RESEARCHES

ON

METEOROLOGY.

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Meteorology by no means corresponds in a literal sense with its Greek origin—that is, μετεωρος, *sublimis; lofty, elevated above the earth; celestial* or atmospheric phenomena; for, "Hecla, pouring her flames through boundless wastes of snow"—the earthquake, the Gulf-stream—physical geography—hydrography and medical topography, are as much subjects of this science as the shooting stars—the thunder-bearing cloud—the hurricane—the hail—the rain—the cloud—water-spouts, those cataracts of the sky—the aurora borealis—the "solar walk and milky way"—"the sun from behind the moon, in dim eclipse"—the monstrous Spectre of the Brocken which looms on the summit of the Hartz Mountains, and which terrifies the good people of Hanover—or "the dewy cloud, and in the cloud a bow conspicuous, with seven listed colors gay."

In fact, Meteorology is becoming more *terrene*, and less celestial—less astrological. Our distinguished countryman, the late Dr. Noah Webster, in his elaborate, but dry work on Epidemics—a work in two volumes, published nearly half a century since, without logical analysis or lucidity of arrangement, but valuable for its historical data, has with unsurpassed research ransacked 'the unrelenting Past,'—collected the debris of departed centuries,—remarshalled the fearful portents,—enumerated the flaming comets,—recounted the planetary commotions, and pointed out the astral harbingers which appeared from time to time in the sidereal heavens, to warn an emperor of impending death,—to foreshadow an approaching earthquake.—or to usher in a mortal epidemic. These cometary visitors from the deeps of infinity, as yet,

do not appear to shake pestilence from their locks upon our planet. This branch of knowledge may be called astrological meteorology or physical astrology, and may lead to ætiological discoveries, barren though the past has been in this respect.

The scope of the present paper is very limited. The enumeration and analysis, of the celestrial, terrestial, and subterranean phenomena and the general doctrines of meteorology, with the physiological, sanitary, ætiological and climatic illustrations and applications of the same, being subjects of vast extent, I have reserved for another occasion. Some of these subjects will necessarily be glanced at now, in an economical as well as in a medical point of view, together with the necessity for a thorough reformation in the manner of taking thermometrical observations, as the sequel will indicate.

It were easy to show, that meteorology furnishes the capitalist and the statesman with the natural elements, so to speak, of individual and national opulence. Whenever the science of Political Economy shall be based on nature—on climate, and not on theories deduced from false legislation, national prejudice, egotism and sophistry, then it will deserve to be called Meteorological, as well as Political Economy. Frenchmen will no longer make sugar of beets. Englishmen will find that the British Isles are too nigh the icy zone to raise—not three crops in a year, as in a genial climate—but even one with certainty,—that a good sun, plenty of caloric, a long summer, and a short winter, are not only necessary, but much cheaper than any other kind of capital to an agricultural population. This fact, as well as the truth of the Malthusian doctrine, namely that population, under certain circumstances, tends to increase faster than the means of subsistence, will be admitted in Great Britain as soon as other nations cease to be dependent on that country for manufactures. Agricultural Europe and America in high northern latitudes, spend half of their surplus capital in contending with long winters, or a low temperature, without any compensation whatever. The winter consumes the products of six month's labor as completely as the fire could,—all of which could be saved by *geniality*, that is *cheapness* of climate. Having said thus much, my Æsculapian brethern will allow me a little further liberty to digress.

In northern Asia and America, twelve millions of square miles sustain less than thirty-four millions of inhabitants, while a similar area in southern Asia contains four hundred millions. Extremes serve best for illustration. Greenland was settled more than a thousand years ago, and soon after christian civilization was introduced. For ten centuries the inhabitants have warred against the climate,—they had perished long ago but for the seal which they contrived to take. Twenty years since the Greenlanders numbered about seven thousand only, spread along the coast from 60° to 73° N. lat. Now, in South America, from the Amazon to the Rio de la Plata, many estates have from fifty to two hundred thousand cattle, without any labor to the proprietor except branding etc. In France the horned cattle fall short of ten millions, averaging only 290 for every 1000 people. All the capital in the United Kingdom cannot produce three crops of maize in Ireland, which an indolent Mexican may do without difficulty. In a

great portion of America, horses, cattle etc. multiply with astonishing rapidity without labor or care, while, in the low temperature of high latitudes, nearly all would perish in a single winter unless provided for at geat expense.

Meteorology, independently of its medical utility, deserves the patronage of every government. It is gratifying to observe from time to time that the Congress of the United States has passed laws appropriating money for continuing the meteorological observations at the military posts, under the direction of the Surgeon General. The knowledge hence arising, from its tendency to accumulation, will be enhanced with the lapse of time. For a century and a half after the Anglo-Saxons settled in North America, this subject attracted but little attention—consequently the data do not now exist for illustrating one of the most interesting problems, namely the influences resulting from the clearing, draining, and cultivating the soil. A correct, continious meteorological history, from the first settlements in New England, Virginia, Carolina, Florida and Louisiana, is wanting to show the comparative humidity, temperature, and salubrity of the past and present.

A correct thermal chart is a national desideratum, especially in America; since it would afford the intelligent planter a guide, in advance of expensive and often ruinous experiments, in attempting to cultivate and acclimate plants in a temperature uncongenial to their natural requirements: the orange, palm, olive, vine, fig, banana,* coffee, tea, rice, wheat, maize, cotton, sugar-cane and many other valuable plants, which might be named as examples. The best coffee or wine cannot be produced, except in such places as have a certain and very limited maximum, minimum and mean temperature.

It is to be deplored that our planters neglect the science of meteorology, in which they have a pecuniary as well as a scientific interest. Planters enjoy opportunities for studying the thermal adaptations of many useful plants, denied to nearly all authors. There are doubtlessly zones for cotton, sugar and so forth, which a faithful thermometrical history of a few years would point out as superior to all other belts for quality, quantity, and economy.

Humboldt considers a mean annual temperature from 75° to 77° as superior to all others for producing the sugar-cane, though he says it may be reared where the mean falls below 66 or 68°. He says, whatever may be the latitude of a place, that good wine cannot be produced unless the mean annual temperature exceed 49°. 55, while the mean of winter must not fall below 32°, nor that of summer below 64°. 4. The range most favorable to the production of coffee, is, according to a late writer,† very limited in Cuba, having for its maximum 80° and for its minimum 75°. Fever, cholera and consumption, health and longevity, are not thus restricted by thermal lines, nor by humidity, nor disiccation.

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* The Galveston News, (Nov. 1847), asserts that a portion of Texas equals Cuba in producing this most valuable plant, which transcends all others in the amount of its nutricious matter on a given area.

† Turnbull's Cuba.

It cannot be denied that atmospheric phenomena, particularly temperature and humidity, exert great influence upon the physiology of plants and animals, as well as upon the progress and termination of many maladies. Yellow fever, for example, is evidently a disease of the warm season and of the warm climates,—typhus chiefly of cold ones. Yet the hottest and the coolest years in almost any locality, stand nearly equal chances of being accompanied by their usual endemics and epidemics. The same is true of dry and wet seasons, at least in New Orleans. But how high soever may be the average temperature, how great soever may be its range, still this fever never assumes an epidemic form in winter. Hence, whenever one hot or cold season, or climate, is brought in comparison with another, even where the topographical and meteorological phenomena seemingly coincide or appear equivalent, it is altogether impossible in the present imperfect state of our knowledge upon this subject, to trace an invariable connection between these and endemics—between atmospheric and morbid actions. No one can affirm that such a connection is improbable, much less impossible, though it has hitherto eluded the observation of meteorologists. New, not lukewarm, careless and desultory researches are necessary, and promise the most important results in political economy, vital statistics, and the ætiology of disease. Synthesis and analysis—the artificial, in imitation of the natural conditions of phenomena, must be put into active operation. Chemistry and physiology are the two eyes of meteorology.

There is, indeed, much assumption, more prejudice, and but little trust-worthy experiment in relation to the agents or the metcorological changes, whether these be regarded as fore-runners, causes, coincidents or neccssary conditions of epidemics.—Cholera, which has again awaked the fears of mankind, since a new invasion is now threatened from the East, will from its history serve to show how little is really known of its meteorology. This destroyer, a few years ago, raged amid Asian Jungles where enormous crocodilians drag their slow lengths along, and upon the confines of the icy zone where the gaunt wolf bays a Siberian moon. The destroying angel dipped his pestilential wings alike in the balmy air of temperate climates, and in the suffocating Sirocco from the great sand-ocean of Central Africa —in the drifting snows of northern Russia, in the humid breezes of Louisiana where the alligator crawls through vast swamps to seek his prey or reedy den—in the dry and cool winds which sweep over the high table lands of Mexico, or which descend from mountains whose lofty heads are white with the snows of countless centuries, and whose foundations rest in eternal summer. Cholera, therefore, prevailed in climates the most dissimilar. It may be impossible to discover the essential cause of such an epidemic, and such a discovery might leave the cause as it now is, beyond our control, but, if the origin, approach, or presence of these deleterious agents, or their harbingers, or the essential conditions of their appearance, could be opportunely tested, or even rendered probable, much advantage would result in the prevention, not to mention the cure of disease.

With our present imperfect means of exploration, how different do we find the diseases of places where the meteorology is similar,—

where, for instance, the annual, the winter and summer average temperatures are alike. About 50° is the yearly mean of Paris and of Fort Van Couver (in Oregon)—in both the winter mean is 39°—the summer 64° or 65°. The annual averages of Berlin, Augsburgh, Bergen, Dresden, Edinburgh, Aberdeen, Zurich and Utica, in New-York, are similar, as are those of Dublin and Boston: the latter corresponds in its summer mean with Baden, and in its winter with Berlin and Dresden. The summer average of London and St. Petersburgh, and the annual means of the following places are nearly identical, that is Vera Cruz, Havana, Rio, Cairo, Canton, and Calcutta.

Hitherto, Meteorology seems to have been regarded by many physicians as of great importance, chiefly, if not exclusively, in reference to the Italian hypothesis of Marsh-exhalation, or Malaria, promulgated by Lancisi in 1717. Theory is often stronger than fact, not with the multitude only, but with many of the wisest men.

Dr. Forry calls the shores of the lower Mississippi, (one of the most salubrious parts of the globe), "the valley of the shadow of death."—The effects of Malaria in the Southern States he enumerates thus,—"so deep and pervading are the effects of this subtle poison on the indigenous inhabitants of marshy districts, in warm climates, that the energies of the system are sapped, and premature decripitude induced;—the mind becomes torpid and embecile, the moral sentiments debased, and the stature and symmetry of the body deteriorated."* "Boys," he says, are bowed down with age at sixteen years." Dr. Prichard, a learned ethnologist, has fallen into this very current error, in his Physical History of Man: "In approaching the equator we find the mortality increase, and the average duration of life consequently diminish. The warmer the climate, other circumstances being equal, so much the shorter the average duration of life."† Some of our Medical colleges announce courses of Lectures, not only explanatory of the *Genus Malaria*, but many of its species, as "*Necro*, *Eleo*, *Lumato*, *Idio-miasma*, *&c.*, —as if these were animals or plants, to be classed in like manner. It is very remarkable that the farther medical writers live from swamps, the more they seem to know about them. Hence, without the least scruple not a few authors undertake to define the movements of miasma with mathematical precision, to tell which side of a swamp is insalubrious, and how many feet miasma travels—how to arrest it by walls, trees, and water-courses—how high it rises—the elevation at which one must sleep to get above it—nothing of which can be known by the residents of the most swampy portions of this terraqueous planet. These quotations and allusions are given not with the view of showing their fallacy, as a complete refutation would require a volume.

That heat, humidity and vegeto-animal matter produce malaria, and thereby epidemics, will be neither affirmed, nor denied. Further investigations are certainly required. In the mean time, Marsh-miasma will answer as an Asylum for theorists when persecuted with antagonistic facts and explanations. Too much is taken for granted in meteorology, instead of "proving all things, and holding fast to that which is good."—

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* Clim. U. S. 21. † i. 116, 117.

Humidity, for example, has been probably much overrated as a cause of disease. Professor Casper, of the University of Berlin, in his work on Medical Statistics, based on extensive data, and published in 1846, concludes that humidity, not dryness of the atmosphere is most favorable to life, while no state of the air is so prejudicial to health, as that of dryness with cold.* Humidity is injurious chiefly from the cold it induces, that is by conducting off or dissipating the animal heat.

Strange it is, that at the present time some of the German doctors, instead of sending their pulmonary patients to lands of perpetual summer, send them to Russia,†—perhaps next to the summits of Greenland's icy mountains,—or to hybernate in snow-houses near the pole, where the most dwarfish shrub dares not show its face,—a most quiet place, withal, for an invalid, since there is no noise except for a few days in summer, from the gratings of ice-bergs that have broke from their moorings, or from a glacier, ever and anon thundering from the mountains into the sea. Doctors like others blow hot and cold.

Thus many of the simplest questions remain undetermined—questions in which common sense, physics, and meteorological instruments aid, nay almost decide many dubious principles pertaining to the healing art, which have not been yet fully tested by the experimental and numeric methods. Can any one from numerous experimental comparisons say, that thousands of fever-victims now mouldering in their graves, might not have been saved by the skillful application of cold water, in addition to other means? Passing by the hot stages of typhus and scarlatina, it may be sufficient to observe, that yellow fever during the first 24 to 36 hours, in most cases, is marked by preternatural heat, which is nearly equally diffused over the entire body, sometimes rising to 109° in the axilla, and to 107° in the hand,—and yet this patient must have hot mustard baths, hot drinks, and be covered with non-conductors of heat, as blankets,—all, it may be, proper enough, nay absolutely necessary, when the circumstances are different—when the thermometer tells a different tale. Dr. T. Mayo, of London, in his clinical work, of the present year, advocating cold Affusions, particularly in Scarlatina Maligna, hurls a well merited anathema against his compatriots, (and he might have included the Anglo- and the Franco-Americans, not excepting New Orleans,) for their neglect of Dr. Currie's experimental teachings: "The neglect, which Dr. Currie's discovery has met with, is," says Dr. Mayo, "infinitely discreditable to the medical science of England."‡ Who applies the thermometer, as a pathological instrument, though more useful than the stethoscope? Is it worth while to fight about abstract theories, while the practical questions of cold or hot are left undecided?

As to the morbific effects of cold in nearly all high latitudes, there is but little difference of opinion. Cold is one of the greatest enemies of human life, particularly during infancy and still more in old age, wherein the heat-producing power is feeble. A single illustration taken from a most civilized and improved country, where, considering its remoteness from the tropic, the winters are extremely mild, will suffice. The English Registry of deaths from 1838 to 1841, gives the

* Brit. and For. Med. Rev. July, '47. † Ibid. ‡ Med. Chir. Rev., April, '47.

following as the mean mortality of the four seasons of each year: Winter 97,765; spring 89,141; autumn 83,639; summer 75,707.—Here the winter mortality exceeds that of summer more than twenty-two thousand. "Cold," says Dr. Reid, of London,* "conjoined with moisture has a powerful effect in lowering the nervous energy of the system, and, consequently, in suppressing the generation of that vital warmth which is necessary for the proper performance of the vital and animal functions, and rendering the body liable to low fevers, dropsies, catarrhs, chronic rheumatism, pulmonary consumption, dysenteric diarrhœa, palsy, congestion of glandular parts, as manifested in *scrofulous* swellings and scorbutic affections."—"At least two thirds of the complaints of children may be ascribed to cold."—"It may be laid down as an axiom that cold is the most common exciting cause of diseases, particularly of those of an inflammatory nature."†

Mr. McCulloch says in reference to persons aged sixty-five, that "warmth, temperance, tranquillity, may prolong their years to the end of a century; a rude breath of the atmosphere, a violent struggle will terminate their existence."‡

It is not intended in this paper to dwell upon the geniality and comparative salubrity of Louisiana, nor on the sanitary character of its capital—a city which is destined to become the commercial arch of the two Americas, and to be gemmed with the treasures of the West-Indies. Nor is it intended to show "a perverse and unbelieving generation," its error in pointing out New Orleans as the grand Aceldama upon the sanitary map of the world;—nor to indicate how wave after wave of an unacclimated population, breaking upon five miles of the Mississippi's alluvious and crescented plain, creates periodical increments and decrements, attractions and repulsions, centralizations and dispersions, and catastrophes like the upheavings of a volcano, unsettling the hygienic, vital, social and commercial elements of society; nor, yet, how many of these evils could and ought to be obviated.

I hasten from these generalities to the more restricted object of this paper, namely, a few remarks on Thermal lines—on the heat of the Globe—on thermometrical observations, &c., though I shall be compelled to omit, as too voluminous, even in the form of an analysis, data which have been long accumulating, and which will require additional labor to give them that *brevity* without which the most accurate observer can hardly hope to escape a punishment more awful than the lash of the critic—the punishment of not being read! interment! annihilation!

With respect to isothermal lines or belts of equal, annual mean temperature—isocheimal, equal winter, and isotheral, equal summer lines, which the learned Humboldt first proclaimed to the world, it may be

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* Philosophy of Death.

† Mr. Kendall, in his Army Correspondence of the New Orleans Picayune, dated in the city of Mexico, (October 1847), mentions the *dryness*, rather than the coolness of the air in that tropical capital, as most prejudicial to the health of the Anglo-American Army, causing rheumatisms, neuralgiàs, etc. The opinion that *dryness* of the air is unfavorable to health, is gaining ground.

‡ Statis. Brit. Emp.

said, without invalidating the truth of the leading doctrine, that, however beautiful and regular these curves may appear in maps, they are far from being at the present time ascertained and fixed. It may hereafter appear, that these lines when traced and deliniated by actual and extended observation in all climates, will be not as now laid down in maps, but far more irregular and complex, far surpassing the almost capricious variations of magnetism itself. Humidity, rain, soil, rivers, lakes, bays, seas, and most of all elevation, (all irregular in their distribution,) will in many places serve to converge these lines almost to a focus. Thus the intertropical mountain, with its base immersed in perpetual summer—its head crowned with eternal snow, presents to the eye at one view all the lines of temperature in close approximation, under the same latitude. Were every house converted into a thermometrical station, it would be impossible in a single year to deduce these devious lines of equal temperature, forasmuch as one season gives in the same place an average different from that by which it was preceded, so that from the nature of the case a considerable period will be required before safe numerical analysis can be made. In connection with this subject, it may be proper to suggest a theoretical question which cannot now be proved, because thermometrical facts are not only too scanty, but too recent for its verification,—namely, whether there be not a thermal cycle—a calorific periodicity of increment and decrement, in which the mean annual heat of a place, though fluctuating, still augments or declines within certain limits and for a definite period. Magnetism furnishes an apt illustration, affiliated as it is with electricity,* caloric, and meteorology: The magnetic poles—the magnetic equator, parallels and meridians do not exactly correspond to those called geographical. The variations of the Needle are, so to speak, both regular and irregular. The seasons—the succession of day and night, change its lines of action. Its curves resemble each other, without being identical. Topographical and meteorological agents, as bodies of iron, and the aurora borealis contribute to augment these irregularities, yet over all these subvariations presides a mightier power, during the long magnetic century, from its maximum to its minimum declination. In 1576, at London, the needle pointed 11° 15′ East of North; in 81 years it had declined so as to point due North. It remained unchanged for five years. It then declined towards the West. In 153 years its maximum Western declination, amounting to 27° 18′, was completed, whereupon it began to retrace its steps, but in an irregular manner, equal times giving unequal velocities in its Eastern declination at the same and at different places. Here, then, is an example of a regular irregular series or cycle (perhaps ætiology may be in a similar category,) requiring the perpetual vigilance of science.—Although the maximum and minimum variations, dip, etc., will no doubt

* Magnetic attraction and repulsion, in their phenomenal conduct, approximate the electrical action;—"in two magnets the North pole of each attracts the South pole, and repels the North pole of the other." Magnetism is comparatively a modern science. The locality of the magnetic pole was indicated, or perhaps discovered, by Captain Ross, in his Arctic Expedition, only a few years ago. Such are the great advances which have rewarded the unwearied labors of philosophers in this branch of—I might say—Meteorology!

continue to recur as long as our planet shall occupy its present position in the solar system. It does not hence follow—nay it is even improbable, that the data of one magnetic cycle, will exactly correspond with its fore-runner, or its successor. Many of the phenomena of nature are invariable, but not all. Facts grow old, or, at least, become in many particulars greatly modified, more especially such as relate to medicine, civilization, political economy, and vital statistics. Thus, in a practical point of view, some of the sciences, owing to remotencss of time, climate and changes among the data themselves, require to be eternally renewed.

Should equal thermal lines be established in all parts of the earth, still as remarked before, it will not follow, that equal or even similar lines of disease will be in every instance thereby indicated. One portion of the thermal belt may have cholera, another typhus, a third leprosy, a fourth elephantiasis, a fifth goître, a sixth yellow fever.

Having said something, and intending to say more, in dispraise of the present state of Meteorology, it is no more than justice to the moderns, by way of comparison, to glance at its former condition, in the century in which Dante, Petrarch, Boccacio, Chaucer, Froissart lived, and the Universities of Prague, Vienna, Heidelberg, Cologne, and Erford, and the Medical School of Montpelier flourished. A single example illustrative of the wisdom of our predecessors will enable us to make comparisons very flattering to our progress in the meteorology of medical ætiology. Near the middle of the Fourteenth century, the Black Plague or Black Death, which threatened to exterminate the human race, and, which in Europe alone hurried to the realms of the dead, twenty-five millions, or one fourth of the entire population, was according to the authors of that day, ushered in with the sublimest meteorological ceremonies. Above, around, below—the elements mustered their angry battalions against poor, frail man. Meteors shot athwart the vaulted skies. A pillar of fire hung over the Papal palace, at Rome. The earth quaked. The Zones and the Indian Ocean were infected,—the atmosphere corrupted.* In the midst of the general consternation, the august Faculty of Paris, then, as now, considered prodigiously learned, assembled. The doctors, after due deliberation, in a most solemn, official manifesto or medical bull, decided in the most positive manner, that the epidemic was "owing to the constellations, which combatted the rays of the sun, and the warmth of the heavenly fire which struggled violently with the waters of the sea, originating a vapor in the great Eastern sea of India, corrupted with fish, enveloping itself in fog. Should the same thing continue *not a man will be left alive*, except the grace of Christ preserve him. We are of opinion that the constellations, with the aid of Nature strive, by virtue of their divine might, to protect and heal the human race, and to this end, in union with the rays of the sun, acting through the power of fire, endeavor to break through the mist." The Faculty proceeded at the same time, to predict in the most oracular manner the future action of the constellations: "Accordingly, within the next *ten* days, and until the 17*th* of the ensuing month of July, this mist will be converted into a stinking deleterious rain, whereby the air

* Hecker, Epid.

will be much purified. Now, as soon as this rain announces itself, by thunder or hail, every one of you should protect himself from the air; and as well before as after the rain, kindle a large fire of vine-wood, green-laurel, worm-wood, chamomile, &c. Until the earth is again completely dry, and *three* days afterwards, no one ought to go about." The means recommended as precautions, are such as the following: "only *small* river fish should be used: rain water must be avoided in cooking, &c; chastity is well spoken of, but bathing above all things is condemned." The physicians and the learned generally, without hesitancy, ascribed the Black Plague to Astral action—the conjunction of Saturn, Jupiter and Mars, in the sign Aquarius, upon the 24th of March, 1345.

In his Decameron, Boccacio, gives a vivid description of this epidemic as it appeared in Florence, where from March to July, 1348, it destroyed more than one hundred thousand persons, "whereas, he remarks, before that calamity, the city was not supposed to have contained so many inhabitants. What magnificient dwellings, what noble palaces were then depopulated to the last person! what families extinct! what riches and vast possessions left, and no known heir to inherit! what numbers of both sexes in the prime and vigour of youth, whom in the morning neither Galen, Hippocrates, nor Æsculapius himself but would have declared in perfect health; after dining heartily with their friends here, have supped with their departed friends in the other world!

Boccacio was a firm contagionist: "It is wonderful, says he, what I am going to mention; which, had I not seen it with my own eyes, and were there not many witnesses to attest it besides myself, I should never venture to relate, however credibly I might have been informed about it: such, I say, was the quality of the pestilential matter, as to pass not only from man to man, but what is more strange, and has been often known, that any thing belonging to the infected, if touched by any other creature, would certainly infect, and even kill that creature in a short space of time: and one instance of this kind, I took particular notice of; namely, that the rags of a poor man just dead, being thrown into the street, and two hogs coming up at the same time, and rooting amongst them, and shaking them about in their mouths, in less than an hour turned round and died on the spot."*

The meteorology of the Earth or mass constituting the Globe, is a subject of great interest in a speculative as well as in a practical point of view, particularly as to the origin, propagation, supply, and waste of caloric. "The present temperature of the earth," says Mr. Bakewell, in his Geology, "appears to be dependent on two causes,—*the radiation of heat from the Sun, and internal fire.*"† It will be preferable for the purposes of illustration to notice this latter cause first.

The internal heat of the globe—or the increase of temperature from

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* This epidemic did not appear to lessen the tendency to refined sensualism in that age—if we may judge from the avidity with which this classical, but licentious work was read. Perhaps no single work of its magnitude was ever sold by an author at so high a price—nearly three thousand pounds—at a time when the relative value of money was much greater than at present.

† 358 Prof. Silliman's Edit.

the surface to the centre, in a constant ratio—is a most prevalent, and as I conceive, doubtful, nay false theory;—an allusion to which may not be improper in this place. Whether the increased temperature observed in deep wells, pits and mines, can be accounted for by atmospheric pressure, forcing caloric from the air as compression does water from a spunge,—whether the existence of certain thermal springs, and the ejection of melted matter by valcanoes, be owing to chemical actions, (a theory altogether probable,) are foreign to the present inquiry. Professor Bischof, of the University of Bonn, in a learned work* advocating the doctrine of the internal heat of the Globe, but proving quite the contrary, if I may judge, says, "Mairan first set up the hypothesis of the existence of fire in the interior of the earth;—at his instance the first observations were made in France, in 1749."† Bischof admits that the air of mines is no guide, and that from observations of this kind, "it is impossible to discover the law."‡ The thermal waters occasionally met with, and upon which he chiefly relies for proving this theory, are equally fallacious.

The water from a snow-clad mountain in descending or ascending through fissures, may be heated solely by chemical action, such as is witnessed in mixing an acid, or alcohol with water, not to name more striking instances where a metal, Potassium, for example, takes fire upon coming in contact with water, burning with a brilliant flame and intense heat. Oxygen has been long and actively at work in changing the earth's crust. If the earth be composed of solid metals, or metalloid substances, (which is probable,) it is reasonable to suppose that their oxydation, &c., would produce not only hot springs, but volcanoes themselves.

As Mr. Bakewell's Geology is but little disfigured by exaggerated theories, it is remarkable, that he should rely on thermal springs as proving the internal heat of the Globe. His statement that "some hot springs have flowed without any known diminution of temperature, for nearly two thousand years," proves not what he wished to prove, but the contrary, namely, that there is no such a mass of melted matter near the surface, as the laws of conduction and radiation of heat clearly show. The *constant* temperature of a spring, not less than of the whole earth, for thousands of years, would be physically impossible upon this theory, and contrary to every known law of caloric.

The internal heat of the Globe is supposed to keep the whole mass in igneous fusion, except a thin pellicle or crust about 25 miles in thickness, less than $\frac{1}{30}$th of the earth's diameter,—thinner comparatively than an egg-shell, or a soldier's canteen, compared with its contents.—The heat, at a mile and a half, is estimated at 212°—the boiling point of water;—the central heat, would, agreeably to this augmenting ratio, amount to nearly half a million of degrees of Fah.—a hundred times hotter than melted gold. Now, if the boiling point be only a mile and a half below the surface, enormous quantities of steam would constantly escape from innumerable points and fissures, more especially in the mountain chains where the crust is known to be broken in all direc-

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* Heat of the Globe, London, 1841. † Ib. 183. ‡ Ib. 186.

tions, vertically and horizontally ;—or, not finding vents, would cause earth-quakes or at least *water-quakes*.

The falsity of this theory,—its physical impossibility, is as I humbly conceive easily proved by experiment: Make a hollow globe, with a shell not quite the $\frac{1}{300}$th* part of its diameter, out of the principal metals and clays which constitute the earth's crust—fill this globe with melted iron, to metion no greater heat—suspend this miniature world in the air, as is the earth, and observe, whether the outside of the crust be in the least heated by the internal contact of the melted mass ;—observe whether in a day, or a year, or a century, not to mention thousands of centuries, the temperature shall remain constant without loss from radiation. Now if the earth were thus filled in its central portion, with melted matter, the heat would be speedily conducted to the surface of this crust, and would reach the poles first, as they are *nigher* the centre than the equator, by thirteen miles and a half. The eternal ice of these regions would dissolve—the glaciers melting at their bases would shoot down the mountains†—the ocean would become a boiling caldron, and every drop of water belonging to our planet would become elastic vapor.—A calorific equilibrium would at length be established between the centre and the circumference. In the meantime the Globe would contract greatly, compared with its size during its maximum temperature—a rapid condensation of vapor would take place—rains—not to mention deluges —would be abundant—the ocean's bed would fill up—the cold would constantly augment—frost would appear on the highest mountains, and the snow line would progressively descend their sides. The refrigeration would never cease, until as before mentioned an equilibrium should be established between the centre, surface, and surrounding media, agreeably to an universal law by which the radiation of heat is governed in a regular series, which may be calculated with exactitude both as to time and velocity. Thus the earth would continue to refrigerate.

The inhabitants would descend to the vallies and most depressed places, until overtaken by a congelation. The last man and the last woman having been petrified into everlasting frost, would be unmourned, and the earth would be transformed into a glittering cemetery of ice, as lifelsss, voiceless, and lonely, as a moon-beam straying through the chinks of a decaying tomb.

Prof. Bischof mentions a fact very little favorable to his theory of augmenting heat in descending from the earth's surface. In the town of Jakutzk in Siberia, under the 62° parallel of North latitude, a man has been engaged for years in sinking a well—in 1830 he penetrated

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* Let the crust of this globe be one inch thick—75 feet in circumference or about 25 feet in diameter—proportions agreeing with the assumed crust and melted contents of the earth.

† In his work on the Arctic Regions, Sir John Barrow shows that even a trifling noise will cause the glaciers to descend from the icy mountains headlong into the sea: "In their vicinity silence is necessary ; the explosion of a gun scarcely ever fails to bring down masses of ice. Mr. Beechy mentions that on discharging a musket, a glacier half a mile distant fell with a thundering noise headlong into the sea—the first wave from which was 96 feet broad and wrecked their boat, throwing it on shore."—(Voy. 66. Lond. 1846.)

78 feet, and the next year 90, without reaching water, and without passing through the frozen soil. In the North-east of that country at a certain depth, even in the hot season, the ground is constantly frozen to an unknown depth.* Mr. Lyell quotes Professor Von Baer, of St. Petersburgh, as stating that the ground is now frozen permanently to the depth of 400 feet in Lat. 62° N., in Siberia, on the Western banks of the Lena, 600 miles from the Polar Sea.†

The influence of solar heat upon the soil, the depth to which it penetrates, the stratum of invariable temperature—in a word, the calorific changes in the earth's surface as well as in its atmosphere, involve an interesting problem. Suitable instruments are wanting to test the terrestrial temperature at a depth of 6, 12, 18, 24 and 36 inches. Although my own experiments on this subject are imperfect, yet I am inclined to think from them and from the physical character of Louisiana that the line of constant temperature sinks but a short distance below the surface. The soil is porous, favoring the percolation of water which abounds, and which at all times, but more especially in the season of the inundation, reaches near the surface—the winds are active, the sun ardent—all tending to favor evaporation, the great refrigerating process of Louisiana, in connection with the sea-breezes of its littoral.

In the hottest portion of this year (1847,) at a depth of six inches, in a grass lot, the maximum heat was 83°. in the afternoon ;—at sunrise, in June, the highest 80°, the lowest 77°—the highest in July, 80°—the lowest 76½°—the highest, August, 80°—the lowest 78°, and for eleven days ending November 25th, the highest 68°, and the lowest 55°—a great terrestrial range, owing to two powerful causes,—rain after a long drought, and a sudden change of the air with Northerly wind, requiring fires—the first that were needed during autumn, with perhaps a slight exception towards the close of October, when the mercury descended to 52°.‡

In the vaults of the observatory at Paris, and in Brussels, with other similar places, at 91 to 92 feet below the surface, an invariable temperature of 52° ever reigns. A number of respectable authors maintain what could not have been readily anticipated—namely, that in the equatorial regions the influence of external temparature does not penetrate one foot, nay half that distance below the surface, where the line of invariable heat is found. This line constantly sinks deeper at every remove

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* Heat of the Globe, 96. † Geol. i. 151. Lond. 1841.

‡ About the middle of October frost was announced—the wish was farther to the fact—frost there was none—the mercury had only descended to 57°.—Even a month later, when Dr. Lindsay of this city returned from his plantation over the lake, nearly one degree North of New Orleans, no frost had yet occurred.

And now, in the last week of November—nearly seven weeks after the Board of Health announced the extinction of the *Epidemic*—no frost has arrived, to the great scandal of all faithful theorists ; the miasma—the contagion, if any, was not frozen into substance. The summer heat was continued in autumn, and yet the city, overflowing with *non-acclimatees*, continued to improve in its sanitary condition. Strangers rushed into houses, where in some instances every person had died a few days before, without being infected. Think of this miasmatists, contagionists, quarantinists.

from the equator towards the poles. In Germany it is 60 feet deep.*—Humboldt says that on the continent of Europe, between the parallels of 48° and 52°, the stratum of invariable temperature occurs at from 55 to 60 feet deep; even at this depth the oscillations of the thermometer, in consequence of the influence of the seasons, scarcely amount to half a degree. In tropical climates, on the contrary, the stratum of invariable temperature is met with at no more than half a foot below the surface; and Boussingault reckons this an accurate way of determining the mean temperature of the air of a place. He gives the following table.†

STATIONS.	Thermom. foot under the surface.	Mean of the air.	Parisian feet above the sea.
Guayaquil	78. 8° ‡	78°	0000
Anserma neuvo	75.	75.	3231
Zupia	70. 5	70. 5	3770
Popayan	65.	65. 5	5564
Quito	59. 8	59. 8	8969

If the intertropical soil at the depth of six inches, according to some authorities, gives a constant temperature at all seasons, and, if that constant temperature be identical with the mean annual temperature of the air, it follows that meteorological labor will be greatly abridged. It is however extremely difficult to believe that the solar heat should not penetrate to a greater depth during the day—in other words, that the coolest part of the night and the hottest of the day, should produce no diurnal range, to say nothing of seasons, which, in some places vary considerably.—The quality of the soil, the humidity or dryness of the sub-soil, and the activity of the winds, must exercise a marked influence on the temperature of the surface. It is probable, as before remarked, that this line of constant temperature, is, for Louisiana, of very little depth compared with similar latitudes. Copious rains, ceaseless breezes, with abundant percolations of water from bayous, lagoons, swamps, lakes, and the great river,—some of which rise 8 or 10 feet above, and none of which fall much below the general level of the ground. These must under a most powerful sun, and ceaseless breezes contribute to neutralize or render latent the heat of the country by evaporation.

It is worthy of inquiry, to what extent stone pavements augment the vernal heat of Southern cities. It is probable that they absorb and radiate a vast amount of calorie, as well as prevent the refrigeration of the soil by hermetically sealing the surface, and thus arresting evaporation.

In the first week of August, (1847,) the average difference between a grass lot and a brick pavement, at similar depths, at 3 P. M., was 8°—an enormous difference—the latter being, of course the hottest.§

* Bishof. Heat of the Globe. 127. † Cosmos. I. 185. 444.

‡ I have converted the degrees from C. to Fah's. scale.

§ The method of taking the temperature of the earth usually adopted (as Dr. Forry's, clim. U. S. 80,) is worse than useless, I mean that of digging down and burying the thermometer three times daily. The ground should be perforated,—the thermometer, being introduced so as to exclude the air, should never be removed.

The meteorology of the Mississippi River, (my observations upon which I have not yet digested fully,) will possibly afford the shortest method of ascertaining, approximately at least, some important average results, or criteria for estimating the temperature of the atmospheric heat of Louisiana. The annual range of the river is remarkably uniform—its diurnal oscillations scarcely appreciable. Its annual maxima, give the same mean as the Gulf-Stream, nearly 86°—its annual minima, scarcely 40°—its range 46°. The mean temperature of two years ending in August, 1847, (by averaging its maxima and minima, not having time at present to be more exact,) is 63°.37.—According to Dr. Barton (now of the Anglo-American Army of Mexico, formerly a resident of New Orleans,) the general average temperature of this city, from 1833 to 1836, was 66°.93.*

The Orinoco running parallel with, and but a few degrees North of the equator, has probably nearly an uniform temperature during all seasons. Humboldt, who explored the upper portion of that river, in the spring of 1800, made a few casual observations on its temperature. He does not give either the diurnal nor the annual maxima, minima, nor the mean. The Apure, a tributary stream, gave 79° to 80°;—the Orinoco in the middle 82°.9—near the shore 84°.6;—670 miles from its mouth, 82°;—the rocks upon the shore 122°.4; at its upper cataracts, Lat. 5° 13′ 57″ N., 81°.7,—the air at night being 80° to 84°, and in the day 86°.† These scanty hydro-calorific facts are quite sufficient to show a marked difference between the Orinoco and the Mississippi, even when they approximate the nearest. In the current of the latter, at the breadth of the hand from shore, the running water is the same in temperature as every other part of the river, with scarcely any variation between the coolest and the hottest portions of the twenty-four hours, while the annual increments and decrements are regular, though the daily is nearly imperceptible. To the eye of science, if not to the eye of the traveller, the Mississippi must appear the greatest of all hydrographical sublimities,—from the volume of its waters, and the depth of its channel, etc.

Without dwelling now on the necesstiy of uniformity in nomenclature, and in classifying the phenomenal data of Meteorology, as in chemistry, physics, and natural history, it will be proper to allude to at least one of its most important instrumental processes, as being so defective as to require experimental researches *de nova*. Experience has convinced me that the method, or rather the lack of method in measuring and determining the meteorology of heat by the thermometer,‡ renders the observations generally made—(including my own for some years)—of comparatively little value for exact calculations, to say nothing of fractional

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* Gibson's Directory, 1838.

† "Humboldt found the air on the Orinoco, at 2 P. M., 86°—coarse, movable granitic sand 140°.45—white, close grained, fine sand, 126°.5—granitic rocks, 117°.725. An hour after sun-set, the coarse sand was 89°.6—the granitic rock, 101¾°."

‡ The Thermometer (from θερμος, *heat*, and μητρον, *measure*—literally *heat-measurer*), was invented nearly two centuries cince by the Florentine Academicians, and which Fahrenheit and others subsequently improved.

decimations. Comparisons can never be accurately made, particularly during the maximum heat of the day in cities, until buildings suitable for observations shall be selected or erected, of similar form and materials agreeing in local circumstances, in radiating media, &c.—The elevation, proximity, and materials of the surrounding buildings, and the relation which they bear to the place where the thermometer is situated, must all be given or estimated, especially in cities where the absorption and radiation of caloric is great. The thermometer will give a different temperature at the same elevation above the soil or the sea, according to the height of the building in which it is placed. A house one story high, will absorb more solar heat during the day, and radiate more during the night than the corresponding or lower story of a house five stories high; the attic of the latter will during the hot season be much warmer than the ground story. The following illustrations will place this in a clear—not the strongest light—because reflected heat was *avoided*, not sought after. The observations on the river and ground were made in the sun,—the residue in the shade:

1847, June 14.	Air.	Office 1st Story.	Ground 6 inches deep.	River.	Attic or 3d Story.
Sun-rise.	75¾°	81°	79½°	80½°	84°
3 P. M.	85	—	83	81	105
Sun-set.	81	—	83	81	91
August 2.					
Sun-rise.	78	83	80	85¾	85
3 P. M.	88	90*	82	86	105

It would be tedious to recapitulate all the experiments made in houses, on the Levee, in the streets and in the public squares, before sun rise, at the minimum of the day, and, therefore, free from the direct influence of solar heat. These media give different, often materially different temperatures. (I give but one example—not the most striking—at the moment of writing this page—November 25th—sunrise—15 feet from the house, east, 38°;—15 feet, west, over a pavement, 42°;—in both places the instrument was alike exposed to the wind, but in the latter, two blocks of houses radiated heat; in the former one.)

The upper story of a high house absorbs not only more heat by day than it radiates by night, but much more than the lower story, for half of the year. The thermometer may give a result differing from 20° to 30° or more, in different stories of the same house, or in the open air, all the observations being equally in the *shade*. A large and high house never becomes heated to the ground floor like a low and small one, other circumstances being equal.

Shade is a material consideration in many points of view. A column of moving air, heated in the sun, on approaching a wall that has been exposed to the solar rays and sometimes heated to 150°, will have its temperature much elevated. A thermometer may be so placed, though actually in the shade, as to rise, perhaps, as high. The air thus heated by the sun, by the radiated heat of the wall and by reflected heat from other bodies, will on passing the line where the solar rays and the

* Picayune office, 91°—the Rotunda of the St. Charles Exchange, 90°, as reported.

shade meet, discharge its excess of temperature unless modified by reflection etc., until it reaches the remotest depth of the shade, in an uniform arithmetical ratio, at each successive moment, and for each increasing distance from the line where the direct and radiated heat is maximized. Perhaps, a thermometer might be so situated with respect to radiating media as to receive nearly as much heat as would ignite gun-powder, and yet be in the shade :* on the contrary, were a building elevated on pillars, so as to cover a vast area, the range of temperature under the centre would be but little, and would correspond to the area of the shade,—the hottest day of summer would be comparatively cool, and the coolest day of winter comparatively warm. The depth of the shade,—in other words the distance from the thermometer to the sun's rays on all sides, is a fundamental point, giving even after the sun dips below the horizon, or suffers temporary obscuration from clouds, a decided influence upon instrumental observations.

In a city during the hot season, houses of various sizes, elevations, colors,† and materials, possessing different calorific powers of absorption and radiation, constantly receive yet in different degrees, increments of solar heat by day, beyond what is radiated at night, until at a certain season of the year, these masses attain, but not always at the same time, their maximum temperature, after which the law of decrement sets in until each mass, but not in equal times, reaches its annual minimum.—The maximum, minimum, range, average, and general laws of temperature in these masses of masonry, and in aërial currents, do not coincide, nay differ materially.

In the Polar regions as the sun moves in a circle around the horizon, the shadows pointing to all points of the compass, it would be desirable that the thermometrical observatory should have a circular gallery, so that observations might be always made at the side opposite or remote from the sun,—in fact this rule applies to all the zones, to an extent corresponding to their winter and summer solstices, so as always to insure an equal depth of shade or an equal distance from the solar rays, how different soever may be the length of the day. Captain Ross, in his Arctic Expedition, saw the sun continuously from June 7th to August 24th,—1,872 hours. From the equator to pole, the reflex action of caloric (which conforms to physical laws, and is within the pale of mathematical calculation,) should be avoided, as causing an elemental perturbation or local change in the atmosphere, and consequently in the data, whether noted in the sun or shade. Take an example from the most boreal climate :—"Captain Scoresby, in his account of the arctic regions, observes, that when the sun's rays fall upon the snow-clad surface of the ice or land, they are in a great measure *reflected*, without producing *any material elevation of temperature ;* but when they impinge on the *black* exterior of a ship, the pitch on *one side* occasionally becomes

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* Dr. Chalmers, of South Carolina, many years ago remarked that the atmosphere of Charleston was always 10° to 15° hotter than that of the country. (Bancroft Yel. Fev. 192.)

English authors mention that the mean temperature of London is 1°.8 higher than the country in its vicinity.

† See Franklin's experiments on the calorific or absorptive power of colors.

fluid, while *ice* is rapidly generated on the *other*." "The radiation of the sun, says Mr. Beechy, is in the Arctic regions, in *sheltered* situations so powerful during two hours on either side of noon, that frequently the thermometer upon the ice in the offing rose to 58°, 62°, 67°; and once at midnight to 73°, although in the shade at the same time it was only at 36°."*

Upon the 23d of July, 1845, perhaps the hottest day ever known in New Orleans, the temperature arose (the house but little suited for observation) to 100o ten feet deep in the shade—the true heat, fairly taken, was probably 96°;—yet many radiating bodies gave from 150° to 152 in the sun from contact. Now had these radiating bodies been properly arranged—had they been changed into concave reflectors, the rays of heat might have been converged upon the bulb of a thermometer in the shade so as to have reached in all probability nearly to the boiling point. Hence we read of a temperature in India, Africa, and other places, as rising in the shade to 125°—130° and more. In California, Dr. Coulter noted 140° in the desert near the mouth of the Colorado, more than two degrees North of the latitude of New Orleans;—the climate of which, according to Captain Wilkes, is colder in *summer* than *winter* owing to the North-west winds.† It is the free, not the stagnant, local air, saturated with radiated heat, to which the thermometer should be exposed, in measuring the heat of the shade, and the same rule applies to the taking of the temperature in the sun. Of the hot climate of Egypt, it is said, that in the night, and every where in the shade, the air is singularly cold.‡

If it be true that the souls of the mighty dead know no peace until they receive the full meed of praise due upon earth, the discoverer of the freezing and boiling points of the thermometer, is, to this day, doomed to wander a discontented ghost. He deserved immortality. Fahrenheit's improvement, which consisted in adopting quicksilver instead of the spirit of wine, was a great one, indeed; for whosoever trusts in a spirit-thermometer, wofully deceives himself, as I can say from experimental comparisons. No one should put any dependence in even a mercurial thermometer, until he has personally *tested both the freezing and the boiling points* of the same. Not more perhaps than one in ten, will be found correct, at least for New Orleans—the freezing point being nearly always too high.

The place where the thermometer is manufactured, that is, the elevation at which the scale is graded, is a fundamental point. For whether the freezing point be the same in all climates and at all altitudes, or not, certain it is, that the boiling point is materially different. General Scott boils his tea-kettle, in Mexico, with about fourteen degrees of heat less, than General Taylor needs for that purpose on the Rio Grande.—The London and New Orleans boiling point is 17° higher than that of Bogota and Quito; 7°.5 higher than that at Jasper's House—8°.5 higher than that at camp d'Orgal, and 14° above that of the Punch Bowl,—all three on the Rocky Mountain route to Oregon.§ Lieuten-

* Sir John Barrow's Voy. Arc. Reg. 69, Lond. 1846.

† U. S. Explor. Ep. V. 155. ‡ Univ. Geog. Edin. 1844. § U. S. Explor. Exped. V. 155.

ant Wood, of England, found in 1841, that water boiled at the source of the River Oxus, in the Himalayan chain of Mountains, at 184°, or 28° lower than the boiling point of London and Paris.

Many circumstances combine to augment the intensity and irregular action of solar heat in cities, whether compared with each other, or with the surrounding country. The absence of grasses, shrubs, and shade-trees—the presence of pavements, the condensation of the alluvial soil, favor absorptions by day, and radiations by night, differing however, according to the locality. Wide streets differ from narrow ones, even where the houses are of the similar materials, colors, and altitudes; the former admit the rays to the pavement over a larger area, and during a longer portion of the day, while the upper stories of the houses forming the latter, intercept and absorb the greater portion of the rays, and, consequently prevent them from reaching the ground, where they produce their chief physiologico-morbid impressions. Hence, also, the ratios of evaporation and refrigeration will be different. Some buildings absorb and radiate almost equally; others absorb but little, and reflect much. It is a curious fact, for which we have the authority of experimenters, that heat passes through certain bodies, especially such as are transparent without heating them. Professor Kaemtz says, that a piece of pure ice made in the form of a lens, will concentrate the solar heat so as to produce combustion, without being itself heated.

The temperature at a short distance above the earth, is, as all know, very cold, and, beyond the atmosphere, in celestial space, where no absorbing or opaque bodies exist to arrest the calorific rays, the cold is estimated at nearly two hundred degrees below the freezing point.—Terrestrial absorption of the calorific rays is greatly diminished by shade. Were half of the native forest trees which once flourished on the site of New Orleans, now standing, interspersed with the houses, its sanitary condition would probably be very different.

Heat is the great agent of development and transformation, not only in the inorganic, but in the animal and vegetable worlds—in the nebulosities precipitated from the deeps of infinite space to form new worlds, and in the microscopic battalions of infusoria which revel in the glittering dew drop. Calorific metamorphoses in physiology, rival those of physics—in pathology, those of chemistry. Professor Liebig remarks, that "the same sugar which in beet-root juice fermenting is resolved into alcohol and carbonic acid, yields upon an elevation of temperature, (no addition whatever being made to the fermenting juice,) mannite, lactic acid, gum, carbonic acid, and hydrogen gas."

Now, as many substances at precisely the same temperature, possess very unequal quantities of heat, that is insensible or specific heat, so may many diseases; and even sensible morbid heat, of the same temperature in scarlatina, yellow fever, and typhus, may be different in qualities, and even in sensible effects;—hence the phrases, sharp, biting heat, &c. Sir John Pringle declared that the touch of a typhus patient produced an uncommon ardor, leaving an unpleasant impression on his fingers.*

The influence of temperature upon the health of cities, is a problem

* Dis. Army, 259; also M. Dance. Clin. 376.

that I do not now intend to examine. I will only add, that sun-stroke, the most fatal of diseases, is a strong example of the injurious effects of solar exposure in hot weather, while exclusion from the sun during epidemics, is probably the means of that exemption from yellow fever, which the inmates of the New Orleans prison have always enjoyed.

As learned treatises have been published, periodicals established, and professorships endowed expressly to teach the science of meteorology, every thing relating to its elementary methods, is fundamentally important. In offering a few remarks in relation to defective methods, I am not insensible to the great merits of many learned men, whose patient researches have brought the science to its present advanced state; nor do I imagine, that there is any great virtue in finding fault. I should not have ventured any opinions in relation to one or two existing imperfections, had I not labored sometime in this department—had I not felt convinced that the defects pointed out deserve attention, and can be remedied. It is here, (I confess it), that the remark of Gœthe upon satirical poets, applies with an almost equal force—"When I have called the bad—*bad*, how much is gained by that? The man who would work aright must not deal in censure, must not trouble himself about what is *bad*, but show and do what is good."

No one can deny, with respect to the meteorology of heat, the importance and the mutual international benefits that would arise from the adoption of an uniformity of method—the same kind of buildings, (however improperly constructed), the same relative positions, exposures, depths of shade, hours of observation etc.,—otherwise the data of Paris, Berlin, Vienna or Rome cannot be correctly compared with those of New Orleans, Mexico or St. Petersburgh.

Having omitted to refer in the proper place to palæontology, the science of the fossil races of animals and plants—the ancient fauna and flora of our planet—the 'Medals of Creation,' the remains of a former world, so much relied on by geological and palæontological writers as proving or favoring the doctrine of the internal heat, it may be proper to remark, that this branch of knowledge proves at most, nothing more than that the polar regions once enjoyed a tropical climate, (as indicated by animals and plants), without accounting for the alteration which has since taken place. The hypothesis of the internal or subterranean heat, with the progressive and continued refrigeration* of the earth, does not account for the appearances of the tropical fossilized and congealed organic remains found in the polar regions, in any degree more satisfactorily, than the hypothetical doctrine of climatic cycles, already mentioned. Even the Auroræ Boreales appear to have cycles or periodical increments and decrements during many years, as well as a maximum and minimum strongly marked for each year. Prof. Kæmtz supposes the auroræ to be intimately connected with magnetism, as magnetism is with heat, and that the poles of cold and the magnetic poles coincide.† The historical evidence, such as it is,

* This refrigeration, however gradual, would have caused great and easily appreciated changes in our planet—contraction—diminished size—acceleration in the diurnal revolution—and diminished length of the days.

† Meteorol. 462.

without thermometical data,—would seem to show that climates are growing not colder, but warmer.*

It is supererogation for philosophers to labor upon far-fetched theories to explain the little that is known in relation to the increase of temperature in descending into the earth, as *pression* alone is sufficient to account for this phenomenon to a great extent—an explanation too, which every body can readily comprehend; for if a few feeble blows of the blacksmith's hammer, produce pression or condensation in a bar of iron, so as to cause it to be red-hot, surely the pressure of perpendicular strata or columns of metallic matter entering into the structure of the earth—columns several thousand miles in perpendicular length—must force heat out of the same as completely as the rock of Gibraltar would squeeze the juice out of an orange, and this too in a ratio corresponding to the depth.

In these matters we know but little and can 'reason but from what we know'—

> "One part, one little part, we dimly scan
> Through the dark medium of life's feverish dream."

The hypothesis of igneous fusion with subsequent refrigeration is less plausible, in explaining the former tropical conditions of the polar regions than that of planetary or celestial aberration. An erratic sun may have communicated its heat to the pole for ages, before disappearing comet-like. With respect to the earth itself, astronomers agree that it does not now pursue its former path through space, that its orbit was once more elliptical than at present, that its eccentricity is diminishing, and that it more and more approximates a perfect circle. When, therefore, its orbit was the most ellipsoidal, our planet must have been nearer the sun during a certain period, than at present, and consequently, the heat must have been augmented in the same ratio, so that the poles may have possessed a climate approximating that of the present tropics. Another hypothesis may be mentioned as explanatory of polar palæontology, namely, the austro-boreal axis of the earth may have approximated the perpendicular axis of the equator. The present inclination 23° 28′—if doubled or tripled would, to the same extent, augment the heat of the polar regions. Milton believed that the earth's axis differs now from its paradisiacal condition:

> ——He bade his angels turn askance
> The poles of Earth twice ten degrees and more
> From the sun's axle.——

It is due to the reader, and still more to the writer of this paper, to mention that so far as arrangement, and especially composition are concerned, time did not allow of proper attention to either, owing to the late period at which the polite request for a communication was re-

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* M. Gayarré, of this city, the distinguished historian of Louisiana, mentions (*Es. Hist. sur la Louisiane*, 1830), that in 1768 the Mississippi in this latitude was upon its shores covered with ice—an occurrence which has not taken place, so far as I have been informed, since that year.

ceived from the editorial department of this journal. It is true, I had the data in my possession—a mere skeleton, not yet articulated, so that the printer got a leg one day and an arm the next. If the reader will join the whole together as symetrically as is possible, I will endeavor to compensate him for his pains, especially if a miasmatist, by offering him a sanitary or meteorological boquet, borrowed from the early history of Louisiana, such as no State of the Republic, during its colonial condition, can rival—if the very modern epidemical blight, (51 years), which has fallen occasionally upon that part of the population transplanted from remote climes, be excepted.—Descendants of Penn and of the Pilgrims! dwellers upon the rocky hills of New England and upon the mountains of Virginia, attend!—In a work published in Paris in 1803, on Louisiana, edited by M. Duvallon, founded on observations by a resident of New Orleans, it is asserted that the mercury never ascended in summer higher than from 24° to 26°.—86° to 90½° Fah.—nor fell in winter lower than 2° below 0, 28°. 4 F. This writer though less fascinated with the climate than his cotemporaries, sums up thus: "I say then, and I repeat it, that the climate of Lower Louisiana, (*le climat de la Basse Louisiane*) is vastly more salubrious than it appears to be upon the first view."*

La Harpe, whose official duties centered chiefly at New Orleans soon after its foundations were laid, kept a minute journal for five years before his return to France, in 1724. In a memoir on the state of the colony at that period, he estimates the inhabitants of New Orleans and its environs at sixteen hundred. The province, which had been settled long before the city, contained then only thirteen hundred negroes; the air was mild and healthy. The people knew nothing of the epidemics which had desolated other parts of America. *New comers* were liable to attacks of a *light* kind of fever, (*une fièvre lente*), which was attended with debility, without proving *mortal*.

According to La Harpe, the tidewater region was beyond all dispute very healthy, which he seems to attribute to the dry, sandy soil of the sea-shore. "Il faut aussi convenir que les côtes de la mer dont le terrein sablonneux est moins humide sont très saines, et dès qu'on a franchi ces bas-fonds, en avançant dans les terres on y jouit d'une santé très constante."†

Lozières, in his second voyage to Louisiana from 1794 to 1798,‡ maintains that the people of New Orleans are healthy; he seems to think this is owing to their using the water of the Mississippi river, which he regards as excellent.§ Indeed, such was the extraordinary salubrity of New Orleans in early times, so unlike the Anglo-American cities of the North, that a number of authors attempted to account for it from the using of the Mississippi waters by the inhabitants. Whether these explanations be correct or not, is foreign to my purpose in quoting them. Nor is the extravagance or exaggeration of some statements—the following for example—a material question:—

In a work entitled Travels in Louisiana, from 1794 to 1798, the author says, that "New Orleans is a particularly enchanting abode, (*un séjour*

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* Vue etc. 83, 93, 98.
† Jour. Histor. 355–6.
‡ 2 vols. Paris, 1803.
§ I. 313.

enchanté ;) its air is so salubrious, its soil so fertile, its position so delicious, one has the belief that he is in the midst of a flower-garden, (*qu'on la croirait du milieu d'un parterre.*) The city borders the Mississippi, whose shores are favored by nature, and whose pure and agreeable waters have, it is said, the property of contributing even to the *increase* of the human species—(*ses eaux pures et agréables ont, dit-on, la propriété de contribuer même a multiplier l'espèce humaine.**) During a journey from New Orleans, up the river to *Pointe-coupée,* in Louisiana, each day, he says, revealed a crowd of new beauties ! What richness ! What elegance ! Here nature is arranged in all her charms ! The air flings forth nothing but the most voluptuous perfumes ! What the poets have said of the Elysian Fields, is not fabulous—all their divinest conceptions are in these enchanting places, realised."†

The celebrated Count Vergennes,‡ "in his memorial to the French government, in the early part of the American Revolution," declared, —"I repeat again what I have already said many times, that Louisiana, without contradiction, is, from the sweetness of its climate, and its happy situation, the most beautiful country in the universe."

Du Pratz,§ affirms that life in Louisiana is not only agreeably, but of long duration to such as avoid debauchery.¶

Now the question is not whether the banks of the lower Mississippi are the *veritable* Elysian Fields or not, but whether they are the special abodes of the Angel of Death—not, whether every plant or swamp is ever flinging its sweet odors to the breeze, but, whether it send forth miasma, as Dr. Forry has said, to deteriorate body and mind, to bloat the one, and dement the other, bringing on premature old age, making boys old at fifteen, and, according to Dr. Prichard, shortening the mean duration of life ? The direct and implied statements of these and other writers concerning the sanitary history of Louisiana, during its colonial condition, show that the horrors ascribed to malaria could have had no existence, but in theories,—in malarial abstractions.

I wish to notify all grave readers that this paper is here concluded —and, therefore, the following anecdote is not to be read, as it is mere surplusage, and, withal, tinctured with levity. The Parish of La Fourche, the great sugar-growing Parish, South of New Orleans, forming the littoral of Louisiana, where more than half the soil, sinking to nearly the same level as the Gulf of Mexico, is a vast salt water prairie–marsh—La Fourche where the other half, the higher portion, is annually inundated with fresh water, during the periodical rise of the Mississippi, except along the River La Fourche, which being an arm of the Mississippi, breaks through the banks of the parent stream, 10 minutes North of New Orleans—La Fourche, where one in every 913 persons is over one hundred years of age—a proportion 250 times greater than the average of the 86 departments of France—La Fourche, at once the most swampy and healthy part of the world, or at least of Louisiana, is the *locale* of the following anecdote taken from the Ascension Herald, of 1838 : "We frequently hear," sys the editor, "persons boast of the health of their several neighborhoods, in very extravagant terms. A friend of ours living in the Parish of Lafourche, insists that no person

* 17. † 22. ‡ Darby, La. § Hist. La. 3 vols. Paris, 1758. ¶ i. 141.

was ever sick in his neighborhood, and that very seldom any person dies. He says that when the vicinity where he lives was first settled, the immigrants were generally very young, and had lived there so long, without seeing any body die, they did not know what death was. They did not travel much or they might have been better informed in other places. He says that at last one man about 140 years old died, and that they could not imagine what was the matter with him, but kept him four days sitting in a chair, when some traveller passing, told them the old man was defunct, and then they buried him."