Observations on the medical and surgical agency of the air pump : read before the British Association in 1835 / by Sir James Murray.

OBSERVATIONS

ON THE

MEDICAL AND SURGICAL AGENCY

OF THE

AIR-PUMP.

READ BEFORE THE BRITISH ASSOCIATION, IN 1835.

BY

SIR JAMES MURRAY, M.D. T.C.D.

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M.DCCC.XXXVI.

TO

RICHARD CARMICHAEL, ESQ. M.R.I.A.

CORRESPONDING MEMBER OF THE ROYAL ACADEMY OF MEDICINE
OF FRANCE, &c. &c.
AND CONSULTING SURGEON OF THE RICHMOND HOSPITAL,
DUBLIN, &c. &c.

My Dear Sir,

I gratefully dedicate to you, as my early and uniform friend, the following paper.

You were present when it was hastily read at the British Association. As there was not then a moment for its discussion, I have consented to submit it to the profession in a separate form.

None of its propositions are recommended, except as agents, auxiliary to such other means as may be necessary.

A general misconception prevails here, which greatly diminishes the interest these novel speculations might otherwise excite.

It was said by some, that, because I had formerly paid attention to Materia Medica, and Chemistry, my propositions, relative to Surgery and Medicine, were not entitled to so much consideration as they might otherwise merit.

As this impression does not depend upon any invidious feeling towards me, I think it fair and just to remove it.

Were any reference necessary for that purpose, further than the records of the Colleges, you would be the *best* authority, because you *best* know the facts, that, as a Surgeon of Edinburgh, since 1807, and afterwards as a Physician of its University, I should be justly entitled to offer improvements in either department of the healing art, and that I have not gone beyond my legitimate province in attempting to do so.

I am, my dear Sir,

With the greatest respect and esteem,

Your attached Friend,

JAMES MURRAY.

Dublin, Merrion Square, 1836.

THE Subjects of these detached Observations are here divided into two distinct heads :—

PART I.

The general and local effects of RAREFACTION of the air, or the artificial diminution of Atmospheric Pressure, as applicable to morbid conditions of the human body.

PART II.

The influence of CONDENSATION of the air, or increase of Atmospheric Pressure, as modified by art, in reference to certain diseases.

OBSERVATIONS,

&c. &c.

PART I.

OF RAREFACTION.

Fishes, at a depth of about thirty-four feet of water, sustain a pressure of fifteen pounds upon every square inch, exclusive of the superincumbent atmosphere. This is the gravity of a column of water an inch square, by the above mentioned height.

In like manner, all bodies placed in the ocean of atmospheric air around us, are pressed by a similar weight.

A column of air of ordinary density and temperature, from the level of the sea, to the highest range or top of the atmosphere, by an inch square, weighs fifteen pounds.

Now, as the human body, like all others, is sustaining the above weight on every square inch, it results, that the superficies of a man, being in general, rather more than fifteen square feet, multiplied by fifteen pounds for every square inch, must

support a weight, not less than fifteen tons. This weight varies according to the temperature, density, and elevation, and produces corresponding changes on the secretions, circulation, and respiration, as well as upon the feelings and animal spirits. The natural exhalation by the skin is very much influenced by this elastic compression, over every pore.

But there is no animal or vital function so much affected by this agency as respiration. The chest or thorax resembles an empty bee-hive, capable of being enlarged at its sides, by the action of muscles pulling out the elastic cartilages and ribs, and expanding its walls. At the base of this cone, a moveable muscular partition, separating the chest from the abdomen, descends at every inspiration, *when not prevented by tight lacing, or abuse of dress.* Expansion downwards, enlarges the capacity of the chest much more than at its upper or narrow apex; whatever, therefore, withdraws some of the atmospheric compression from the exterior of the thorax or chest, facilitates the easier expansion of that cavity, by diminishing the resistance from without.

In like manner, whatever lessens the pressure over the abdomen, renders it more easily propelled outwards, and downwards, and consequently permits a more free descent of the diaphragm at the base of the chest.

As the lungs are chiefly composed of a congeries of small air vessels, they expand exactly in proportion

as the chest enlarges, and admit air in the ratio of their extension, during healthy inspiration.

When, by the natural contractile powers of the muscles and cartilages, all these parts are approximated, then the thorax is reduced in capacity, the lungs are compressed, and the air expired.

The external pressure of the atmosphere upon the sides of the thorax and abdomen, aids the diminution of the chest during expiration, by the compression of its walls.

But the contractile powers inherent in all the parts, proceed without interruption, even when the circumambient air is *rarefied* to a considerable degree by art, and consequently its compressive power diminished. Therefore, removal of part of the gravity of the air may permit the easier expansion of the chest for inspiration, without preventing due contraction for expiration.

This provision of nature enables us to abstract a part of the surrounding weight of air, without risking derangement of the circulation, or rupturing the air-cells of the lungs, because they are sustained by the surrounding walls of the chest, as a bag of air would be supported, if inclosed in a common bellows, always in contact with, and compressed, or dilated by, the sides of the instrument.

When, a person inhales air, which is *naturally* pressed into the expanding lungs, by its own weight of *fifteen* pounds on the square inch, and

when the atmosphere is artificially rarefied around the chest and abdomen, so as only to compress these parts with *fourteen* pounds on the same space, then there is gained in favour of easier inspiration, an advantage of one pound on each inch, or nearly half a ton on the circumference of the entire trunk.

The benefits of this easier acquisition of pulmonary capacity, are important, in all cases where there is debility or torpor of the respiratory nerves and muscles, and where the lungs require an additional supply of fresh air.

These and similar considerations induced me to withdraw a part of the atmospheric gravity by art, in cases where the powers of inspiration were diminished by disease, and where it was desirable to determine the circulating fluids more readily towards the exterior surface of the body.

So far back as 1812, I had proposed to my estimable friend, Dr. M'Donnell of Belfast, to apply this principle towards accomplishing a great desideratum in practice, that is, to cause a person to perspire without sickening medicine or exercise. I may here also mention that many of the propositions which I suggested, respecting the local and general agency of *artificial pressure*, as well as of *rarefaction of air*, on man and other animals, were afterwards confirmed by the experiments of Mr. Job Ryder, an eminent Artist at Belfast.

SECTION I.

CUTANEOUS TRANSPIRATION.

The pores of the skin are capillary tubes, formed by processes of the cuticle, which run deep into the true skin. If cold air or damp beds induce diseases by suppressing the exhalation from these pores, derivation to the surface must be accounted a beneficial counter-indication. One principal object of encouraging that vital energy which promotes cutaneous transpiration, is, to diminish untoward temperature of the body, and to counterbalance internal determinations. Such refluxes are observed even from common perspirations, which lessen the secretion from the kidnies, nearly in proportion to the augmentation of cuticular exhalation. In inflammations, the abstraction of heat from a limb or part of the surface, by pumping off the surrounding hot air, drawing away the caloric of the patient, and admitting cold fresh air, is a very grateful and reviving process. I have frequently proved that general suction carries off a great quantity of Carbon and Hydrogen from the circulating fluid.*

Common diaphoretics seem to act in two ways, *first*, by a general stimulus actively exciting propulsion towards the minute capillaries of the surface,

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* See my paper in the London Medical Journal 7th July, 1832.

secondly, as nauseating medicines, operating by the nerves, through sympathy with the stomach, and consequent relaxation of the cutaneous vessels.

But, in many diseases there is already high excitement of the general circulation, and yet the skin remains dry ; in these cases it is necessary to remedy the diminished energy of the exhalants, and the impeded power of the secreting capillaries, when it would be deleterious to attempt inducing perspiration, by heating or stimulating diaphoretics.

Many other circumstances render it a matter of great delicacy to discriminate, not only which to select, the stimulating, or the nauseating sudorifics, and again, which individual article of either class, organic, or inorganic to administer.

If, therefore, we can induce perspiration, by SUCTION towards the extreme vessels, we avoid a great degree of perplexity and risk.

The diseases in which, *a priori*, artificial determination of blood to the surface would be expected to give relief, and probably dispose to a more speedy cure, are, *first*, all simple fevers, especially at the commencement.

Whether we attribute the proximate cause of fever to the retirement of the blood, from the surface to the interior, as evinced by the shiverings, coldness, weakness, and atony, with which the disease begins, or if we suppose, that the phenomena of fever consist in a salutary effort of nature to throw off some

noxious matter, *(probably a struggle to restore the balance of the circulation)* if with Boerhave, we believe in a lentor or viscidity of the blood, if with Hoffman, we credit the doctrine of *diminished energy of the nervous system*, or if with Cullen, we combine with this diminished energy the theory of early spasm of the *extreme vessels*, as a "*proximate cause*" or if with Dr. Wilson Philip, we attribute the phenomena to "*debility of the capillaries*" in either of these cases, or in all of them, nature would point out the propriety of drawing the circulating fluids to the surface, and filling the ramifications of the vessels during the primary or colder stages, when their state of collapse cannot be denied. Indeed the promotion of determination to the surface was the indication always aimed at by the administration of diluents and sudorifics, and by the artificial means of emptying the internal and overcharged arterial trunks, by venesection and other evacuations.

SECOND—*Intermittents and Remittents.*

If the doctrine now set forth be correct, the incipient cold stage of intermittents presents desirable opportunities of giving the new means of drawing the blood to the surface, fair and decisive trials.

THIRD—*The order exanthemata or eruptive diseases.*

It is reasonable to conceive, that if we possess the power to draw out the blood towards the skin, we

favour the full and free appearance of eruptions, and diminish the chance of those pulmonary and other congestions, which often succeed measles, small pox, scarlatina, and various eruptive fevers.

From the intimate connexion of the Exanthemata, with disorders of the mucous membranes, it is also probable, that these internal surfaces might in many acute disorders, be unloaded and relieved by producing a general rash and artificial fulness of the cutaneous vessels, and pulpy terminations of the *exterior branches*. Hence probably, the relief obtained in the ill-defined and ill-understood practice of counter-irritation.

In cases of retrocession of eruptions, whether those arising from specific contagion, or otherwise, the new plan presents the most reasonable means of eliciting them again to the external tissues. There is every reason to expect, that the power of altering the condition of the skin and cuticle in so effectual and speedy a manner, will present great advantages in treating the *minor exanthemata*, such as *Urticaria*, *Herpes*, *Lichen*, and all the shades and colours of cutaneous disorders depicted by Willan and Bateman.

SECTION II.

INTERNAL INFLAMMATIONS, AND VISCERAL CONGESTIONS.

Inflammation of the brain, lungs, pleura, heart, stomach, liver, or any other internal organ, can only be properly treated by abundant and unsparing abstraction of blood. Will not its instantaneous diversion to remote and healthy parts, relieve those which are too much distended, when the process is employed in conjunction with the ordinary means already in use?

I mentioned in another place* that after full and free bleeding, it is often a question whether more blood can be lost with safety, here, its abstraction from the *diseased viscus*, and its diffusion among the sound vessels of the skin, unloads the *part affected*, without dangerously debilitating the constitution. We draw off the blood from the oppressed organ, but we do not risk the patients life by too much waste of that fluid which sustains it.

Simple congestive apoplexy must be relieved by drawing the blood to the limbs and surface. In many cases venesection does not succeed in abstracting a flow of blood sufficiently sudden, but, this mode of determining it to the remote

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* London Medical Journal, July, 1832.

vessels, might very much assist the other requisite measures.

In the early stages of Consumption, when there is such weakness as forbids depletion, and yet, sub-acute activity of the pulmonary tissues demanding it, then unloading the distended vessels, without producing debility of the whole system, is a desideratum anxiously wished for since the earliest dawn of medicine.

To all who know the influence of change of air, and the exhiliration produced by a lighter atmosphere, any means capable of yielding such an advantage, in low districts, or smoky towns, must be evident.

If this rarefying procedure can elevate the ribs, expand the chest, lighten the external atmospheric pressure, and augment the quantity of the air inhaled, we obtain a very desirable agent, which may supersede the use of many active remedies.

In certain cases of asthma, and other pectoral diseases, this principle should become of great value. In the treatment of metastasis of gout and rheumatism, a ready mode of producing revulsion is thus presented, and we may reasonably expect that gout may be frequently re-translated from the heart or stomach to the feet.

SECTION III.

DERIVATION, AND REVULSION.

The change of the seat of irritation, or excitement, the diminution or removal of the morbid condition, and its derivation elsewhere, are the indications of treatment pointed out by the example of nature, and the precepts of art in almost every case, where the phenomena depend on passive congestion or active repletion. A diarrhœa, or eruption on the skin, will effect a natural revulsion, and sometimes carry off inflammation of the lungs. We even attempt a similar derivation by art, and endeavour to translate the same disease by evacuations and blisters.

The efforts of nature in translating disordered conditions of parts, sometimes succeeds in effecting a removal of the primary disease, but oftener, as Broussais demonstrated, the sympathetic, predominates over the original irritation, and then the secondary, may surpass in violence the primary affection. Observe the incessant translations of inflammations occurring between the skin, and its great continuation, the mucous linings; not only do conversions of complaints take place between these tissues, but also between all analogous membranes; thus, who has not seen the inflammation of the *synovial*, suddenly translated to the *serous*

tunics, acute inflammations of the knee-joint quickly subside, and instantly the pleura, pericardium, peritoneum, or arachnoid membranes, become inflamed? A metastasis from diarrhœa to acute bronchitis, is daily met with in practice. Again, surfaces and organs, not physiologically uniform, partake of the operations of reciprocal translations; thus of catarrh into hemiplegia; of suppressed perspiration into ascites, of exanthematous desquamations into hemorrhage from the kidnies, of swellings of the legs to mania, or of gout to inflammations of the bowels or windpipe.

There is thus a play of natural revulsions from the *interior* to the *surface*, and vice-versa; and again, from one organ or viscus to another.

With respect to artificial derivations, we tacitly or avowedly endeavour to imitate the conversions effected by nature. We attempt to direct revulsions from the centre to the circumference, by using diaphoretics, diluents, warm-baths, and frictions.

Many other artificial means are employed to effect revulsion, but as all these act by producing more or less activity of the arteries, their use is objectionable, unless preceded by the requisite depletion. Who has not seen intense excitement succeeding the injudicious use of cantharides, mustard, moxa, pustulation, and ammonia, when applied over, or near a part already in a super-excited condition?

On the contrary, did we possess an external revulsive agent, *passively derivative*, not *actively*

stimulating; such agent would be safe, not only in cases where the powers of life are low, the inflammation mitigated, and the irritation chronic, but also salutary, even when fever is high, circulation active, and sympathetic irritation considerable.

This is the great line of distinction between derivation of the fluids to the surface by SUCTION, and its propulsion by the usual medicinal revulsives; that the *former* method acts in making the capillaries *passive* conductors of increased circulation, but the *latter* operate by rendering the vessels more *active*, aggravating acute cases and adding to their over-excitement. The one method *leads* determination, the other *drives it.*

In dealing with the usual internal revulsive remedies, or the external stimulating applications, there is the nicest discrimination required, to ascertain whether the inflammation be sufficiently subdued to admit of the use of excitants over the affected parts, or whether they are not demanded by weakness of capillary circulation, when a condition of the ultimate ramifications exists approaching to debility. This line of demarcation is difficult to distinguish, where the promotion of revulsions would be hurtful, by exciting too much sympathetic irritation, or beneficial, by augmenting feeble vital action.

The derivation of fluids by expanding the vessels from *without*, is not liable to place the Physician in the above dilemma, he can by this means solicit

the circulation to the *branches*, and avoid exciting increased action in the *trunks*.

Repleting the vessels of an exterior part which has lost a portion of its vitality in consequence of the high irritation of an internal organ, is a great desideratum in practice, for it frequently happens, in such cases, that blisters will not vesicate until a nearer balance of the circulation is restored, and hence, in many instances, incalculable advantage is derived from dry-cupping over such a locality, rendering the capillaries of the skin turgid, and the subsequent vesication easily produced.

I have frequently induced increased action in a semi-torpid surface, with a corresponding subsidence of the primary inflammation, merely by drawing the blood into the skin, and maintaining that determination until the interior irritation had abated.

There is no organ so much injured as the brain, by blisters applied over it, when the inflammation is acute, and not sufficiently subdued, by vigorous antiphlogistic treatment; on the other hand, when congestion of the brain depends on atony, then powerful revulsives over the scalp, act directly through the medium of the nerves, as well as of the anastomosing and perforating vessels, in determining a new condition, calculated to unload them.

In either of these cases, the abstraction of the blood to the extremities, diminishes the congestion, whether it arise from active surcharge of the tissues,

by excited circulation, or from passive engorgement, depending on lentor or diminished energy.

It is for these reasons that translations of the circulating fluids to more distant parts is an important desideratum in cerebral diseases, whether functional or organic. I have observed the best results from this practice in cases of paralysis, depending on surcharge of the vessels of the brain or spinal marrow, and where coma, stupor, embarrassment of speech, distorted vision, intolerance of light or sound, and loss of memory, arose from the same causes.

SECTION IV.

DISEASES OF THE ORGANS OF RESPIRATION.

Similar reasoning will nearly apply to many disorders of the respiratory organs. Revulsive means, of one kind or other, have ever been the principal treatment adopted in relieving the substance of the lungs, the linings of the air tubes, or the serous membranes around those organs. When bleeding has reduced high inflammation, blisters and derivatives have rendered important service. The free communication between the pleura and surface of the thorax, renders suction an efficient medium of translation to the surface. My learned

and esteemed friend, Dr. Stokes, jun. assures me, that in numerous cases, where the congestion of the lungs was so great as to yield a dull sound on percussion, as if hepatized, the application of dry cupping, over the part, soon relieved the vessels, and quickly restored the natural resonance. If a partial use of this principle produces such beneficial effects, how much more may we expect from its extensive application?

The influence of external agents is proved, by observing the map which a blister on the chest imprints on the lung under it. A round, square, or oval blister, leaves its shape and outline accurately delineated on the diseased lung, as is observed at post mortem examinations.

Consumption, or phthisis, consists in the formation and subsequent breaking down of tubercles in the lungs. No person will venture to affirm, that determination to distant parts will remove tubercular disorder, once fairly established.

But if we cannot remove such consequences, may we not sometimes prevent their causes. Persons predisposed to that condition, which Dr. Clarke calls *tubercular cachexia*, have that hereditary, or other condition developed, by suppressed perspiration from damp beds, wet clothes, night air, sudden reductions of temperature, and neglected colds.

When patients have been exposed to the operation of such causes, and before tubercular diseases are

induced, then is the time to aim at *prevention*, by restoring the cutaneous functions to their healthy condition.

This is particularly desirable in strumous habits, where there is already a disposition to a congestive state of the abdominal circulation, which, when neglected, superinduces that condition of the lungs, which Dr. Wilson Philip calls, dyspeptic phthisis.

It is in the premonitory stages, that the peripheric determination from the centre, promises to restore that balance, which we formerly endeavoured to promote, by the operation of emetics, sudorifics, warm-baths, and other debilitating means. If the condition, favorable to the evolution of tubercles, be truly one of weakness, then active evacuations must surely be injurious.

When we reflect how useless have been all the means employed for the discussion of tubercles, a proposal of this nature may be the more entitled to trial for their *prevention*. This inducement is strengthened by the circumstance, that in all probability the state of the skin in early stages, is the most essential consideration to direct our progress.

SECTION V.

ON THE BALANCE OF THE VENOUS AND ARTERIAL CIRCULATION, IN THE DIGESTIVE ORGANS.

As there is no class of membranes so easily and frequently affected by the influence of the cuticular functions, as those of the stomach and bowels, so there are no disorders in which the relative agency of the skin, and internal tissues requires to be so accurately discriminated. When the determination to the cutaneous surface is obstructed by cold, or damp, and revulsion is directed upon the organs of digestion, there is first set up, *active* congestion, arising from increased determination, and plethora, and to this succeeds *passive* congestion, depending upon the vessels having been over distended, and consequently debilitated.

The ordinary treatment of these conditions of parts, should widely differ; aud yet there is no series of diseases in which errors are of such frequent occurrence, as in those of *active* and *passive* congestion in the minute capillaries of the alimentary canal. It would be very desirable if any mode could be rendered practicable for directing the circulation from the *gorged interior*, to the comparatively *empty exterior tunics*, and to effect this object *passively*, by *suction*, towards the vessels of the surface, which do not possess sufficient energy

themselves to restore the balance of the circulation. It would be a great advantage if we were enabled to treat active and passive congestion, by an adaptation of the same principle. When we remember the ease afforded from severe pain in the inflamed mucous membrane of the stomach, by leeching over it, we may appreciate the advantages of an *exterior agent* of more extensive influence.

SECTION VI.

NERVOUS DISEASES.

This division of disorders may be less under the influence of the agent now treated of, but I have collected such proofs demonstrating that so many of those complaints called *nervous*, depend on various congestions, chronic enlargements, fullness, and sometimes sub-inflammatory states of parts of the brain, spinal marrow, or their investments, as to infer, that any agent capable of drawing away the fluids from those over distended tissues, without at the same time irritating or enfeebling the patient, will be found highly important in the treatment of such numerous varieties of diseases.

Every person is aware, that in spinal irritation, and sometimes cerebral vascularity, will be found to originate numerous instances of paralytic affections,

certain kinds of ailments of the eye, ear, and other organs of sense, epilepsy, spasmodic affections, mania, chorea, and several of the neuralgia, such as tic douloureux, with chronic pains, and various disorders of the viscera.

Many other observations present themselves upon the subject of general rarefaction of the air around the whole body, for which I beg leave to refer to my original paper in the London Medical and Surgical Journal of July, 1832, and again to the Lancet, of 28th March, 1835.

The cases there recorded by the assistants of the talented Doctor Hart, all confirm in *practice* the *theory* of the procedure : copious perspiration was in every instance easily and speedily produced.

With respect to the local agency of rarefaction, that was in some measure attempted by trials of apparatus for steaming a limb or limbs, after drawing off the air by a pump, but then as the vapour of the hot water filled up the rarefied space around the part affected, steam, *not rarefaction*, was the object of the contriver.

But my object is simply to diminish atmospheric pressure, and consequently to fill up the vessels of the part, to draw engorgements of the head or body, to one or more of the limbs, or in cases of partial paralysis, to elicit heat and active circulation to the part, by charging the local vessels with additional blood, and consequently restoring their tone. To

save time I shall only allude to two cases of this partial dry-cupping.

CASE I.—BY C. CLARKE.

June 24th, 1835, James Macartney, aged 44, a Brewer, complains that he has suffered, for seven months, from a pain over the right side of his head, extending to the ear, and eye; had momentary tremors of the head, face, and upper extremity. The pain is constant, and so excessive as occasionally to make him start out of his bed; it is increased by stooping.

His bowels are generally torpid; appetite bad; great depression of mind; languor and lassitude.

His skin is harsh and dry, and he complains of a stiffness in the knees.

He has taken Plummer's pill, mercurials, antimonials, and various opening medicines, had Tart. Emetic plaster to the neck, blisters, leeches, &c. without advantage.

June 25th, His leg and thigh, up to the middle third, were enclosed in the exhausting air-bath, an hour and a half, during which time his limb attained considerable increase of size, it feels hot and itchy, there is a great determination of blood to the extremity, and the most minute capillaries seem injected; the internal surface of the bath is bedewed with condensed perspiration.

On the bath being removed, and the limb measured, it was found to be enlarged, (when compared with the other,) three inches in circumference above the knee, one inch and a half, at the calf, and nearly one inch, above the ankle. During all the time the mercury was sustained five inches high, showing a rarefaction of two pounds and a half, on every square inch.

A considerable time after removal, the part retained a genial warmth, and remained red on the surface.

26th, Pain of the head diminished, the leg put into the bath has felt much warmer; since the operation, prickling, very itchy, and much more pliable and active.

The bath is composed of tinned-iron, shaped like a boot, closed round the thigh by a collar of oiled-silk.

CASE II.—BY C. CLARKE.

June 1st, 1835. William Campbell, Hammond lane, House-Painter, during seven years has complained of pains and weakness of the arms; the right arm has been much colder than the left, and the wrist very weak, incapacitating him from using the joint at his work; fingers sometimes cramped: has a wife and four children to support, but was obliged to leave his work: he has frequent cold

shiverings; cannot lift a pin, his fingers being torpid and paralyzed: his ankles sometimes swell; and then pains succeed in all the other joints; sleeps well, appetite good.

June 28th, The right arm was introduced into the tin case, and suction effected, the mercury was maintained at six inches high, for an hour and a half. At first, the fingers became gradually hot, then the wrist, and lastly the elbow; when the exhaustion had continued half an hour, he felt the perspiration copious, the fingers as if pulled out, and expanded, and the hand enlarged so as to fill the case. He could not well bear the exhaustion, if more rarefied than seven or eight inches, that is, a diminution of about a quarter of the atmosphere.

My respected colleague, Doctor Smith, saw this man after the operation, the arm and hand were tumid, red, warm, and wet with perspiration: the glow of heat continued a long time after.

July 4th, This man called on me to-day, his arm remains warm, and he reports himself well, and able to work.

It is my earnest wish that the distinction between the influence of *rarefaction*, and that of *condensation* should be duly observed.

This is, in my opinion, their great distinguishing outline; when I desire to restore heat, energy, and re-action to a part of the body, or to one of the limbs, to elicit the vital fluids from one place to another, and maintain the circulation, until nervous action is established, or when I wish to draw out ruptures, or hernial tumours, when strangulated in the canal, or other outlets, then I resort to the rarefaction of the air, from the surfaces alluded to.

On the contrary, when I wish to dissipate heat or redness, to diminish tumors or swellings, empty the vascular branches, or tissues, of superabundant blood, or to return protrusions into the pelvis or abdomen, then I select the equable and powerful agent of atmospheric pressure.

It is thus that both agencies may be required in two different stages of the same complaint. Early in 1834, I explained to my respected friends, Doctors Harvey, Hart and Ireland, and to Messrs. Colles, M'Donnell, and Cusack, of Dublin, this distinguishing feature in the reduction of Hernial tumors; I pointed out to them, and many others, that *rarefaction* would draw out fresh portions of the rupture, act upon the contents of the intestine, and sometimes render strangulated Hernia reducible: whilst on the other hand, reversing the principle, and employing

compression of air, would return the protrusions, or at least send back their surcharge of circulating fluids, and consequently, diminish tenderness and inflammation.

BURNS AND SCALDS.

Rarefaction of air, from a severely burned limb, brings a supply of blood and nervous energy, when the circulation becomes languid, and sphacelation is threatened.

In such cases, replenishing the part with blood, until re-action is restored, prevents or retards the progress of gangrene.

The same reasoning will apply to other interruptions of the capillary circulation, in the cellular membrane or skin, whether occasioned by disease or accident.

But after the chilly stage is removed, and heat restored, the rarefaction must be discontinued, lest the re-action should set in too violently; the reversal of the above plan, will then be necessary, to retard undue influx of blood, prevent inflammation, and abate the violence of pain.

In the treatment of some female complaints, rarefaction will be proper at one time, and condensation at another.

At the ages of 14 and 45, when the circulation is unduly balanced, the extremities cold, the nervous influence dull in the limbs, and too sensitive in the head and body, then, eliciting an influx of blood where it is deficient, equalizes the circulation, and nervous feelings, and seldom fails to impart heat and activity to the extremities, however cold and bloodless before.

PALSY.

In partial Paralysis there is coldness of the limbs, because the nervous energy is weak, and consequently, the circulation languid. Again, like every cause and effect, there is an augmentation of nervous debility and torpor, because the circulation is slow and ill-supplied. In such cases you may give the nerves an impulse and support, by renovating the arterial activity, through this process of suction.

In fact, with respect to the limbs, it is dry-cupping on a *new scale, and for new purposes,* but as I

said before,* it is not dry-cupping, when the whole body is concerned.

The trunk may be compared to a hollow tube, or case, filled by our vital organs: abstracting a part of the surrounding compression from the exterior of the body, permits its easier expansion, dilates its interior, and allows the great viscera to unload themselves of the surcharge of fluids, frequently detained in their vessels and spongy membranes.

When we reflect upon the laws of hydraulics, and consider that the brain and its blood are incompressible in their air-tight case, it will at once be admitted, how important it is in practice, to adopt means in addition to those usually had recourse to, capable of abating an untoward impetus of the circulation to the brain.

Although the propositions here detailed appeared extravagant to many, yet some eminent practitioners have since proposed the application of parts of the theory, without having seen my original suggestions. Amongst others, Dr. Clanny, of Sunderland, sent to The Lancet, of March 7th, 1835, a paper, to which I published a reply on the 28th of the same month, part of which I now beg leave to quote:—

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* London Medical Journal, 1832.

"Any medical man who has been the first to propose or practice an improvement in his profession, is naturally anxious for the credit of his discovery. The process of altering the density and pressure of the atmosphere on the whole body, or on one or more of the limbs, was submitted by me to the profession after long reflection, but I did not think it met with the consideration it deserved. During the prevalence of the cholera here, all my time was engaged as a member of the Central Board of Health, and I had not a moment to spare for personal attendance on the sick; therefore the adaptation of my theory to practice was not so well supported as I could wish. After that time, long absence in Italy, and subsequent illness, prevented my prosecuting the subject with attention, but since my return to Dublin, I have renewed my endeavours to render the general and topical powers of this agent better understood, and to extend its application towards aiding the treatment of many disorders. Actuated by this desire, I read papers on some of its adaptations before the *Surgical Society of Ireland*, and had determined to give the results of certain trials in a separate publication, but seeing the paper of Dr. Clanny in THE LANCET of the 7th inst., I am now induced to submit my views to the profession through the same channel.

I am much more anxious respecting the *merits* of my propositions than their *priority*; but if Dr.

Clanny has any doubt of the latter, I can refer him to most respectable medical gentlemen with whom I had made the rarefaction and condensation of air, on man, and other animals, a subject of discussion since 1812. The application of this process to Cholera, was only a small part of my original propositions, as I still think it applicable to many other purposes.

Dr. Clanny has candidly awarded to me the merits of the priority in *practice.* I am pleased that the *theory afterwards* presented itself to his mind. I have no doubt that he will evince the same liberal feelings as those which actuated Dr. Orpen, when set right on this identical point by my friend Mr. Carmichael, in 1832; part of Dr. Orpen's letter is subjoined :—

North Great George's-street, Dublin, August, 1832.

'If you wish, I will write to the *Medical Journal* acknowledging that you have convinced me of the priority of your ideas; occurring *first* to your mind without suggestion, as they did *afterwards* to mine without suggestion. I am truly yours,

C. E. H. Orpen.

To Dr. Murray.

The following paper was read by me before the *Surgical Society of Ireland,* on my return from Italy :—

GENTLEMEN,

Two or three interesting discussions have already taken place in the *Surgical Society of Ireland*, on the theory of the effects arising from dissection wounds, and I hope it will not now appear out of place, if I lay before you some outlines of the principles which I think should direct our *treatment* in such cases. To those who lament the loss of Dease, Shekelton, and many others, suggestions will not, I trust, be considered useless on a subject which concerns the safety of the pathologist, as well as that of the student in anatomy.

You are well aware, Gentlemen, that no plan hitherto devised has been found capable of preventing the progress of any subtle poison to the heart, except that which comprises some modification of "suction." You also know, that during post-mortem examinations, when the hands are covered with the most offensive animal matter, suction by the mouth is seldom efficiently practised, and also, that it is difficult to employ exhausting or rarefying glasses on unequal surfaces, such as those of the fingers, and other parts of the hand. The consideration of these difficulties led me to contrive a metallic case for embracing the whole hand, with an adaption to render it air-tight, either above or below the elbow, a pipe to connect it with the exhausting syringe, and another to attach with a mercurial gauge, which should regulate the degree of vacuum.

When the rarefaction is properly effected, it can be continued for any length of time which may be considered requisite for the protection of the patient from the effects of these wounds, as well as the bites of rabid animals, and similar sources of deleterious matter.

This plan is certain of being effectual for spaces between the fingers, where proper suction could not be effected by the mouth, or any topical instrument: this mode is sure to embrace every scratch about the parts which have been most exposed,—even such, indeed, as are not seen, felt, or suspected. It will not only act as an effectual preventive, if used as a precaution, but it will greatly assist the cure, even after the symptoms have set in. Sir David Barry was able to arrest the most violent constitutional symptoms, in inferior animals, by dry-cupping.

Long before the discussion on these matters commenced here, I had put into the hands of your Secretary, Dr. Jacob, and others, a prospectus of some lectures, in which I had proposed to explain this, and similar adaptations of the principle; but as the plans require demonstration, in order to become perfectly intelligible, I shall not now trouble you with a description of them.

The value of suction in preventing the introduction of poisons into the circulation, was as well known to the ancients as it is to the moderns; and

much more frequently practised by them. The wound of Philoctetes was inflicted by one of the poisoned arrows of Hercules, and cured by Machaon, by the power of "suction" alone, as we find related in the fourth book of the Iliad. Plutarch mentions that the Psylli and Marsi were hired to attend the camp of Cato in Africa, for the purpose of sucking the bites of venomous reptiles, and that they invariably succeeded in their attempts, at the same time causing the part to swell, which proved the power of the vacuum they had produced.—Hippocrates mentions the use of dry-cupping, to extract injurious matter from wounds:—

> "Cucurbitulæ quæ enim in usum fabricatæ sunt,
> Ut ex carne attrahant et avellant."

and Cêlsus says, that if it should so happen that the cupping-glasses are not at hand, a man must be procured to suck the part. "Homo adhibendus est qui vulnus exugat."

The experiments of Sir David Barry confirm the opinion and practice of the Greeks and Romans, and even extend so far as to prove that the application of the cupping-glass for half an hour, deprives the vessels of their absorbent qualities, during an hour or two after its removal. Modifications of the apparatus alluded to, are, in my opinion, much better adapted for effecting this important object on irregular surfaces, than any of the usual cupping-glasses.

Upon the subject of diminishing or abstracting atmospheric pressure, I should not omit to enforce the value of forming a vacuum immediately on opening a lumbar abscess, into which vacuum it is easy to elicit the matter by means of an elastic pipe, when such may be required. Without in this way abstracting the atmospheric air from the cavity of the sac, it is almost impossible to prevent the ingress, and supposed bad effects of the air.

Around an abscess in a limb you can apply circular pressure, and bring the sides of the cavity into contact; but not so in cases of psoas abscess, where the bones of the pelvis, and the irregularity of the passages, prevent the application of such pressure, besides, every motion of the lumbar and flexor muscles of the thigh, and even the act of respiration itself, tends, at intervals, to make a vacuum in the sac, into which the air rushes, producing many evils, and causing the absorption of the pus and its vapour or effluvia, which cannot so readily take place, if the atmospheric pressure be taken off.

Independently of the value of this principle in the evacuation of matter, air, water, or extravasated blood, it is very advantageous in drawing out such hemorrhoidal, or other tumours in, or about, the anus, as it may be desirable to have fully elongated for the purpose of excision, either by the knife, or ligature.

In a subsequent paper, read at the College of Surgeons of Dublin, I detailed several cases, in which I had succeeded in reducing hernia by this plan. Among others, I related one which occurred in 1834, and had also been seen by the President of the College of Surgeons. When every means of reduction had failed, I effected a partial vacuum over the tumour, and drew out more of the intestine and its contents; it readily returned of itself in the course of the night. I may now mention that where there is high excitement, great tenderness on pressure, and incipient inflammation, I resort, in the first instance, to the plan of compressing the protrusion, by additional air-pressure, until the vessels are emptied, the congestion of the tissues diminished, and sensibility reduced.

Then, reversing the operation, and abstracting the air from the surface of the tumour, I draw it outwards, and bring forward a fresh, uninjured piece of intestine, or omentum, through the ring or canal.—The effect produced by drawing forward the hernia is this, that we have then to deal with a part of the protrusion not already swelled or inflamed, and the tumour becomes more of the nature of reducible hernia, for it cannot properly be called strangulated so long as we can cause the transit of new portions through the passage, in either directions, and so long as the circulation is maintained uninterrupted. This gains time, and frequently ensures success.

No doubt, failures sometimes occur, when the constriction has been of long standing. In *femoral hernia*, the acute angle presented by the protruded parts, greatly retards the process of reduction.

I tried the air-pump, in a case of femoral hernia, in Jervis-street Hospital, last year, but did not succeed; Mr. Wallace operated afterwards with success. Where there are adhesions, we must often submit to disappointments.

The lectures alluded to in a former paper, were intended to exhibit the practical applications of these processes. In the printed prospectus the *reduction of hernia*, by the air-pump, or rarefaction, formed a part of the subjects of the course.—It is difficult to explain in writing the mechanism of these various adaptations of mechanical agents; but then, as now, I have always been ready to point out every part of the propositions, and contrivances, to any medical gentleman desirous of unprejudiced consideration and impartial judgment.

I have had occasion to show its power of reducing hernial protrusions to several surgeons. Cases of its efficacy were witnessed at my house, by Messrs. Carmichael, Ellis, Lynch, Duggan, and others.

Rarefaction of the air is, in many other ways, an agent of great power, and extensive adaptation; for instance, ladies in whom the development of the breasts is deficient, and who have, consequently, a paucity of milk, may have the supply required,

merely by increasing the caliber of the arteries, and of course the determination to, and retention of, the blood in those parts; for milk is but blood, altered by the vital and galvanic apparatus of the mammary glands. In cases of small contracted breasts, I have seen the abstraction of one, two, or three pounds, per inch, of pressure, expanding the vessels, augmenting their tortuosity, filling up the mammæ, and producing plenty of milk in healthy subjects. By determining a similar plenitude in this manner to the uterine vessels, through the well-known sympathy of the breasts, I have frequently succeeded in causing the menses to appear after long-continued amenorrhœa. How rational is this mode of determining the vital fluid through the mammary arteries, when compared with the method, lately proposed, of curing obstructed menstruation by applying leeches, sinapisms, and other irritants to the breasts, and how superior to the plan just now tried in France of eliciting menstruation by suckling the nipple! The French mode only dilates that appendage; mine replenishes it, as well as the whole body of the breast.

Having now spoken of *particular* applications of this principle, I shall say a few words of its general powers. On the 14th of July, 1832, I published in the *London Medical and Surgical Journal*, a description of an apparatus for abstracting part of the atmospheric pressure from the entire surface of

patients. This proposal was made for cases in which it was desirable to determine the circulation from the *centre* to the *circumference*, to open the pores of the skin, induce perspiration, and cause a revulsion of any congestion from the internal organs to the superficies of the body. One of your talented members, Dr. Hart, and his associates, published the result of some trials on cholera patients, who had previously been relinquished to their certain fate at the hospital. Even then, the results were sufficient to prove the great efficacy of the principle, for in all cases it rendered the cold and bloodless integuments warm, and the capillaries permeable to the circulating fluids. Many of you, Gentlemen, may have seen the apparatus and the publications respecting it: I now observe, that in 1835, it is copied exactly by the French, and notwithstanding I had circulated the journal, in Paris, in 1833, on my way to Rome, yet, like most other imitators, they have misunderstood the theory, and misapplied the practice. They put the patient wholesale into the bath, pump off the air, and let the unfortunate person gasp for breath; whereas, all the merit of my plan consists in furnishing the lungs with air of the usual density and pressure, while I diminish the density and pressure on the exterior parietes of the chest, and entire surface of the body. At some of my lectures I mean to show this, along with the other apparatus.

For the purpose of insulating a patient's body from the external air, a small oval bath, of tin, zinc, or copper, is employed; its lip is furnished with a groove to contain luting, for connecting the lid or cover.

In this lid is an aperture to pass over the patient's head, and around this opening is fitted a margin of air-tight cloth, which applies itself so as to embrace the top of the chest and back of the neck. The patient sits upon a seat, easily varied to a regular height, and his head is unconfined, the body and limbs only being inclosed. When the bath is thus adjusted, it is to be partially rarefied, either by the condensation of a little hot air, or steam, or by a few strokes of the suction-pump.

When the air of the bath is exhausted, to the extent of two inches, upon the mercurial gauge, it indicates the removal of *one hundred and forty-four pounds* from every square foot of the patient's surface, or one pound from every square inch.

Rarefaction to this degree is the utmost at any time required, and does not injuriously interfere with those great hydraulic laws, which modify either the general or pulmonary circulation. But, on the other hand, when the principle is applied *topically* to a part of the trunk, or to the limbs, as no interference with respiration can then occur, *two or three pounds* of pressure may be drawn from every square inch, but there is seldom occasion to

proceed to that extent. To draw away even a fifteenth part of the atmospheric gravity, will, I think, be found a therapeutic agent, abundantly powerful for any useful purpose.

It was my intention to give drawings of the various adaptations, but as it is obvious that any misconception might lead to injurious results, I have thought it safer to direct an able artist, Mr Hodges, of Westmorland-street, to make the apparatus, supply proper directions, and send a careful person conversant with its mechanism to apply it. He has also arranged a similar facility, to be afforded by Mr. Hart, 25, Hunter-street, Hanover-square, London, and any other place that may require it.

I have further requested him to communicate to any medical gentleman, the most free and explicit explanations respecting the mechanism and applications of the general, or local baths for RAREFACTION.

I am nervously anxious that this principle should not be longer misunderstood.

I have already had ample proofs of the misapplication of another remedy, which I suggested sixteen years since ; viz. the topical application of *Iodine, in vapour, diluted and diffused in that of water, or of soothing decoctions* to be administered by inhalation.*

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* See Treatise on Iodine Inhalation, p. 171—260, &c., and Lancet of March 28, 1835.

This local treatment was brought into disrepute by the persons who since attempted its employment: they cause their unfortunate patients to inhale the *concentrated and undiluted vapour of Iodine*, from *a confined pipe*, and mingled with the irritating alcoholic vapour, rising from the tincture, which they so injudiciously employ, to afford the Iodine inhalation.

OBSERVATIONS,

&c. &c.

PART II.

THE INFLUENCE OF CONDENSATION, OR INCREASED ELASTIC PRESSURE OF THE ATMOSPHERE, UPON A PART, OR THE WHOLE OF THE HUMAN BODY.

As rarefaction of air on the surface of the living body, will abstract the blood and other fluids from the interior, expand the exterior, and fill its vessels, so on the other hand, *compression* or *condensation* may be employed in various other cases, besides those enumerated in my former papers; particularly in suddenly charging the system with mercury, as in cases of inflammation of the brain, and in croup.

In a general point of view, we may glance at the agency of a condensed atmosphere on respiration, and the supply of additional quantities of air to the lungs, without increase of the volume or bulk inspired: many proofs of its influence might be

related, in cases where persons have been confined in air-tight vessels, and air pumped in, to such an extent as not to become oppressive. In several instances of difficult respiration, its application was beneficial.

As *Asthma*, depending on inability to expand the air-cells, and walls of the chest, is relieved by the process of rarefaction *outside the thorax*; so on the contrary, that species of Asthma, which is caused by over dilitation of the cells, and want of contractility, is alleviated by *Condensation.* Persons have been cured of Asthma, by descending in a diving-bell, where their lungs and entire body were subject to an additional elastic compression of air, equal to forty tons.

Some persons may object, by saying, that if we facilitate *inspiration* by the air-pump, we impede *expiration* in the same proportion. This is a very rational argument; but the practice is only recommended in cases where the balance between these two processes is already unequal, and where we might be justified in attempting to aid either, by rarefaction, on the one hand, or by compression, on the other. This circumstance shows the necessity of due discrimination, and that much judgment must be exercised, should the principles come into use.

The importance of employing this adjuvant, may be more readily admitted, when we consider the amazing extent of surface, over which the blood is presented to the atmospheric influence in the lungs,

an extent, thirty times greater than that of the entire superficies of the whole body, as calculated by Monro, the second. The air vesicles being only one-eightieth of an inch in diameter, there will be five hundred and twelve thousand vesicles in a cubic inch. Supposing the cells cubical, the sides will then extend, in a cubic inch, to three millions seventy-two thousand. If we deduct one third for the communicating apertures, two millions seventy two thousand will remain, constituting a space equal to three hundred and twelve square inches, or two feet, twenty-four inches Now, as the lungs, when expanded by a full inspiration, contain about two hundred and twenty cubic inches of air, the whole internal surface spread out to the atmosphere, extends to four hundred and forty feet, that is, nearly thirty times the expanse of the external surface of an ordinary man, which was computed, at page 1, to measure fifteen feet. The above differs from the calculations of Kiel, and others, but for all practical purposes, the difference is not very material.

With respect to the partial or local effects of atmospheric pressure, I have observed its utility in Hernia Humoralis, and other glandular swellings. I also showed to Mr. Little, and other students at the College of Surgeons, the facility by which a *prolapsus uteri* was reduced and retained in its place. This was effected simply by connecting the

neck of a small oiled bladder with the air-syringe; when the air was forced into the bladder, it was reflected around the protruded Uterus, embracing that organ, as if in a double night-cap; it then grasped, corrugated, and diminished the prolapsed womb, and propelled it back into the pelvis, pushed on, and retained in its place, by the expanded bladder.

When you put the hand into a wet bladder, and exhaust the air, there is a very intense degree of cold generated, and the compression is more than the fingers can easily bear. I heated the bladder in warm water, and even then, the temperature of the hand was reduced. The fingers seen through the bladder, were wrinkled and bloodless. There is no doubt but that hemorrhages would be instantly suppressed by this tight embracing involucrum, which adapts itself to every eminence and depression of the joints and fingers, so as to press equally on all parts. There is very brisk re-action when the compression is removed, the hand becomes red and hot, by the increased return of the circulation to the surface.

Drawing a limb into a tube of oiled-silk, or even a softened bladder, open at both ends, and confined by tape, above and below the part affected, presents a ready method of effecting speedy and equable compression. When the contained air is withdrawn from this envelope, it contracts and embraces every

point, *high* or *low*, in an equal degree; this is much more suitable for *inflamed*, or *ulcerated burns*, than the diachylon strapping of Professor Valpeau.

By this means, we can regulate GRADUATED compression upon angular, or irregular joints or surfaces, and thus arrest hæmorrhage, and repress protuberant granulations.

One avowed design of bandages in cases of fractures, particularly in the French schools, is "for the purpose of benumbing the irritability of the muscles;" but, if unequal and chafing bandages are useful, how much more so must be the soothing power of *elastic compression*, exercised only on the portion of the limb or body that requires it, and leaving the parts adjoining free and unconfined.

Ulcers of an indolent nature, may have their activity increased, and granulations elicited by the principle of suction, and inversely, ulcers of a vascular, turgid, or inflamed character, may be rendered much less active by this species of pressure.

Mr. Spender, and others have shown that the majority of ulcerous diseases of the legs are not so much owing to the depending position of the parts, as to a positive and palpable unhealthiness of the superficial structure of the limb, consisting of a varicose condition of the cutaneous veins. Most writers attribute this varicose state of the superficial veins, to weakness of their tunics, or to some mechanical interruption to the upward flow of blood.

Whatever the above author, or any other has said on the subject of the depending position of the limb, there can be no doubt that the ascending columns of blood in the veins, and their distance from the heart, greatly tend to augment the dilatation and debility of these vessels in the legs. Observe the effects upon the two legs of the same individual, if he permits the one to hang down, as he reclines, on a bed or sofa, and if he rests the other much higher than his body, the elevated limb will become smaller than the other, and similar ulcerations will heal in half the time.

The veins are furnished with valves, at certain intervals, so that in the natural state, the space between each valve, keeps its own quantum of blood poised up, as if it were almost an insulated link of a tube, like that separated by the joints in a cane or other hollow reed. But when debility of the sides of the veins takes place, or when they are distended by obstructions in their course, such as those occasioned by garters, and tight lacing, or pregnancy, then the walls of the veins are pushed so far asunder, that the tube no longer embraces the valves, the latter become too small for the calibre of the vessel, and the column of blood, in place of being insulated, and supported, as if by separate joints, is now all bearing upon the already enlarged and relaxed tube, and there are engorgements and distension of the

veins, and of all the little rivulets that should flow into them.

CASE.

Herbert, a cabinet-maker, was admitted into the Netterville Hospital in July last, labouring under extensive ulceration of the ankle joint, of nearly ten years' continuance: the foot was swelled and œdematous, and the ulcers spongy and ill-conditioned. So obstinate was the disease, that it had been repeatedly proposed to amputate the limb. The whole joint was subjected to atmospheric pressure for ten days, when the swelling was reduced, and the entire ulceration healed up.

HERNIA HUMORALIS.

The greatest cause of pain in this disease is the distension of the tunica albuginea. This arises from the pressure from *within*, putting the unyielding tunic on the stretch. In this case, compression from *without*, balances the other expansive tension, and overcomes it, thus the pain is relieved, at the same time that the vessels are emptied, and the inflammation consequently abated.

I had resolved to adduce many cases illustrative of the foregoing propositions, but I lament my paper is

already too long. I shall with pleasure explain the modus operandi, to any gentleman who may honor me with a visit, and beg to conclude by an extract from a paper formerly read to the Surgical Society of Ireland.

The influence of increased pressure, and the elasticity of the atmosphere, are matters of great moment, the details of which admit of varied extension. I am the more desirous to call your attention to the consideration of this topic, in order that I may submit the result of certain trials of the effects of atmospheric pressure. In presence of the respected Vice-President of the College of Surgeons, Mr. White, I instantly reduced a very inflamed, turgid, tender, and most troublesome prolapsus ani, *without touching the sensitive protrusion.* Any of you may see the child of Larkin, No. 32, Bridgefoot-street, and it is worth the trouble of visiting. I succeeded in a similar extremely bad case last winter at Rome, after all the usual means had failed in the hands of others. The great advantage of my plan consists in this, that it *empties* the turgid blood-vessels, and quickly reduces the protrusion, without inflaming or irritating the rugæ or folds of the mucous membrane, and without the painful operation of introducing the fingers, paper cones, or folded cards, as formerly recommended. When the prolapsus is reduced by the pressure of air, over a surface of oil, lime-water

or infusion of galls, the relaxed villous coat seldom descends again, and if it should, it may be returned with the greatest facility, because its veins are comparatively empty, and its morbid sensibility abated, by the uniform pressure.

It is almost incredible to relate the advantages I have seen from the introduction of an elastic compress of air, under a cup, confined by a wet bladder, or some other cover, upon tumors and swellings of various kinds. Among these may be mentioned chronic enlargements of the breast, and other glands, depositions in the cellular and interstitial tissues, white swellings of the joints, and distensions of the bursæ, bleeding, or fungous sores, or surfaces, indurated tumors, and local congestions. Owing to my long absence, I had not sufficient opportunity to try this mode of compression in varicose veins, or aneurismal dilatations; but I have frequently returned reducible herniæ, without pain or difficulty.

The mode of pressure recommended by Recamier, Young, and other writers, is liable to many objections. Their compresses bear most upon the centre and sensitive apex of the tumefaction, press with great inequality, abrade the parieties, and frequently hasten the degeneration of schirrhous enlargements, into cancerous ulceration; but on the contrary, the method here recommended, presses equally upon all parts of the swelling, defends the skin from abrasion, compresses the circumference of

the part, acting upon the vessels *around the tumor, where they are most capable of absorbing*, propels away the contents of the veins, and prevents further untoward influx by the arteries. To persons accustomed to the manipulations of valves and machinery, these processes soon become manageable, the degress of compression being easily regulated by a mercurial gauge.

I have already mentioned, that Sir David Barry, and many others have proved, that the withdrawal of the air by suction, or dry-cupping prevents the penetration and imbibition of poisons. I have proposed a reversal of this law, that is, *to enforce the absorption of remedies*, by superadding an artificial atmospheric pressure, over the part.

Warm or cold lotions, medicated infusions, gases, or vapours, may thus be introduced into the part affected, and the power of imbibition be very much increased, by well regulated compression. In this manner, solutions of iodine or its vapour, sulphur, mercury, narcotics, or sedatives, can readily be introduced in local affections or general complaints. In cases of tic douloureux, spinal disease, and sciatic ailments, I purposely detach the scarf-skin, and topically introduce the appropriate remedies, by pressing them into the affected tissues, on the principle of transfusion through the membranes. On the other hand, a compression of atmospheric, or any other air, *over inflamed surfaces*, is well

calculated to propel the overflow of blood onwards to the general circulation. I have experienced the good effects of such condensation over erysipelatous and erythematous inflammations.

The arteries of the female breast, become remarkably distended and tortuous after parturition. In cases where the mother cannot nurse, or the child dies, this untoward circulation produces fever and irritation. It becomes, therefore, a matter of great moment, to diminish the blood-vessels, and to lessen their activity. Cold applications, astringent lotions, and irregular compresses, have frequently been productive of serious constitutional and local injuries; but when you surround the whole mamma by a disk of proper shape, as it were *insulating* the breast, and pressing only around its base, you cut off the supplies by moderate gradations, and you diminish sensibility by gentle, diffused, and elastic compression.

All organs requiring sudden augmentation of activity, and great occasional supplies, such as the womb, the stomach, the spleen, &c. are furnished with tortuous arteries; and this twisted condition increases, as the volume and active functions increase. This tortuosity may be designed by nature, not so much to impede the force of the circulation, as to detain and delay the blood in its way, through the organs, requiring at those periods such extra-replenishment. Pressure remarkably diminishes the

tortuosity of arteries which supply enlarged and inflamed glands and tumors, approximates the sides of the vessels, abates their sensibility, lessens their contents, and reduces large trunks to the diameter of minute branches. This constriction is admirably calculated to impede and expel an excess of blood, to diminish engorgements, and to dissipate infiltration.

Infants may die from leech-bites; the whole family cannot stop the hæmorrhage; even the doctors have failed in extinguishing the rush-light. They all knew they could command any quantity of blood *to flow* by making a *vacuum* over the bites; but it never entered their heads that it would be just as easy to stop the orifices, by making a *plenum* over them. Three or four strokes of the compressing piston condense the air, and instantly arrest the hæmorrhage. The by-standers stare, and exclaim, "how curious!" "it is so simple," "we never thought of it before." But it is not only leech-bites, that condensation will stop, but uterine and other hæmorrhages, whenever compression can be applied by means of water, or other proper liquids, so as to overcome the impetus of the blood. A few inches of mercury indicate a pressure quite equal to this. The condensation you can regulate with the utmost precision, every inch of mercury indicating half a pound of pressure.

By means of well regulated condensation of air, you can retain the bowels in the cavity of the abdomen, when its parieties have been opened or torn, and you will be able to command the flow of blood from fungous tumors, wounds, and ulcerations.

I now conclude by the following extract :—

" Such, Mr. Editor, are the original papers, read by me in the College of Surgeons of this city. In the discussions which followed, I mentioned, that I did not wish to appear to prove too much, by adducing additional details, but stated, that from the numerous experiments I had made, on the comparatively moderate impulse of large arterial trunks, not exceeding two or three pounds of pressure, I should entertain no fear of arresting the flow of blood from any stump or limb, and thus preventing many of the accidents consequent on amputation, secure a close adaptation of the soft parts, prevent turgidity or inflammation, and effect a perfect adhesion by the first intention.

" I forgot to mention in the paper, that in 1816, I prevented the re-action, consequent tumefaction, heat, and probably, the sphacelation of an extensive and dangerous laceration of my right hand (torn by glass in a chemical experiment), merely by maintaining such compression over the blood-vessels,

as kept them comparatively empty, and all the separated parts in exact apposition.

"It is probably, by diminishing the caliber of the vessels, that cold lotions, affusions, evaporating and astringent washes, were first found useful in inflammations. Perhaps, it is the lacing, by the new pressure, after firing, that benefits the legs of the horse. It may be the retraction of the fibres during the shower-bath, and the consequent contraction and pressure of the skin and other tissues, that give tone to the exterior, and impulse to the interior circulation. We all remember the pressure of the plug of blood in the divided artery, and of the clot in the womb. The philosophy of a principle, is sometimes much diversified in practice. Although it may be illogical to attempt to prove too much, and imprudent to provoke ridicule (the weapon only of the weak), yet I can assure your readers, that in one case, where I had dissipated the œdema of a lady's legs by atmospheric pressure, her husband maintains to this day, not only that the swelling was removed, but also that the over-bulky texture of her ankles was reduced to that of a neat and sinewy joint!

"Whether this mode of assisting percolation be adopted or not, I can refer to the following pages of my work, on the "Inhalation of Iodine, &c.,"*

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* Vide pages 31 to 34, 133, 145 to 147, 157, 180, 181, 301 to 303.

to prove, that the subject of cutaneous imbibition was not now taken up without study and experiment.

"As this communication commenced on the subject of *priority*, it may be proper to settle another claim. I have before me a letter from Professor Duncan, dated Edinburgh, November 15th, 1823, from which the following is an extract: "I shall be glad to learn the results of your trials of the inhalation of *iodine vapour;* it is at least rational." This is exactly five years previous to Sir Charles Scudamore's thoughts upon the subject, for he wrote to me in May 1830, that the idea had first occurred to his mind two years and a half prior to that date.*

Some physiologists may consider, that mechanical philosophy detracts from the importance of the agency of the vital principle; but on the contrary, I think that the inductions derivable from material phenomena, more strongly elucidate the functions and powers of the human body. I hope, therefore, I may be excused for this endeavour to invite my professional friends to an extensive field of investigation, in which I fear, as yet, I have only reached the entrance. If, even in a single case,

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* Lancet, March, 1835.

out of a thousand, relief or recovery be obtained, or accelerated, by the means here imperfectly submitted, then, I shall consider myself abundantly rewarded.

Merrion-square, Dublin, April 25th, 1836.

When the preceding pages were printed off, the *Medical Review* for this month, by Drs. Forbes and Conolly, reached me. It contains a translation from *Hecker's Annalen. Erster Band. Viertes Heft,* 1835, on the employment of the Suction-pump, in Incarcerated Hernia, by Dr. Köehler, of Warsaw. This gentleman's observations afforded me more pleasure than I can describe; they confirm every suggestion of mine on this subject, since 1812. Soon after that time, when I mentioned, that strangulated hernia receded after having been first drawn out by a large cup, in which camphorated spirit had beed burned to exhaust the air; the incident was considered visionary, or accidental, and I was discouraged by that ever-ready logic of my merry countrymen, a loud laugh. But now when foreigners adopt the theory, which I was the first to promulgate, and to practice, my good friends, the laughing philosophers must resort to some better argument, and take the trouble, at last, to study the new topic of mechanical philosophy, in relation to the healing art. Want of space precludes the

entire paper of Dr. Köehler, but the following extract from it is conclusive :—

"A further enumeration of cases in which taxis was accomplished, and the knife superseded by means of the suction-pump, appears to Dr. K. to be superfluous. In twenty-three cases, most of which were of a hopeless kind, the new method never once failed him; and it were greatly to be wished, he concludes, that so simple a remedy might be called into more general use."

In the Dublin Medical Journal, published this day, the able editors give extracts from the above periodical. I lament that they had not seen my present paper; but if any doubt shall hereafter remain, with respect to *priority* and *originality*, I can set the matter at rest, to the satisfaction of the entire profession—The following are the observations of the excellent Journal alluded to :—

"Sir James Murray published a paper in July, 1832, in the London Medical and Surgical Journal, upon the remedial efficacy of the air-pump, and the effects of diminishing atmospheric pressure.

"We were present at the meetings of the Surgical Society of Dublin, early in 1835, when he read papers on the local and general agency of this principle, and detailed cases, among others, of the reduction of hernial tumours by means of the air-pump, either by increasing or diminishing pressure, some of which operations had been witnessed by several eminent surgeons of this city.

"We may also observe, that the adaptation of this process to *hernial tumors*, formed part of the printed prospectus of his lectures in 1834.

"From these facts, we think Sir J. Murray may lay claim to originality, if not priority in this treatment of strangulated hernia."—Eds.

The following letter, from my respected townsman, Doctor Ferrar, relates so much to the present subject, that I hope to be excused for adding it to this paper :—

Belfast, April, 1836.

My Dear Sir,

Having just learned, from our friend, Dr. M'Donnell, that a work of your's was in the press, in which you notice some of the effects of the removal of atmospheric pressure, from the external surface of the human body, in various diseases as well as cholera, I am induced to trouble you with a few lines relative to this most interesting subject. You will excuse my intrusion on your valuable time, when I remind you that I was one of the first medical men, (if not the very first,) who witnessed your strenuous exertions in the epidemic of 1832, to apply this principle to the relief of some of the patients who were in the Townsend-street Cholera Hospital, in the month of July.

The cases which were afforded you to try the effect of your invention, were certainly most unfavourable ones, and it is scarcely justice to any new discovery, to make trial of its effects only in extreme cases, more particularly, where there is not involved in the experiment any degree of bodily suffering.

Yet, notwithstanding the unfavourable condition of the patients, (in fact they were moribund,) the effects of the experiment were decided and beneficial : and I am convinced, that bodily energies were restored, in a considerable degree, and life was prolonged, in every instance for several, (say from twenty to twenty-eight) hours ; even this partial success is gain, in a disease so rapidly fatal as Cholera.

During the last three years, I have been so circumstanced as to have little opportunity of attending to any thing in my profession except the routine details of every-day practice, and consequently have not had opportunities of witnessing the further development of the effects of the principles of your discovery, as applied to other diseases, whether surgical or medical. I think it likely that the effects of the vacuum would be very striking in Pleuritis, or Pneumonia, or in Gastroentiritis, or in Peritonitis; in fact, in any of those diseases of mucous or serous surfaces, in which there is generally present more or less internal and defined congestion.

In some surgical diseases, abscesses for instance, and hernia, wherein the removal of the atmospheric pressure might cause such an internal change of the parts affected by the stricture, as to either effect or assist reduction, without proceeding to the last resource of an operation but too often undertaken as a forlorn hope.

I know that all these thoughts had already occurred to yourself, during upwards of thirty years study and practice of surgery and medicine in this country, as well as in Edinburgh.

There is one circumstance, however, to which I would call your attention; a continental surgeon is just now before the medical public, as the discoverer of what really and unquestionably is your discovery; and it is equally certain, that many members of our profession (to our shame be it said), are but too ready to retard the improvements of their own countrymen, more particularly, if an individual happens to make any discovery, and thereby justly earn for himself well-merited professional distinction. There cannot be any one, who ought to be more sensible of this than yourself, when you recollect how you were treated relative to your improved mode of the operation of tracheotomy. In the Dublin Hospital Reports of 1834, there is a detail of some operations of this nature, done on the former, and then usual principle. This was before the publication of your work, *on heat*, at least four or five years; but you had in (I think) 1818—19, first proposed and performed the operation, which is now generally practised by some, too, who have not, in their published reports, stated to whom they are originally indebted for a new and safe form of an operation, which affords few difficulties, apparently, or when it is talked of, but, in reality, many, in its safe performance.

Believe me, to remain, my dear Sir,

Very faithfully yours,

THOMAS FERRAR, M.B.

LICENTIATE OF THE ROYAL COLLEGE OF SURGEONS, IN IRELAND.

Sir James Murray, M.D. &c. &c.
Merrion-square, Dublin.