

An essay on burns, principally upon those which happen to workmen in mines from the explosions of inflammable air (or hydrogen gas).

Contributors

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AN
 ESSAY ON BURNS,
 PRINCIPALLY UPON THOSE
 WHICH HAPPEN TO WORKMEN IN MINES
 FROM THE
Explosions of Inflammable Air, (or Hydrogen Gas.)
 CONTAINING A VIEW OF THE
 OPINIONS OF ANTIENT AND MODERN AUTHORS
 UPON THE
SUBJECT OF BURNS;
 AND A VARIETY OF
 CASES CONDUCTED UPON DIFFERENT PRINCIPLES:
 FROM WHICH
 AN ATTEMPT IS MADE TO RESCUE THIS PART OF THE HEALING ART
 FROM EMPIRICISM, AND TO REDUCE IT TO THE LAWS
 OF THE ANIMAL ECONOMY.

BY EDWARD KENTISH, SURGEON.

“The assignment of a multiplicity of causes, to account for particular phenomena, always betokens a backward state of knowledge. The business of science is to generalize facts, to class phenomena under distinct heads, and shew their dependence upon a common principle or cause. In the progress of human reason, polytheism has yielded to the existence of one God; the intricate and seemingly opposite phenomena of matter and motion have been referred to one general law of gravitation; the puzzling and diversified appearances of electricity have been reduced to a few plain rules: the multitude of facts concerning light and colours have been in like manner arranged into a scientific form; and both the RAINBOW and the TELESCOPE bear witness to the simplicity of optics.”

S. L. MITCHELL, M. D.

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ERRATA.

- Page 64, line 13, *for* this the use of, *read* the use of this.
70, line 3, *for* by cures, *read* by the relation of cures.
114, line 23, *for* increased, *read* caused.
121, line 19, *for* quantity, *read* quality.
176, line 3, *for* endured, *read* induced.

TO THE PROPRIETORS OF COLLIERIES UPON THE RIVER TYNE.

GENTLEMEN,

IN sending the following Essay into the world, I take the liberty of addressing it to you. There are two motives that induce me to do this: First, That I may profit by this opportunity of thanking some of you for the favours which I have received, and which have enabled me to collect the following facts. Secondly, Because you are the natural guardians of the health and comforts of an important class of workmen, for whose benefit it is particularly written. Enquiries into the diseases which are peculiar to any class of workmen have ever been deemed objects of the first importance, insomuch that many philosophical societies have offered premiums for such productions; but, so far from any thing of this kind having taken place upon this subject, I am afraid the following remark will be found as true as it is extraordinary, That during a period exceeding six hundred years that the coal-trade has flourished in this neighbourhood, not a single remark upon the subject has been preserved upon record, though during that period some of the first medical and surgical men in the kingdom have had the phenomena constantly before their eyes. What causes can be assigned for such inattention to the interests of humanity? Ignorance and prejudice on the part of the people, and disgust on that of the faculty:

These appear to me the principal causes why so little attention has been paid on the part of the practitioners. I need not point out to you, Gentlemen, that an ignorant old woman, or a more ignorant man, has frequently been enforced upon you, by the turbulent call of your people, against your better judgment: Can it be wondered at, when the best efforts of a man of sensibility are thus repelled, that disgust is too frequently the consequence. I must confess I have felt it myself in the moment, but when I have thought of the greatness of the object, viz. that of acquiring the power of preserving the lives of otherwise devoted individuals, on whose exertions perhaps families depended for their very existence, the bare idea has ever increased my efforts, and made me return to the charge with redoubled energy. Should the dispelling of this cloud of ignorance and prejudice from the minds of the people appear to you in the same light it does to me, I should have little doubt of pointing out to your consideration means that would tend to fix the treatment on such sure principles, as would procure the greatest safety to your workmen, give the result of facts interesting to society at large, and be truly honourable and worthy such patronage.

I have the honour to be,

GENTLEMEN,

Your obliged, obedient servant,

E. KENTISH.

CONTENTS.

CHAP. I.

Analysis of Airs—Lavoisier's Experiments—Phenomena of Combustion in general—Water—Decomposition of it—Experiments—Production of Hydrogen Gas in Mines—Of Combustion in Mines in particular.

Atmospheric air consists of two elastic fluids, page 1.—Analytic method of discovering these principles by the oxydation and disoxydation of mercury, 2.—Effects of these principles when separate, upon life, 3.—One of them favourable to life, and combustion is denominated *oxygen* gas: The other adverse to both, *azotic* gas;—proportion of each in the atmosphere, 4.—Oxygen and azotic gas are also compound fluids, 5.—Combustion takes place on the principle of affinity, 6.—Theory of the extrication of light and caloric, ib.—Decomposition of water—hydrogen gas, one of its constituent principles, obtained by passing water over ignited iron—oxydation taking place at the same time in the iron, proved the existence of oxygen, 8.—Water *synthetically* formed by the combustion of hydrogen with oxygen gas, 9.—Water, by being in contact with pyrites, metals, or coal, may be decomposed, and hydrogen gas separated, 10.—The phenomena of combustion of hydrogen gas in mines, resemble in many particulars the explosion of gun-powder in pieces of ordnance, 11.

CHAP. II.

Ancient, Heister.—Commentaries by Van Swieten.—Modern, Bell.—Encyclopedie Methodique—Med. Eclairée.—Practice and Opinions of Authors and Practitioners in this Island.

Medical facts the most valuable, often lost or neglected by being blended with false hypothesis, 12.—Heister's division of burns into four classes, 13.—Astringents or stimulants recommended, 14.—Emollients recommended, 16.—Even blood-letting and purgatives enjoined by him, 18.—Remarks on Heister's practice in this accident, 19, 20.—Van Swieten's Commentaries on Boerhaave's Aphorisms, 21.—Emollients directed for the cure of burns, 23.—Relation of an accident which happened to Boerhaave, from the bursting of Papin's digester—treatment, 30, 31.—Why Heister, Boerhaave, and Van Swieten denominated by the author, ancient,

cient, 31.—Bell's opinions upon and treatment of burns, 32, 33, 34.—Remarks upon Bell's practice, 34, 35.—Translation of the article *Brûlures* from the *Encyclopédie Methodique*, 35 to 43.—Striking coincidence of sentiments between the writer of that article and Mr Bell, 43.—*Medicine Eclairée*—Memoir communicated to M. Fourcroy on the treatment of burns, 44.—A view of various opinions by Fourcroy, 45 to 51.—A case by M. Emalle successfully treated by cold water, 52 to 55.—Remarks upon the case, 55, 56.—A case by M. Didier, 56.—Remarks upon it, 60, 61.—A case by M. Reyne, 62.—Remarks upon it, 67.—Information given by the author's acquaintance of the practice in burns, by surgeons in the navy, 68.—By the faculty at Whitehaven, 69.—The author's motives for publishing, *ib.*

CHAP. III.

First Mode of Treatment.—The Progress of Medicine much retarded by the Relation of Cures effected in slight Injuries—Severe ones best for ascertaining Truth.—Oily Applications externally universal in this Neighbourhood.—Complete debilitating Plan internally.—A Case A. B.—Death happened upon the Ninth Day.

The relation of cures in unanalysed cases has not only retarded the progress of real medical science, but wonderfully favoured the influence of empiricism, even among the intelligent, 70, 71.—The mischievous tendency of empiricism increasing, and only to be checked by legislative interference, 71.—Mode of treating accidents of this nature by practitioners in this quarter, 72, 73.—Meaning of the vulgar term, *killing the fire*, 74.—Case A. B. 76.—A violent *shivering fit* quickly followed the injury he received from the explosion of hydrogen gas; Journal of the case, 77 to 80.—Oily applications externally, and the debilitating plan internally, were duly persevered in.

CHAP. IV.

Second Mode of Treatment.—The present Ardour in search of Truth is remarkable, and promises much.—John Hunter's Merits as a Physiologist.—Observations on the Case A. B.—C. D.—internal Treatment, stimulant,—external, oily or debilitating.—Life protracted to the Twelfth Day.—Case E. F. internal Means stimulating,—external, debilitating—Life preserved,

served, but the Cure tedious, from too long Continuance of the Stimulant Plan.

Implicit obedience to the mandates of medical authorities has long repressed investigation, 82.—The freedom from this yoke enjoyed at present, though it may hurry us for a while into the opposite state, will ultimately be of permanent advantage, 82, 83.—The mode of conducting investigations physiological and pathological, as planned and partly accomplished by John Hunter, carries with it many advantages, 83.—The treatment of the case A. B. was conducted upon the principles enjoined by Van Swieten,—of the symptomatic fever, 84.—Case C. D. attacked soon after the accident with a shivering fit, 86.—Opium freely administered: Journal of the case, 88 to 92.—External treatment the same as case A. B. Death upon the twelfth day. Case E. F. stimulant plan internally,—oily, external. On the eighth day suppuration took place, 95.—The patient survived, though the cure was tedious: Improper perseverance in the stimulating plan the probable cause, 99.

CHAP. V.

Third Mode of Treatment.—Reflections on the Cases related above—Change of Treatment indicated, and at length established upon the following Principles—Of Heat and Cold—Nature of the Injury produced by Fire—What Remedies hence necessary, with their Mode of Action.—Division of Burns, 1st, Where the Action of the Part is only increased,—2d, Where the Action of some Parts is increased, and other Parts destroyed.—Treatment of the 1st Division—Treatment of the 2d Division. Cases G. H.—I. K.—L. M.—Mr Hopper.

The fatal termination of so many cases under the first mode of treatment gave rise to the following train of thought: That mortification attended all the instances from the excess of the stimulus (caloric) being instantly succeeded by the greatest diminution of it, or cold—that the symptomatic fever which attended, exhausted the system without inducing suppuration, 100, 101.—Remarks upon the second mode of treatment: Necessity of commencing the stimulant plan early: When this plan was adopted, reason for administering *internal* stimulants only at first, 101.—On the effects of heat, 103.—The terms *heat* and *cold* vague and indefinite: Of the effects of heat below the freezing point, commonly called the effects

effects of cold, 104.—Hunter's experiments, 107, 108.—Indications of cure in the disease named "frost-bitten,"—law of the system which reasoning suggests, and long practice by the nature of cold climates confirms,—of treating this accident, 110.—Of the effects of heat above the freezing point, carried to the extent of what is termed *burning*, ib.—Experiments conducted by Blagdon, Solander, and Banks, 111.—Experiments by the author in the vapour bath, 112.—What ought to be the object in treating accidents from fire: Application of the principles mentioned when relating the management of accidents from extreme cold, 113.—In the cure of burns, the highest stimulus being indicated, fire itself may, and has been applied with advantage: Difficulty of its application the chief reason of its being objectionable, ib.—Order of stimuli, 114.—Divisions of burns, 1st, parts having increased action,—2d, parts having increased action, while other parts are destroyed, 115.—Error usually fallen into in the treatment of the suppurative stage, 117.—The order of treatment enforced in this Essay, directly the reverse of that usually pursued: Instead of bland, oily, and debilitating means at the beginning, the highest stimuli: Instead of stimuli at the suppurative or terminating stage, debilitating remedies, 118, 119.—Of oils—opium dissolved in oil—lime-water, 112.—Goulard's Extract—unguentum *é lapide calaminari*, 123.—Fluor volatile alkali, 124.—Æther—disadvantages attending its application, 126.—Alcohol, 127.—Oil of turpentine, 128.—Detail of the author's practice in burns externally, 131 to 135, and internally, 136 to 142.—Of those cases where the increased action of a part is combined with the destruction of other parts—external treatment, 142—internal treatment, 146.—That during the separation of eschars, such means ought to be employed as give strength without increasing action; perhaps nourishing diet and Peruvian bark are of this description, 147.—Case G. H. which was conformable to the plan already mentioned, 148 to 153.—Case I. K. 153 to 159.—Case L. M. 159 to 162.—Case Mr Hopper—the circumstances of this accident similar in almost every particular to that which happened to Boerhaave (related page 30) 162 to 165.

APPENDIX.

Extracts from and remarks upon "letters addressed to the late John Hunter, by Mr David Cleghorn of Edinburgh," inserted in the 2d Vol. of Medical Facts and Observations, relating his treatment of burns, both external and internal, 167 to 175.—Letter to the author from Mr Thomas Leighton, Surgeon, Newcastle, giving his testimony in favour of the external application of *fluor volatile alkali*, and of *rectified oil of turpentine* in burns, 175.

ESSAY ON BURNS, &c.



INTRODUCTION.

CHAP. I.

Analysis of Airs—Lavoisier's Experiments—Phenomena of Combustion in general—Water—Decomposition of it—Experiments—Production of Hydrogen Gas in Mines—Of Combustion in Mines in particular.



IN an Essay, having for its more immediate object the treatment of a species of accident too frequently happening to workmen in coal-mines, it will not appear irrelevant to the subject to take a short view of the phenomena attending the explosion which occasions it. And, as these explosions in mines are altogether dependent upon the doctrines of pneumatic chemistry, it will be necessary to explain the nature of the different gasses by which they are produced. The atmosphere, which formerly, under the denomination of the air, was supposed to be a simple element, has, by the indefatigable researches of modern chemists, been analysed in so clear a manner as not to leave the shadow

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dow of a doubt of its being a compound mass. It is capable of taking up various matters in solution; but its most common composition, or what may be called its healthy state, consists of two elastic fluids, the one highly conducive to all the purposes of life and of flame, and the other equally noxious to both. This is fully illustrated by the following experiment by M. Lavoisier:— Having placed a certain quantity of pure mercury in a retort, adapted to a bell-glass which inclosed 100 cubic inches of common air, he kept up in his furnace a constant fire, of such a force as to keep the mercury almost always at the boiling point. On the second day, small red particles began to appear upon the surface of the mercury, which gradually increased in size and number for four or five days. Convinced that the calcination of the mercury after that time did not go on, he extinguished his fire, and when the vessel was cool he found in his bell-glass, instead of 100 cubic inches of air, only 86—consequently a loss of 14 cubic inches of air. Fourteen inches of air weigh 7 grains, and the red particles of the calx of mercury being carefully collected, these had an increase of weight of 7 grains, the exact weight of air which seemed lost. The 86 cubic inches of air, remaining in the glass after the calcination, were examined, and found to possess the following properties:—

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An animal being put into it, was suffocated in a few minutes; and a taper plunged into it, was extinguished as if it had been immersed in water: This air has been differently denominated by chemists, but at present is generally known by the term *azotic gas*. M. Lavoisier's second experiment was to take the calx of mercury weighing 90 grains, the product of the last process, and put it into a glass retort, fitted to a proper apparatus for receiving aerial products. Having applied a much stronger fire than in the last experiment, he observed that at first, in proportion as the calx of mercury became heated, the intensity of its colour became augmented; but soon after the calx began gradually to decrease in bulk, and in a few minutes its red colour altogether disappeared, and the calx was converted into running mercury, and 14 cubic inches of an aerial fluid passed over into the recipient. These 14 cubic inches of air weighed 7 grains, the exact weight of the air consumed by the calcination of the mercury in the first experiment, and the calx of mercury reduced to a metallic state being examined, had lost in weight 7 grains, the weight of the air obtained. This air possessed the following properties:—An animal being placed in it, became remarkably lively; a taper burnt in it with a dazzling splendour; and charcoal, instead of consuming quietly away, as it does in common

air, burnt with a flame, attended with a decrepitating noise, and threw out such a brilliant light that the eyes could scarcely endure it. This species of air was discovered nearly at the same time by several learned chemists, who denominated it differently according to their own ideas respecting some of its various properties ; it was termed *vital air* by Lavoisier ; and from the great influence it has over the phenomena of life, when its uses come to be known, it is likely to induce a greater revolution in medicine than any that has happened since the time of Hippocrates. At present it seems, by general consent, to pass under the name of *oxygen gas*.

These are experiments by which M. Lavoisier analysed the atmosphere ; and it tends to give them an additional weight that, by repeating the experiments, and adding the products, viz. the 36 cubic inches of azotic gas, and the 14 cubic inches of oxygen gas, he synthetically recomposed an elastic fluid similar in all respects to the atmosphere. The above experiments prove the compound nature of the atmosphere, but do not give the exact proportions of each part ; for the attraction of mercury to the base of oxygen gas, is not sufficient to overcome all the circumstances that oppose its union. These obstacles are the mutual adhesion of the two constituent parts of the atmosphere

sphere to each other, and the elective attraction which unites the base of oxygen gas with caloric ; in consequence of these, when the calcination ends, there is still a portion of oxygen gas united to the azotic gas, which the mercury cannot separate. But from repeated and varied experiments, which it would be tedious and useless to relate, M. Lavoisier concludes, that the common proportions of the atmosphere in our climate are 27 parts of oxygen gas, and 73 azotic gas.

We have thus related the experiments by which the atmosphere is demonstrated to be a compound fluid consisting of oxygen and azotic gasses ; and it will now be necessary to proceed to shew that these gasses themselves are other compound bodies, viz. that they are compounded of oxygen and azote, with a sufficient quantity of heat to hold them in the gaseous form.

The following experiment proves the above :—
A glass jar full of pure oxygen gas being inverted over mercury, a fine piece of iron wire heated red hot at its extremity plunged into it burns with an astonishing brilliancy, giving out large sparks similar to those in Chinese fire-works, and falling to the bottom in round globules. At the beginning of the combustion there is a slight augmentation in the volume of air in the jar, caused by the dilatation of heat ; but presently after a rapid diminu-

tion takes place, and the mercury rises in the glass, infomuch that when the iron is sufficient, and the oxygen gas operated upon perfectly pure, the whole gas employed is absorbed. The theory of this experiment is the same as the former. At a certain temperature iron has a greater affinity for oxygen, than caloric and light have. Iron therefore attracts to itself the oxygen of the gas; and the heat and light which kept it in a gaseous form becoming disengaged from the union they held with the oxygen, are rendered active, and evident to the senses, with an avidity to combine with the first medium that presents. In the former experiment of the calcination of the mercury, which lasted for some days, the disengagement of heat and light was in so small a proportion during each individual moment of time, as to be imperceptible to the organs of vision, though there can be no doubt from the result, of the same having taken place in both experiments. In fact, in all combustion the heat and flame do not arise solely from the coals we use, nor from the tallow or wax of our candles, but these are only *means* to furnish us with small portions of hydrogen gas, (hereafter to be described) which combine with the oxygen gas of the atmosphere by means of flame, which is a conducting medium to the union of the gasses, and continues as long as the combination

nation goes on ; if a small quantity is supplied, the pleasing effects of a candle or fire are produced ; if a large quantity, the terrible effects which we shall presently mention. An old pit at Whitehaven, furnishing a quantity of hydrogen gas, was set fire to, and continued to burn for a length of time, and giving a great light at night, suggested the possibility of conveying the air in small pipes to different parts of the town, and firing them during the night, to make them answer the purpose of lamps for the convenience of the inhabitants.—The care of man is only necessary to find the hydrogen gas in the quantity he wants it—the oxygen for the purposes of combustion, abounds in the atmosphere nearly in the proportions as before mentioned, of 27 to 73 parts azotic gas. When these proportions are much changed, the effects vary according to the change ; whether towards the greater quantity of azotic gas which diminishes all these phenomena of combustion, or to an increase of oxygen gas which augments them. These different experiments and views of the new gasses (or airs) will appear sufficient to shew the compound nature of the atmosphere.

It will appear that *water* is not that simple element which the ancients supposed. As the phenomenon we wish to explain depends chiefly upon the decompo-

fition of that fluid, it will be proper to relate the following experiment made by Mons. Meusnier, in which water was decomposed. He took a gun barrel, into which he put some pieces of iron wire flattened by a hammer. He weighed the whole with a scrupulous exactness. He then luted the gun barrel to secure it from the immediate contact of the fire. It was then placed in a furnace, but so inclined that water would easily run down it. He adapted to the upper extremity a funnel containing water, from which it could not escape into the gun barrel but drop by drop. This funnel was closed at the top, to avoid the least evaporation of water. At the lower extremity vessels were adapted to receive any aerial product. To use every précaution, these were exhausted of their air :—The gun barrel was now rendered red hot, and the water passed into the funnel drop by drop. An astonishing quantity of hydrogen gas (or inflammable air) was quickly obtained. Having removed the luting, the gun barrel with its contents weighed heavier than before; and the acquired weight of the gun barrel being added to the weight of the hydrogen gas thus produced, was precisely the weight of the water expended in the process; and the iron wire found in the barrel after the process was over, resembled in every respect iron that had been consumed in oxygen gas,

that

that is, it had become an oxyd of iron. In this experiment the oxygen of the water combines with the iron, which it renders a calx or oxyd; whilst the hydrogen of the water combining with the heat and light from the furnace, escapes into the receiver under the form of hydrogen gas, or inflammable air.*

Water has not only been thus decomposed, but the truth of the doctrine was still further proved by synthesis, or the composition of water by the combustion of hydrogen and oxygen gasses by Messrs Meusnier and Lavoisier, under the inspection of the academy of sciences at Paris.

Having related some of the most striking facts which tend to prove the compound nature of the common atmosphere and of water, we need proceed no further to prove that they will follow the laws of other compound bodies, and be decomposed whenever they meet with substances having a greater affinity to any of their component parts than

* This experiment is now performed with much greater facility by the assistance of the convenient apparatus invented by Mr Watt to assist Dr Beddoes' laudable undertaking of administering various factitious gasses as medicine; which, though not yet generally adopted, appears in several instances to be highly advantageous, particularly in a case of paralysis, which the gentlemen of the faculty at Newcastle had an opportunity of seeing, in a patient at the Baths.

than they have to each other. Thus it is easy to conceive how hydrogen gas (or inflammable air) is generated in coal pits; for the water filtrating through the different strata of the earth may be decomposed when in contact with pyrites, metals, or coal itself, and collected in old pits, or in any part of pits through which a constant and brisk current of fresh atmosphere, which would carry off the hydrogen gas as it generates, is not made to pass. Sometimes it happens that they perforate with some of their working tools a barrier which separated them from what they term a waste, or a part from which the coal had been formerly taken. But by whatever means the collection is admitted, the effects are the same. If *not* allowed to combine with the oxygen of the atmosphere, they mix without exploding; but if a combining medium is at hand, such as the electric spark, but most frequently the flame of a candle, the rapidity of the combination produces effects most deplorable; the heat and light under the appearance of a most vivid flame, form a medium of disengaged fire, which violently tends to combine itself with every thing it comes in contact with; sometimes the very horses as well as the miners in the pit are scorched to death, and die in the most cruel torments. Can there in imagination be any thing more horrible than to be thus engulfed in pure elemental fire!

And

And to add to the horror, when the collection of hydrogen gas is large, the immense vacuum that is caused by the sudden formation of water disturbs the equilibrium of the atmosphere, and causes such gusts of wind down one shaft and sometimes up another to such a degree, as nearly to resemble a piece of ordnance. In fact, the materials of both phenomena are the same, only the order is inverted. In the one instance there is a sudden formation of elastic fluids; in the other a sudden condensation of the same species of elastic fluids, viz. hydrogen and oxygen gasses; in the one instance, the atmosphere supplies oxygen, and the mine hydrogen; the flame, or electric spark, is the flint; in the other the nitre supplies the oxygen gas, and the sulphur and charcoal the hydrogen gas, while the steel and flint give fire to loosen them from their bonds, and enable them to exercise their destructive power. These phenomena are beautifully illustrated by passing an electric spark through a glass tube, filled with a mixture of oxygen and hydrogen gasses.

CHAP.

CHAP. II.

*Ancient, Heister—Commentaries by Van Swieten.—
Modern, Bell—Encyclopedie Methodique—Med.
Eclairée—Practice and Opinions of Authors and
Practitioners in this Island.*

IN shewing the contradictory *opinions* of physicians and surgeons, ancient and modern, on the treatment of burns, nothing can tend to give us a clearer idea of the imperfection of our knowledge than to collect *those* maintained by the most enlightened medical characters. As every succeeding investigator has a right to canvass the opinions of his predecessors, I shall profit of this right, not to cavil at them, but merely to shew that when physicians and surgeons, who have seen some laws of the animal œconomy more clearly than their brethren, are not content with marking their information, or giving the simple fact to posterity, but are eager to overturn the usually received, and give us a *new*, system, a great many errors creep into their works. These a future age finds out, and perhaps may throw away the good with the bad ; so that instead of our art being progressive, as the marking the laws of the animal œconomy, and stating the different facts as they

they happened, would make it, we sometimes are obliged to throw away real knowledge, when jumbled with hypothetical chimæras. As a proof of this, which I fear may be called a rash assertion, I beg leave to make some quotations from the works of authors of the first respectability, who, in medicine and surgery may be termed both ancient and modern. Heister, in his Elements of Surgery, says, * “ Burns may not improperly be divided into four classes or degrees; the first and least appears to be, when the part affected feels pain, attended with redness and heat, and after a short time shows a rising blister.—The second is when blisters rise with great pain immediately after the burn.—The third, when the skin, and the fat, and flesh under it, are so much burnt as immediately to exhibit a scab.—The fourth and last is, when the burn has been so violent as to have destroyed every thing to the bone. The third degree resembles gangrene;—

* Enimvero quatuor admodum combustionis gradus constitui haud inepte poterunt. *Primus* quidem atque minimus ille nobis videtur, quando membrum corporis adustum cum rubore atque calore dolet, pustulamque supereminentem, post elapsam brevem aliquod temporis spatium, ostendit. *Alter* gradus is est, quando statim ab ambustione pustulæ cum insigni dolore prorumpunt. *Tertius*, quando cutis eidemque subjecta pinguedo ac caro sic aduruntur, ut crustam statim referant. *Quartus* denique is dicitur, ubi

gangrene;—the fourth sphacelus: Whence it is further evident that burns very nearly resemble inflammations, and that each degree of them is marked by nearly the same indications.

“ The resemblance of burns to inflammations is shewn not only in the degrees, but in the methods of cure; for in cases of the slight or first degree, resolvent applications are by far the best, such as we have directed in cases of inflammation, (C. II. No. 9 and seq.) of which two kinds are chiefly to be preferred, astringents and emollients. Among the gentle astringents, common spirit, or rectified, or even camphorated spirit of wine, may be reckoned, provided the injured parts be dipped into it, or be carefully bathed with rags moistened

ubi ita vehemens ambustio contigit, ut nihil fere non ad ipsum usque os perierit. *Tertius* gradus gangrænæ, quartus autem sphacelo non absimiles videntur. Unde simul istud liquet; nempe ambustiones quam proxime ad inflammationum similitudinem accedere, iisdemque propemodum signis unumquemvis ipsarum gradum dignosci.

II. Quemadmodum autem in gradibus, sic in ipsis quoque curandi viis haud absimilis inflammationi combustio deprehenditur. Quoties enim levior seu *primi gradus* ambustio contigit, longe optima sunt medicamenta resolventia, qualia quidem in phlegmone proposuimus. (Capt. II. No. ix. seq.) Quorum bina potissimum genera sunt: *Adstringentium* videlicet atque *emollientium*. Leniter autem adstringunt *spiritus vini*, vel *vulgaris* bonæ notæ, vel

recti-

ed in the spirit. Nearly the same effect is produced by litharge dissolved in vinegar, (Goulard's extract) the liquor of pickled cabbage, (sour crout) or a decoction of oxycrate (vinegar and water and sometimes a little honey) with salt applied hot, and as frequently as possible, in the same manner as the spirits before recommended. Oil of turpentine also is usually of advantage, if it be early applied. Lastly, it is not improper immediately to expose the burnt part of the body, as a finger or a hand, to the candle or to a fire, and to hold it so exposed as near and as long as the pain will allow, or to bring it near and to remove it alternately, till the sensation of heat and pain is abated.— For thus not only the stagnated blood is, by the
vehe-

*rectificatus, vel et camphoratus; siquidem pars læsa immittitur, vel et per linimenta spiritu illo madentia diligentissime fovetur. Eiusdem fere usus hic sunt acetum lythargyrifatum, muria brassicæ conditæ, vel et oxycratum cum sale decoctum calidumque, perinde ut spiritus modo laudati, quam sæpissime superimpositum. Expeditum quoque hic esse solet terebinthinæ oleum; siquidem opportune ac sæpius corpori illinatur. Denique haud alienum hic est, partem corporis adustum, ut digitum, vel manum candelæ protinus vel igni objicere, eandemque, quam proxime diutissimeque quam propter dolores fieri potest, ita continere, vel et alternis nunc remove, nunc denuo admovere, donec et caloris, et doloris sensus sese remittant. Sic enim non sanguis tantum stagnans, per ipsam ignis vehementiam, in pristinum ordinem redigitur, sed pustulæ quoque una cum symptomatibus aliis quam aptissime præcaventur; atque ita primus ambustionis gradus haud difficulter
ut*

vehemence of the fire alone, reduced to its former state, but blisters also, with the other severe symptoms, are most effectually prevented, and the first degree of burn is often without difficulty cured. An almost opposite, but equally effectual, method of cure is that which has recourse to emollient medicines; by these, whatever is contracted and wrinkled up in the fibres and small vessels, is softened, the natural passage and circulation of the blood through them is restored, and thus the fatal consequences which might have been apprehended are obviated. Water moderately heated as the part affected will bear it is of considerable use, if a folded linen cloth dipped in it be applied to the burnt part, and the moisture be added through it every now and then, till the sense of heat and pain is by degrees abated. But 2dly,
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ut plurimum curatur. Idque magis etiam, si commendata superiora medicamenta simul adhibentur.

III. *Huic fere contraria, sed æque tamen apta illa curatio est, quæ ab emollientibus medicamentis sua petit præsidia. Hic enim quicquid in fibris, ac venulis adstrictum et corrugatum fuerat, emollitur, naturalisque proin sanguini per easdem transitus atque circuitus, propulsus, quæ accidere poterant, malis gravioribus, restituitur. Haud exigui usus hic est 1) aqua modice calida, ipsiusque membri afflicti sensui accommodata; siquidem tinctum in ipsa linimentum complicatum super partem adustam imponitur, subindeque denuo per eandem humectatur, dum ignis ac doloris sensus paullatim evanescat. Sed 2) valentior tamen ad ambustionem leniendam istiusmodi aqua calida esse solet, ex qua vel althæa, vel malva,*

This hot water is more effectual if marshmallow, mallow, mullein, linseed, seeds of fenugreek or quince, or other similar emollients, have been boiled in it. 3dly, Emollient cataplasms made either of the herbs above recommended, or of any other obvious poultice, and applied as hot as they can be borne, are found of great advantage; for scarcely any poultice can be found which does not possess some emollient quality. 4thly, Emollient oils, as of bruised sweet almonds, olives, white lilies, hen-bane, or others, are valuable in this way: These are applied either upon linen cloths, or often with a feather, applying them frequently so that the part may not get dry. 5thly, Mynsichtus's burn-ointment must not be omitted, which is an excellent lenitive; it is made of olive

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or

malva, vel verbascum, semina lini, fœnum græcum, mali cydonii semina, iisdemque non absimilia medicamenta emollientia alia decocta sunt. Deinde 3) commodissima quoque hic ea *cataplasmata emollientia* reperiuntur. quæ vel ex jamjam laudatis herbis fiunt vel etiam ex quacunque demum alia *pulticula* obvia conficiuntur, calidissimaque, quantum licet, crebro supradantur. Fere nulla enim inveniri pulticula unquam potuit, quin aliaquam saltem emolliendi vim obtineat. Tum 4) satis quoque nobilia ad emolliendam sunt *olea emollientia*, lini puta, amygdalarum dulcium, olivarum, liliorum alborum, hyoscyami, et si quæ alia sunt hujusmodi. Hæc ipsa linamentorum adminiculo supradantur, vel plumulæ instrumento frequenter, antequam siccescant, illinuntur.

Denique

or linseed oil, mixed with the white of egg, and applied in the usual way. The mucilage of quince (seeds) is of remarkable efficacy; but of the above-mentioned applications it must be observed in general, that they are of little or no use unless they be frequently repeated.

“ When this second degree is a little more violent and affects a great part of the body, it seems necessary, in order to guard against exulceration, ugly scars, or even gangrene, to *take blood* in proportion to the degree of the burn; in some cases *even to fainting*; and afterwards to prescribe strong purging medicines. The external applications must be the same as before.

“ In

Denique 5) nec omittendum hic illud Mynsichti *unguentum ad ambustiones*, quod egregium leniens est, quodque ex olivarum aut lini oleo cum albumine ovi mixto conficitur, eodemque ut cetera modo superimponitur. Quanquam *mali cydonii mucilago* insigniter quoque hic proficiat. Ceterum de præceptis hætenus medicamentis breviter hic tenendum illud est; parum scilicet atque adeo nihil eadem efficere, nisi sæpius iterentur.

Quoties paullo vehementior ambustionis secundus ille gradus incidit, ingentemque corporis partem occupat, necessarium utique ad exulcerationem, cicatrices deformes, ipsamque adeo gangrænam præcavendum videtur esse, sanguinem protinus, pro ambustiones modo, *vel ad animi defectionem* usque detrahare, deinceps autem vehementius aliquod medicamentum purgans, cujusmodi supra in contusione præscripsimus (Lib. I. Cap. xv. No. 13.) Cetera enim extrinsecus eadem facienda sunt, ut jamjam proposuimus.

“ In infants, for whom bleeding is less proper, a revulsion must be procured by repeated purgings; for the rest, as in other severe wounds and inflammations, great attention ought to be paid to the diet; the thinnest drinks and ptisans ought to be used; for every thing which is heating or taken immoderately, is usually fatal, by increasing the heat and pain; but nothing is more efficacious in cooling the heat of burns than the directions of the famous Sir Kenelm Digby, to give ten or twelve drops of spirit of salt every now and then, either by itself or dropped into other drinks.”

Heister seems evidently, from his observations, to lean very decidedly to the use of astringents: the use of spirits externally, of oil, of turpentine, of hot water, and of applying the part to a candle or fire, will come more readily under the denomination of *stimulants*. But what can we suppose when this very man, with all his acuteness, recom-

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mends

fuimus. In infantibus autem quia minus apta sanguinis missio videtur, revellendi causa iteranda potius alvi expurgatio est. De cetero ut in vulnerationibus atque inflammationibus gravioribus reliquis, sic in ambustionibus quoque solertissimam victus rationem observare convenit. Igitur *imprimis* adhibenda hic sunt *portiones*, ac *sorbtiones* quam maxime *tenuēs*. Quicquid enim aut ex *caleficientibus*, aut intemperanter assumitur, quia *calorem*, ac *dolores* adauget, *pestilentissimum esse consuevit*. Sed nihil tamen ad calorem ambustionibus ortum attemperandum valentius quicquam celeberrimo Dygbæo visum legimus, quam salis quidem spiritum ad x vel xv guttulas identidem ægro vel seorsim ingestum, vel portionibus instillatum.—*Heisteri Inst. Chirurg. tom. I, p. 330—333.*

mends remedies of a directly opposite tendency, viz. his emollients, his linseed, his almond, and his olive oils ;—can we hesitate in saying he had not had an opportunity of properly appreciating the merits of the different methods he recommends ?—for I have too great a respect for the heart of so enlightened a head as to suppose he would either wish to lead into error or record an untruth. It falls to the lot of few men to appreciate properly the effect of various modes of treatment in a particular disease ; for if a patient recovers, whatever was the treatment, whether good or bad, we flatter ourselves it was the effect of our superior merit in conducting the disease ; but future experience may convince us that the recovery, of which we so vainly boasted, was a victory of Nature over the mal-practice of art.

The external means he recommends we thus see are various and opposite ; the internal are more in unison,—bleed and keep all low, and in young subjects purge : But I shall cease for the present, as we have the contradictory opinions of other authors to look at. I need not make any further apology for these remarks, or for the quotations from other authors, as the opinions I shall bring forward, from their works, are the ground-work upon which I am induced to offer my ideas upon the subject ; for feeling as I have done the pain
arising

arising from my own ignorance, and the little benefit I have received from any of the authors whom I have consulted upon the subject, I hope that by thus candidly stating the struggle I have had through chaos, my difficulties may serve as a guide for future practitioners to avoid the same rocks.

Let us now see what Van Swieten, in his Commentaries on Boerhaave's Aphorisms, says on the subject of Burns :—

Secl. CCCLXXVI.—If actual fire, or any thing which conceals fire, is applied to our bodies, there follows a destruction of the small vessels in the part, and an extravasation of their humours, varying according to the difference and duration of the cause, and the nature of the affected part.

“ *Nature of the affected part.*—But the different nature and action, or use of the affected part, will again make a difference in the effects of fire: Those smiths who are daily employed in the making of anchors, have the palms of their hands extremely hard and insensible like horn, insomuch that they are capable of holding burning coals, or even hot iron from the furnace, without danger; but the same smiths, when they lie sleeping by the fire side, after they have been tired by their day's labour, have the skin of their legs often burnt, and raised into a blister, by a small particle of such fire. When a citizen of the Hague was blowing with

his mouth into a musket, the piece being charged, unfortunately took fire, the man not knowing that it was loaded; and by this accident his palate, gula, gums, and tongue were miserably burnt, inso-much that he was not able to swallow any thing for the space of eighteen days; though bleeding and other select remedies were used, and the dead parts separated from the living; which being extremely painful and sore, created much misery to the patient, till at length some fragments of bones being separated from the palate, he did well, and gained the better of death after a hard struggle*. But it is very evident that a burn would be much less dangerous and troublesome, provided the hand was to be burnt with gun-powder, instead of the mouth and gula.

“ *Sect. CCCCLXXVII.—The different degrees of these several effects from burning, resemble those observed from the first and slightest degree of an inflammation, till it degenerates into the worst or most severe sphacelus.*

“ *Sect. CCCCLXXVIII.—Hence the phenomena or symptoms, the diagnosis and the prognosis are the same in both.*

“ *Sect. CCCCLXXIX.—But in the cure also there is no difference; and more especially the antiphlogistic drinks, proper for inflammations, are always necessary in burns.*

* Stalpart. Vander Wielen Observat. rar. Cent. Ob 24.

“ For in the same manner as no general method can be prescribed for the cure of inflammation, but the means are to be varied according as it tends either to a resolution, a suppuration, a gangrene, or a scirrhus ; so also in burns, a very different method of treatment is required, when it stops within the limits of a resolvable inflammation, than when the fire has destroyed, or converted the part into gangrenous or dead escars. In the following aphorisms we shall therefore prescribe the method of cure proper to each degree of burning, by which it will appear, that this disorder corresponds very much to the curative indications enumerated in the history of phlegmons ; insomuch that there is but *one* remedy that can be universally recommended in all the species of burns, namely, the use of a *thin antiphlogistic*, or *cooling drink*. For there is a degree of inflammation, which accompanies even a slight burn. But in the more intense burns, especially if a large part of the body has been injured, *all these remedies will be convenient*, which we recommended before for the cure of a *violent phlegmon*, and more especially *bleeding*, repeated according to the nature of the case, with *antiphlogistic purges*, will be *of the greatest use*. By these means Hildanus* happily cured the

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servant

* De Combust. cap. 7, pag. 922.

servant of a dyer that fell into a copper full of hot dye, which was not yet scalding, and by the external application of the best topical remedies, he cured this slight scalding of the whole body; which yet appears from the history not to have exceeded the limits of a resolvable inflammation, except in a few parts of the body, which touched the oak chips and other hard materials *lying* next to the bottom of the copper; to which parts a different method of treatment was used, as Hildanus informs us. At least it is evident from this instance, how serviceable those means may be for the cure of burns, which were recommended before for the cure of a resolvable inflammation.

“ *Sect. CCCCLXXX.—Burning or scalding, within the limits of a resolvable inflammation, is to be treated with such remedies as preserve, or as it were pickle the juices and put them into motion, and by such things as open and preserve the vessels; and this is performed by the application of a moderate degree of fire, by fomentations and cataplasms, by washed butter, or lastly, with spirit of wine and a little vitriol.*

“ If a burn has injured a small part of the body, there will be no necessity to disturb the whole by bleeding and cooling purges, &c. for in that case it may be sufficient to treat the part itself affected with topical remedies. When the burning has been so slight as only to cause a resolvable inflammation

mation in the part, the cure is then easy enough, even by most of the different remedies which are kept in families for that purpose. But what seems not a little surprising is, that even the best surgeons should recommend medicines of opposite virtues in these accidents, namely, emollients and astringents, attractives and repellents, &c. &c. Thus Parey* recommends the juices of house-leek, lettuce, plantain, &c. mixed up with the white of an egg; and in the same place, and for the same disorder, a mixture of clay and vinegar, or writing ink mixed with oxycrate, or *roach* allum dissolved in water; and observes, that the acrid bulbous roots of onions, beat to a cataplasm, with a little salt, are applied with very good success. I have also observed several other things applied in these cases, to the great relief of the disorder, provided the application of them is frequently repeated. And this is a caution given almost by all surgeons, that at the beginning the remedies applied to the burnt part ought to be frequently renewed until the pain is abated, or as Parey expresses it, till the heat or fire of the part has been drawn out. When the wife of Hildanus had several times dipped her hand, up to the wrist, inadvertently into boiling soap, immediately after a violent pain followed,

* Livre xii. chap. 17, 18.—page 300.

lowed, not only in the hand, but also throughout the whole arm; but immediately after the soap was washed off with warm water, and then the injured part was anointed with a liniment made up of raw onions, salt, soap, oil of sweet almonds and of roses mixed together; the arm was also anointed with oil of roses, and the affected parts invested with a bandage dipped in vinegar and water; and he adds, that he often repeated these means with good success; that no ulceration of the skin followed so violent a scald, except a small pustule in the thumb, and another in the fore-finger, which yet were easily cured, only with a little unguentum basilicon*. In another case, he says he renewed emplasters four times every hour for the first day, and by that means drew out the greatest part of the fire. Thus therefore there seem to be many remedies capable of curing this degree of burning, provided they are such as keep the stagnating humours from corrupting, and put them into motion, while at the same time they preserve the continuity of the vessels, and render them pervious. It may be asked, whether fire applied to any part of the human body, does not remain united to it for a time? and whether it may not be *extracted* by *attractive remedies* in the same manner as the freezing

* Livre xii. chap. 17, 18.

ing spiculæ are drawn out of *frozen bodies* by the application of *snow* and *cold water*? At least it is certain that, barely by a prudent application of *fire*, the pain is abated in the burnt part, and at length totally removed. Hence Fernelius* has very well pronounced, that fire itself, applied near to the burnt part, is its own antidote to drive out the fire of the burnt part, by which the pain is abated; and he adds, that some remedies applied to the parts, entice out the fire. Thus he says, that the leaves of leeks and arum, or wake robin, make a present remedy for a burn; and soon after he adds a numerous catalogue of medicines which serve to the same intention, though their medicinal virtues are very different from each other. I have frequently seen that the mere application of warm water, or anointing with unguentum populeum or the like, has relieved the pain in the burnt part; and when the pain has encreased again in a little time afterwards, it has been a second time removed by the application of linen cloths moistened with warm water, or by renewing the unction with the same liniment; and thus, by the repeated application of the same remedies, all the pains have by degrees vanished.

“ But spirit of wine, we are assured by Sydenham,†
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* Therapeut. lib. vi. cap. 20.

† De Peripneumonia nota in fini, pag. 343.

is preferable to any other remedy as yet known ; namely, if linen rags are dipped and applied to the burnt parts, and the application of them repeated till the pain excited by the fire is entirely removed ; and afterwards the same application he would have repeated only twice in a day. It is to be here observed, that this great man recommends the frequent application of the same remedy in the beginning of this disorder. It will be also equally serviceable to add a little vitriol to the spirit of wine, or else alum or the like astringent, and repelling substances which have been recommended by Parey and others. Perhaps these remedies exert their efficacy by preventing the blood from passing into the smaller vessels, and by constringing the vessels, so as to propel their contents from the smaller towards the larger capacity of the tubes, and by that means resolve the inflammation there seated. But all these remedies, however celebrated, are only serviceable where the burning has produced a resolvable inflammation ; for if the vessels have been so far destroyed, or their contained juices evaporated to such a degree, that there is no room to expect a resolution of the concreted parts, nor a possibility of restoring the stagnant juices to their proper motion, in that case another method of cure is required, as we shall explain in the following aphorisms.

“ *Sect.*

“ *Señ. CCCCLXXXI.—A burn which tends to a gangrene, which may be known from the skin being already turned into a crust, or else eroded and elevated into blisters, is to be treated as an inflammation of the same nature, namely, by fomentations and cataplasms of emollient and digestive remedies. (402 to 454.)*

“ But since the burning cause does not always act with the same violence upon every point of the flesh which it touches, we therefore frequently find that the inflammation is in some part resolvable, and in others not at all, whence different remedies are to be applied to the different parts according to the nature of the circumstances; as for example, when scalding water falls upon some part of the skin, that part which it runs over first will be injured more than the adjacent skin which it passes over afterwards. Hence in that case of the dyer’s servant, who fell with his whole body into water almost scalding. Hildanus anointed almost the whole body with a mixture of salt, soap, crude onions, &c. formed into an ointment; but to some certain parts where the burn penetrated more deeply, the most emollient remedies. But *bleeding, cooling purges*, and the use of diluent medicines, can never be prejudicial, even though a resolution can be hardly expected in the most violent burns. Since by these means, speedily applied and discreetly

creetly repeated, even an incipient gangrene is often happily cured, more especially when the face is burnt, from whence a disagreeable scar or disfigurement might be feared as long as the patient lives, or even sometimes blindness itself, when the eyes or their adjacent parts have been thus injured*. A misfortune of this nature once happened to the celebrated author of these aphorisms, when by the bursting of Papin's machine or digester, the most scalding water flew into his face, and penetrating through his cloaths, miserably scalded his arm. His whole face was in a little time blistered, and his eye-lids so much swelled as totally obstructed his sight, insomuch that he could not distinguish the light of a candle; he immediately ordered himself to be bled *ad deliquium*, and the next day caused the phlebotomy to be repeated, and afterwards took a pretty strong purge, even though he
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* The following case I should wish to call to the particular attention of the reader; the character of Boerhaave holds so high a rank upon the Continent, more particularly in the United Provinces, having been the Professor at Leyden, that to differ with him in opinion, is there looked upon as heresy; but though Boerhaave was without doubt one of the best of men, yet he was but a man, and as such liable to err. I am very far from wishing to derogate from his exalted character, I am only induced to wish that prejudice should not prevent us from making the most extensive use of our senses, in all natural facts which are submitted to their testimony.

was reduced nearly to a state of fainting by the weaker purges. He took care to have his face anointed only with *unguentum nutritum*, and covered with *emplastrum ex lapide calaminari*. After these profuse evacuations, the tumour of the parts subsided; and by the use of a thin diet and plentiful drinking of cool liquors at the same time, the cure of this dangerous scald was so happily advanced, that after eight or nine days time he appeared again in public, with his eyes saved from so great a danger, for the great benefit of mankind in general. But yet an unsightly scar remained in his arm after a tedious suppuration, for there the scalding water insinuating into the cloaths, continued to be applied for a longer time to the skin."

In these Commentaries, Van Swieten seems to have collected the opinions of his predecessors and cotemporaries in so clear a manner, that we may fairly suppose them to contain a candid account of all that was known upon the subject at that time. Therefore Heister and Van Swieten will serve as a specimen of the variety of modes, and the different opinions which have induced them, among the older authors*.—I shall now bring forward the opinions of the moderns.

Mr

* I am well aware that the term *ancients* to Heister and Van Swieten may be objected to; but as they have given us an epitome

Mr Bell of Edinburgh, having compiled a system of surgery, we shall look at the opinions given out by him for the treatment of burns; the copy of his work from which I shall take the following observations, is the third edition, printed in 1789. He says, "Burns, which do not destroy the cuticle, and which irritate the skin only, act nearly in the same manner as cantharides and other vesicantia. The irritation which they excite produces an increased action in the exhaling vessels of the affected part, by which vesications are formed in extent and number proportioned to the violence of the cause.

"In every case of burn the pain is severe; but in general it may be observed, that it is more considerable where the skin has been merely much fretted or irritated, than where such a degree of heat is applied as to destroy it entirely. In deep extensive burns, mortification sometimes takes place to an alarming degree very soon after the injury is inflicted, but for the most part the symptom we have most to dread is inflammation. The pain and

some of the opinions of the ancients, I thought it better to let them pass under that denomination, than to load my Essay with further quotations; as those I am necessarily induced to make, for the illustration of the subject, may without any addition appear too large.

and irritation which burns excite, are in some instances so violent, that all our efforts are apt to fail in preventing them from inducing the very highest degree of inflammation: And when the surface of a burned part is extensive, the effects of this inflammation are not confined to the spot which has more immediately suffered; they are apt to excite fever; and in many cases such a degree of torpor is induced, as at last ends in death.

“ An abatement of pain may be procured by the application of remedies of very different, and even of very opposite natures;—by dipping the part affected in very cold water, and keeping it for some time immersed in it, the pain will often be rendered very supportable; while on the other hand, a considerable degree of ease may be procured by plunging the injured part suddenly into boiling water, or any other fluid of nearly an equal degree of heat. Emollients are often employed, and in some cases they procure immediate relief; but in general, astringent applications prove much more successful. One of the best applications to every burn of this kind is strong brandy or any other ardent spirit; it seems to induce a momentary additional pain, but this soon subsides, and is succeeded by an agreeable soothing sensation.—It proves most effectual when the parts can be kept immersed in it; but when this cannot be done,

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they should be kept constantly moist with pieces of old linen soaked in spirits. The *acetum lithargyrites*, a strong solution of *saccharum saturni*, or Goulard's saturnine water, make useful applications for the same purpose; and as a proof that it is the astringency of the remedy which the effects result from, the same benefit is derived from a strong solution of alum, or even from common ink."

In comparing the above, as a work of the present day, with the opinions of Heister, &c. we find very little or no advancement in treating this accident, according to any principle. The knowledge we have of chemistry, indeed, enables us to simplify our applications, and teaches us not to make use of such a farrago as they used to do; but though the means are simplified, they are even yet as contradictory;—heat and cold, emollients and astringents.—From this it will appear that though we are advanced in the circle of time, yet in the matter in point we are now where our ancestors left us.

Thus much Mr Bell gives us in respect to the external means; we will now see how far he agrees with his predecessors in the general internal treatment.—“In this manner all such burns as we are now treating of may in general be cured, excepting where they are so extensive, as by the irritation which they produce, to excite much inflammation and fever.—In such circumstances

stances *blood-letting*, and other remedies adapted to the particular symptoms, must be advised.”—There can be little hesitation, when blood-letting is premised, that the other remedies would be purging, and what is generally termed the whole of the antiphlogistic regimen, in which are included cooling drinks, aperient ptisans, and low diet; thus the general means appear exactly the same as recommended by all former authors.

This view of the present opinions of the modern authors of our own country, will shew the great similarity there is between them and their predecessors. To enable us to judge of the opinions of our brethren upon the Continent, I take the liberty of translating the article *Brulure*, from the French *Encyclopedie Methodique*; it is from the edition of 1790.—I need scarcely make an apology for this, as many of my readers may not have had an opportunity of seeing the original work; the surgical part was compiled by M. de la Roche, physician to the regiment of Swiss guards, member of the College of Medicine at Geneva, and of the Royal Society of Medicine at Edinburgh; and M. Petit Reael, Doctor Regent of the Faculty of Paris.

“Burn—a wound more or less superficial, occasioned by the contact of some substance, heated beyond the point which the body could bear, with-

out destroying its organization. Burns have a different appearance, according to the degree of violence the body exerted that produced them, and according to the kind of body which produced such an effect. Those which have only irritated the skin, differ essentially from those which have corroded and destroyed it; and these last have a different aspect from those which attack deeper seated parts, such as muscles, tendons, ligaments, &c. Burns occasioned by boiling water or by any other liquid are not like those produced by the contact of any heated metallic body, or by the inflammation of any combustible substance. Burns which do not destroy the epidermis and only irritate the skin, are very similar in their effects to cantharides and other rubefacients; the irritation they excite increases the action of the exhalent vessels of the affected part, and the fluid which this furnishes, detaches and raises up the epidermis, from whence arise the vesicles or blisters, more or less numerous, or more or less extended, according to the manner the offending cause acted. But if the skin and adjacent parts are destroyed, no blisters will appear; then a black and gangrenous eschar is seen, and after the eschar is thrown off, there remains an ulcer, more or less deep according to the degree of heat by which it was produced. The pain caused by a burn is always very great,
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but in general greater when the skin has only been irritated upon its surface, than when it has suffered such a degree of heat, as is capable of entirely destroying its organization. Sometimes one sees a violent gangrene shew itself, and spread to an alarming degree, in the cases where the burn occupies a considerable surface, and this very soon after the accident has happened: But in general, the symptom most to be dreaded in such a case, is the inflammation: The pain and the irritation sometimes arises to such a pitch, in spite of all that can be done, that it is with difficulty the inflammation is prevented from going to the highest degree. And when the surface affected is of considerable extent, the effects of this inflammation are not confined to the parts which were first hurt, but they frequently extend to the system, and cause fever; nay, in certain cases, such an engorgement is produced in the part as may terminate in death. The first thing to be done when one wants to relieve a burn of any kind, is to attempt to ease the violent pain by every possible means. When the structure of the skin is not destroyed, but only irritated, one is enabled to moderate, and in some cases to allay the pain by applications of a very different nature, and even directly opposite; as for example, one produces this effect by plunging the part burned, if practicable, into cold water, which

is kept in that state by renewing the cold water, and retaining the part there; or if one cannot conveniently put the part into cold water, the keeping it constantly wet with sponges dipped in cold water, or compresses repeated as often as they lose their coldness. This method, which we have always at hand, and which is not in sufficiently general use, is the best one can have recourse to in the first moments, and that which will in the surest manner prevent inflammation, if its use is continued a sufficient length of time; one ought at least to continue it some hours. What will appear very singular, and *which we shall not undertake to explain*, is, that the same effect is obtained by rapidly plunging the part which has suffered into boiling water; a remedy, notwithstanding, which we shall not recommend, and whose use is very precarious. Emollient applications are frequently used, and sometimes with sufficient success, but in general it is not these which succeed the best; those which are of an astringent nature produce the most marked effect. It is with this view that brandy, and even spirit of wine, applied to a burn, relieves the pain, though at the first instant it renders it more acute. For obtaining all the possible advantages from these strong liquors, it is necessary either to keep it plunged in, or continually moistened with compresses wet with the spirit. Goulard's water
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is also advantageously used for the same purpose, or a solution of the sugar of lead. Also other astringent applications as ink, or a strong solution of alum. It is in general thought that these remedies act by the preventing the formation of vesicles or blisters, which superficial burns commonly give rise to; although it does not appear that this idea is well founded; for astringent and spirituous applications ease the pain more immediately when the epidermis has been detached from the skin, than when they are immediately employed after the accident took place, and before the blisters have sufficient time to be formed. Whatever means we employ, we should continue its use as long as there is a continuance of pain; and in cases of very extensive burns, attended with much irritation, it will be well, independent of external applications, to give some doses of opium, proportioned to the acuteness of the pain; it is this medicine, amongst all those we can employ, that will succeed the best in preventing that stupor which people, who have met with such accidents, frequently fall into;—a symptom which appears to depend entirely on the violence of the irritation caused by the action of the heat. The bark is likewise employed with much success, to combat this symptom, and above all, in those cases where the wound carries any appearance of gangrene.

When the epidermis is raised in the form of blisters, there are some who advise that they should be opened; whilst on the other hand, there are who say, they ought not to be touched. It is certain that in opening them, the pain is sometimes much increased, but more particularly so when they are opened too soon, and before the state of irritation caused by the burn has ceased; the least admission of air to the surface of the skin deprived of its epidermis, is at this stage extremely painful; but when the irritation is over, the blisters may be opened without fear, to allow the escape of the serum they contained; it ought to be done then, lest the serum, remaining too long upon the surface of the skin, should produce a degree of ulceration, as sometimes happens when it is not absorbed sufficiently quick by the lymphatic vessels. But it is better, even at this period, to open them by simply pricking them, than by large incisions; by which means the air will have the least possible access. After the serum is evacuated, the best topical application to the part, is a liniment made with oil, wax, and a little sugar of lead. Oil alone has not a sufficient consistence, and runs off too quickly; and ointments which are stiffer are more uneasy than a liniment, because they neither apply so well, nor are they taken off with so much ease. With this mode of treatment, all burns of which

we have been speaking will be easily cured; that is to say, those that are superficial, unless they are of a great extent. For in such case they sometimes excite a violent inflammation, and much fever; and then it is necessary to have recourse to bleeding, and such other means as the particular symptoms that shall happen may indicate. And when a disposition to ulcerate is observed in the part, such remedies are to be used as the nature of the ulcer seems to require. In cases of burns, where, from the beginning a loss of substance has taken place, as happens when it has been caused by the application of a metallic body heated to a certain point, that which succeeds the best in easing the pain, after the application of cold water sufficiently long applied, is the use of soft and cooling emollients. A liniment composed of equal parts of lime-water and olive, or linseed-oil, with which the affected parts are kept constantly moist by means of a soft brush, gives in general marked and often immediate relief. The patient suffers much by the application of any sort of bandage; an inconvenience which will be avoided by the means which we recommend. But as soon as the pain and irritation occasioned by the burn ceases, the part affected must be covered, and treated in the same manner as if it had been an ulcer arising from any other cause. The liniment of lime-water and
oil

oil which is mentioned, is one of those which gives the greatest ease. Nevertheless, sometimes one succeeds as well, and even better, by the help of Goulard's cerate, or other analogous topical means.

“ In the cases of burns by the explosion of gun-powder, there is often a greater or less number of the grains of the powder lodged in the texture of the skin ; these grains greatly increase the irritation ; and if they are not taken away, they commonly leave marks which are never eradicated. It is therefore necessary to take them away with the point of a needle as soon as possible after the accident ; and, with a view to diminish the inflammation, as well as to dissolve and draw away the particles of powder which might still remain, it will be as well, for one or two days, to cover the affected parts with an emollient cataplasm. In other respects, these sorts of burns ought to be treated as the others. When the burn affects two contiguous parts, they are liable to form adhesions together, if precautions are not taken to prevent them. This most commonly happens to the fingers and toes ; also to the nostrils and eye-lids. The surest way to prevent these adhesions, is to keep the parts separated by pledgets retained in their situation by any convenient bandage. It will be well to observe in this place, that in the
treatment

See also the Breast

treatment of ulcers occasioned by burns, one often observes the flesh to take a soft consistence, to become fungous, and to rise above its natural level. When they put on this appearance, we must abandon emollient topical applications, and substitute in their place those which are rather of an astringent nature, and gently compress the part by means of a bandage. The surface of the ulcer should be bathed with Goulard's water, lime water, or a solution of alum, and it should be dressed with an ointment with prepared tutty. These means will in general be sufficient to repress the growth of fungous flesh; but should it still continue to arise, one may apply some burnt alum, vitriol, or *lapis infernalis*, to destroy it."

This article from the French Encyclopedie, in many parts, bears so striking a resemblance to the former quotations from Mr Bell's system, as to leave little room to doubt, that the one in a great measure has been taken from the other. I rather suppose these gentlemen have written the above article strongly impressed with some theoretical notions; they very strongly recommend the application of cold water, and seem to regret that it is not sufficiently had recourse to.—Hot water is also recommended to plunge the part into, which they say gives immediate relief; *but they do not undertake to explain it.* Cold certainly decreases the
 pain

pain during its application, but makes it less supportable upon the least application of subsequent heat; whereas, heat does not increase the pain, but makes the excess of it which had produced the pain, less observable.

In my attempt to do away prejudice, I must avoid the imputation of being affected by it myself, and shall therefore relate a case in which cold water is said to have performed a cure;—it is related in *La Medicine Eclairée*, published in the year 1792*.

Extract of a Memoir communicated to M. Fourcroy, on the treatment of burns.

“ The most ordinary diseases and the most common accidents are the worst treated, as blind empiricism has multiplied the means of cure. A burn is a striking example of this. There is no accident for which we have a greater number of remedies;

* *La Medicine Eclairée* is a work of great merit, conducted under the auspices of *Monf. Fourcroy*; it was begun in 1791, and conducted for two years; two sheets were printed every fortnight, which formed two volumes annually; at the close of 1792, the author laments the circumstances which oblige him to desist the work in its present form, and adds, that though his *zeal* is retarded, it will not be diminished, as he continues to collect every interesting fact relative to the healing art, and when his materials will permit, a volume will be published; no more has *yet* appeared. The work itself not being translated, will be an apology for inserting the whole upon burns.

remedies; and at the same time there is none where the curative power is less ascertained;—each family has its receipt, and each empiric his ointment;—to such a degree of absurdity is this carried, that with reason the term *nostrum* is meant to denote any useful or dangerous secret. This multiplicity of means to cure burns proves that none of them have the power, and that Nature must do her own work. It would be very fortunate if none of these pretended means did not retard the operations of Nature. It will be impossible to entertain any other idea of these ridiculous and absurd mixtures, when we look at their composition; but more particularly when it is known that they are recommended in every species, as well as in every stage, of burns. If any authors have given rules concerning this treatment, they are so different among themselves, as glaringly to shew the necessity of submitting this subject to new discussions: In this point of view select facts should be collected and compared, and none but just inductions be drawn. It is not enough to divide the remedies into heating and cooling, moistening and drying, tonic and relaxing, nor burns themselves into superficial, as those of the skin, and others of the deeper seated parts, or to consider the general difference of the burning matters, but we must even yet follow the road pointed out by Fabricius Hildanus,

Hildanus, who is the author that has best treated this part of our art, and apply the most convenient treatment to each species of burn, and to the particular circumstances as they arise. But above all, we ought to study the prognostic; and to know, that if in general deep and extensive burns are troublesome, yet those of the skin are often more dangerous, from the violence of the pain, the profuse suppurations, and the quick manner in which they weaken and exhaust the patient. A treatment without rule exposes us to the same danger. The ancients thought that in order to cure burns, it was only necessary to extract the *empyreuma* fixed in the burnt part: They attempted to draw out the fixed fire from the part burned. Fernelius regards *fire* as the *true remedy* for the evils it produces. Fabricius Hildanus advises the immersion of the part into water as hot as can be endured. Fallopius recommends this also as one of the best means. Dry heat, according to all these authors, had the property of preventing the formation of vesicles or blisters. Van Swieten in discussing at length this subject, Heister and Parey, all recommend the same, and support their own opinion by their own experience; but all agree that it is only useful in superficial burns, and at the time of receiving the accident. It is with the same intention that alcohol, and all remedies which are de-

nominated

nominated spirituous, are recommended. Sydenham advises alcohol in recent burns, not only, as Van Swieten supposes, to resolve inflammation, but to prevent it. He (Swieten) would have spirits of wine instantly used, to prevent suppuration and dissolution. Applied later, it might be dangerous, and give rise to more distressing symptoms. Van Swieten does not advise the use of alcohol in deep seated burns caused by gunpowder, boiling oils and resin, or other very hot bodies, for fear of hardening the eschars. Notwithstanding it is a certain fact, that the drier eschars are, the more easily are they detached from the living fibres. The emollients, and softening relaxing ointments recommended by Van Swieten, frequently retard suppuration, and give rise to a foul putrid ulcer; the more to be feared, as it is what we ought particularly to guard against in burns. In observing what passes in burns made by art, such as the actual cautery, or by means of moxa, we may form some just idea of what happens in accidents of this kind. We know that the falling of a dry eschar is retarded by the application of unctuous bodies; that if it is not divided, it does not fall off until some weeks; that a slow inflammation is excited around the edges, which is opposed by relaxing and softening means. But on the contrary, by drying it by the use of spirit of wine, and dividing

viding it, and then putting the lint into the scarifications impregnated with the Egyptian ointment,* the cellular membrane below is hardened, suppuration takes place in a few days, and the falling of the eschars shews the healthy fibres below disposed to cicatrize; whilst those which appear after the fall of an eschar treated by relaxing means, are soft and fungous. We may therefore conclude that the common method of treating eschars from burns, by oily, unctuous, and relaxing means, is highly pernicious. Van Swieten, in throwing aside the use of spirit of wine, and recommending the use of relaxing methods, has certainly fallen into a very great error. In vain he brings forward an observation of La Motte, which we will relate.—“ This surgeon was called to the assistance of a young girl who had fallen on her face into the fire in an hysterical fit, and, in attempting to disengage herself, fell backwards, so that she was burnt in the face and neck to the breasts, and behind from the nape of the neck to the shoulders; rags moistened with spirit of wine were applied immediately, and continued for three days; but the pain increased, and the blackness which was apparent on the first day spread on all sides, accompanied by an insupportable cadaverous stench. The face was more slightly

* This is the *Mel Egyptiacum* of the shops.

ly burnt than the rest; but from the chin to the breasts, and from the nape to the lower part of the scapulæ, there was only one gangrenous and one dry crust. Deep scarifications were made, the Egyptian ointment dissolved in spirit of wine was applied, and the whole covered with compresses moistened in the same liquor. Nevertheless, all the parts became very dry, and as no appearance of suppuration ensued, these means were desisted from. The parts were then dressed with a soft cerate composed of yellow wax, olive oil, and the yolk of eggs roasted under the fire. Three days after the use of this, the parts became moist, and the dead eschars began to fall pretty quickly, so that in the space of a month the whole was tolerably clean. It was four months before this patient was cured. Van Swieten draws the same conclusion as La Motte, who, after this and some similar facts, declaims much against the use of spirits of wine, and pretends that his softening ointment is able to obviate every untoward symptom that may arise in the treatment of burns. It is very evident that the alcohol used in the first instance dried the eschars, which, had it not been applied, would have followed that tendency to corruption and gangrene which takes place in all burns, and would undoubtedly have destroyed the

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subject. La Motte is mistaken in regard to the pretended inconvenience of this remedy, as well as in the pretended power which he ascribes to his ointment of causing the suppuration; the very case itself proves the drying power of alcohol. It is equally true that alcohol, though extremely useful in the first instance, may prove highly pernicious when a great inflammation has succeeded to the first effects of the burn. Repellents have been much boasted of; we are told they throw back the blood and humours which are carried to the burnt part, and that they resist the formation of blisters. Ink is the most common of these remedies, and if its success is most common in trifling cases, yet there are examples of its utility in very serious cases. Diemerbroeck gives instances of this in his works: A man wishing to extinguish a kettle of melting resin which had taken fire, he took a pillow, and in his hurry plunged his arms into the inflamed matter; the pain he had in consequence was extremely severe. Diemerbroeck ordered a servant to bring a large stone bottle of ink, which he had just made, and poured it into a large vessel, in which he made the man plunge his arms, and keep them there for half an hour, at which time the heat and pain were dissipated, nor were there any blisters formed, so that this burn
had

had no other ill consequence. In case ink in a sufficient quantity should not be at hand, street mud may be used as a substitute. Panarole, an Italian Physician, recommends that if mud cannot be found, to make artificial, by mixing water with street dust, or the sweepings of houses. Onions have been much boasted of. Fallopius says he has tried them successfully upon himself. Fernelius speaks of the powers of a poultice made with peeled onions and salt in such cases. Parey remarks, that it should only be used when the skin is not destroyed, and that it prevents blisters. Fabricius Hildanus adds to the onions, white Venice soap, oil of sweet almonds, and oil of roses, so as to form a mass of the consistence of an ointment. He quotes many cases in which his application was of use; particularly to his wife, who had burnt herself by imprudently plunging her hands into some wine she was cooking. It is difficult to account, amongst so many different boasted remedies, and the many attested proofs we have of their efficacy, why authors have never mentioned the application of *cold* liquors. Instinct which carries a burnt person to the application of cold, the most natural of all remedies, we might suppose, would have induced surgeons to have made trial of its efficacy. The following observation will shew us

that the mere renewal of cold water is one of the most precious means we are acquainted with.

*Observations upon a burn communicated by Mons.
Emafle, in the month of February, 1774.*

“ A servant girl taking a large pot from the fire, spilt a portion of the hot broth upon her fore arm. Emafle happening to pass through the kitchen at the same time, he immediately made her expose it to a stream of cold water which was conveyed to the kitchen by a cock; he was determined in his choice, as it was the readiest application that he could find in the moment. The girl had sufficient perseverance to submit to this application for more than an hour; her arm was covered with flour, (a remedy recommended to her by one of her fellow servants.) On the evening of the same day she walked about without feeling any pain; on the following day when the arm was cleaned, it appeared in a healthy state, only some days after the cuticle peeled off. This observation may have its use; it shews the success of cold water in burns, and seem to lessen the opinion of Van Swieten, who says, (in the Commentary upon the 480 Aphorism of Boerhaave De Combustione;) it is observed that all lotions or topical applications used cold, produce a pernicious effect in burns.

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This assertion appears to have been advanced in too decisive a manner, as it may set aside an efficacious remedy; the commentator ought to have divided the different stages of burns, and to have brought into one point of view what was indicated in each; in having made these distinctions, he would have developed the essence of burns, and appreciated the true value of the action of cold. If it should be proved, from observations, that it is dangerous when a part is much inflamed and engorged, perhaps others may be found wherein it would be successful, as in the instant of certain species of burns happening. In reality does not cold class with repellents, and why may it not be conveniently employed to throw back the flux of humours from the part, and to prevent or moderate the engorgement? Do not we see every day that in sprains, when the foot is put into cold water, the action of cold produces the most salutary effects, provided that it is immersed in the instant? Thus it is with burns; allow the first moments to be neglected, and the regular practice will not then allow such proceedings. When the tissue of the skin is burnt, and relief has not been given in the first moments of the burn, the blisters are cut, and are dressed with some cooling ointment, as populeum cerate, linseed-oil with lime-water, or nutritum; notwithstanding several facts

prove that these greasy applications aggravate the ill. The example of Boerhaave, who treated himself for a very severe burn of the face, from the vapour arising from the bursting of Papin's digester, does not increase our hopes, as he, from the application of nutritum, had a long and tedious suppuration. The same consequences are frequently observed in military hospitals, in the case of burns produced by explosions of gunpowder in the parks of artillery. The ointments which are used frequently produce tedious suppurations, and leave the fibres in a state of softness and inertia, which sets aside cicatrization, and exhausts the patients. Fabricius Hildanus was astonished to find more than half a pint (*demi livre*) of pus upon the leg of his servant who had scalded herself with boiling water; she was dressed twice a day. The same fact takes place in blisters, and may be seen every day. All greasy and relaxing applications inevitably produce this effect; therefore the cure must always be compleated by absorbents. Lime-water and the oxyd of lead are the principal. We see that the eschars produced by burns, ought always to be scarified to prevent too abundant collections of matter which take place underneath them. We should not spare these scarifications; they ought rather to be increased, in order to bring it to the state of a simple wound. The incisions

cisions ought to cross, so as to present several angles. It was for the want of such a proper treatment as this, that King Stanislaus fell a victim to his burn. By great attention in the dressings, and a scrupulous exactness, we frequently obtain a cure in burns of the most severe and desperate kinds."

I cannot agree with Mr Emalle in the conclusions he draws from this case, of the use of cold water; nay farther, it appears to me a striking case against its general use. What takes place in this cure?—The part was thrown into a diseased and violent action by the application of hot broth; to cure which, this action was paralysed by the application of cold, or subtraction of heat:—Nay, this is not enough, it must be continued until the vital principle of the part so excited, is destroyed, or otherwise the pain returns with redoubled violence, so that this ought to be termed the *killing cure*; for any thing short of this, as the accurate Hunter has observed,* would be ineffectual; to

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* Cold lessens all inflammations, and is a very good application where it can be applied, but it cannot be applied so universally as many others: however, cold has this disadvantage, that the pain, although removed while under the application, occurs with double force when it is removed, much more than from any of the applications; and the reason is evident, for as the warmth returns, the pain is increased by the warmth, even in the sound parts. On the

what a train of untoward symptoms would the system be exposed, were we in an extensive burn obliged to submit the living parts to the torpor that would take place, in applying cold in a sufficient degree, and for a sufficient time to kill the diseased part! In the case alluded to, the connecting medium of the skin and cuticle was killed, as the cuticle fell off in two or three days after. In very slight cases, where the pain is great and the injury small, the death of the part may be adviseable; but in general, it is our duty to keep the vital principle in every part as long as we can. These observations I hope will appear clearer after the perusal of the remaining part of the Essay, in which an opposite principle is wished to be established.

Observations on a severe burn of both legs, by Monsr. Didier the elder.

“ In the month of September, 1773, a person taking from the fire a mixture of oil and turpentine, it inflamed and fell to the ground, when a young man, a student in pharmacy, wishing to assist

the contrary, it is recommended, when a part is burnt, to hold it to the fire as hot and as long as it can be held, which undoubtedly lessens the succeeding inflammation, and soon gives ease. This I have often seen, and probably it can only be accounted for on the principle of producing the act of contraction in the vessels.—*Hunter on the blood, inflammation, &c. p. 218.*

assist in putting out the flames, received a great portion of this matter upon his legs; his cloaths immediately took fire, when, with great presence of mind, he ran and threw himself into a large vessel, where he made them throw several pails of water upon him to extinguish the flames: While in this situation he had no other desire than to remain immersed in the water, and wished to increase its efficacy by adding ice; but being obliged to desist by the advice of his friends, he left his situation, and placed his legs in a bath of spirit of wine, where he remained an hour. Having come at this period, on examination I found the burn extended from the knee to the ancle of each leg. The cuticle was totally destroyed, and exposed the skin to view, of a dirty white colour, hard, dry, and stretched. The first indication which struck me as necessary, appeared to be a salutary relaxation of the parts, to procure which I covered the parts with lawn paper, spread with recent populeum [this is an emollient ointment made with wax and palm oil, &c.] To prevent any accident arising in consequence of inflammation, and to abate the violent agitation in which my patient was, I bleed him twice the same day. In spite of which, he became very feverish, and was delirious during the night. The following day, when the dressings were taken off at a consultation, we found the
whole

whole of the skin black, dry, and struck with a gangrene. Not entertaining any hope of preserving the skin, with a view of accelerating its being thrown off, and preventing the evil consequences of a deep seated suppuration, which would necessarily take place internally, we thought proper to make scarifications, and even incisions. The dressings were afterwards applied according to art, and in the space of a fortnight the eschars began to fall, and exposed the muscles of the legs for the whole extent of the burn. In this state I substituted instead of the first dressings [it does not appear whether these first dressings were the populeum at first applied, or any other application *according to the rules of art*, as mentioned being applied after the scarifications] equal parts of cerate [*ung. é lapide calaminari*] and populeum; large soft pledgets of which were applied. The suppuration was for a long time very abundant; to moderate which, greasy applications were desisted from, the use of which is indicated only in the first moments; and recourse was had to wine with honey, and, in the end, dry lint. Cicatrization began pretty quickly around the edges, which was encouraged by applying pieces of cloth dipped in the Nuremberg plaster [I do not know its composition.] Small points of cicatrization were imperceptibly formed in the different parts of the wound, and made as it were so many

many little islands, which soon joined with each other, and blended themselves with the circumference, so as to form a greater number of curative edges, which appeared to multiply the powers of Nature. The part of the wounds which was over the gastrocnemii muscles, resisted for a long time every means that could be used to them. Nature seemed fatigued with her exertions, and the cicatrices remained for some time stationary; even those which carried the appearance of being well formed and strong, began to give way here and there. These circumstances were frequently attributed to the irregularity of the patient; but they more essentially depended upon the very rudiments of the skin being destroyed. The muscles being laid bare, the process of skinning was with difficulty carried on upon the muscular fibres, which offered no good base for its formation. Continually exposed to the involuntary contractions of the muscles, the tender new formed skin was frequently torn and destroyed, and often, at the end of a week's dressing, the wound was more considerable than before. It was with the greatest difficulty that the last point of cicatrization was accomplished.—With this view I have been induced to point out the difficulty, to shew the inefficacy of the variety of means pointed out by interested people, as a radical cure of such a serious accident.

Besides

Besides these means, many astringent lotions are recommended ; such as a decoction of aristolochia, plantain water with prepared tutty, a decoction of Peruvian bark in wine, and many *etceteras*. That which succeeded the best with me, was a solution of *lapis infernalis* and dry lint : Yet by employing all these means, it required a full eighteen months to cure the right leg, and more for the left. After some time the right leg acquired strength and motion, so that he was enabled to move about with the assistance of crutches, hoping that the left leg in time would recover its powers. The severity of the accident, the oppressive position the patient was obliged to keep, made him fear he should lose the use of his legs. I always kept up his spirits, by assuring him of the contrary, and I have not been disappointed ; time, with proper and repeated flexions, partial warm baths, and rubbing the part with a pomatum, restored to the muscular parts their softness, and, to the joints their motion."

The above case, as related by Monf. Didier, was certainly a very bad one, and consumed a great deal of time, as well as required infinite care, during its very tedious treatment : The circumstances are related with great candour, and I hope I shall not be accused of a wish wantonly to blame any person, should I even in this instance say, that I believe the symptoms were rather aggravated than
relieved

relieved by the faculty. I shall afterwards make the same confession in my own practice, which must be my apology. The first treatment was inconsistent; cold was applied to render torpid the increased action of the part affected, but not long enough continued to effect its purpose, consequently the irritability of the part was accumulated, and then, instead of being treated as a part torpid with an increased irritability, it was excited by alcohol; this, of all modes of treatment seems to be the worst conceived; no principle determines it, and the unhappy consequences that followed this inconsistency was carried still farther; for after the alcohol had stimulated the parts, after their irritability had been accumulated, the mode was then changed again, and the soft populeum was applied. The scarifications were both useless and pernicious, and is highly probable that the parts were then dressed with the Egyptian ointment and spirit;—the idea of a deep seated suppuration from such a superficial injury is absurd; it becomes the business of the system to throw off such injured parts; and according to its energy, that will be done in a longer or shorter space of time. I hope I shall afterwards shew by observations taken from actual attendance, in a great number of cases of a similar tendency, that to bleed and otherwise debilitate the patient by what is called the *antiphlogistic regimen*,
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(in the first moments) is a plan pregnant with the most dangerous consequences. To do this is one of my great objects; and if I can do it with half the energy I feel it, I have no doubt it will answer the purpose I intend.

Observations upon an extensive burn, by Mons. Reyne, surgeon, at Vaucouleurs.

“ On the 27th of October, 1774, a young woman of 28 years of age, was brought to the hospital of La Charité;—in a paroxysm of epilepsy she had fallen into the fire, and was alone at the time of the accident. Having been sent for to give her assistance, I found her in a most deplorable state, suffering the most excruciating torments. The superior extremity on the left side, from the upper and middle part of the humerus to the ends of the fingers, presented only one scorched surface, hard stretched, and no appearance of blisters; the accident was the most severe at the inferior part of the extremity, and still more so on the anterior and inferior, than on the posterior and inferior. The wrist as well as the fingers were of a black colour. These parts were all considerably diminished in size; and the two last phalanges were so contracted as to lose the power of extension. The motion even of the lower with the upper arm
could

could not be executed without violent pain. The left breast, as well as the anterior part of the thigh and leg of the same side, were pretty deeply burnt. The right side, though less exposed than the left to the action of the fire, did not escape without feeling its effects. The burn extended not quite so high on this arm as the other; the fore arm, the wrist and the fingers were spared in different parts anteriorly. Blisters were observed in different parts of the breast, abdomen, and thigh of the right side. At the very sight of such a terrible accident, the first impulse was to abate the pain; I opened the blisters to discharge the extravasated serum, and made an ointment with linseed oil, virgin wax, and calamine stone;—all the parts that had been exposed to the action of the fire were covered with plasters spread with this, upon lawn paper. The patient was *twice bled* that night, and *once* the following morning. In the taking off the dressings, which was done at the end of four and twenty hours, little change had taken place; the plasters remained equally moist, except in those places where the blisters had been, and the pain was little diminished. I continued these dressings during three days, when the burnt parts began to exhale a thick fetid vapour. The wrists and fingers of the left hand were the only parts which did not give this sign of *volatility*; this made me fear that

that the vital action of this part was destroyed. The great extent of the wounds, and the frequency of the dressings, which I foresaw must be the consequence when suppuration was established, induced me, from motives of œconomy, to make use of an ointment which I had frequently ordered to poor people, and seen used with success. Lemery praises it very much, and says there is no application of such general use, in all species of burns, and in all stages. It is made with two parts of hog's lard, and one of fresh horses' dung, fricasseed together for some time over a slow fire, and then strained. Two days after ~~this~~ the use of the skin became much softer, and rose in those parts where the burn was the most superficial. The wrist and fingers of the left hand also gave the same marks of life, which, as I have before mentioned, were shewn by the others. As soon as the suppuration was established, I cut off the eschars as they became detached, so that the body of this poor girl was covered with deep ulcers. The superior extremity of the left side having, as I have already remarked, suffered the most, it had the deepest ulcers; there were places where the bone was exposed, and the extensor tendons of the fingers were partly destroyed; thus the flexors having nothing to counteract their action, drew in the phalanges. Notwithstanding this, as soon as the parts which covered them were

a little softened, I was enabled to bring them into their proper position ; the capsular ligaments were bare and open in some points, so that I despaired of saving them. To have taken them off would have simplified the cure materially, but the desire of saving for the poor girl such useful and necessary organs, induced me to make every attempt in seconding the efforts of Nature for this purpose ; and I had the satisfaction to find that my endeavours in this point were not fruitless. After a month of this treatment, when the exposed fibres looked healthy, and the superficial ulcers were drying, the cure was stopped and retarded by an accident, the cause of which I could not divine. A general leucophlegmatic habit, with a tendency to an ascites, on a sudden shewed itself. The ulcers discharged a great quantity of serum ; and the fibres, which were before red and healthy, became white, flabby, and fungous. I had my fears for the life of my patient ; but by the use of the aperient remedies generally resorted to in such cases, this disease disappeared almost as quickly as it came. The ulcers did not easily recover their former healthy state, yet by time and proper treatment, I ventured to hope for a perfect cure. On the whole surface of the burnt parts there daily arose points of drying [skinning] according to the depth of the wound ; these increased their circum-

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ference,

ference, and joined each other. Water retiring from an unequal surface after an inundation, will give us a tolerable idea of the appearances that took place. At the end of ten weeks the breast, the right arm, the abdomen, and the thighs were cured; and there only remained the left breast, a part of the fore arm, the wrist, and the fingers of the same side. These ulcers were of a much more obstinate tendency than the others; they even yet required three months more dressing. The breast was nearly destroyed by the great suppuration, the extensor tendons of the fingers and the metacarpal bones both exfoliated; and notwithstanding all my care, the fore and middle fingers could not be preserved. During the whole of this long cure I always used the same ointment to the soft parts; and to the denuded bones, lint dipped in tincture of myrrh and aloes. To prevent an anchylosis the joints were made to perform their proper motions, and I retained them in a state of extension to prevent the unpleasant consequences of forming the cicatrix in a state of flexion. In the beginning the patient was put *upon a severe regimen*. I made her take *cooling ptisans*, and *calming soothing potions*. She was discharged from the hospital in the month of April following, having been there six months; she was afterwards enabled to gain her livelihood by spinning cotton, with the fingers that remained.

What

What is worthy of remark is, that during two years and a half she has been cured, the fits of epilepsy have been more distant the one than the other, and of shorter duration than before."

The above case, communicated by Mons. Reyne, does not raise his mode of treatment very high in my estimation. There undoubtedly was a stricter adherence to principle than in the former case. This, so far as it goes to enable us to draw clearer inductions from it, is the better; as I hope a number of the ill consequences may fairly be imputed to the treatment.—The external means from the first were of the soothing or cooling nature, and the general or internal means were highly so;—two bleedings in one day, and one the following morning; with a severe regimen, cooling ptisans, and soothing potions, to a poor weakly girl subject to epileptic fits!—I am only surprised that her system was enabled to withstand such treatment.—From the very account given of the volatile or ammoniacal smell of the eschars, it would appear that the system had so little a share in throwing them off, that they rather appeared to be undergoing a chemical decomposition, than under the influence of a vital process. The dropical appearances which took place afterwards, no doubt originated, in a very great degree, from the same debilitating mode of treatment.

The former part of this memoir is drawn up with great accuracy, and places in a very strong point of view the want of principle in our former treatment of this accident. The remedy they offer to notice, viz. cold, does not appear to me to possess the powers we want; nay, on the contrary, it is diametrically opposite; but as this is a position in which I hope its inefficacy may more clearly be pointed out, it perhaps is better than if it had been *nearer* the truth.

In conversing with an ingenious friend, who is a surgeon in the navy, of considerable practice and nice observation, he informed me, that when his ship was at Barbadoes during the American war, some of the men were much burnt by an explosion from some gunpowder; they were immediately sent to the naval hospital, and the whole of the method used for their relief was nothing further than anointing them with oil by means of a feather, and that thus they remained tormented for a few days, when they expired.

A gentleman who received his medical education at Whitehaven, where accidents of this class frequently happen, informed me, that the oily applications, and the antiphlogistic regimen, are the only means used by the faculty in that district. In short, I have conversed with gentlemen of the faculty who have practised in all quarters of the world,
both

both in the army and navy, and have found the greatest number had seen used, and been in the habits of using, emollient applications ; some, linseed-oil and lime-water ; others, Goulard's water and saturnine applications : One physician told me an old woman used to be famous for curing burns, and that she washed them with gin ; another said he had seen spirits of wine applied with great success ; but all, without exception, when they came to speak of internal means of relief, always agreed in the cooling antiphlogistic method, with this reserve, that they admitted the use of anodynes to mitigate the intolerable pain.

One of my chief motives for committing these observations to writing was the having facts to bring forward to shew the fallacy of these opinions, which have continued for ages, and might remain so for ages to come. Peculiar circumstances have made me more attentive to this accident ; and as opportunities do not happen frequently to individuals duly to appreciate many opinions, when facts do happen that give them an occasion of detecting error, it becomes a sacred duty to them to communicate such observations to society.

CHAP. III.

First Mode of Treatment.—The Progress of Medicine much retarded by Cures effected in slight Injuries—Severe ones best for ascertaining Truth.—Oily Applications externally universal in this Neighbourhood.—Complete debilitating Plan internally.—A Case A. B.—Death happened upon the ninth Day.

FROM the very great variety of applications so strongly recommended by the first characters, an unbiaſſed individual would be at a loſs on what to determine; and were we to add the miraculous cures performed by the noſtrums of every village doctreſs, we ſhould only add to his embarraſſment. I preſume one of the great cauſes of error is the aſſigning to various applications the cure of ſlight burns, ſome of which no doubt would have got well without any, and perhaps much ſooner than with thoſe which were uſed.—This miſtake frequently happens from good motives, and by the beſt intentioned people; for if we have ſeen a perſon recover from any complaint during the uſe of any

any particular means, we naturally imagine such beneficial effect to have arisen from that cause, although, upon further investigation, it may be found to have been inadequate.—There cannot be a more fruitful source of error than this; for the sanguine and credulous have always facts to bring forward in support of their favourite remedy; and, as they say, “There is no arguing against matter of fact:”—Surely not,—but what do such facts prove?—Nothing more than this, that there are some persons whose vital power is so strong, that, with all the endeavours of officious ignorance, it cannot be overcome. This is the fruitful source from whence all quack medicines draw their support: nothing is more easy than to have as many of these attested facts as you please; these facts beget dupes; these dupes beget knaves; and so the circle is formed. And the evil seems to have taken such root in the country, that to exterminate them is beyond the power of individual efforts; but the evil is progressive, and when it becomes of a sufficient magnitude, an enlightened legislature must relieve the country from such a hydra. To avoid this source of delusion, I purpose bringing into comparison very severe cases only, and some which must, in all probability, terminate in life or death, according to the different modes of treatment.—Such a view will at once do away all dis-

trust, and, I hope, give room for the establishing of principles or laws which will be found unalterable, according to the present arrangement of the system of Nature*.

It will not be necessary to apologize for any mode of practice, as all may be supported by high authority. I shall therefore begin with that which I learnt *en routinier*, and which, from enquiries, I find has been the practice of the first practitioners in this neighbourhood for a century back, and has been, and is at present, the mode pursued in the hospital here in respect to burns or scalds which accidentally happen.—The sufferers, however, from that species of accident to which I principally allude, seldom or never go to the hospital, but are, in general, attended at their own houses by the surgeon who attends the colliery. When sent for to a patient who was burnt by an explosion in a coal pit, the messenger, according to his report of the extent of the injury, was furnished with common green, or linseed-oil, with

* As far as man is physically a part of that system, it is his interest to know the laws, and his duty to obey them; for in every deviation from them, there is undoubted punishment according to the unlawfulness of the action. Thus it is a general law of Nature for fire to burn; so that if a man place himself, against his *own* law of self preservation, in contact with fire, Nature will follow her law, and he in the instant is punished for transgressing it.

with ceratum flavum, made softer with a greater quantity of oil, for the convenience of spreading, and lawn paper to spread the salve upon: When you arrived and examined the patient if there were any vesicles (or, as they term them, *blushes*) arisen, you were immediately to snip them with the points of your scissars, to let out the extravasated lymph.—On the dexterous execution of this part of your business depended in a great measure your reputation with the patient and his attendants; when this was done, you anointed him well with the oil, which in general was applied by means of a few feathers they have taken care to pick up for you; the ointment was then spread pretty thick upon lawn paper, and cut in the most convenient manner to be applied to the different parts of the body which were injured, and afterwards kept upon the parts by bandages, if on the extremities; you then saw your patient put to bed, and left orders that, when the plasters were dry, or he complained of great pain, they might raise the dressing, and anoint the pained part with oil.—To this order they paid due attention; for I have known in extensive burns where the paroxysms of pain have been severe, that above a gallon of oil has been applied in the course of four and twenty hours to one individual: When such accidents happened in summer, such a deluge as this caused upon the bed

and

and linen, and the heat of the weather tending to make it more rancid, gave rise, in the course of a few days, to such an effluvium as contaminated the air of the house.—This alone would have been a terrible ordeal for a delicate constitution to have gone through.—This mode was pursued until what they termed *the fire was killed*, when the oil was desisted from, and the ointment alone applied. This term of *killing the fire* means the period when the pain ceases, and the suppurative process begins to take place;—this seldom happened until the fourth day, and the more severe the burn, the later this salutary process begun: If it did not take place by the eighth day, the patient was exhausted by the symptomatic fever; the irritated parts lost their colour, the tumified parts suddenly fell, and spots of various hues on the burnt surface took place, from ash colour to dark and livid, approaching to black; the face shrunk, the pulse became tremulous, and a hiccup announced the approach of death, which happened always in five cases I have seen upon the eighth day, or the succeeding night; this was the uniform progress of this complaint so treated externally.—Internally, the plan of cure was perfectly consistent with the external means;—what is termed the antiphlogistic plan, which Van Swieten asserts in all cases of burns must be strictly attended to, was duly observed.—

served.—Under the idea of the fire having got within him, (which is certainly possible to have been the case upon the surface of the lungs,) oily emulsions were given in large quantities, for the two or three first days, with an opiate at night;—if the fever ran high, cooling purges were given, with nitre powders, and *decoctum antiemeticum*, or some cooling febrifuge drinks: This was generally the course until the suppuration took place, and perhaps the day before the patient's death a cardiac julep might be ordered, at which time we well know he was out of the reach of medicine, as a mortification had then taken place. In those cases where recovery followed the above plan, the secretion of pus was very abundant, and it was very difficult to prevent the surface from putting on a loose, glossy, fungous appearance, which required the use of astringents, such as infusion of roses to wash the part with; and if very obstinate, strong vitriol water, or any caustic application; the consequence of which was very unseemly and tender cicatrices. With a view of supporting the patient's strength, as soon as the suppurative fever ceased, and the plentiful secretion of pus took place, he was ordered more nourishing food, and to take the bark, and if his circumstances were adequate, he was permitted to indulge in a little port wine; but in general, an ale posset was substituted,

substituted, as a stimulus more congenial to his former habits of living : As the pain ceased and his appetite increased, he indulged it to the utmost, supposing he was assisting the intentions of his surgeon to support his strength : Thus I have seen a fore of this kind become as it were a drain to the system, and be almost as difficult to cure as an old ulcer.

Having thus drawn a concise general view of the manner of treatment I found in use in these cases, I shall draw up one case which terminated unfavourably ; and as there were very few changes of symptoms in the others which I saw, this may be looked upon as a description of the whole.

C A S E.

A. B. a pitman, aged 30, was exposed to the contact of the flame disengaged from a collection of inflammable air (hydrogen gas) in a coal-pit in the neighbourhood of Newcastle in the year 1786 : The dress he had on was a flannel waistcoat and drawers ; these preserved the parts which they covered, from the effects of the fire : Viewing him thus equipped, the parts which remained liable to the action of the flame were his face, neck, breast, arms, hands, legs, and feet ; after examining him I found several vesicles formed on his legs and feet ; these were cut with the points of a pair of sharp

sharp scissars, and then he was anointed with oil, and plaisters of yellow wax and oil, spread upon lawn paper, were then applied: When he was put to bed, upon inquiry how he felt when the fire left him, he said he was in great pain, and had as violent a *shivering fit* as if he had been in the ague. It is not above two hours since the accident happened, and he has had three of these shivering fits. As his face is much burnt, there is reason to be apprehensive that he may have inspired some of the fire, and injured the surface of the lungs; the arms appear much burnt, for they have not shewn the re-action which slighter burns do, by quickly raising vesicles. He is ordered an oily emulsion, with a view of being of service to the internal injury; and is to have an anodyne at night, with thirty drops of laudanum.

Second day.—Has passed a very restless night; very few intervals of ease, and those only of short duration; was frequently anointed with oil during the night; his pulse 100, felt in the groin as the wrists were burnt; on dressing him to day found some more vesicles on the legs, and some upon the neck and face; these were cut as the former; the extent of the burn is much more easily perceived to-day than yesterday; the injured parts are now distinctly marked by their colour, which is a kind of dirty red, as if stained by port wine; this colour

lour may partly proceed from some of the fine coal-dust which insinuates itself into the skin, and is difficult to be taken off: I have sometimes tried to wash it off with a fine rag and warm water; but if the injury has been considerable, the attachment between the cuticle and true skin is so much destroyed, that the cuticle is torn like wet paper, and exposes the true skin in a most exquisitely sensible state: This attention to cleanliness must therefore be avoided. He is, as before, anointed and covered with plasters; a dose of purging salts is given, and the anodyne repeated.

Third day.—The salts had given him two stools, notwithstanding which he passed another restless night; the arms feel tense; they are again dressed as before; some cooling powders are ordered with nitre, and ten drops of laudanum added to the anodyne.

Fourth day.—Pulse 112; urine high-coloured; the arms are considerably tumified, and round the circumference of the injured parts of the arms an induration or thickening, somewhat raised, with an appearance of a fresh inflammation; more lively in its colour than that which was caused by the accident; emollient cataplasms are to be applied to the arms; the medicines continued as yesterday.

Fifth day.—Pulse 120; urine the same; has
had

had no evacuation by the bowels since he took the salts ; is to have a purging enema, and other medicines as before ; the inflammation, mentioned as taking place round the edges of the burnt places upon the arms yesterday, still continues, and is rather broader, being in some places near an inch in breadth ; the highest colour where it joins the burn, and gradually shaded away to the natural colour of the parts, very much resembles the inflammation arising from the efforts of the system to throw off an eschar formed by the application of a caustic. The other parts of the body continue much in the same situation, nor is there yet any appearance of pus.

Sixth day.—Pulse 130 ; the glyster procured a stool ; was delirious during the night ; tongue parched, and complains of a great thirst ; is to have a pint of *decoctum antiemeticum*, and his anodyne ; the inflammation around the edges still continues, and there are several ash-coloured irregular spots in different parts of the arm where it was burnt ; still no appearance of pus in the legs, neck, or face.

Seventh day.—Pulse 130 ; not so strong as yesterday ; has been delirious during the greatest part of the night, and appears at present in a comatose state ; has frequently a hiccup after drinking ; and sometimes his stomach rejects the fluids which
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are given, (which consist chiefly of tea, broth, or his medicines;) he is ordered a cardiac julep, and his anodyne: The ash-coloured spots observed yesterday are more numerous, and appear drier; the whole of the arms do not seem so much swollen, though the inflammation around the parts still remains, but not of so bright a colour.

Eighth day.—Pulse 130; very unsteady and small, mouth much parched, and seems in a continued stupor; hiccup still remains; the swelling of the surrounding parts has disappeared, and also the inflammation; the whole of the burnt parts have a nasty brown colour, and the spots which were only ash-coloured are now of a much deeper hue, resembling those of a mortification from any other cause; medicines as before.

Ninth day.—He continued in the state of stupor as mentioned yesterday, until early this morning, when he expired.

CHAP.

CHAP. IV.

Second Mode of Treatment.—*The present ardor in search of Truth is remarkable, and promises much.*
—John Hunter's merits as a Physiologist.—*Observations on the Case A. B.—Case C. D.—Internal Treatment stimulant.—External, oily, or debilitating.—Life protracted to the twelfth day.—Case E. F.—Internal Means stimulating—External debilitating.—Life preserved, but the Cure tedious, from too long continuance of the stimulant plan.*

IN the preceding section I have faithfully detailed the symptoms of a violent burn, which terminated in the death of the patient, between the eighth and ninth day.—I might have added four other cases which I have seen treated, and ending in the same manner; but as they offered so little variety, I thought this one would shew the natural course of the complaint, under similar circumstances; and I have likewise confined myself to the most severe cases, as from such a method I hope a comparative view will tend to fix the attention of practitioners; by which means the subject may be

thoroughly investigated, and the public at large will be benefited.

The opinions collected in the former part of the work will shew that the manner of treatment, particularly internally, was conformable to the advice and practice of the most orthodox in medicine and surgery. Perhaps, strictly speaking, the antiphlogistic plan was not carried so far as they would have recommended, for bleeding was not had recourse to in all the cases, although in one I knew so little what to do, from my own experience, that I followed the advice so strongly insisted upon by the first authorities in medicine, and tried bleeding; it gave no relief, and certainly was of no use, as the patient died in the same manner as the others. It is in the internal treatment alone that we find a uniformity in the opinions of all: Their ideas of abating inflammation by reducing the powers of the system; by bleeding, purging, and above all by a low diet, have acquired a sanctity by age, and the habit of implicit obedience inculcated by the schools; but the liberality of the present æra may perhaps expose us to the hazard of an opposite extreme, as the mind just broken loose from its fetters is hurried on to lengths it would not have gone, had it been originally cultivated with liberality. These excesses, however, will be temporary, and the advantages will be permanent;

manent; for when men seriously, and without prejudice, seek after Truth, for her own sake, there can be little doubt of their success in finding her. The celebrated John Hunter has marked out one of the best methods for studying the laws of the system. With that acumen which so peculiarly marked his character, and that respectful attention to the powers of the system which a knowledge of the laws of Nature inspires, he has observed the peculiar healthy and diseased actions of parts, and noted them in so clear a manner, that, should the same method be followed by other individuals, we may hope, in time, to form a collection of pathological remarks, which will display the whole power of our complicated system.

The external mode of treatment was according to the orders of Van Swieten, in the cases of irrefoluble burns, which these in certain parts undoubtedly were, particularly in the arms of the case above-mentioned, (though I believe other parts were resolvable, although they were not resolved, but of that afterwards :)--Certainly the external and internal means used were concordant with each other; for the bland, smooth, oily substances agreed perfectly with the cooling medicines: Thus one principle seemed to govern the whole, except in the emollient cataplasms. This exception may appear extraordinary, for as far as

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they were emollient they certainly classed in the same species; but as they are the best means we have of applying caloric or heat to any part of the body, in this view they will class under a very different species, namely, the strongest stimulants.

In the case of A. B. we observe a great part of the body exposed to the action of flame upon it; this, in some parts, as the legs, induced an immediate reaction with the formation of vesicles; but, from the fire acting more violently upon the arms, the organization of the parts was destroyed which prevented their reaction, as they then became dead parts, no longer capable of fulfilling the functions which are assigned to them in health just as parts destroyed by a caustic. From this rude an attack it became necessary to summon the whole system; this we repeatedly find to be done in the shivering fits; and, in all injuries of this kind, when they are great, the same effects take place; and, according to the torpor previous to and during the shivering stage, the consequent reaction of the system will be more or less. Under this point of view the fever will appear a necessary effort of the system to throw off these dead parts, and certainly will not require a debilitating plan, but every support, until it is enabled to disengage itself, and restore the surface to its natural state, that is, to the state of a secreting surface.

face; for the skin in its healthy state is both a secreting and absorbing one, as is sufficiently demonstrated by various experiments. Thus we see the surface of a wound or ulcer performs the same functions as when covered by the skin; and the healing of such diseased secreting surfaces will very much depend upon the nice equilibrium maintained between the secreting and absorbing processes. We find that the system was enabled to withstand the violent irritative fever produced upon the immediate application of the injury; for when the patient dies from irritation, it happens before the fourth day, as I have had occasion to see in three cases: On the fourth day the suppurative fever seems to take place; the parts immediately in contact with the injured parts then begin to tumify, and an effort is raised to throw off these sloughs, which if the system is not able to accomplish before the eighth day, it is overcome, and the patient dies of a real mortification; which appears from the ash-coloured spots, and their becoming more livid before death. The sudden disappearance of the swelling, with the vomiting and hiccup, leave little room to doubt of this fact.—From viewing the disease under this aspect, I was induced to treat the following cases in the manner of a mortification arising from any other cause,

with respect to the internal mode, as I thought it would be more easy to overcome any objections, that prejudice might form against medicines, than against the external applications, of which people in general think they are judges.

C A S E.

C. D. a pitman, aged 35, belonging to a colliery in the neighbourhood of Newcastle, in the latter end of the year 1790, was in the pit when an explosion took place from his candle inflaming a quantity of hydrogen gas, which had been collected in that part of the pit, since he had worked there the day before: The dress he had on was a pair of flannel breeches, shoes and stockings, and a flannel waistcoat; this covering saved his lower limbs from being affected by the flame disengaged in the combustion, so that only his face, neck and breast, hands and arms, were exposed: From some of his companions saying he called out much while surrounded by the flames, there is reason to be afraid his lungs may be affected; after the fire left him he had a severe shivering fit, which was succeeded by intense pain; it is now an hour and a half since the accident happened, and he is trembling as if in an ague fit; he takes sixty drops of laudanum immediately; as they suppose he is burnt in the inside he must have something oily; he :

he therefore has an emulsion, in which an ounce of camphorated tincture of opium is put, and at night two grains of opium : The oil to anoint with, and the salve upon lawn paper, are applied as in the former case already stated.

Second day.—Has passed a very restless night, with great pain, notwithstanding the large opiates; pulse 100; has been profusely anointed with oil, (a gallon used since yesterday), the greatest part of which is worse than wasted, as it remains upon the bedding, and, with the heat of the patient and the atmosphere, generates most noxious and offensive odours; several vesicles about the neck near the roots of the hair; the hair itself on one side of the head nearly destroyed by the fire; this has saved the part underneath, as the scalp seems unhurt, and the adjoining skin only has suffered.—The extent of the injury is more plainly perceived to-day than it was at the first dressing; the different colour of the sound and unsound parts is very easily discriminated, and the irritated parts have the same dull red from the fine coal dust attached to the skin, as mentioned in the former case. Under the right arm and in the axilla the fire seems to have been particularly severe; as this had not the dark red colour, but was a brown, as if the fire had deprived it of life, and partly charred it, the parts were

dressed as before. Having seen the effects of the first mode of treatment, I had determined the first opportunity to try if an internal stimulant mode of treatment would be attended by more beneficial consequences. I wished therefore to begin early and before the patient's strength was exhausted, to see if I could get him beyond the fatal eighth day, and thus support the system to throw off the deep sloughs, and afterwards assist it in the curative indications as symptoms required; with this intention he was ordered a drachm of bark, with half an ounce of the tincture of bark, and ten drops of laudanum, to be taken every two hours, and sixty drops of laudanum in a cardiac draught at bed-time. According to this plan the diet was allowed at the time to be what it formerly was in the latter stages of the complaint, when the patient's strength was wished to be kept up, with the idea of supporting him under the profuse secretion of pus, which always took place when the patients recovered by the former plan of cure: Thus he was allowed to have ale posset night and morning for his breakfast and supper, and any solid meat or strong broths that he could take for dinner, with port-wine-negus for his common drink.

Third day.—Has been restless and uneasy these four-and-twenty hours; his slumbers at night were short

short and disturbed; the appearance of the wounds much as yesterday, except the right arm, which, though not much changed in appearance, is beginning to feel tense, as if a deep inflammation was about to take place; an emollient cataplasm is applied, made with linseed-oil and white bread; an ounce of laudanum was added to a quart of the oil; the bark, laudanum, &c. are continued as ordered yesterday, and he is to have an anodyne to take to-morrow morning two hours before the time he is dressed, with sixty drops of laudanum. Not having had relief by his bowels, he is to have a large purging glyster.

Fourth day.—Pulse 110; the glyster procured a large evacuation; symptoms much the same as the day before; though he takes so much laudanum, does not appear to have so much stupor as those I have seen before who only took it in small quantities at night; he takes his medicines very well, and his generous diet rather with pleasure than reluctance; the right arm rather more swollen, and the face puffed up about the eyes; continues the medicines as before.

Fifth day.—The swelling of the face and arm still continues the same; the edges of the part described to be so much burnt in the axilla, extending itself to the integuments that cover the pectoral muscle, and on the arm to those which cover
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the insertion of the deltoid, the superior parts of the biceps muscles are beginning to thicken, and a fresh line of inflammation forming round the part described; the emollient cataplasm is continued to the arm, and the dressings as before to the burnt parts; the medicines continued as before.

Sixth day.—Pulse 120; the appearance of the parts much the same as yesterday; has had no evacuation by the bowels since the last enema; it is to be repeated immediately, and should it not procure a stool, to be repeated at night; to prevent constipation, he is to have five grains of calomel and aloes, in pills, to take at bed-time; other remedies as before.

Seventh day.—He had the second glyster given him, which brought away some hardened fæces; the pills to be repeated at night, with the calomel and aloes; I avoid a liquid form of purge at this period, as I wish to keep the stomach free from any nauseating effect of medicine, as this is a critical period, having found all those who sunk under this accident to have gone off the eighth day or the night following; as he has taken his bark, the laudanum, and his generous diet hitherto without hesitation, it makes me more anxious to avoid offending his stomach, upon which so much appears to depend. There seems little alteration in the appearances to-day, except that the inflammation

tion round the great eschar seems to have spread a little in its whole circumference, which, as it appears similar to the inflammation arising on the original accident, gives rise to an idea, formed by the friends of the patient, that the fire is not yet killed, though this arises from the severity of the original accident, and is evidently an effort of the system to throw off this dead part ; yet of this it is difficult to convince them, the more so, as this is a fatal stage of the complaint, from which few recover.

Eighth day.—He has had a stool by the pills ; continues his medicine ; does not take his food so well as before, although his stomach has not yet rejected it after it is taken ; is to have twenty drops of æther with each dose of laudanum and bark, and half a dram in each of his anodynes ; the parts appear much the same ; the eschar has not begun to separate, nor do the other parts of the body which were burnt appear to have more moisture than what arises from the dressings, so that there cannot be said to be any pus secreted yet.

Ninth day.—Pulse 125 ; urine high coloured ; in other respects the same as yesterday ; there is yet no appearance of pus.

Tenth day.—In dressing him to-day some small vesicles were upon the eschar in the axilla, which,
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upon being punctured, emitted nothing but a little gas; this symptom is common in mortifications happening in different parts of the body, and convinced me that I was right in my conjecture of the patients in such accidents dying under a real mortification if they survived the eighth day; the skin beneath the cuticle where the vesicles were, is of an ash-colour; the face is not so much swollen, tho' the inflammation continues around the eschar, but no separation of the skin between the original injured parts and those excited into inflammation by their continuity, nor is there yet any pus; he objects to take his medicine so frequently as before, and has now and then a hiccup; has had no stool, therefore let him have five grains of calomel, and ten of aloes, in pills, at night.

Eleventh day.—Pulse 135; has rejected his medicine twice, and once some food they gave him; the hiccup more frequent; the swelling of the arm has a good deal subsided, and the inflammation also; they are to give him as much wine as he will take; has a good deal of stupor.

Twelfth day.—Pulse very small, quick, and unsteady; has been comatose the last four-and-twenty hours; the swelling and inflammation of the parts entirely subsided; mouth very dry, and takes little; continued in this state until the evening, when he ceased to breathe.

CASE.

C A S E.

E. F. a young man, aged 20, belonging to a colliery in the neighbourhood of Newcastle, was exposed to the contact of flame disengaged from the combustion of hydrogen gas, in the summer of 1791: The dress he had on was breeches and stockings, which saved his lower limbs; the whole of the upper part of the body was consequently exposed; says, he threw himself upon his face as soon as he found his situation, by which means the fore part of his body has not been so much injured as the back part, neither the mouth nor nose being burnt: I had no doubt in my own mind of his having escaped any internal effect from this accident; this prevented me being obliged to accord with their prejudices, by giving him oily remedies internally, and, from the preceding case, it may be supposed I found the power a different mode had given me of continuing the existence of my patient for at least half the usual period: I therefore lost no time, but immediately begun the stimulant plan; he had 50 drops of laudanum in a cardiac draught given immediately, and to be repeated at night; a volatile julep, with *aq. menth. pip.* was ordered during the day, and the diet was allowed to be as good as he could take, with strong negus for his drink; the external means were such as
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have been described in the former case; has had several shivering fits before he was dressed, and was trembling during the whole time of my visit.

Second day.—Has passed a very restless night; had but few and short intervals of ease; the parts injured are more marked than they were at first; a large portion of the breast and abdomen is much inflamed, and of a dusky red, from the small coal-dust; the left side and upper arm carry the same appearance; but the back, from the nape of the neck to the breeches waistband, has a much deeper colour, more inclining to a brown; he has the opiate repeated night and morning, and the julep continued, with the same diet.

Third day.—Pulse 110; has had no evacuation by the bowels since the day of the accident; is to have a purging enema given directly; five grains of calomel to take at night, and his other medicines as before; the injured parts have changed little in appearance; the external means still continued the same.

Fourth day.—Appearances much as yesterday, except that the left arm is becoming a little tense and swollen; the same applications; the enema procured a stool yesterday, and the calomel one to-day; is to take half a drachm of bark in an ounce and a half of decoction, and half an ounce of compound

pound tincture of bark every three hours, and to continue the anodyne night and morning.

Fifth day.—Pulse 120; urine high coloured; still continues restless, and has considerable pain; the arm more tense than yesterday; applications and medicines continued as before.

Sixth day.—No change in appearance or treatment.

Seventh day.—The plaisters taken from the breast seem rather more moist than they hitherto have done; the arm much the same; the edges of the burnt part upon the back beginning to thicken, (by this term I mean to swell and inflame) as is always observed around a part destroyed with a caustic, and denotes the necessary efforts of the system to throw off the slough; medicines and external means the same.

Eighth day.—The moisture which appeared upon the breast yesterday, to-day carries evidently the marks of a laudable pus; the application of oil to this part as a liniment is desisted from; the inflammation of the arm and upon the back seems much the same; not having had a stool since that procured by the calomel, it is to be repeated; the other means continued as before.

I have thus continued my journal, thinking it necessary to give a daily account until the system had taken on the secreting action upon the surface; having,

having, in all the cases I have seen, deemed this a certain criterion of the future safety of the patient; besides, it would be tedious, as well as useless to continue the journal in this case, as twelve months elapsed during the cure of the case I am relating: I shall therefore beg leave to continue the account, by giving a view of the symptoms and mode of treatment from this time to the cure.

Although a part of the injured surface was secreting, yet a very large part remained which was prevented from performing this function, by broad, deep eschars upon the neck, shoulders, back, left side, and left arm. On the thirteenth day there was some appearance of the eschar separating in a small portion on the lower edge of the left arm; and, in a few days more, pus was plentifully secreted; the thickening of the edges around the eschars upon the back gradually took place; and about the twentieth, appearances of separation in different parts; the throwing off such broad deep sloughs was a very tedious process, and very distressing to the system of the patient; as the slough became partly detached, the loose parts were cut off; it was near three months before the last of the eschars came away; it was placed upon the spinal process of the scapula, and, from the slowness and difficulty of its detachment, seemed to include some of the tendinous fibres of the trapezius muscle, which
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are there inserted. The parts which, in comparison, were only slightly injured upon the breast and abdomen, after they had begun to secrete pus, and the external treatment altered, that is, the oil defisted from, and the cerate, with lapis calaminaris used in its stead, soon put on a pleasing aspect and healed readily; but it was far otherwise with those exposed surfaces where the eschars had been: They secreted an astonishing quantity of pus, and filled up with a loose, spongy textured fungus, which obstinately resisted the efforts to give them firmness. As this disposition early shewed itself, that is, long before the sloughs were separated, the parts were washed with an infusion of rose leaves and lime-water, finely levigated lapis calaminaris was plentifully applied as an absorbent, and dry lint covered with a plaster spread with cerate; these being ineffectual, solutions of vitriolated zinc to the whole surface, and the strong aqua cærulea to the edges were had recourse to; by a continuance of such means, varied according to circumstances, the case terminated in the perfect cure of the patient in something more than twelve months. In the dressings of such sores, for so long a time, however proper the applications may be, the parts become so accustomed to their use, that they cease to cause the salutary effects which they produced upon their first application, so that it is necessary to choose a

variety of means, apparently the same, and when one ceases to act, take another, by which means, in so long a cure, the same application may several times be so managed as to excite a healthy action of the part.

Having thus far given an account of the external means used, and appearances as they occurred from the eighth day to the cure, I shall now mention the mode of conduct in regard to the internal treatment. It will be seen, from the journal, that I had the same view in treating this case, as in that of C. D. The stimulant plan so far succeeded as to astonish me in bringing the patient through the suppurative fever, as every symptom appeared more aggravated than several I had seen, whose systems by the antiphlogistic plan were unable to take up the action of secreting pus, and all evidently died with marked symptoms of local mortification: But, not content with having thus brought my patient through the most critical stage of his complaint, to a state of comparative safety, I was induced, from an idea of the necessity of supporting him, to persevere in the same means, although not in the extent, yet in a considerable degree; the irritation of so large a wound induced a continuance of the opiates, and the immense secretion of pus made me give him the cortex as a tonic; and, with a view of assisting
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these remedies, a nourishing full diet was allowed : These means, I have since had cause to think, excited the system to the extraordinary exertions, and hurried it on to that state of permanent fever, which, in its appearance, much resembled hectic. I do not mean, by this to say, that the whole train of symptoms might have been avoided ; but I do not hesitate to confess that they might have been rendered infinitely milder, and of much shorter duration, by means I shall afterwards develope. During so long an attendance, and course of taking medicines, it was as necessary to change the remedies, that is, from one bark to another, and bitters, &c. as it was to change the external applications ; notwithstanding, by a continuance of such means as I have above related, the case terminated favourably, and shews in a strong point of view the utility, nay, I may go further, and say the necessity, of the early use of such means.

CHAP. V.

Third Mode of Treatment.—Reflections on the Cases related above.—Change of Treatment indicated, and at length established upon the following Principles—Of Heat and Cold.—Nature of the Injury produced by Fire—What Remedies necessary, with their Mode of Action.—Division of Burns—1st, Where the Action of the Part is only increased—2d, Where the Action of some Part is increased, and other Parts destroyed.—Treatment of the 1st Division—Treatment of the 2d Division.—Cases G. H.—I. K.—L. M.—Mr Hopper.

I HAVE already remarked that the termination of the first mode, in extreme cases, which appeared evidently to take place from mortification, left me little room to doubt that this train of symptoms was the consequence of general debility, from excess of stimulus at the moment of the accident, and a subsequent defect of it; and that the sympathetic fever, which arose from the original irritation, exhausted the powers of the system, without obtaining the wished-for end, which, in this case, ought to have been suppuration: And although the doctrines of
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all writers had inculcated the evacuant, cooling, antiphlogistic method to overcome the inflammation, the want of success in this, and a contrary mode in other cases of mortification succeeding, induced me to make an effort to support the system in the feverish stage of the disease; and the better to do this, I determined to begin early; for when the actions of life are sunk to a certain degree, it is no easy matter to recall the system back to her efforts. The extraordinary and wonderful effects of this trial are very apparent in the cases in the second mode of treatment. The first case is very striking; for in that, we see the life of the patient sustained to a period half, or a third as long again as his existence would have been by the first mode of treatment. This case, though not so fortunate as the next to the individual, yet, as establishing the principle, is more valuable to determine the practice; for of two persons, both burnt so as to destroy their existence, by the different modes of treatment the life of one was continued half as long again as the other; and the case of E. F. shews, that had the extent of the injury been a very slight degree less, what had prolonged his existence in the one case, would have saved it in the other. I think it will appear extraordinary, that in a local injury, I should first of all have attempted a change of the internal

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treatment,

treatment ; but when the prejudices of the class of persons to whom the treatment was applied is considered, it will be a sufficient apology for a cautious change in what they were capable of discerning ; the internal treatment was much more easily changed ; a generous diet was more congenial to those around them, they live well when well, and judge that what does them good when in health, can do them no harm when indisposed, if they have the ability to take it ; besides, I now have no doubt that had I been induced at first to try topical applications of the class I shall presently recommend, I should have found so much benefit from them, as in a great measure to have superseded the use of active internal means, by which I should not have been enabled to have drawn this parallel, and might have contented myself by having sided with those who recommended astringents, instead of those who advised emollients. I therefore hope my errors may have their use ; with this view I confess them.

It cannot be supposed but that when I found such striking benefit from this change of mode, it must have occasioned great alteration in the whole train of my thoughts upon the subject. To attempt to trace the various ideas I had upon the subject, would be difficult to myself and tedious for my readers ;—it will be sufficient for me to observe,

serve, that what appears the least abstracted method of accounting for the phenomena will be the most desirable; and, with this intention, I shall take the liberty of investigating some of the most obvious effects of heat and cold.

ON THE EFFECTS OF HEAT.

Before we proceed to describe the third mode of treatment, it will be necessary to take a cursory view of some of the phenomena of heat, as far as our present knowledge of the subject enables us so to do: The common terms of hot or cold are so vague, that they hardly convey any precise idea, depending solely upon the sensation of the individual; and the same body may, at the same time, appear both hot and cold. Thus if a person just emerged from a cold bath at 40 degrees of Fahrenheit's thermometer, and another who has been some time in a hot bath at 112 degrees, should both touch a piece of glass at 70 degrees of heat, they will give a very different account of their sensations; it will appear warm to the person coming out of the cold bath, and cold to him coming out of the hot one.—Independent of this fallacy of sense, cold is generally esteemed only a smaller degree of heat; as no such thing has yet appeared as absolute cold. Under this point of view, it will be necessary for me

first to investigate the effects of the minimum of heat or cold, as by the contrast, the effects of the maximum of heat will be the more evident: In this investigation it will only be necessary to look at those degrees of heat above and below the freezing point of the thermometer, which destroy the living principle of the subject submitted to their action:—

First, of the effects of heat below the freezing point, commonly called the effects of cold.

All animated nature is endowed with a self-preserving power, which, when assailed by noxious powers, acts according to the laws of the individual possessing it. Vegetables follow this law of self-preservation as well as animals; they bear the want of heat several degrees below the freezing point; but if the heat is suddenly abstracted after wet weather, or a thaw, the fluids contained in their vessels lose their individual power, and follow the laws of inanimate matter in respect to congelation with a lowered temperature. Thus, in severe winters, a great number of plants and trees are killed; the latter are sometimes split with a considerable report. Animals possess this power of self-preservation in a greater degree; in some of the lower orders of animality, as in the earth-worm, it exists when the surrounding medium is considerably less than

than 32 degrees of Farenheit's scale, although the heat of the worm itself did not sink below that point; but if the heat be suddenly diminished by keeping itself at the freezing point for some time, it exhausts its power of life, which, when done, it immediately takes on the temperature of the surrounding medium. The more perfect the animal becomes, the greater his powers; and, although man does not seem so well defended by nature as some other animals, yet, when we behold the advantages he has already drawn from experience, and the progressive state he is in with respect to the improvement of social intercourse, and the power of banishing unpleasant sensations by various contrivances, he has no reason to envy the fleecy covering of the sheep, nor the warm fur of the fox. But, notwithstanding those aids which man from his experience is enabled to procure, he is sometimes so circumstanced as to be exposed to a sudden diminution of heat; this happens most frequently in Siberia in Asia, in Switzerland in Europe, and in Canada in America. There are instances recorded that some of the conquerors of the new world, in the beginning of the sixteenth century, rather than take a circuitous march round the mountains of Peru to search for those mines which their insatiable avarice prompted them to seek, attempted

tempted to cross over the mountain of Antifona, where neither their thirst for gold, nor all the passions it inspired, could prevent their suffering from want of heat, which fixed and preserved them in the very place and attitude they were in when they suffered ;—they were found above a century afterwards in this state, and may be regarded as natural mummies.

Travellers in Switzerland are sometimes attacked, particularly on horseback, with a great desire to sleep ; if they do not oppose this, they soon fall a sacrifice to the universal torpor.—This mode of dying does not appear from the relation of those who have escaped it to be painful ; the surface of the body is that part which loses its motion or life the first. In Canada, when a traveller is thus seized, and appears to be dead, his companions bury him in the snow for the night, and on the following morning he is generally found in such a situation as to be enabled to pursue his journey ; but if he appears slow in coming to himself, they throw a little warm litter about him, which being some degrees warmer than the freezing point, causes an appearance of a gentle thaw, which is found a sufficient stimulus to excite the suspended functions of life. These are the effects of a low degree of heat when long continued :—It is not uncommon in countries where, during a great part of the year, the heat is much diminished,

diminished, to see people who have lost a part of their nose or their ears from this cause.

That great philosophic physiologist, John Hunter, observes that in the year 1776, the combs of his cocks in the country were smooth, with an even edge, and not half so broad as they formerly were, appearing as if one half of them had been cut off;—inquiring into the cause, he was informed by his servant that it had been common in the country during the hard frost, for part of the combs to become dead, and then to drop off. Mr Hunter imputed this to the frost which had frozen the part and deprived it of life, when consequently it dropt off: He endeavoured to prove this idea by experiment, and attempted to freeze the comb of a young cock, by putting it into a mixture of salt and ice, which stood at 0 of the thermometer; the comb itself was thick and large, and resisted the being frozen; but the serrated edges of the comb, which were half an inch long, were perfectly frozen; they were white and hard, and when a piece was cut off it did not bleed, nor did the animal shew any sense of pain: He next introduced into the freezing mixture one of his wattles, which was very broad and thin; this froze readily; on thawing the comb and wattle, they became warm, but were of a purple colour, having lost the transparency which remained in the other wattle; the wound in the
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comb now bled freely: It was near a month before the parts frozen were well, and returned to their natural colour; this they did nearest to the sound parts first, and so on gradually, until they were of their usual appearance. Mr Hunter also froze the ears of rabbits in the freezing mixture; they became hard and stiff, and, when cut with a pair of scissars, flew from between the blades like a piece of hard chip; when thawed, they began to bleed, and were very flaccid, so as to double upon themselves, having lost their natural elasticity. When out of the mixture about an hour they became warm, which increased to a considerable degree; they also began to thicken from inflammation, and retained the warmth for several days.

From these experiments of Mr Hunter, it appears that the action of the parts is suspended; for when the comb of the cock or the ear of the rabbit was cut, there was no appearance of circulation, and there was no bleeding. This suspension of action in a part of the system is by proper care to be recovered. When this happens to people in Canada, for instance in the hands or feet, they restore the action by rubbing snow upon the part, as snow is warmer than the atmosphere they were exposed to; then the coldest water is applied, and to this there is the additional stimulus of friction, as possessing
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still more degrees of heat than snow ; and by thus gradually restoring the action of the part by increasing the stimulus of heat gradually, and waiting till the part has taken on the action necessary to the degree of stimulus applied, the parts thus affected may be recovered.

But if this is not attended to, and the proportion of heat should be too great, the part will be thrown into inordinate action ; and as its powers are so much reduced, they are soon exhausted, and the part mortifies.

After reviewing the phenomena which take place in the disease termed *frost-bitten*, we see it depends upon a cessation of action of the vessels of the part, from a deficiency of the stimulus of heat. The mode of relief in this accident is, by cautiously and very gradually restoring the action of the part, by small additions of temperature, until it can bear the accustomed heat, and take up the action of the vessels to which it is attached ; thus restoring the system to its unity of action. Should internal means be necessary, they will be such as diminish action ; for if the action of the heart and arteries should be increased by stimulating the stomach, the disease will be increased, as whatever augments the disparity of action between the system and the part is noxious, for on the restoration of the equality of action depends the cure ; therefore the
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mode of cure will be to increase the action of the part by a greater quantity of heat, and to diminish the action of the system to meet the reduced action of the part, so as to form a whole again : If this is not nicely attended to, a solution of continuity of action takes place; the part, being no longer a conductor of the circulating powers of the system, becomes a dead body, and requires a process of the system in order to be separated from it, as in any other case of mortification arising from any other cause.—From this I think the following law may be established, namely, WHENEVER THE ACTION OF A PART HAS BEEN CONSIDERABLY DIMINISHED BY WITHHOLDING AN ACCUSTOMED STIMULUS, THE REAPPLICATION OF THE STIMULUS SO WITHHELD, (OR ANY OTHER WITH A VIEW TO MAKE UP FOR THE DEFICIENCY) MUST BE VERY CAUTIOUSLY ADMINISTERED, UNTIL THE PART IS GRADUALLY RESTORED TO ITS FORMER HEALTHY ACTION.

2dly, Of the effects of heat above the freezing point, carried to the extent of what is termed burning.

It appears that according to the perfection of the powers of life, the preserving powers are equally delegated : From investigation we have found the power of resisting a diminution of heat; and the experiments of Messrs Blagden, Solander, and Banks, shew

shew we equally possess the power of retaining our existence under very high degrees of heat; even to 260 degrees of the thermometer, which we may term the powers of resisting an increase of heat.

The Abbé Chappe informs us that the Russians pass hours in their vapour baths at the increased temperature of 160 degrees, from whence they immediately plunge into the cold stream, and not only with impunity, but with the most beneficial effects, both in the cure and prevention of diseases. But it is not our intention at present to point out the reaction of the system from temporary variations of temperature, but to shew the *primary* effects of a sudden subtraction or addition of heat, upon the system, with a view of pointing out a rational cure. From a diminished temperature, the diminution, and also the suspension of action and circulation, seem sufficiently proved from Mr Hunter's experiments on the comb of the cock and the ear of the rabbit.

With a view of shewing the effect of heat upon the circulation of the blood, I went into a vapour bath when my blood was going at 60 strokes in the minute; the range of the thermometer while I was in the bath was from 100 to 116; after having been in a few minutes my pulse gradually began to rise, and when I had been there near twenty minutes, it beat at 130 strokes in the minute.

nute. From repeated trials of this experiment, cannot hesitate in concluding that one of the most obvious effects of heat is to increase action; which if moderately and generally applied, is conveyed to the whole system; but if the action is sudden and great, the vessels themselves are destroyed as organs before they can take on the action, and communicate it to the rest of the system. Thus do the ends of vessels, which a few moments before had functions to perform, become inert and dead bodies, attached to living parts of the same vessels which from this moment require a process of the system to throw them off, and restore itself to its functions, viz. to those of a secreting and absorbing surface, which the skin evidently is in its healthy state: But there are very various degrees between a slight increased local action and a destruction of the part itself; probably there seldom or never happens an accident where a part can be so totally destroyed, but that other parts will only come within the limits of an increased local action.

From this view, injuries caused by a pernicious quantity of heat suddenly applied to a part of the body, may be termed *local injuries from increased action*; the mode of relief in this dreadful accident will be thus indicated in order to restore the unity of action; 1st, By gradually diminishing the excitement or action of the part; and 2dly, By increasing
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fining the action of the system to meet the increased action of the part, holding this law of the system in view, THAT ANY PART OF THE SYSTEM HAVING ITS ACTION INCREASED TO A VERY HIGH DEGREE, MUST CONTINUE TO BE EXCITED, THOUGH IN A LESS DEGREE, EITHER BY THE STIMULUS WHICH CAUSED THE INCREASED ACTION, OR SOME OTHER HAVING THE NEAREST SIMILARITY TO IT, UNTIL BY DEGREES THE EXTRAORDINARY ACTION SUBSIDES INTO THE HEALTHY ACTION OF THE PART.

With this view, holding the part to the fire, seems the best mode of relief; but as parts of the body are injured where this cannot be done, the most stimulant applications must be had recourse to, for in this class there is little fear of any of them being greater than that which originally caused the accident; the strongest rectified spirits, made still stronger by essential oils; add to which, they may be heated as much as can be suffered on the sound parts; these, and many more applications of the same class, will give the speediest and most effectual relief: These are only to be continued for a certain time, otherwise they may afterwards cause the very ill they were given to cure, and then to be succeeded by less stimulant applications, until the parts act by the common natural stimuli.

The internal mode of relief will be to give those substances which soonest excite the system to great action, such as æther, ardent spirits, opium, wine, &c. by which means the solution of continuity of action is allowed to continue the shortest time possible, and the unity of action restored, which constitutes the cure. The propriety of practising from these principles, I hope will be sufficiently illustrated in the third mode of treatment.

If the foregoing views of the effects of heat are admitted, the following will be the law from which the practice in the treatment of burns must be drawn, THAT ANY PART OF THE SYSTEM HAVING ITS ACTION INCREASED TO A VERY HIGH DEGREE, MUST CONTINUE TO BE EXCITED, ALTHOUGH IN A LESS DEGREE, EITHER BY THE STIMULUS WHICH EXCITED THE INCREASED ACTION, OR SOME OTHER HAVING THE NEAREST SIMILARITY TO IT, UNTIL, BY DEGREES, THE EXTRAORDINARY ACTION SUBSIDES INTO THE HEALTHY ACTION OF THE PART. Let us for a moment reflect upon the agent which has ^{caused} increased the evil,—disengaged caloric, the most violent and active of all known stimuli: If this is the case, we must look for some of the strongest stimuli, and the nearer we get to the one which caused the injury, it is the best for the instant, though even should that be

continued too long, it of itself might be injurious. Suppose, for instance, we apply the strongest alcohol at first, and, to render it more efficacious, it should be heated to what the sound part would bear without injury; afterwards it should be gradually diluted until it comes to proof spirit, and the heat diminished, although that gradually, as cold is always pernicious, bringing on that tendency to shiver, which should ever be cautiously guarded against, as being a most pernicious symptom, and the forerunner of a violent sympathetic fever: With a view to prevent which, external heat should be kept at a high temperature, and the action of the whole system excited to as great a degree as the safety of the subject will admit of. By this means you make the action of the whole meet the increased action of the part; by which, the lessening of the increased action of the part to join the action of the whole, is rendered more easy: Thus there is a unity of intention by both the external and internal means, which leads to the restoration of the unity of action, and thus is the cure performed. It will be said that is only the case when there is an increased action; but when the parts are destroyed, other means should be used, such as emollients, &c.

Some have divided burns into several species,—but I shall content myself with dividing them into two:—1st, *Those where the action of a part is only*

increased.—2dly, Those where some parts have increased action, and other parts are destroyed.

In parts that are totally destroyed, it is of little consequence what is applied to the dead part, as the throwing off an eschar depends upon the action of parts which remain alive, and not upon what is applied to those which are dead. But I must own I never saw an instance of a burn where, though some parts were totally destroyed, there were not, always, other parts where there was only increased action. Now, as our duty is always to save living parts, our mode of cure in the first instance will be always the same, that is, to save the parts which have only an increased action; in the doing of which, the dead parts will not be the worse, for the separation of them is a process of the system which requires time, and if the injury is to any extent, draws forth the joint efforts of the system, and even calls up all the energy of its powers to violent fever; which, from the observations in the second mode of treatment, it requires every artificial aid to support, to bring the parts to suppuration, otherwise the subject falls in the contest; for if the living parts have not the power to throw off the dead, the dead will assimilate the living to themselves, and a mortification ensue.

When the living parts have been preserved, which according to this treatment will be in the course

course of two or three days, the dead parts will be more plainly observed, and the beginning of the process to throw them off will be commencing. This process, as has been shewn in the second mode of treatment, must be assisted by keeping up the powers of the system against debility; by stimulant medicines, and a generous diet: The eschars will be much aided in coming away by the application of the stimulus of heat, by means of cataplasms frequently renewed;—they may be made of milk and bread, and some camphorated spirit, or any essential oil sprinkled upon the surface: These means need only be continued until the suppuration is established, as then a different mode must be pursued.

I mentioned in a former part of the Essay, that when suppuration had taken place, it was the custom to allow the patient a better diet, and to give more stimulant medicines under the idea of supporting the system under the great secretion of pus, which in general took place if the accident had been severe. In the case of E. F. this mode was adopted. The subject of this case was above a year before he was cured; though I must own the case, from the great sloughs that were thrown off, was the worst I ever saw; and we find in some of the cases related of scalds of the legs, that above eighteen months elapsed before they were healed.

Having found the former parts of the practice wrong, I began to doubt of this also, and determined the first opportunity to convince myself of the propriety of this mode. It was not long before I had a favourable case for the experiment ; accordingly after I had supported the system to a suppuration, I then gradually desisted from my stimulant plan, and was astonished to find that a diminished secretion of pus was the consequence, and the healing process wonderfully quickened. This is clear in the following case of I. K. for that case was finished with bleeding and purging, which used to be the beginning of others.

From this view, it would appear that the system during the time of suppuration had formerly been distressed with a too abundant quantity of food and stimulus, and had been at the pains of assimilating that which was obliged to be thrown off as an excrement ; the system thus excited took up the action of hectic, as in the case of E. F. who had flushings after eating, and exacerbations in the afternoon : Though these symptoms left him as the wounds healed, there is no doubt of their being very much increased, if not entirely caused, by the improper method of cure.

Thus we see the whole of the former treatment inverted ; the most gentle soothing means were used both externally and internally, when an accident

dent of this terrible nature happened ; these were continued until suppuration took place, and then the system was excited under an idea of supporting it, which not unfrequently so fatigued the system, as induced a fever of the hectic form. The present mode is the reverse of this ; when a part of the frame has been much excited, this part is not allowed to cease to act for want of stimulus, but is kept in action by an adequate stimulus, gradually diminishing it until it returns to its ordinary action: With the same view the internal means are highly stimulant to the whole system, which must be supposed to be in a natural state at the time of the accident. Thus increasing the action of the whole generally, by strong stimuli, and decreasing the action of the part by lessening the stimuli, the desired end will be more readily obtained, that is, the equilibrium of the action will be restored. Should the injury have gone the length of destroying any part of the body, I have observed that this cannot take place without some other parts of the system only having their action increased. The restoration of those yet living parts must be first attended to ; and this very mode will facilitate the process of throwing off the dead parts, which, when done, and a suppuration having taken place, the exciting of the system by any thing sti-

mulant, either by food or medicine, should be cautiously avoided. Should the secretion of pus continue too great, gentle laxatives, and a spare diet are indicated: If any part, as the eyes for instance, keep weak, with a tendency to inflammation, topical bleedings, or small quantities of blood taken from the arm, are useful: To defend the new skin, camphorated oil, or camphorated oil and lime-water, equal parts, are very good topical applications. Wounds of this kind heal very fast when the diminution of pus is prevented, by attention to the diet: If it is necessary to keep up the patient's strength, small doses of bark, taken two or three times a day in some milk, will answer that purpose, and will not excite a quickened circulation, as wine, ale, or spirit is too apt to do.

By attention to these general principles, I can truly assert, that I have cured very many extensive and dangerous burns and scalds, in one, two, three, and four weeks, that by the former method would have taken as many months; and some which I believe to have been incurable by the former method.

It must be supposed that before I had determined all these points in my own mind, I have had a considerable opportunity of appreciating the just value of several applications from repeated and numerous trials. At the same time, when I point

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out what I believe to be the best, I by no means purpose to say that it cannot be exceeded, but only that it has so far exceeded what I had been accustomed to, as to astonish me. The principles however are, I hope, clearly laid down; every scientific man will therefore have an opportunity of choosing for himself.

When speaking of the application of *oil* externally, to burns, I mean olive-oil, rape-oil, linseed-oil, and, in general, all oils which are obtained by pressure from any of the emulsive seeds, or kernels of vegetables. The great degree of smoothness they possess, and their being void of every irritating quality when applied to a sound part of the skin, appears to have been the great motive of their use. There certainly are cases where the cuticle receives benefit from their use: By filling up the pores they prevent absorption:*. But this very quantity which has its use in other cases is one of the chief causes why it is detrimental in this; for the secreting, or exhalent vessels of the surface being greatly excited, the absorbents ought to be urged to an equal action, or the consequence is the extravasation of serum under

* With this view Mr Hunter recommended them to his assistants, when dissecting, to apply over the surface of their fingers to prevent the absorption of animal poisons.

der the cuticle, which forms the blisters ; instead therefore of a medium that lessens or prevents an increased action of the absorbents, it should be avoided as pernicious.

With this view theoretically, I would say oil is perhaps the worst of all applications, as it has been practically proved in the cases of the first and second mode of treatment. *Opium dissolved in oil* I frequently tried, but I must confess I never found any other effects than from oil with itself : I am therefore obliged, from experience, to class it with oil, although I have heard several practitioners speak highly of its great efficacy. *Lime-water*, mixed with any of these oils, but chiefly with *linseed-oil*, is an application held in very great esteem in several hospitals in England, and is in use in most parts of Europe ;—it forms an elegant saponaceous liniment, and is certainly preferable to oil alone. On account of its consistence, and if continued during the curative process, it prevents in some degree the immoderate secretion of pus, which the too great use of oil encourages ; but as an application to be used in the first instance, it is very inadequate to produce any beneficial effect. The great repute this application possesses, seems to arise from its being contrasted with common oil ; but I am led to believe this cause has ranked it

it higher than it merits. *Goulard's water* has been very much boasted of, and is a very general application both in this and other accidents; but it is employed with very little discrimination. This, though a weak preparation of lead, partakes in a small degree of the general properties of that mineral. John Hunter thinks it lessens the power more than the action; if therefore to this is added the cold water as its vehicle, the action will be likewise lessened, so that it combines both the debilitating properties of decreasing power and action. Viewed in this light, it is highly improper, and very inadequate to any useful purpose, as I have experienced. It is likewise in direct opposition to the principle. *Goulard's cerate* is a better application than the mere wax and oil which was formerly used, and if continued during the whole of the cure, becomes a very useful application, and ranks above the linseed-oil and lime-water; but if the surface injured should be large, I have seen bad effects from its use, particularly in children, therefore the *unguentum é lapide calaminari* should have the preference.

Having been anxious to procure the opinions of practitioners upon this subject, wherever it might have been a subject of thought or practice, when upon the continent, I conversed with students
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from all the countries in Europe upon the treatment of accidents of this kind; in general they agreed in the Boerhaavian treatment already described; but at Paris I found Monf. Le Sage had recommended the use of the *fluor volatile alcali*, which was spoken of in high terms: From several trials by men of eminence, it was certainly worthy of more general use: The mode in which it was applied was as follows:—Cloths moistened with it were applied to the injured part, and renewed as often as dry until the pain vanished, when the part was said to be well. From this account I can only suppose it had been used in slight cases, otherwise the above description could not have been accurate; for the suppurative process must have required a very different treatment. I have employed the *fluor volatile alcali* myself with considerable benefit, but not in the manner above described, but as follows;—the parts were washed with a wet rag, or an armed probe, well moistened with the liquid; afterwards a plaster of a good strong digestive ointment, composed of yellow basilicon rendered to the consistence of a liniment, by the addition of spirit of turpentine: By these means a great portion of the inflamed surface was cured, if I may be allowed so to express it, by the first intention, and the parts more injured were soon brought

brought to a suppuration, and the cure considerably hastened. I had no occasion to repeat the application of the wash more than twice or thrice; this was done at each dressing, which was at the interval of twenty-four hours. I do not therefore hesitate to recommend in strong terms the use of this as I used it, or a trial of it as recommended by *Monf. Le Sage*: In slight cases I make no doubt but it would answer. *Monf. Fourcroy*, in his lectures at the Lyceum in Paris, recommends it, and supposes it may act by combining with, and carrying off, some of the disengaged matter of heat which had not had time to combine with the part, by which means the parts are prevented from being disorganized by its further action. *Monf. Chaptal* seems to be of the same opinion. This explanation favours the opinion of fire being a body, although most probably it is only an effect; but that is of no consequence; if the application produces beneficial effect, it is sufficient for the sufferer.

In this trial I must not give the whole of the merit to the fluor volatile alcali, as the mode of applying the digestive will have a powerful influence; as I shall attempt to shew in appreciating the value of spirit of turpentine. From the component parts of *æther*, from its quick and strong action upon the stomach, and from the
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great excitement it causes over the whole system, I was led to believe it would be of use externally in such cases. With this view I made some trials upon trifling accidents, and used it in the same manner as I described the use of the fluor volatile alkali; but in a more extensive accident, its use appeared less beneficial, and this appeared chiefly to arise from its quick evaporation, inducing that tendency to excite torpor on the part, and that *general shivering* which I have always found in cases of magnitude; this disadvantage was sufficient to make me desist from the external use of it; as I have been induced, in the multitude of cases I have seen, to draw favourable or unfavourable inferences, according to the degree of this untoward symptom. From the experience of this effect of æther, I am rendered the more doubtful in accepting the explanation of the action of the volatile alkali, as mentioned by the French chymists; for this very property produces a prejudicial effect, when carried to so great a degree as æther is capable of doing.

Alcohol.—It is the greater or lesser quantity of this principle that varies the strength of all fermented liquors, for when they are submitted to distillation, this principle being more volatile, separates from the others in the still, and comes over as an ardent spirit, which, by repeated distillation
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and rectification, is deprived of all the watery and other casual combinations, and becomes spirit of wine, or what is termed by the Arabian chymists, *alcohol*; a name which the framers of the new chymical nomenclature have chosen to retain. As a great number of substances had been recommended, such as brandy, gin, &c. &c. which all contained this principle in different degrees; and as I believed that their efficacy arose chiefly as it abounded, I made trials with it of different strength, diluting it with distilled water when I wanted to weaken it; but, from experience, I am confident of its greater efficacy when pure. This fact did not escape that most attentive and honourable recorder of medical truths, I need scarcely mention the name of Sydenham; he strongly recommends it in all which are denominated resolvable inflammations. I have seen the most happy effects from the use of this in the same manner as I used the fluor volatile alcali, and afterwards the same digestive as I then pointed out. From the known property of this substance to increase action, as well as several of those whose effects I am now relating, and from the general idea of their being the strongest stimulants we are possessed of, I must request the reader to keep in mind the stimulus which occasioned the injury, as in that scale, if such a denomination is admissible, they will be termed *sedatives*;

tives; or, as Dr Darwin names a class, *torpentia*, or applications that lessen action.

From the effects of alcohol, it stands very high in my estimation in such cases; and no doubt any substance containing much of this principle, will produce beneficial effects in some stages of the accident. Camphor adds to its efficacy if care is taken immediately to cover the parts with a cloth smeared with an ointment; this precaution is necessary for these reasons; it prevents evaporation, consequently the unpleasant symptoms attending that process already mentioned; and, by continuing the spirit and camphor on the surface, the absorbents are excited to action, and take it up, together with part of the serum which is brought to the surface, by the increased action of the exhalents from the stimulus of the caloric. Thus the balance of the secretion and absorption is kept up, and the increased actions of both are gradually allowed to subside.

Spirit of turpentine is obtained from the distillation of common turpentine; it is regarded as an essential oil, but has this peculiarity, of being immiscible with the alcohol of the shops;* it has a peculiar strong smell, and an acrid pungent taste. A very few drops taken internally, with some constitutions,

* Chaptal says pure alcohol combines with it.

stitutions, produce a most violent effect upon the urinary passages, for which reason it is seldom ordered for internal use. When applied externally, it powerfully excites the absorbents of the part. As a proof of this, a few hours after its application upon any part of the external surface of the body, the urine will be highly impregnated with its odour. As this is a fact I wished to be perfectly clear in stating, I have repeated it upon myself and others, and now assert it without hesitation. Many other substances may both possess and exert the same power, but as they are not so obvious to our senses, such effects can at most be only hypothetical: It is principally from this sensible power of its action that I am induced to infer a great part of the very considerable benefit arising from its use in accidents of this nature. We have already seen that one of the principal effects of heat applied to the surface, is to increase the action of the exhalant vessels and cause an afflux of their secreted fluid to the surface, which, if not counteracted by an equal excitement of the absorbent or recurrent vessels, the consequence will be an extravasation of that secreted fluid, as we see actually takes place in such cases in the form of blisters or vesicles; therefore one of the great desiderata must be an application which excites the absorbent system equal

to the excitement of the exhalant, so that the circle of action which is necessary to keep up a living system is thus preserved. This salutary effect I have repeatedly seen produced by the application of spirit of turpentine even after slight vesications have appeared in different parts, the power of the application has been equal to produce absorption ; but where this has not taken place, I frequently find it equal to keep up the equilibrium of action, and prevent that unpleasant effect which in the best mode of cure always produces a desquamation of the cuticle.

From this view it will be seen that I have a high opinion of the powers of this application ; and that opinion is not taken from theory alone, but from an extensive use and attentive observation of the effects it produced upon the living subject in the most desperate cases.

Having thus given a short comparative view of the efficacy of some of the applications formerly used, and which at present hold a very considerable degree of reputation in several hospitals in this country, as well as in different parts of the world ; and likewise some of those which, upon comparison, I have found of infinitely superior merit, it will be expected that I should now give an account of the means I use in cases according to the division I formerly pointed out :—1st then,

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Of those cases where the action of a part is only increased.—To enable us to give a clearer description it will be necessary to divide the treatment into two parts, namely, the external and internal.

1st, The external means.—

When the system is exposed to a certain degree of caloric (heat,) all its functions are performed well : If the heat applied to any part should be gradually increased, the action of that part is likewise increased, which, if in a small degree, and long continued, would produce various effects upon the rest of the system ; but it is not this degree I am now to describe ; it is a sudden application of a quantity of disengaged or combined caloric to a part, which throws it into a violent state of action according to the structure of the part injured : This takes place sometimes from the combustion of inflammable gasses, as in mines, or the explosion of gunpowder ; and, at other times, from heated or boiling fluids, such as oil, steam, water, &c. or from heated solid metallic or stony bodies. The extent of the injury may be easily judged of from the appearance of the parts, except, as in the instances of the miners, where the cuticle is so filled with fine coal dust as to render them quite black ; but the feelings of the unhappy sufferers will prevent

your neglecting any part which has been hurt ; it will always, however, be better to apply the remedy to parts that have not been hurt, than to neglect any that have : The next dressing will sufficiently point out to you if you have either been too profuse or too negligent ; but as the intolerable pain is such, there is no fear but you will be called in as soon as possible : If vesications have begun to form, trouble neither yourself nor the patient to open them, as your time may be more usefully employed : If the cuticle should be lacerated in any part so as to expose the skin, it need not make any difference in the means used, as the extent and pain of an injury which has detached the cuticle by means of the violent application of heat, will not be increased, even in pain, from any application I have ever yet seen used.

Take a tea-cup and put some of the best rectified spirit of wine, or spirit of wine with camphor, or spirit of turpentine into it, then place it in a basin of hot water, so as to heat it to what you can bear with your finger ; then, by means of a rag dipped in this, or a probe armed with a good deal of lint, wash and bathe the whole of the injured surface, which, when done two or three times over, apply plasters to the whole, formed in the following manner :—

Take of the common yellow basilicon according
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to the occasion; let it be mixed up with as much spirit of turpentine as it will take to make it of the consistence of a liniment, which, when spread upon thin old cloth, is to be applied to the part; the wax and oil of the basilicon will fill up the pores of the cloth so as to prevent evaporation, by which means the strong stimulant powers of the turpentine, or alcohol, or camphor, or all together, are so confined upon the surface, as to excite the absorbents to the very increased action we wish; and when this has taken place, the small quantity of oil is sufficient to preserve the cuticle in a pleasant state.

I have not found the strict order given by former authors of very frequent dressings so necessary as they inculcated, nay, on the contrary, I have found them prejudicial; for the very quick evaporation that takes place on exposing or uncovering the surface any time during the first four-and-twenty hours is pernicious; I therefore only dress the patient once a day even at the first, unless in some instances: If the accident should happen early in the morning, he may be a second time dressed in the evening, but even that indulgence is more in compliance with the prejudices of the patient and his friends, than from any advantage I have ever observed to arise from it; if he will submit to it, it will be better to allow him to remain for the first

twenty-four hours without being disturbed ; if the plaisters are spread tolerably thick with the ointment, there will be no need of using any further means until the next dressing. On the following day, when you are going to dress your patient, the first thing to be done is to have your plaisters spread before you begin to take off the others ; (they are to be spread with the digestive liniment, the same as at the first dressing,) and then not to take off more than one at once, as the less time the parts are exposed to the action of the external air the better. It will seldom be necessary to have recourse a second time to the application either of the pure heated alcohol, or camphorated alcohol, or spirit of turpentine, as the redness or apparent inflammation will appear much less vivid ; it will be necessary therefore to diminish your exciting means as the action diminishes ; some proof spirit, or some laudanum with the coldness taken off, will be sufficient for this dressing, and the plaisters immediately applied : They ought to have been so near a fire as to make them near the temperature of the patient's body, to avoid any chilliness succeeding their application ; this being done, your patient is to remain quiet for twenty-four hours longer, at which time you will generally find that the appearance of inflammation has disappeared, and
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where there had been any small vesications in the first instance, there will be seen such a secretion of pus as may be noticed the second day after the application of a blister; the stimulants will now have performed their office, and if continued in, they will produce unpleasant effects themselves, somewhat resembling the complaint they were meant to cure, although on a different part of the system, as by these means the external absorbent vessels would be the most excited, whereas the original accident appears to have excited the exhalant vessels more; for which reason, as the equilibrium of action will appear nearly to be restored, it will now be necessary to apply less irritating substances, therefore, instead of basilicon made into a liniment with spirit of turpentine, it may be rendered into a proper consistence with camphorated oil; should even this be too strong, and any appearance of irritation take place, the cerate with lapis calaminaris, or Goulard's cerate, will answer every purpose, and abate any irritation that may have arisen from the former applications. What I have found very effectual in such cases, is an ointment made with the addition of a scruple of flowers of zinc to an ounce of the white ointment, (*i. e. the ung. ceræ. albæ.*) this continued until the part heals is in general sufficient; but if the skin should

after healing remain very tender, and likely to crack, a liniment formed of lime-water and linseed-oil would be useful. I have frequently found much advantage from camphorated oil in this stage. These means properly attended to, and keeping the tender skin covered from the too great action of the external air, I have found effectual in curing and quickly restoring the cuticle to a healthy state, after most severe cases.—See case of Mr Hopper.

2dly, The internal means.—

In order to form a judgment of what ought to be the internal means, let us inquire what effects are produced from slighter irritations upon subjects possessing different degrees of strength:—Suppose, for instance, a healthy vigorous man receives a scald upon his body, of the size of the palm of the hand, a considerable degree of pain follows, the parts are thrown into a violent action, and, from absorption and secretion being unequal, an effusion takes place; whatever be the means that are used for this accident, the energy of the parts is such, as in a few days to have run through their different stages, and the part gradually re-assumes its former healthy functions, without having disturbed those of the other parts of the body. But
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had this accident happened to a man of an irritable habit, the consequences would be very different; the pain would appear to be much greater, at least the patient would shew greater symptoms of suffering; not only the action of the part would be increased, but also the action of all the sympathizing parts of the body, the pulse would be quickened, and a real sympathetic fever would take place; probably the part itself, instead of speedily coming to a suppuration, might communicate its diseased action to the contiguous parts, which would assume the erysipelatous inflammation, and require a much greater length of time to run through the different stages of the disease. Now such different effects being produced upon different systems, by exactly the same cause, would require very different treatment: To the robust constitution, nothing might appear necessary; the *vis medicatrix naturæ* would alone be sufficient; nay, it might go further, and resist the rash attempts of ignorance under the specious pretence of assistance. But with the nervous, irritable habit, we should be obliged to have recourse to tonic remedies, or submit to long and tedious cures, which too frequently are the consequence.

To what are we to attribute the different appearances in these two cases, both arising from the same cause? Is it not natural to conclude, that
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the different degrees of strength which they possessed was the cause? What conclusion may we draw from this? Surely, that strength resists the sympathetic irritative actions of other parts, and that weakness induces them. Now if this is admitted, it will follow that in all cases we should make the system as strong as we can, immediately upon the attack; for, according to the degree of strength the subject possessed at the time, such will be the degree of injury. From whence it will follow, that in cases of great magnitude, where the violence is considerable, the strongest habit will stand in the same relative state to this accident, as the weak irritable habit did to the smaller, that is, the quantity of violence is stronger than the resisting powers of the system; the weakness therefore of the system is the cause of its fall.—This weakness is no reflection upon the powers of the system; for fire is not the element we are organised to exist in: But the subject leads to the investigation of our powers, with respect to resisting the action of fire, in order that when we are unfortunately exposed to its pernicious influence, we may place ourselves in that posture of defence, which, from experience, we are convinced is the best.

The animal system performs a series of actions; different parts have different functions; but the result of the whole is unity or health; for if any
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part is either increased or diminished in its proportion to the whole, the other parts sympathise with it. This sympathy is more strongly marked in some diseases than in others; the skin and the stomach have a particular sympathy in most diseases; and the skin in others, which are not of consequence enough to affect the stomach.

In intermittents we find this solution of the continuity of action upon the surface, excites the system to use the most violent exertions, which throws it into unnatural increased actions, in order to restore the unity of action; which when done, it gradually subsides, and leaves the body in a weakened state, from the too great exertion which the alarm of the system had thrown it into. As this exertion is totally involuntary, it may be termed the *vis conservatrix naturæ*.

This symptom of intermittents seems entirely to have depended upon this cause; for if the system is placed in such a situation as to prevent this taking place, the other consequences will not follow: For instance, previous to an ague fit, put the patient into a warm bed, keep him heated with cloaths, and excite the internal surface with warm stimulating substances, and that paroxysm will not take place; that is, prevent the torpor of the part taking place, by keeping up the unity of the action of the whole, and all the symptoms will be avoided.

avoided. Now, it appears from the shivering always taking place in burns of any extent, that a solution of the continuity of action must, if great, produce the same effect, whether arising from excess, or defect of action in the part; that is, whenever a solution takes place from the torpor of a part, the whole is thrown into inordinate action, to make the part take up the action of the whole: On the contrary, when a solution of the continuity of action takes place, from the excess of a part, the whole system is thrown into a commotion to take on the action of the part. Thus, in both cases, the natural bias to an equilibrium of action is sufficiently apparent. Vomiting, which is a common symptom previous to the hot fit of an intermittent, and seems to proceed from the sympathy of the external and internal surfaces*, sometimes takes place in burns. In one case where the subject was immersed in caloric, which was in contact with the whole, without any intervening substance, the solution of the continuity of action brought on such severe shivering, as to cause violent sickness, and a bilious vomiting, the same as in an ague fit.

From what has been already said, it will appear obvious, that the intention to be fulfilled ought to be

* By internal surfaces, I mean all the secreting surfaces of the body, which I believe have a very considerable sympathy with each other.

be the restoring the unity of action of the whole system as soon as possible ; so that those parts which have only had their action increased, are, by this reunion, as it were, to the system, allowed again to form a part of the whole, and recover as it were by the first intention ; the more immediately these means are used the better. The first few hours in the treatment of such accidents is of the greatest moment ; as the cause was violent and instantaneous, the effects will be in some degree similar : This mode of relief is only to be continued for a certain length of time, and it requires great attention in the practitioner to be enabled to throw the system into such a state as to absorb the diseased action, and then gradually bring down the whole to the natural standard of action, by nicely diminishing the exciting powers, so as to assist, and not offend, the system by our interference. After the excitement has been carried as far as may have been thought necessary with *æther* and *alcohol* internally, which ought only to be given once or twice, and that within the first eight or twelve hours, wine or ale may be allowed the following four and twenty hours, and very little on the third day, as the secretion of pus will begin to take place, when it will be no longer necessary to excite the system. I have generally added laudanum to the alcohol, from the
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general idea of its abating pain ; whether in this complaint it may be an auxiliary to the other means or not in the first instance I am uncertain, but future experience may enable me to gain that information, either from my own observation or that of some ~~of some~~ of my medical friends, who have promised that they will not only give me information on that part, but of every other particular which may occur ; and some of them have extensive fields for remarks upon the treatment of this species of accident.

35 Secondly,—Of those cases where some have their action increased, and others their action destroyed. The mode of treatment in this class, I shall divide into two parts, namely, the external and internal means.

1st, The external treatment.—

Having already mentioned what I found the most advantageous in burns with only increased action, it will be unnecessary in this place to repeat what was there said : I shall only add, that as I never saw a burn where the part was so completely destroyed as not to leave other parts where the action was only increased, I should strongly recommend the use of those means which would save the then living parts ; this is of the first consequence ;

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as for the dead parts, the application which is immediately applied to them is of very little consequence, for the throwing off these eschars depends upon a process of the system, which the immediate application to the dead part will in no way either retard or facilitate; but to place the contiguous parts in a state of health and strength, so as to perform their actions with vigour, will certainly facilitate the process, and relieve the system from greater efforts, and the patient from a tedious cure.

The progress of those parts which have only been slightly injured, will lead us to form a judgment of the state of those which are further injured; for if the curative indications take place soon, and proceed with vigour in the one, we may be assured all the other functions are performing their offices duly in the other. As soon as the skin which has had the cuticle detached from it, begins to secrete pus, which is sometimes the case upon the second day, the parts adjoining an eschar begin the suppurative process; that is, they tumify, and the absorbents detach the dead and living parts from each other, while the exhalant or secreting vessels form pus; thus the surface is restored to its former functions, that of a secreting and absorbing surface, and although the parts are not guarded in the manner nature meant, yet, when the natural surface

surface of a part is destroyed, this *secretion* and *absorption* is necessary to the healing process, and the quickness or slowness with which an ulcer heals principally depends upon the management of these states. I am now speaking of the most favourable cases; for though in some subjects this process may begin in sixty hours, yet I have seen it retarded to the tenth day, and the patient recover; but in general I believe it will be found that if it does not take place before that period, the erysipelatous inflammation is communicated by the absorbents, and the secreting vessels having their action upon the surface suspended, the inactive parts become greater and greater, till at last the system, thrown into *despair* as it were, increases its action, so as to exhaust its powers; and the whole fabric sinks, from general debility and local symptoms of mortification. The eschar will begin to detach itself around the edges, and, when once the skin is separated, the other parts will follow according to their specific nature: If only the adipose and cellular membranes are affected, they will soon be absorbed and leave the wound in a situation to granulate. During the process of sloughing, a cataplasm of milk and bread, from its softness, and as applying a grateful degree of the stimulus of heat, is perhaps one of the best topical applications

tions at this period ; the eschar may be washed with a little camphorated spirit so cautiously as to avoid touching the living parts, by which means the offensiveness of the wound will be much less to the patient and the attendants. Should the process stop at any period, touching the part either with camphorated *spirit*, or *essential oil of turpentine* will be a sufficient stimulus to produce a renewal of action. If the secretion of pus round the edges of the wound, from the application of the cataplasm, should be too great, they should be washed with a little tepid Goulard's water, and afterwards well dusted or covered with some flowers of zinc : A cataplasm made with Goulard's water is sometimes of very great use ; but if the surface was large, or the wound deep, the absorption of this mineral solution is sometimes attended with danger : Nay, I have sometimes seen bad effects from it in an ointment, which has induced me to give the preference to the *flowers of zinc*, or the *-lapis calaminaris*. When the dead parts are come away, the wound must be treated in such a manner as to keep as exact a balance between the absorption and secretion as possible ; sometimes gently exciting, at others repressing, so as to allow the system to repair itself, which all its efforts tend to ; but, as much of this depends upon the internal means, we must now treat of that.

2dly, The internal treatment.

From the opinion which I have already advanced, viz. that I never saw so compleat a destruction of a part as not to have left other parts only in a state of greater action, it will be natural to conclude, that the mode of treatment I followed in cases of increased action, will be necessary to be pursued until those parts are restored to the system; I shall therefore refer the treatment in the first instance to that head, and shall now only add what will be necessary, after the unity of action has taken place with all the living parts, to throw off those that are dead; and the after-treatment to facilitate the cure.—After the system has been excited to such increased action as to take up the action of the diseased part, it will not afterwards be necessary to continue it longer, although it must not be so quickly lowered as if there were no eschars. When the unity of action is restored, the next process will be the commencement of the separative, that is, the edges of the eschar will tumify, be absorbed, and pus secreted: This process of the system requires strength, that is, according to the strength of the subject, it goes on more or less favourably; therefore the internal means must be such as give strength without increasing action; This

This is perhaps answered by what is called a strong nourishing diet, better than by any other means ; at the same time diminishing the fermented liquors. The bark is by some supposed to possess the power of strengthening in a very considerable degree ; it therefore may be given in decoction, or in powder mixed with milk : The latter mode seems to have the advantage, as it answers partly for food at the same time. An anodyne may be given at night, as rest contributes much to facilitate the process ; for all the actions which are involuntary, are less disturbed during sleep than at any other time, consequently better performed. This strengthening plan ought to be continued until the eschar has loosened around the edges, when it may be lessened, by taking less animal food, but should not be totally desisted from until the wound is quite free from the dead parts ; when instead of giving much strengthening food to support the discharge, he ought to be put upon rather a strict diet than otherwise, by which means the discharge moderates, the granulations take a firm healthy aspect, fungus is prevented, and the cure will proceed with such a degree of quickness as to astonish the surgeon, should he have been accustomed to view the slow progress from the former methods of treatment.

C A S E.

G. H. a pitman, aged about 36, belonging to a coal-work in the neighbourhood, in the month of November, 1792, was exposed to the action of disengaged caloric, from the combustion of a large quantity of hydrogen gas, which, from the neglect of keeping up the circulation of the atmospheric air, had been allowed to collect in a part of the work he had to pass with one of the small lighted candles they work with, which acting as a combining medium of the oxygen and hydrogen gasses, caused the explosion: He had on a flannel shirt, drawers, and shoes and stockings, so that the parts exposed to the contact of the flame were his face, neck, and part of his breast, also his hands, and some part of the arms; from the whole of the face being much burnt, particularly the lips and the nostrils, there was as much reason to suppose this man as much burnt internally as any I ever saw; the hands in several places appeared deeply burnt, and he had very severe shivering fits, and all the bad symptoms which indicated a very rude shock to the system: The whole of the burnt parts were liberally washed with spirit of turpentine, and covered with plasters spread with a liniment composed of basilicon, made very thin with

with spirit of turpentine ; he had a cardiac draught with fifty drops of laudanum to take instantly ; a pint of oily emulsion with an ounce of camphorated tincture of opium, to take a tea-cup full every three hours ; and a bolus at night with two grains of opium ; the diet was ordered to be generous and stimulating

Second day.—Had several paroxysms of pain during the night, and also some short intervals of repose ; slight vesications appeared in different parts of the neck and face ; the serum of these was discharged by puncturing them with the sharp point of a probe ; it was not thought necessary to repeat washing the parts with the essential oil of turpentine, but to use something less stimulating ; tincture of opium was thought of and applied, after which the dressings as before ; a decoction of the bark, with the proportion of two ounces of the tincture to a pint, was ordered to be taken in the quantity of a tea-cup full every two hours ; the bolus, with opium at night, was repeated, with the addition of five grains of calomel to obviate constipation ; he continued the diet as at first ordered.

Third day.—Had more sleep last night, and less pain than the night before ; the redness of the neck and breast had a good deal disappeared ; where the vesications were, a kind of secretion had taken place, such as may be remarked upon the

second or third day after the application of a blister; some of the redness had also disappeared about the wrists, but the hands seemed to remain much in the state they were in at first; the redness was not so perceptible as before, and the parts secreting had nothing applied to them but the plasters as before; the parts of the hands which appeared little changed, were again washed with the tincture of opium, and treated as before; the medicines were continued, except the calomel, which had procured a stool.

Fourth day.—Was not so easy last night as he had been before: pulse 110; tongue dry with thirst; the parts which had been red, and ceased to appear so, were now reassuming that appearance, and the secreting surface under the vesications was dry; from these circumstances I supposed that the stimulating applications to the absorbents being continued after they had reabsorbed the secreted fluid, might be the cause of this reappearance of inflammation, accordingly I ceased the digestive liniment, with the basilicon and oil of turpentine, and applied plasters spread with *ceratum é lapide calaminari* to the face, neck, and breast; the hands were tumified, but as there had been no appearance of pus upon them, I judged that to be an effort of the system to throw off the eschar; with
this

this view I therefore continued the former dressings to the hands; the same medicines and diet were still ordered.

Fifth day.—Has passed an easier night; pulse 100; the new inflammation upon the face, neck, and breast not so violent as before, and a little moisture on the part which had been secreted; the dressings to those parts the same as yesterday; the hands still much tumified; they are dressed as before; continue medicines as before.

Sixth day.—Continues easier; the face, &c. much better; some parts beginning to skin; the hands remain much swelled, but the skin is beginning to separate, and a degree of moisture to be secreted round the edges of the burnt parts; the same means continued.

Seventh day.—The upper parts are healing very rapidly, and there is a greater secretion of pus from the hands.

Eighth day.—Appcarances still as favourable; the hands secrete a great quantity of pus, and the eschars are loosening; both external and internal stimulants having brought about the state of the system I wished, that is, a sufficient secretion of pus, it now appeared from my former experience to be necessary to desist urging the system any further, therefore the diet was changed in its quality, and

the tincture of bark was omitted; one half the quantity of opium was given, and the dressings on the hands were changed for the same cerate as the face.

From the eighth to the fifteenth the same means were continued with the best effect; the change of diet moderated the discharge, and brought on the disposition for healing in a much better and more rapid manner than I was ever before capable of producing: Notwithstanding the use of every topical astringent, the quantity of pus formerly secreted, and for the length of time, brought on such a state of surface, as resisted every effort of art to heal; and the very means pursued to prevent the patient sinking under the discharge, appears if not to have been the only, at least the most hurtful, cause of the complaint it was meant to remedy. The face and neck being now skinned, they are anointed once or twice a day with some camphorated oil to prevent the cracking of the new skin, which is likewise of much use in taking away that unpleasant redness which sometimes remains a long time after the cure. The sloughs upon the hands come away kindly; three of the nails of the left hand have been thrown off, and the ulcers are healing at the edges.

From the fifteenth to the thirtieth day nothing particular happened; the ulcers gradually cleaned,
and

and after the formation of granulations when there was a loss of substance, they healed kindly; a little fungus now appearing, required to be touched with the common *aqua cærulea*, and in about ten days more the cure was compleat, that is to say, the whole was covered with a cuticle, but which as yet was very tender, and required time and caution both to give it strength, and to restore the motion gradually and safely to the flexors and extensors of the fingers, which, from want of use, had acquired a degree of rigidity; by the use of camphorated oil, and keeping the parts from the external air by the use of gloves, in the course of a fortnight more he was perfectly cured.

C A S E.

I. K. aged 20, a clerk in a foundery in the environs of Newcastle, on the 23d of June, 1794, trying some experiments on the fluxing of brass, had the misfortune to let the crucible, when at a white heat, fall into the ash pit, which had been previously filled with water to increase the heat of the furnace, which it does by supplying an elastic vapour capable of being decomposed by the fire, and thereby assisting very considerably the combustion: The instantaneous decomposition of some of the water in the ash pit, from the sudden application of the heated metal, caused a great explosion,

plosion, equal in report to the greatest piece of ordnance, and terrible in its effects; the windows of the building were blown out, and the operator thrown to a considerable distance; he received considerable injury from the violence of the shock, the heated elastic vapour from the water, and portions of the fluxed metal upon different parts of his body: The face was the most exposed to the vapour, the whole of which was much burnt; the eye brows, eye lashes, and a great portion of the hair of the head, were quite consumed; the integuments of the eyes, and the *tunicæ conjunctivæ* were so much burnt as to make me apprehend the loss of these organs, but more especially the left, which had suffered the most; the neck and a portion of the breast were also affected from the vapour: the legs and feet appeared most injured from the metal, as those parts had a number of circumscribed spots of different sizes;—these had gone through his cloaths, which, for his lower limbs, were nothing but trowsers at the time of the accident; several metallic scales which had adhered to the integuments, were detached by the point of a probe; these had instantly formed an ash-coloured eschar. He was visited within a quarter of an hour after the accident: His situation and appearance was so dreadful as to render a description

description impossible,—blind, frantic with pain, all his entreaties were to give him instant death ;—shivering as if in an ague fit, yet dying from a sense of burning heat over the whole of the injured parts : The essential oil of turpentine was liberally applied to every burnt part except the eyes, which from the swelling of the integuments would have been impossible, except they had been opened by force, but it was employed to the integuments themselves, and then covered over with plasters spread with the digestive liniment ; fifty drops of laudanum in a cardiac draught was instantly given, and as soon as the dressings were compleated, he was put to bed ; a mixture with the cardiac confection and camphorated tincture of opium was ordered, to take a dose every hour until easier. The accident happened about four o'clock in the afternoon ; on seeing him in the evening about nine o'clock, found the pain had gradually abated in about three hours so as to be supportable, yet his mind was greatly agitated in respect to the fear he had of losing his sight : I therefore ordered him another cordial draught, with thirty drops more laudanum to take immediately, and to go on with the mixture when awake in the night, and to have strong port wine negus to drink when thirsty.

Second

Second day.—Pulse 120; has had paroxysms of severe pain during the night; has also had some disturbed slumbers; on dressing the parts this morning they appear much as at first, except that some slight vesications appear about the face, neck, and breast; the eyes are totally closed up; tincture of opium and camphorated spirit are used to wash the burnt parts with to-day, and the other dressings repeated; two ounces of decoction of bark, with ten grains of cardiac confection, are given every three hours; the anodyne with thirty drops at night; the negus to be continued, and any food he can take, either roasted or boiled.

Third day.—Has been easier than before; pulse still 120; more vesications; in other respects appearances much the same as yesterday; continue diet and medicines as before.

Fourth day.—Has been much the same as the last four-and-twenty hours; an appearance of pus where the vesications were; the ointment to be changed in those parts to the *ceratum è lapide calaminari*, but in the other parts, where no appearance of secretion is taking place, the wash and the former dressings continued; medicines and diet the same.

Fifth day.—Remains pretty free from pain; a good deal more pus appears upon the face, and a discharge from the angles of the eyes; he thinks
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he perceives a light when a candle is brought near his right eye; this circumstance has given him great pleasure; the circumference of the eschars on the lower limbs, caused by the heated metal, is beginning to inflame and tumify round the edges, attended with a good deal of pain; the washing them with the mixture of opium, camphor, and spirit, gives immediate relief; the digestive is also continued, and the other means as before, except that a bolus, with five grains of calomel, is given to cause a motion.

Sixth day.—Has had a motion from the calomel; a considerable discharge of pus from several parts about the face and neck, but more particularly from the eyes; the swelling abating, shew the eyes themselves to be in a very inflamed state; a little of the following ointment is applied with a camel's hair pencil upon the eyes; an ounce of rose water, with twenty drops of extract of lead, gradually mixed in a marble mortar, with an ounce of the unguentum album of the shops. Some of the eschars are beginning to grow moist round the edges. The exciting means having so quickly brought my patient to this stage, I began to diminish the stimulants; the negus was gradually withdrawn, and a little boiled meat or broth once a day was now thought sufficient; and as the cuticle around the eschars was off, exposing the living parts

parts below, I found the use of the spirits, &c. painful, and therefore desisted from its application, and used the cerate instead of the digestive.

From the *sixth* to the *twelfth* continued to recover very fast; the face, neck, and breast have skinned rapidly; the eyes remain weak, discharge much, and are apparently much inflamed; eight ounces of blood are taken from the arm, and a collyrium with a solution of vitriolated zinc is ordered; the ulcers upon the legs are cleaning; he takes the bark decoction alone, and ceases taking the anodyne; his diet is now to be much more severe; no fermented liquors of any kind; milk night and morning, with a very little boiled meat at dinner, and toast and water for his common drink.

Sixteenth day.—The eyes appear better for the bleeding and regimen; they are still inflamed, and vision not clear, but gradually growing better; the new and tender cuticle of the face, neck, and breast is anointed with camphorated oil to guard it from breaking; the ulcers of the lower limbs going on well; granulations forming to restore the loss of substance, and skinning round the edges.

From this time to the *thirtieth day* his progress was regular and his cure was compleat; he continued the strict regimen, and occasionally took a
dose

dose of purgative medicines ; as his eyes continued weak, he went into the country for quietness, and returned in a fortnight perfectly well.

CASE.

L. M. aged 45, a labourer at a mill in Newcastle which is worked by the power of steam, having something to do about the boiler, missed his hold and fell in ; he fortunately caught hold of some part of the machinery which prevented his total immersion, and only his legs up to the knee were exposed to the boiling water : When I saw him his situation was truly lamentable ; in taking off the shoes and stockings, the cuticle, which had been totally detached by the boiling water, was lacerated and torn in ribbands hanging over his ankles ; he was dancing round the room from pain, and when he stood to speak his teeth chattered in his head ; the whole of the legs were immediately washed with alcohol, and afterwards the plasters spread with the digestive liniment, formed with the basilicon and the spirits of turpentine ; a cardiac draught with sixty drops of laudanum were immediately ordered, with a cardiac mixture and camphorated tincture of opium to be taken every two hours, with orders that he might take any thing comfortable either to eat or drink.

Second

Second day.—The pain gradually abated after he was dressed for about three hours, when it remained stationary, and returned in paroxysms, which became less painful, and of shorter duration the one than the other; a few vesications about each ankle; the other parts have much the same appearance, except that there is a considerable swelling upon one of the shins, which I suppose must have arisen from some contusion, although he is not conscious of any thing of the kind having taken place; notwithstanding which I have no doubt of its arising from that cause, for in such circumstances, consciousness is very imperfect: The parts were washed with tincture of opium and camphorated spirit of wine in equal proportions, and the former dressings applied; the mixture was continued, and an opiate at night, with only thirty drops of laudanum, was ordered; the generous diet to be persevered in as at first ordered.

Third day.—Has passed a tolerably easy night; pulse 110; some slight appearance of secretion where the vesications were; cease to apply the spirits and digestive to these parts, and use the *ceratum é lapide calaminari*; the bruised part seems to be so much destroyed as to be irrecoverable; the digestive is continued to it, and it is treated as an eschar; a warm milk and bread cataplasm, with some spirit of turpentine sprinkled upon

upon it, to be applied to this part ; the anodyne mixture was now desisted from, and a decoction of bark with some of the cardiac confection ordered, and the diet is to be gradually diminished in respect to its stimulant qualities ; the proportion of fermented liquors less ; five grains of calomel to be given at night, as he is rather costive ; the night draught as before.

Fourth, fifth, and sixth days.—Has continued to do well ; pus secreted where there were vesications, and the process of skinning is going on rapidly on both legs, except in the part mentioned to have been tumified, which, with the use of the cataplasms, appears as if it would separate ; it is now turning moist about the edges ; continue the cataplasms alone to that part, and the cerate to the others ; the diet is to be now moderate,—not very severe, as he is of a debilitated habit, nor stimulating, as it would cause too great a secretion, without adding strength ; the bark in substance to be taken twice a day.

From the *sixth* to the *sixteenth* nothing particular took place to retard the progress of the cure, which in respect to the scald might be said to be complete, as the legs were now covered with a new skin ; to guard which from cracking, I ordered the liniment, with linseed-oil and lime-water, but the

eschar, though nearly all thrown off, has left a kind of ulcer which will require some time yet to heal ; a little dry lint is applied to the center as an absorbent, and afterwards covered with a plaster of cerate.

The ulcer continued to heal, and in less than a fortnight was well. The liniment with lime-water and linseed-oil appeared to answer very well in this stage of the complaint, as an application to harden the new skin, and to prevent its cracking and breaking, as new cicatrices are liable to do.

The following case, which appears to have had a great simlarity with one related in the former part of this Essay, page 30, from Van Swieten's Commentaries, as having happened to the celebrated Boerhaave ;—the treatment having been totally different, I should wish them to be contrasted.

C A S E.

Mr Hopper, my apprentice, distilling some rose water on the 14th of August, 1795, in a portable tin still, having filled it too full, the head became stopped up, which rendered it exactly simlar to Papin's digester : Having remained thus for some time, the fire being urged, and nothing coming over, the head was thrown off with considerable violence

violence, and the contents were thrown upon the operator; he received them principally upon the thighs; his covering was only a thin pair of pantaloons; the thighs were each of them scalded for a space that would have taken half a sheet of paper to have covered the surface, besides the whole of the scrotum and penis, as were different parts of the wrists: In taking off his cloaths, a small portion of the cuticle was torn, and some vesications took place immediately; the parts were profusely bathed with spirit of turpentine, and dressed with the liniment formed with basilicon thinned with spirit of turpentine; this was at half after eleven o'clock; he was put to bed, and had a violent shivering fit; a large bladder full of hot water was placed between his legs, and he took sixty drops of laudanum in a bumper of brandy; the pain gradually abated, and in about an hour after he was quite easy, when a little after a slight rigor came on, which was succeeded by a paroxysm of pain; this continued to be repeated at more distant intervals, and with less violence during the course of the day; in the evening he was tolerably easy; his pulse two hours after the accident had mounted up to 90, but now it has returned nearly to its natural standard, about 60.

Second day.—Has passed an easy night, and is

now free from pain, nor has he had much uneasiness since yesterday afternoon; on examining the parts to-day when dressing, the extent of the inflamed surface is very considerably diminished, so that a resolution of the inflammation has taken place, or if I may be allowed to use the expression, a great part of the injured surface is cured by the *first intention*. The parts were washed to-day with tincture of opium and camphorated spirits, and the same digestive liniment as before was used for the plasters; he had made a great quantity of urine during the night, which was strongly impregnated with the odour of the turpentine,—a strong proof of its absorption by the skin; the great cause why I think it preferable to any other application.

Third day.—The wash having come in contact with the part where the skin was off, had caused a slight degree of pain, which he described to be similar, though infinitely less in degree, to what he originally felt in some of the paroxysms; it soon shaded itself away, and he remained easy; this part itself had been well washed at first, though the skin was off, with the spirit of turpentine, and so far from having given any pain, it abated the pain from the moment of its application; the appearance of the parts continue nearly as yesterday, except that there is a little moisture where the skin

was

was off, which seems to hold a middle state between serum and pus; the exciting means having so astonishingly brought the surface to a secreting state, they were desisted from, and the parts covered with the following ointment, *Ungt. ceræ albæ* ℥ij. *Florum Zinci* ʒi.

Fourth day. Has been very easy since the last dressing; one of the places where the cuticle was off is thinly covered with very good pus; the inflammation has nearly disappeared; in those places where the cuticle was detached from the skin, it is cracking, and a new cuticle is forming underneath, without any appearance of moisture.

Fifth day. The part which was covered with pus is drying, and nearly skinned over; the cuticle of the penis and scrotum peels off in large scales, and leaves a perfect skin underneath; a considerable degree of itching in the part; continue the same ointment, and take an ounce of salts in a basin of broth.

Sixth day. The whole of the parts covered with cuticle, but as it is yet tender, to continue the plasters for a day or two; he may now be said to be cured.

The whole of this case has in so pointed a manner established the superiority of practice when conformable to the laws of the animal œconomy,

that upon its revision, it appears so unlike the common course of any injury of even half its magnitude that I ever saw, as to make me doubt it will meet with that ready credit which I know it deserves : In comparison not only of the efficacy, but of the manner, I think it merits Asclepiades's motto, "*tuto, celeriter, et jucundé.*"

APPENDIX.

HAVING appropriated the second chapter to the detail of the various opinions of different physicians and surgeons on the subject of Burns, I must explain why I did not place the following there also : I would observe that I only wished to bring such a mass of evidence of the indefinite state of our knowledge upon this subject as might appear a sufficient apology for laying it before the public in the present state, as an investigation highly interesting and closely connected with principles, which are not merely confined to the treatment of this injury, but may ultimately exercise a very material influence upon the practice of surgery in various diseases. Hoping that the necessity of the inquiry was made sufficiently apparent, I wished not to exceed due limits in quoting authorities ;

thorities; yet there remain some observations, communicated to the late Mr John Hunter, and recorded in the second volume of Medical Facts and Observations, &c. by Mr David Cleghorn of Edinburgh, which contain so much candour in the relation of the facts, and are so striking in themselves, that I cannot avoid taking notice of them. Mr C. is not of the faculty, and avows himself unbiassed by any theoretical opinion, adhering strictly to appearances resulting from experience, so as to enable him to *conclude*, that the certain repeated effects were produced by as certain known causes.

Mr C. recommends the immediate application of vinegar, which is to be continued for some hours, by any the most convenient means, until the pain abates. Should it return, the vinegar is to be repeated: If the burn is so severe as to have destroyed any part, when the pain has ceased it is to be covered with a poultice made of white bread and milk, which remains six, or at most eight hours; when removed, the part is to be entirely covered with very finely powdered chalk, until every moist appearance upon the surface of the sore has disappeared, when it is again to be covered with the poultice. The same mode is then to be pursued every night and morning until the cure is complete. If the use of poultices appears to relax the wounds too much, they are to be covered with a

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plaster

plaster or ointment made with white lead, but the chalk is still to be used next the wound.

In respect to general remedies, he says, " I allow my patients to eat boiled or roasted fowl, or in short, any plain-dressed meat they like ; and I do not object to their taking (with moderation, however) wine, water and spirits, ale, or porter. My applications, as hath been already observed, allay pain and inflammation, and also always either prevent or remove feverishness ; and at the same time (if one may judge from their effects) they have powerful antiseptic virtues ; I have never had occasion to order bark or any internal medicines whatever, and I have only once thought it necessary to let blood. When a patient is costive, I order boiled pot-barley and prunes, or some other laxative nourishing food, and sometimes an injection, but never any *purgatives*. It is distressing to a patient with bad sores to be often going to stool. Besides, I have remarked that weakness and languor (which never, in my opinion, hasten the cure of any sore) are always brought on, more or less, by purgatives. From the effects too I have felt them have upon myself, and observed them to have upon others, they do not seem to me to have so much tendency to remove heat and feverishness, as is generally imagined ; and I suspect that, contrary to the intention of administering of them, they often-

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er carry off *useful humours* than *hurtful ones*. But I am going out of my depth, and exposing myself to criticism, by speaking upon a subject that I surely must be ignorant of; I will therefore return to my vinegar. I have already said that I always prefer *wine* vinegar when it is to be had; I have however used, with very good effect, vinegar made of sugar, goose-berries, and even *alegar*; but whichever of them is taken, it ought to be *fresh* and *lively tasted*. I once made some trials (on a burn I met with myself) of oil of vitriol diluted with water, and of different degrees of strength; but I found its effects to be the very reverse of vinegar, for it increased the pain and heat even when it was pretty much diluted. I make no doubt but distilled vinegar might do; but since the common sort, when fresh and good, has in every case been so efficacious, there seems to be no occasion to attempt improving upon it; and as acids are of a pungent penetrating nature, perhaps it would not be safe to apply one too strong to a raw and tender sore. Even the common vinegar, only by being used too *cold*, affected two of my patients with *tremblings* and *chillness*, which alarmed me a good deal. I removed these symptoms indeed (as I before mentioned) very readily by warming the patients feet with cloths dipped in warm water, and giving them warm water and
spirits

spirits to drink ; but ever since I have been careful to use precautions against the like symptoms, particularly in cold weather, by *warming* the vinegar a *little*, placing the patients near the fire, giving them something *warm internally*, and, in short, by keeping them in every respect *in a comfortable condition.*”

The number of cases related by Mr Cleghorn in his letters to Mr Hunter, besides a still greater number he has attended during a period of seventeen years, demand a degree of attention and investigation, more particularly after I have been offering what at first appearance may be supposed to be a very different mode of practice. The vinegar which Mr Cleghorn relies the most upon, is that made of the *best white wine*, and even this is only efficacious whilst it remains *fresh* and *lively tasted*, and must be changed or renewed as soon as it becomes vapid, or has lost its spirit. Do not these remarks, made by Mr C. himself, plainly point out to us that the great efficacy of his remedy resides in the proportion of alcohol, or spirit remaining in the vinegar, after it had undergone the acetous process ? It is apparent, from the experiment he made upon himself, with the diluted sulphuric acid, that the acid alone is not the part of the application to be depended upon.

I have not the pleasure of knowing Mr Cleghorn,
but

but should these observations fall into his hands, I should be happy if he would try the use of alcohol, and appreciate its merits with vinegar. It would also be worth observation to try if spirit, added to the vapid vinegar, would restore to it those curative powers which it before possessed. I purpose trying it myself, should a favourable occasion occur; but it would be much sooner determined by Mr C. as with him the powers of the vinegar are ascertained, whereas, with me, I shall have to ascertain its powers before I can make a comparison.

The next application Mr C. makes, is powdered or scraped chalk: This is confessedly used as an absorbent, and, from the relation of the cases, with very great benefit. It was with this intention that I used large quantities of powdered *lapis calaminaris* in the case related of E. F.; yet in that case I found it insufficient, and was obliged to have recourse to substances of a caustic nature. It will be seen that I attributed the abundant discharge in that case to a too great excitement of the system in that stage of the complaint; and I have no hesitation in saying, that by a very different mode, (which I have described) the profuse discharge which formerly accompanied such accidents, may be avoided. I have sometimes, in ulcers in the legs, used chalk as an absorbent; in one or two instances

instances it rather increased the discharge, and gave pain: I attributed these effects, in some degree, to its not being sufficiently powdered, but have not since used it. When I first heard of Mr C.'s using vinegar and chalk for burns (i. e. before I had read his letter to Mr Hunter) I supposed he had put on the chalk immediately after the vinegar, with a view of disengaging the carbonic acid gas. From some experiments of Dr Beddoes's upon himself, it would appear, that the skin deprived of its cuticle by a blister, and rendered acutely painful by the contact of the atmosphere, is instantly soothed by its immersion into the carbonic acid gas, and that the pain as soon returns upon changing the medium. How far the acid gas would be of use in the first instance, I have my doubts; I think it could not act sufficiently through the cuticle, but I have no doubt it would be of use in the cure of the ulcers after the sloughs were thrown off; but I mean to put that idea soon to the test, by a course of experiments.

Mr C. further remarks, that in applying the vinegar cold, he brought on *tremblings* and *chillness*, which he afterwards avoided by warming it, and recommends that in all considerable cases it should be so used. This observation is valuable, as it corroborates that by experience, which is theoretically right, viz. the continuance of the stimulus of heat.

heat. The *chillness* and *shiverings* are here mentioned as being brought on by the application of the *cold* vinegar. What is not a little extraordinary is, that no mention is made by any author whatever (that I know) of the violent shiverings, which, in any burn of consequence, I have universally found to be the first symptom that occurs, and from which, latterly, I have been enabled to form a prognosis, which, if not always certain, is a great guide to me in practice; for the danger is in proportion to the *violence* of this symptom. The remarks respecting the general or internal mode of treatment are highly interesting; he is the first author who, in such cases, has shewn the fallacy of what is termed the antiphlogistic method of treatment. His idea of purgatives carrying off useful, as well as noxious, humours, from the system, is certainly very just: Great evacuations by the bowels are always *weakening*, as well as distressing, to patients so situated. When large opiates are used, means to prevent constipation are necessary; but need not be carried to the effect of purging.

Is it not wonderful that the precepts of *bleeding* and *purging* in all such cases should for *ages* have been taught in the schools, and that an unprejudiced observer, as it were with a glance at the subject, should in a moment point out the absurdity of such a treatment!—But let us not be offended at hav-

ing

ing our errors pointed out by one who is not in the profession: On the contrary, it is worthy such a liberal, nay, I might almost add, sacred profession as ours, trusted as we are with the lives, consequently with the happiness, of the community at large, to confess our faults, and profit of every opportunity to *reform* them. By such conduct we should atone for our errors, and should give the best pledge for the future confidence of the public; which, if we so act, we deserve, and ought to possess.



It gives me considerable satisfaction to add the following letter from a medical friend, whose attention to, and opportunity in, his profession, enable him to form an adequate judgment of the means recommended: It will also have another good tendency, viz. that of inducing other gentlemen of the faculty to have less difficulty in adopting the same means, when supported by further testimony than the author's; for, however free from prejudice a man may think himself to be, yet an idea springing up and taking root in his mind, produces a greater effect upon him than it can, or perhaps ought to do upon the mind of another:

DEAR SIR,

I have tried the *fluor volatile alkali* and the *ol. terebinth.* in a great many cases of Burns, and have great pleasure in saying,
that

that either of them has a better effect than any thing I have hitherto used. When I first commenced practice, the liniment composed of *linseed-oil* and *lime-water* was the application in general use, particularly for the burns of the people employed in the collieries, and was used in such quantities that the miserable patients were kept constantly soaked in it, their beds and bedding were often rotted, and the effluvia arising from it and the discharge of the sores must have been no less noxious to the patients themselves, than intolerable to the surgeon. The greatest objection, however, to it was, that it did not answer the intention; it merely soothed the parts, and procured a temporary relief from pain and smarting, without stopping the progress of inflammation; and it did not tend to promote the suppuration, consequently the healing process was tedious.

Being dissatisfied with this application, I made trial of the *aq. vegeto mineralis*, and found it very useful in abating the violent heat and smarting, which is the immediate effect of fire; but in cases where the skin is much destroyed, and the eschars are deep, it does not seem to be so well adapted. In looking into authors on the subject of burns, I had found various stimulating applications recommended; but never having seen them used, I had not sufficient confidence to try any of them, until you recommended the *fluor volatile alkali* to me, and explained in a very clear and candid manner your ideas on the subject, and at the same time informed me of the result of your practice: I have ever since that period made use of the *fluor volatile alkali*, or *oleum terebinth.* sometimes one, and sometimes the other, and can hardly give a preference to either, both having the same good effects. On the first application, the patient complains of a short increase of heat and smarting, which is immediately succeeded by a pleasing sensation of cold; and continuing to apply it a little longer, the patient becomes quite easy, and in general has no return of heat and smarting; the inflammation is checked

ed, suppuration advances kindly and speedily, and the healing process is readily completed. In many slight cases no suppuration was endured, the cuticle peeling off, and leaving a new one underneath: I use *Goulard's cerate* only as a dressing in the slighter cases; but when the skin is much destroyed, and there is likely to be considerable eschars, I employ a stimulating ointment, such as the *ungt. resin. flav.* with *ol. terebinth.* which I always find promotes this ready suppuration. I have had no case where the injury was so extensive, and the consequent affection of the system so considerable, as to require the exhibition of stimulants internally; but I must observe that I have not been so strict in keeping my patients to the antiphlogistic plan as formerly, nor have I had occasion to give opiates so largely as when I pursued a different practice.

With best wishes for success in your endeavours for the improvement of your profession, to which your zeal and industry justly entitles you,

I remain, dear Sir,

Your's sincerely,

THOS. LEIGHTON.

Westgate-street, Newcastle, }
Nov. 6th, 1796. }

