it into the tumbler, remove your finger, and the singular phenomenon mentioned will be witnessed. The young gentleman who has produced the foregoing effects for the delectation of his friends may now make solid and visible matter vanish much more effectually than does the magician by his mystic "pass," for, while the latter will "palm" a coin, the budding chemist-conjuror will drop the silver into that clear and colourless liquid, nitric acid, and dissolve the metal altogether; he may then conclude his experiments by taking spirits of wine, in which has been mixed some salt and saffron, dip a little tow (not his own little *toe!*) in and set fire to it, when, all other lights being "down," he will bring about such a transformation as will greatly enhance his reputation as a wizard. This yellow light causes a mysterious change to come over all things:—faces, but now bright and happy, grow ghastly in their livid tints; the bloom of health fades from the cheeks; the ruddy lips become pale; roseate colours in the ladies' dresses assume a funereal hue; and the company taking the hint (almost as good as "God save the Queen" at a fashionable concert), break up in "most admired disorder."

REMARKABLE COINCIDENCES OF DATES.

SEVERAL years before the fall of the late Emperor Napoleon III, and when he was still at the height of his power, I made the following extract from a newspaper. The paragraph, in the form of a letter from abroad, was entitled, "A new Key to the Emperor's destiny:"—

"Allow me to communicate to you the details of a very extraordinary numerical coincidence, which is at this moment the talk of every one in Paris. Some one has discovered that a curious relation exists between the dates of certain events in the life of a defunct king of France, and the date of his fall; and this has been made the groundwork of another more speculative, but not less curious, calculation on corresponding events in the life of the reigning emperor. Persons whose minds are at all tinged with superstition may see something more in it than the mere accidental arrangement of figures. The first table is as follows:—

Louis Philippe was born in ...1773,
Married Marie Amelie in 1809,
She herself was born in 1782,
Ascended the throne in 1830,
And fell in .....1848.

Taking 1830
1
7
7
3
1848

As the basis of the table, we find that in adding the date of the king's birth—taking the figures that compose that date one after the other—we arrive at the date of his fall.

The same thing is found by adding the date of Marie Amelie's birth:—		Again, by adding date of marriage, the same fatal date is produced:—	
	1830		1830
	1		1
	7		8
	8		0
	2		9
	1848		1848