

**An essay on the medicinal properties and deleterious qualities of arsenic : submitted to the examination of the Rev. John Ewing, S.S.T.P. provost ; the trustees and medical faculty of the University of Pennsylvania, on the seventeenth day of May, 1796, for the degree of Doctor of Medicine / by Nathaniel Potter, of Philadelphia.**

### **Contributors**

Potter, Nathaniel, 1770-1843.  
Rush, Benjamin, 1746-1813  
Woodward, William W.  
University of Pennsylvania.  
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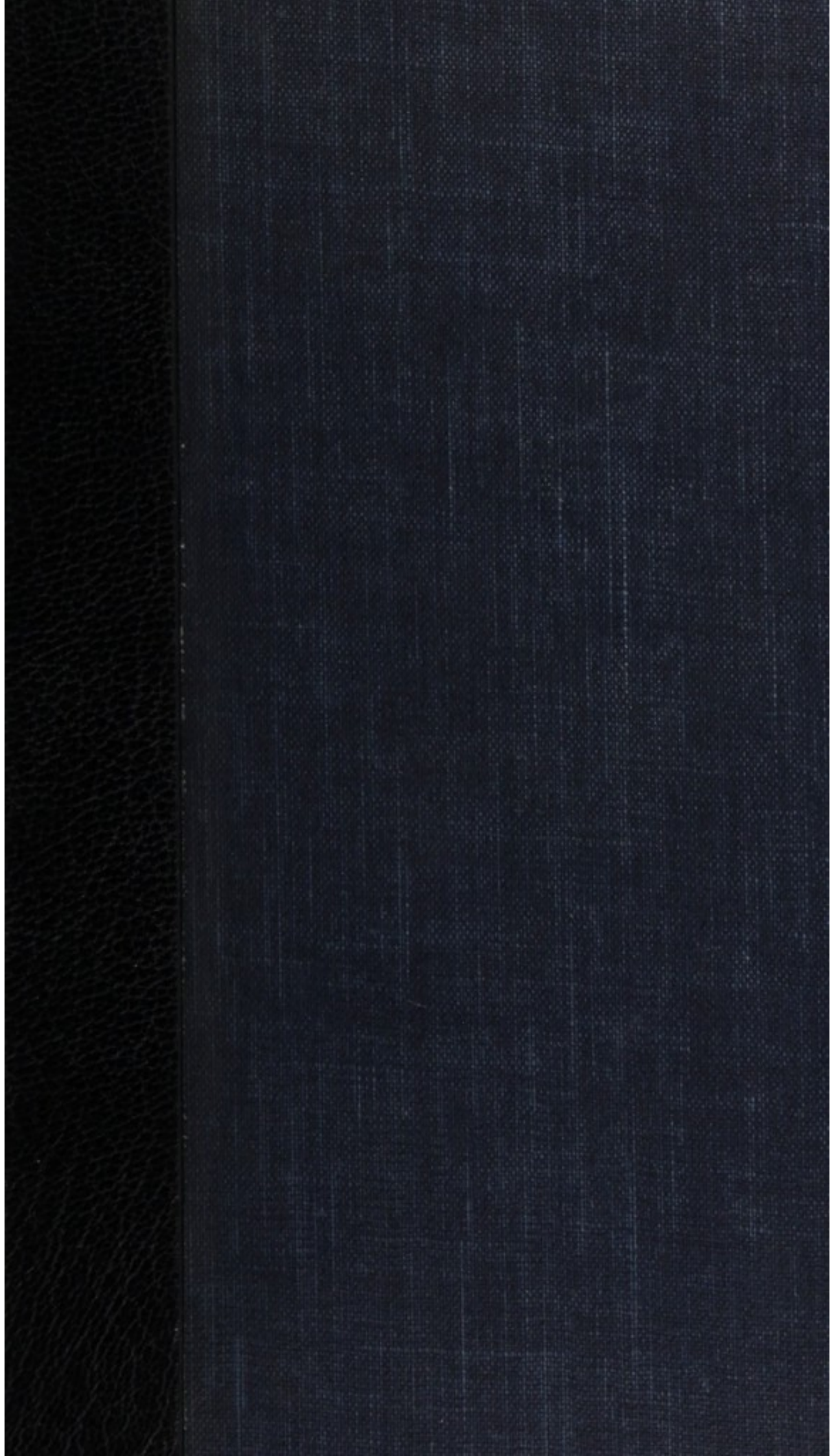
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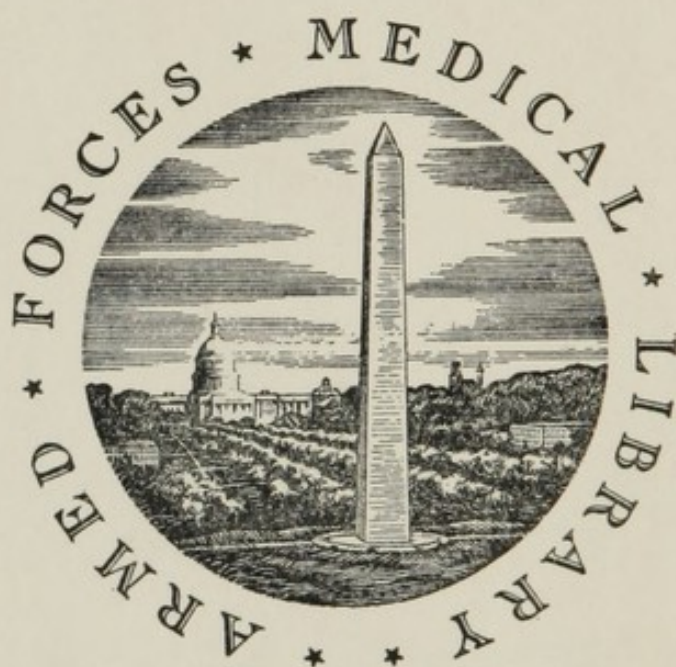
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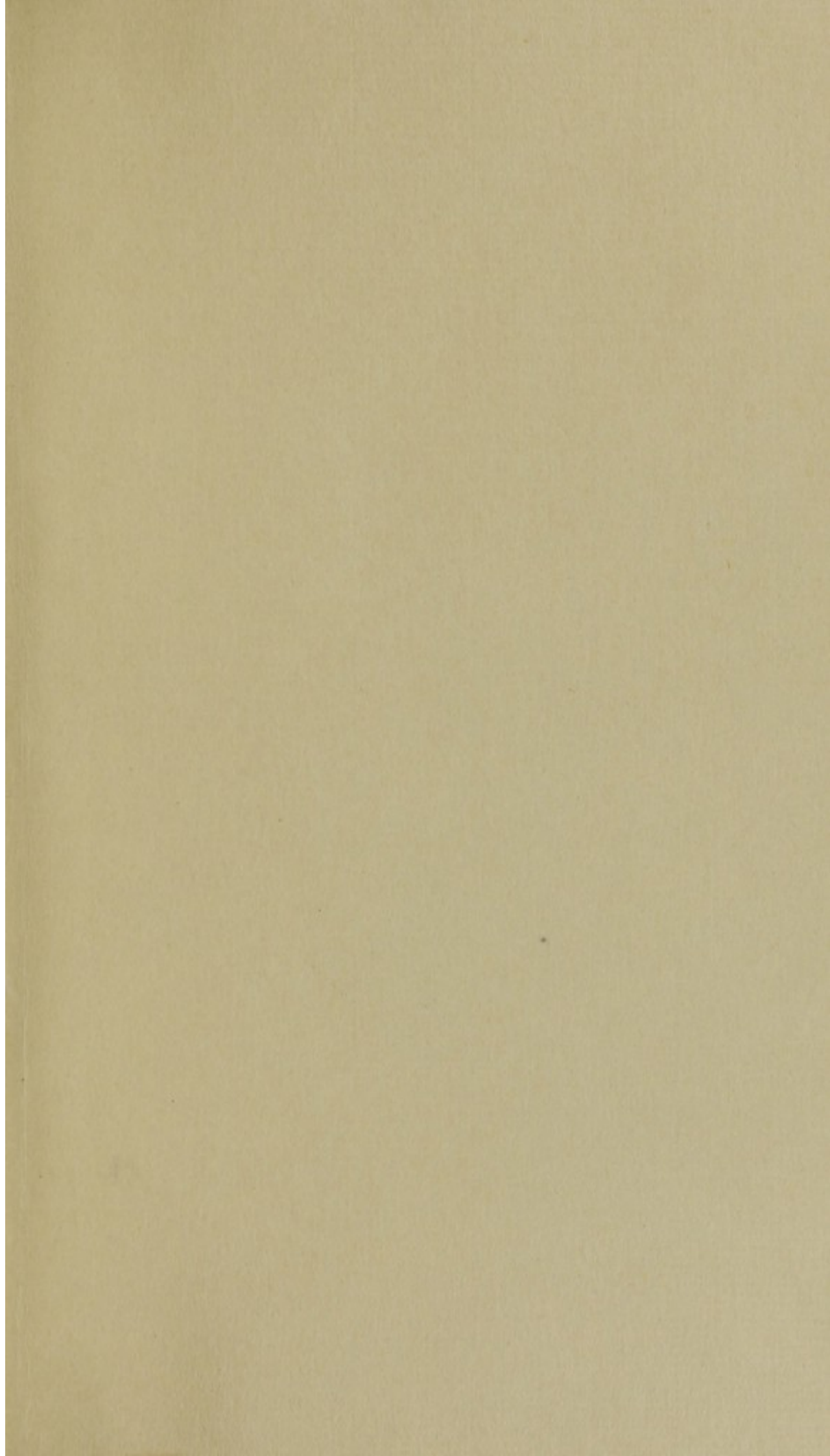


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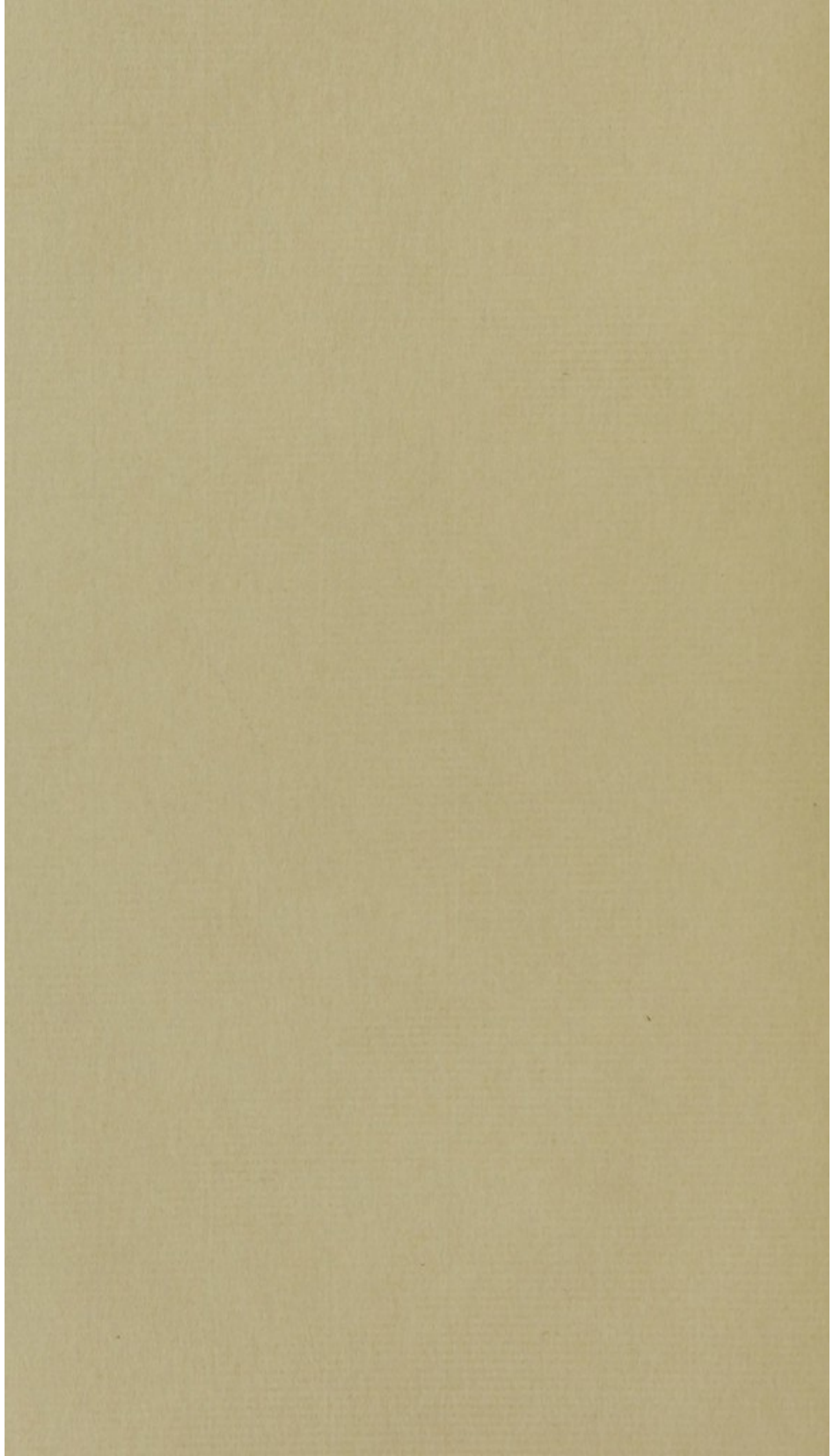
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WASHINGTON, D.C.









*Recd 1819.*

AN

*Author*

E S S A Y

ON THE

MEDICINAL PROPERTIES

AND

DELETERIOUS QUALITIES

OF

A R S E N I C :

SUBMITTED TO THE

EXAMINATION OF THE

REV. JOHN EWING, S. S. T. P. PROVOST ;

THE

TRUSTEES AND MEDICAL FACULTY

OF THE

UNIVERSITY OF PENNSYLVANIA,

ON THE

SEVENTEENTH DAY OF MAY, 1796,

FOR THE

DEGREE OF DOCTOR OF MEDICINE,

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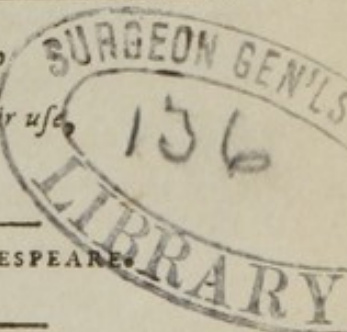
By NATHANIEL POTTER,

OF PHILADELPHIA.

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*" Nor ought so vile that on the earth doth live,  
" But to the earth some special good doth give ;  
" Nor ought so good, but strain'd from that fair use,  
" Revolts from true birth, stumbling on abuse :  
" Virtue itself turns vice, being misapply'd,  
" And vice sometime by action's dignify'd."*

SHAKESPEARE.



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PHILADELPHIA :

PRINTED BY WILLIAM W. WOODWARD, N<sup>o</sup>. 17,  
CHESNUT-STREET.

1796.

L. S. 20 A. Y.

BENJAMIN RUSH, M. D.  
PROFESSOR OF MEDICINE

DEPARTMENT OF MEDICINE  
CLINICAL MEDICINE

UNIVERSITY OF PENNSYLVANIA

My dear Sir,  
I have the honor to acknowledge the receipt of your letter of the 10th inst. and in reply to inform you that the same has been forwarded to the proper authorities for their consideration. I am, Sir, very respectfully,  
Yours, &c.

W. M. WATKINS, Esq.



TO  
BENJAMIN RUSH, M. D.  
PROFESSOR OF THE INSTITUTES  
AND OF  
CLINICAL MEDICINE,  
IN THE  
UNIVERSITY OF PENNSYLVANIA.

IN departing from your protection, and appearing on the wide theatre of the world, I feel like a man exiled from his friends and native country; permit me therefore, to solicit a continuation of that salutary advice, the benignant influence of which I have so often felt. The acknowledgment of the infinity of obligations I owe you, for your assiduous attention in conducting me through the arduous pursuits of a difficult profession, during six years, constitutes but an inconsiderable part of the claim you so justly hold upon my gratitude: Whether I view you as a citizen, a philosopher, or a friend, you are equally entitled to my admiration and esteem.——May the rays of light from the principles of science which you have taught, like those of the sun, fall upon the most distant parts of the earth; may their truths, which I have so often seen exemplified, like the waters of the Nile, fertilize the soil they inundate.——That your life may be as long, and as happy, as it has been useful, is the most ardent wish of

Sir, your Affectionate Pupil,

NATHANIEL POTTER.

TO

BENJAMIN R. M.D.  
PROFESSOR OF MEDICINE

THE UNIVERSITY OF CHICAGO  
CHICAGO, ILL.  
DEAR SIR:  
I have the honor to acknowledge the receipt of your letter of the 10th inst. in relation to the matter of the donation of the library of the late Dr. J. C. Smith to the University of Chicago. I am very glad to hear that the library is to be placed in the hands of the University, and I am sure that it will be a great benefit to the students and faculty of the University. I am sure that the University will be able to make the best use of the library, and I am sure that the students and faculty will be able to make the best use of the library. I am sure that the University will be able to make the best use of the library, and I am sure that the students and faculty will be able to make the best use of the library.

Very respectfully,  
J. C. Smith



## P R E F A C E.

*I N the subsequent investigation little aid can be derived from the opinions of preceding writers. The few lights that have appeared on the subject, have been so faint and transitory, that they have only served to conduct us into a solitary and uncultivated desert. The ingenious Dr. Fowler, of Staffordshire, in England, is the only author who has treated systematically of the virtues of Arsenic: Although his observations have been confined to intermittent fevers and periodical headaches, he has done much toward establishing the reputation of this valuable acquisition to the materia medica.—It may be thought by some, superfluous to increase the catalogue of medicine, with which the materia medica already superabounds; it must nevertheless be acknowledged, that medicine to fulfil certain indications with promptitude and energy, are the grand desiderata of the materia medica. The man who shall discover a solvent for the urinary calculus, or a cure for the epilepsy, will, in my opinion, better merit immortality than all the astronomers from Sir Isaac Newton to the present time.*



P R E F A C E

# INTRODUCTION

I have the pleasure to inform you that the first volume of the *Transactions of the American Society for the Improvement of the Condition of the Female Sex* has been published. It is a work of great interest and value, and one which will be found to contain much valuable information. The volume is divided into two parts, the first of which contains the reports of the various committees, and the second contains the reports of the various societies. The reports are all of great interest and value, and will be found to contain much valuable information. The volume is published by the American Society for the Improvement of the Condition of the Female Sex, and is sold by all the booksellers.

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# INTRODUCTION.

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THE man who presumes to recommend to the world a medicine which has ever been deemed a most virulent poison, ought seriously to contemplate that mixture of admonition and consolation, which the poet offers to the juvenile satyrist.

“ But tread with cautious steps the dang’rous ground  
“ Beset with faithless precipices round,  
“ Truth be your guide ; disdain ambition’s call ;  
“ And if you fall, with truth you greatly fall.”

ALTHOUGH eight hundred years have elapsed since a celebrated Arabian physician\* prescribed Arsenic as an internal medicine, and although its success has been attested by the most respectable authorities, yet, even at this enlightened period, it is scarcely known as a medicine. The frequent attempts that have been made to introduce this mineral into the practice of medicine have either perished with their authors, or soon followed them in silence and oblivion. To de-

\* Avicenna. Lib. 2. Tract. 2.



termine whether the fate of this medicine has been the just reward of its pernicious effects, or the inevitable consequence of scepticism and timidity, shall be the business of the subsequent disquisition.

THE idea of a poison associates itself so intimately with death, that the thought of separating them would at first view seem to offer a violence to the understanding. The epithet poisonous has generally been made to designate some enigmatical or inexplicable quality, and a poison has accordingly been defined, "whatever by its action upon the body produces death by its quality, without respect to its quantity." The reverse of this definition is perhaps the most accurate idea of poison that can possibly be given. Little sagacity will be required to perceive, that poisons are, in their own nature, as relative as heat and cold, and that the same substance may be either a medicine or a poison, according to its strength and quantity. However repugnant this opinion may have been to the feelings of physicians, it was familiar to the penetrating eye of the philosophic Shakespeare; who makes Friar Lawrence in his soliloquy exclaim :

- ‘ Within the infant rind of this small flow’r
- ‘ Poison hath residence and medicinal power,
- ‘ For this being smelt, with that sense cheers each part,
- ‘ Being tasted, slays all senses with the heart.’\*

\* Romeo and Juliet, Act II.—Scene 3.



AN ingenious living author\* has expressed the same thought, with a stricter application to the practice of physic. “ Poisons in small doses  
 “ are the best medicines, and the best medicines  
 “ in too large doses are poisonous.” There is no substance so replete with death as not to admit of a safe application to the body, both externally and internally, by a certain degree of division or dilution; neither is there any so innocent as not to be capable of abuse by excess in quantity, or by long continued application. Opium in portions accommodated to the excitability of the system, proves a most exhilarating cordial, and by its universal stimulus imparts tone to every fibre of the body; but increased to the quantity of a few grains, it dissipates life like a vapour.—  
 \*The oxygenated muriate of mercury, in doses of the fourth or sixth part of a grain, is an inoffensive and efficacious medicine, but ten grains of the same salt will annihilate life with irresistible impetuosity. †Strammonium, ‡Digitalis purpurea, §the cicuta viroga, and many of the metallic preparations are invaluable medicines while they are confined within their proper limits, but in large doses derange and disorganize the most vital functions of the animal economy.—

\* Withering’s Botanical Arrangement.

† Corrosive Sublimate of Mercury.

‡ Jamestown weed.

§ Foxglove.

|| Hemlock.



The virus of the spider, which has so often extinguished the lamp of life, when taken into the stomach diffuses the animating sensation of the mildest stimulant, and is often used in the cure of intermittents with the most propitious effect.

\*The carbonic acid in combination with wine, cyder, and malt liquors, gives to them the most delicious flavour, but is so poisonous to the lungs as to be totally unfit for respiration.—†Nitrogene gas, which in combination with oxygene composes  $\frac{72}{100}$  of the atmosphere we breathe, is incapable of supporting respiration. Bile, by its excess in quantity, or by a morbid quality, revolts with deleterious malignity against the system in which it was generated. Even the direful contagion of the plague and yellow fever, when diluted by water cease to propagate infection.—Ardent spirits are as certainly poisonous as arsenic, but they differ in this, the former requiring a series of time to accomplish what the latter effects in a moment: the one, like an enemy in ambush, insinuates itself into the most vital parts, while the latter surprises the mind by an instantaneous operation. Every substance that can possibly destroy life by being taken into the stomach, must accomplish this end either by its excess of force dissipating the excitability and running the excitement to its highest pitch, terminating in

\* Fixed Air.

† Impure Air, or atmospherical mephitic.



death, or by gradually wasting the excitability by feeble but repeated efforts of the same nature. In the first way, such substances as are denominated poisonous act, in the last all the ordinary stimuli of life produce their effect. It is almost an invariable law of the animal economy, that impressions by repetition become more feeble, until at last no sensation is produced: it is in this way that the lives of old persons not diseased go out like a taper. The same catastrophe which is effected by a poison in a moment, an hour, or a day, is brought about, in process of time, by aliments, drinks, and all the stimuli that ever have been the most friendly auxiliaries of life, and by a perfect similarity of operation. It is therefore as unphilosophical to say, a man was poisoned by arsenic, as to say of him who died of old age, that he was poisoned by his drinks or aliments. To condemn a medicine because it has been abused by the injudicious, is as illiberal as it would be to stigmatize the inebriating qualities of wine because drunkards have sometimes expired in a paroxysm of intoxication.

OTHER reasons no less formidable, and equally unjust, have co-operated to prevent the introduction of arsenic into the practice of physic. An ignorance of its true operation, as well as of the pathology of the diseases in which it has been prescribed, have rendered its exhibition hazardous and uncertain. Without previous informa-



tion on these two particulars, it must be impossible to adapt any medicine to those states of disease which they are intrinsically calculated to relieve. Without the minutest attention to the condition of the system at the moment the medicine is taken, how vague and uncertain must be the prospect of relief? The neglect of this particular has induced some practitioners to assert, that blisters are useless in the Scarlatina, yet, what physician who has applied them in the typhoid state of that disease cannot testify in their favour? The same cause has produced such repugnant accounts of the digitalis in the treatment of dropsies, a medicine which I am confident never cured that disease, unless it was accompanied by some degree of inflammatory diathesis. The want of attention to the same circumstance, I have no doubt, caused that collision of opinion between Mr. Chaptall and Doctor Beddoes on the subject of vital air in phthisis pulmonalis; yet, as in other dissensions, both may have been right or wrong. In the inflammatory state of phthisis, so stimulating a power as oxygene cannot rationally be expected to harmonize with the tender vessels of the lungs, altho' it might prove the most salutary cordial, at a more advanced period of the same disease. We shall see in the sequel, whether or not this important circumstance has led Doctor Clark to deny the efficacy of arsenic in the cure of intermittents.



HOWEVER much physicians may felicitate themselves on the boasted advantages of experience, without just principles to direct them in deducing their indications of cure, they must ever float upon an ocean of doubt and uncertainty. If the materia medica contained the principles upon which medicines produce their effects upon the different \*departments of the system, the practitioner would then possess a luminary to conduct him, but how little better is the materia medica in its present state, than a compages of empiricism and contradiction? There is no such thing in nature as a specific; no remedy will infallibly cure any disease. No disease appears invariably with the same series, degree, succession and continuation of symptoms, even in those bordering nearest on uniformity: No two persons of an hundred will be affected with the same symptoms, alike in number, force and order. The physician who prescribes for the picture of a disease as it is delineated on paper in a systematical nosology, acts as scientifically as he would do, were he to write a prescription for the day of the month, or for the colour of his patient's skin. If all the wisdom from Hippocrates to the immortal Cullen could be concentrated in one man, he could not, after defining a disease, say with what symptoms it would appear the next year. He therefore, who spends

\* See page 9.



his time in searching after specifics will find his scheme as visionary as the pursuit after the philosopher's stone, or as that of the Alchymists, who imagined themselves capable of forming a substance that, like the hand of Midas, could metamorphose every thing into gold.

The exhibition of such an heroic medicine as arsenic renders the strictest attention to the preceding observations indispensibly necessary ; for, he who expects it always to succeed in diseases of the same name which it has occasionally cured, will soon have reason to lament the fallacy of his own errors.

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#### Of the Internal Operation of Arsenic.

PREVIOUS to treating of the therapeutic virtues of Arsenic, it may be useful at least to attempt an explanation of its operation, especially as its internal effects (so far as I can inform myself) have never publicly been the subject of a conjecture. No branch of medicine is veiled in more mystery than the true operation of medicines. The following division of the human body into different systems by a late writer,\* opens the fairest prospect of improvement in this department of science. 1. The brain and nerves.

\* Rush on the Yellow Fever.



2. The liver, lungs, and alimentary canal. 3. The sanguiferous system. 4. The muscular.— 5. The glands and lymphatics. 6. The cutaneous. 7. The secretory and excretory organs. 8. The blood. 9. The senses and appetite.

As health consists in a due proportion of excitement being kept up between these different systems, so disease consists in divided excitement, or a loss of that equilibrium which constituted health. To cure diseases, it therefore becomes necessary to find out what system or systems are more immediately the seat of the disease, and to accommodate the remedies accordingly. There is so intimate a connection between these several systems, that the action of a medicine upon one, may bring another or more into sympathy, yet it is sufficiently demonstrable, that some medicines possess a greater affinity to one system than another.—The fœtid gums have a greater attraction for the nerves.—Mercury acts more particularly upon the lymphatics.—Cantharides seem to stimulate the urinary organs specifically.—The oil of amber excites most particularly the muscular fibre.—Antimony is determined to the skin.—Stramonium affects the brain violently; and Columbo root does not extend its influence far beyond the alimentary canal. I am so sensible of the propriety of considering the operation of medicines in this view, that were it not for



the implication of juvenile presumption, I should be led to hazard an opinion, that no great improvement will be attained in the materia medica, until its different articles shall be classed agreeably to the systems on which they principally exert their influence; and however discordant this idea may be to the minds of physicians, I flatter myself that future observation will demonstrate, that it is neither the vision of a youthful brain, nor the offspring of a disordered imagination.

✓ As Arsenic is taken immediately into the stomach it acts primarily on the primæ viæ, and frequently proves eccoprotic. The Chinese are not ignorant of this property: travellers inform us, “that they manufacture a variety of vases, “pagods, and other ornamental works, from “that union of arsenic and sulphur which chymists call realgar. They make use of these “vessels to obtain a purgative medicine; for “this purpose they leave vinegar or lemon juice “several hours in these vessels, and afterwards “drink it.” In doses larger than can be judiciously administered with a curative intention, it affects the brain and nerves with vertigo and tremours. The arterial system is subject to the action of this medicine; the quantity usually taken as a medicine increases the force of the pulse in a small degree, but does not seem to impart that tension and fullness occasioned by the Peru-



vian bark: By increasing the dose until it begins to disorder the bowels, it increases the frequency of the pulse, diminishes its force, and deprives the muscles of their firmness and vigor. The glands and lymphatics are not exempt from the penetrating influence of this medicine, as is demonstrated by its power of removing obstructions, and of resolving schirri. Its action on the skin is still more conspicuous; the effluvia emanating from it, even in a state of rest, frequently affects the face with swellings, and its internal use often produces an erysipelatous efflorescence over the whole body; but the power of this medicine on the cutaneous system of vessels will be more perspicuously illustrated by its property of eradicating cutaneous affections. Some have imagined, that this mineral must prove diaphoretic, on account of its easy determination to the superficies; but we never have been able clearly to trace such an effect to its operation. A diuretic property has moreover been attributed to arsenic; but when pure arsenic has been administered, such an effect has so rarely occurred, that it would appear more rational to consider it as an accidental concomitant of the disease, or the effect of other remedies used at the same time. \*Doctor Fowler observes, that arsenic has no pretensions to the character of a corroborant, but has not

\* Fowler's reports on the effects of arsenic in intermittent fevers and periodical head-achs.



decided on its operation. It would, indeed, appear to be less durable and invigorating than some other tonics, particularly the Peruvian bark; yet when we compare the modes in which they are generally exhibited, we shall find it more difficult to draw a line of distinction between their tonic powers, than we might on a superficial view, be induced to suppose. Arsenic is not generally prescribed more than three times a day, by which means the system relapses into its former atony; whereas bark is given at least every two hours in the same diseases: The former, from an ignorance of its immense power, has been prescribed in doses so large as seldom to be accommodated to the excitability of the system, while the latter acts more feebly, and requires but little judgment to manage it to the greatest advantage. By the stimulus of arsenic the system is irresistibly precipitated into indirect debility, and even by a very inconsiderable dose; to obtain its corroborating effects it is therefore necessary, to begin with the minutest doses, and to increase them in the most gradual proportions. The Peruvian bark may be compared to a ligature, while arsenic more aptly resembles a two-edged sword. One of the most valuable attributes of this medicine is, its inherent power of accumulating the dormant excitability of a callous system; it would seem to fasten on the stimulability of the stomach, while it was insensible to all other impressions. It may be established as a



✓ general position, (and I shall have frequent occasion to repeat it) that arsenic can never be judiciously administered while the smallest degree of inflammatory diathesis is present; it is therefore in a state of fever not to be put in competition with the Peruvian bark, which being less stimulating, may overcome a slight fever by a stronger action, without throwing the system into those turbulent commotions excited by arsenic. The dominion of this medicine will be more conspicuous when we come to apply it to particular states of disease; and first of those of the

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#### Arterial System.

THE patent ague drop, formerly so celebrated in England, has been the principal means of calling the attention of physicians to the internal use of arsenic; for, although it had been before recommended by the indefatigable Baron Stork, it had not obtained much celebrity. \*Doctors Fowler, Arnold and Withering have united their testimony in favor of arsenic in the cure of intermittents. The first of these gentlemen has recorded, that he relieved or suspended two hundred and forty two cases out of two hundred and forty seven, one hundred and seventy one of

\* See Fowler's works for the letters of Drs. Arnold and Withering.



which number were radically cured. Dr. Withering informs us, that thirty three out of forty eight persons were cured under his care by Dr. Fowler's mineral solution. Dr. Arnold does not mention the number which he either treated or cured, but observes, "that the solution seldom failed." †Dr. Clark informs us, that he only cured twelve out of twenty five patients by the mineral solution, and that another physician of the Newcastle dispensary succeeded in only eight out of eighteen cases, but adds, that he received a communication from an ingenious medical friend which informed him, that only four cases out of an hundred had resisted this remedy. During my residence in a part of the state of Maryland where autumnal fevers prevailed epidemically, I resolved to try the comparative efficacy of arsenic and the Peruvian bark. Many of the fevers at that time assumed the remitting type, to such I gave either emetics or purges of calomel previous to the exhibition of tonics; by this practice I either obtained a complete apyrexia, or so far subjugated the fever as to venture with safety on the use of stimuli. For fifteen cases of this description I prescribed the solution, six of whom were cured, and four suspended: I then gave the bark to an equal number under similar

† See Observations on the Diseases which prevail in long voyages to hot climates, and on the same diseases as they appear in Great Britain, by John Clark, M. D.



circumstances, thirteen of whom were cured, and the other two suspended. From the unpleasant effects produced by arsenic in these cases it was obvious, that it was a substance too stimulating for the remaining portion of phlogistic diathesis which still accompanied the remittent state. I likewise administered the bark to twenty persons laboring under tertians, without previous evacuations of any kind, and found sixteen of that number effectually cured: I repeated the experiment with the solution, and found it to succeed equally well. In many other cases I premised evacuations, and found whether I used the bark or the solution, that no advantage resulted from them in purely intermittent fevers. From the fifteenth of October to the fifteenth of November, I perceived that most of the intermittents had degenerated into quartans, and that those recently attacked, now generally wore that type. The two remedies were now again put in competition: The bark cured twelve out of twenty, whereas the arsenic out of an equal number of cases cured nineteen. This experiment was again attended with nearly the same result. In a few cases both remedies failed; I then combined them, and found them more successful, but still some obstinate cases resisted their power. Reflecting on the pathology of this disease, and upon the nature of the remedies upon which I had so repeatedly experimented, it appeared to



me, that the insensibility of the system was obviously the cause of failure in the few cases unsuccessfully treated : I therefore administered the arsenic three times a day, in doses so large as to produce some sensible effect, by thus increasing the excitability, I found, that the bark given in small doses, and gradually increased according to the state of the system, proved almost universally successful ; for I do not remember more than two who returned for cure after I instituted this method.

ALTHOUGH it may be reasonably inferred that arsenic and the Peruvian bark are nearly equal in point of efficacy in the cure of intermittents as they occur in their variety of types in different seasons, yet the former possesses some advantages over the latter with respect to the facility of its administration to all ages and conditions. Patients (more especially children) can seldom be prevailed on to persevere in the use of the bark until a complete cure is obtained. In an economical point of view arsenic has a still stronger claim upon the attention of physicians. An ounce of the best Peruvian bark at this time costs two shillings and six pence, and will seldom cure more than one person when it may be proper to exhibit it ; whereas the same money will buy as much arsenic as will make as much of the mineral solution, as will (at the most moderate



calculation) cure ten thousand persons of the same disease.

I attempted the cure of intermittents by arsenic in Philadelphia during the autumns of 1794 and 1795, but was compelled to desist from its use; it occasioned those unwelcome symptoms which I shall hereafter notice, so frequently, and in doses so inconsiderable, that independent of its inefficacy it became at best a very disagreeable remedy. It only succeeded in a few quarters, for so great was the inflammatory diathesis of the intermittents of those seasons, that their cure was most commonly effected by remedies of a very opposite character. From a retrospect of the preceding facts and observations, it will not be difficult to account for Dr. Clark's unfavorable deductions from the exhibition of arsenic, especially as he concludes his paragraph on that subject with this observation—"when the continuation of the ague had brought on much weakness, I seldom in such cases tried the solution."

To elucidate more satisfactorily the operation of arsenic in the cure of intermittents, it may be useful to reason on the condition of the system under the influence of that disease. Whatever may be the specific nature of miasmata, or of other remote causes of this state of fever, they all give a pre-disposition to disease, by inducing a state of either direct, or indirect debility, which when



not induced by causes of a long continued or flow operation, leave the system more sensible to impressions. In this defenceless capacity of the system, every stimulus acts with double force, and the arterial system which would always seem to be the first to take the alarm whenever the harmony of the animal economy is molested, is thrown into convulsive motions.\* In this situation of things, the excitement is divided, and that portion which belongs to the others is concentrated in the arterial system. This state which is a *fever*, continues to agitate the system, until it depletes from the arteries so much as to leave them upon a level with the other systems. With this picture of an intermittent before us, let us attempt its removal. In that preternatural state of excitement which constitutes a paroxysm, the disease is confined exclusively to the arterial system, and to cure it, the remedy should be directed specifically to that system. The use of stimuli will ever be an unavailing mode of practice, unless their power is so great as to overcome the

\* These irregular motions have generally been attributed to the friendly interposition of an imaginary *vis medicatrix*, but they seem to be nothing more than the effect of stimulus disproportioned to excitability, or impulse disproportioned to resistance: we might as well say, that a ship under sail was actuated by a *vis medicatrix* because she did not stand still, for it is an universal law that force unequal to resistance shall produce irregular motions or a deviation from order, nor will the difference between animate and inanimate matter afford us a means of discrimination.



† diseased action of the heart and arteries, to attempt which might often prove dangerous; we therefore leave this state to be treated by other remedies. Where the fever is almost in an evanescent state, and the action so feeble as not to call for a treatment in some measure antiphlogistic, the presumption then may be, that it can be subdued by arsenic, bark or other stimulating powers: but that state of atony in which a paroxysm leaves the system, is what more particularly demands our attention in the cure. In this state the excitement although at a very low ebb, is presumed to be perfectly equal, but the same remote causes continuing to operate, reproduce the same coincidence of excitement and excitability, from which the disorder first originated, and thereby invite the same repetition of motions, with which it was before associated.

The excitability of the system, after the paroxysm of an intermittent is, whether in a state of direct or ‡ indirect debility, easily excited by the

† No two unequal actions can exist in the same system at the same time, the stronger always deposes the weaker. I would as soon suppose that two cubic inches of a solid, could each occupy the same cubic inch of space at the same instant: yet the arterial, lymphatic and nervous systems may each labour under a distinct disease at the same time.

‡ Dr. Brown has told us, that in cases of indirect debility the most powerful stimuli are necessary, but independent of



action of stimuli: unless the disease has become chronic, by a long continued operation of causes, or a reiterated repetition of paroxysms. Arsenic may be advantageously used to prevent the recurrence of that condition from which the paroxysm first originated: This indication will be most effectually fulfilled, by administering it as nearly preceding the accession as possible. If the disease shall have become chronic, although the debility be ever so great, a powerful stimulus will generally be requisite to excite the system above the danger of a relapse. Although the versatility of the excitement and the excitability of the human frame is so great as often to render it difficult to account for all the phenomena of its morbid states, yet, from what we have already seen, we may presume with some confidence on the operation of arsenic in this and other states of disease, and perhaps distinguish some of those to which it is more particularly adapted. As we have already learned that arsenic acts powerfully upon the skin, some may be led to attribute the cure of intermittents to such an operation: If any benefit is derived from this part of its operation, it consists (like other stimuli) in restoring the excitement of the languid extremities, thereby equalizing it throughout the whole system.

the impropriety of stimuli in many cases of indirect debility recently induced, this theory is erroneous, because whether the debility be direct or indirect, the excitability is equally susceptible of the action of stimuli.



It is probable that arsenic frequently excites some degree of inflammation in the stomach, which communicates a temporary artificial inflammatory diathesis to the whole system, and may thereby occasionally supersede the diseased action.

THE epithet intermittent, has generally been intended to convey the idea of a disease of extreme debility, so great as always to require stimuli; but as diseases of a very malignant nature sometimes assume that type, and exhibit the specious aspect of a mild disease, when the patient is in the most imminent danger, particular care is necessary to discriminate: The causes producing such a disease often prostrate the system suddenly into the most abject state of indirect debility, rendering the pulse almost imperceptible, with many other spurious symptoms of a common intermittent. Should a physician unfortunately attempt the cure of such an intermittent by arsenic, he would prescribe as judiciously as he would do, were he to administer liquid laudanum to a patient poisoned by opium.

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#### In Periodical Head-achs.

DOCTOR Fowler, to whom we are already so much indebted, has recorded seven cases of *periodical head-ach* successfully treated by the mineral solution of arsenic, without the excep-



tion of a failure. I do not know of a more vague appellation than that of HEAD-ACH; we hear of nervous head-achs, hystERIC head-achs, and a variety of others, yet as we presume them all to be diseases of the arterial system, we shall arrange them accordingly. As the words periodical head-ach, are an indefinite mode of expression, it will be necessary to affix some determinate state of the system to the terms, before we can deduce our indications of cure with any degree of certainty. All the cases of periodical head-ach which have occurred to my observation, appeared to have been no more than intermittent fevers under a \*concealed form, appearing at the same seasons with other intermittents, and yielding to the same remedies. The Peruvian bark often succeeds in the cure of this disease, but so far as I have been able to ascertain, is far inferior to the solution; nor need this surprise us, for this affection generally exhibits a more chronic appearance, is not attended by much inflammatory diathesis, and is consequently admirably adapted to the operation of arsenic. There is no reason why this medicine should cure a periodical head-ach more certainly than others, provided they are constituted by the same degree of action; and from the general operation of arsenic we should be induced to expect the happiest effects from its use, in all cases not the consequence of consider-

\* Febres intermittentes sub forma larvata of Dr. Senac.



able inflammatory diathesis. The head-ach is often a chronic disease; the effect of a feeble morbid action in the vessels of the brain, while the other parts of the system possess their usual powers. In all such cases as cannot be traced to some offending matter in the stomach, or to some local cause, arsenic may be recommended with the most flattering prospect of success. Although the action in this disease is so inconsiderable as to be easily overcome by arsenic, it is nevertheless indisputably the effect of excessive morbid excitement, and the pain is incontrovertibly the effect of inflammation, \*without which there can be no pain. The proximate cause of all fever consists in an irregular action of the arterial system, and the most abject state of typhus is essentially a fever, and as certainly the effect of some degree of inflammation, however insignificant, as a phrenitis or a pneumony. As the proximate cause of all fever is the same, there cannot possibly exist any other just distinction between them, than what arises from their different degrees of inflammation. The cure, with this view of fever, divides itself into two parts; such as require depletion to subdue them, and such as are capable of being overcome by the action of stimuli. Arsenic may be used advantageously in all such cases as require a new action to be suddenly excited,

\* See Dr. Alexander's ingenious dissertation on the effect of one disease curing another, page 20.



unless so great a degree of debility exists as to render other tonics, more certainly invigorating, indispensable.

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#### In Diseases of the Alimentary Canal.

AMONG the variety of cases in which I had occasion to prescribe this medicine in the diseases of children, I sometimes observed, that such as were affected with symptoms usually judged to be most characteristic of worms, recovered under its use. The worms were in some cases discharged, but this occurred in a very small proportion of cases, in which the most prominent symptoms were effectually removed. In many of these cases the symptoms were so ambiguous, that I found it difficult to determine whether the arsenic acted by obviating a state of debility with which worms were accidentally connected, or by destroying the worms acting as the cause of an idyopathic disease. In two cases where the most unexpected cures were obtained, the symptoms rather indicated the phenomena of an atrophy from lymphatic obstructions, than of any other disease, and whoever reflects on the insinuating properties of arsenic, will not think it irrational to conjecture that it might have operated as a deobstruent upon the mesenteric glands. The pulvis stanni has formerly been a remedy much celebrated as a vermifuge, and has by some



been supposed to act mechanically ; although it is possible that it may produce some effect in this way, it would appear to me more philosophical to ascribe its virtues to the arsenic it contains. As this remedy which suggested itself fortuitously is yet problematical, with respect to its operation as an anthelmintic, we shall not presume to recommend it in preference to the more ordinary remedies ; nevertheless, as they are all occasionally fallible, it will be laudable in such cases, to experiment with judicious caution on this new remedy.

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#### In Diseases of the Skin.

WERE we to speak strictly anatomical, we might have classed these diseases with those of the arterial system, and indeed some of those under this head, invade likewise the glandular and lymphatic system ; but as they appear more conspicuously on the superficies, and affect more particularly this part, we have judged it most convenient to arrange them with the cutaneous affections. Whoever observes the force which this medicine exerts upon the skin, will find the transition to its use in cutaneous diseases natural, and the prospect of its advantages plausible. I received the first information of its success internally in cutaneous diseases, from the judicious Doctor Martin, of Maryland ; who had witnessed its



victory over an obstinate case of leprosy. Soon after I received this useful instruction, I was appealed to, to decide on the nature of a case which had run the ordinary routine of remedies generally resorted to in such cases, and which so strongly resembled the description the Doctor had given of the case which he had cured, that I did not hesitate to denominate it the *lepra græcorum* of medical writers. As this case had already become one of the opprobria of medicine, I undertook it with much diffidence, rather to gratify the solicitations of the patient's friends, than because I expected to perform a cure. I directed ten drops of the mineral solution to be taken morning, noon, and night; distance prevented my seeing the patient for the space of two weeks, but the medicine was assiduously persevered in: I now had the pleasure to observe, the hard white surfaces of the ulcers which had usurped almost the whole superficies of the body, beginning to moult away in white, pulverulent sloughs, and the bottoms of many of the sores, before of a phagedenic appearance, assuming a more salutary complexion. At the end of six weeks the disease was completely eradicated, and had not returned two years after. On my return to Philadelphia in the summer of 1792, I informed my preceptor, Dr. Rush, of what I had heard and seen concerning the internal use of arsenic; he soon had an opportunity of trying its efficacy in an obstinate herpetic eruption



which had resisted the usual remedies ; it succeeded, but as it had been a tedious chronic case, and the predisposition not completely removed, some symptoms of the disease have since returned.

I have repeatedly seen this remedy tried in various anomalous cutaneous affections, and find it a powerful medicine where neither fulness nor inflammatory diathesis exist ; in which cases we shall soon say, previous depletion is necessary. In cutaneous diseases we may observe two states of the excitement diametrically opposite to each other : Some cases depend upon a loss of tone in the extreme vessels, by which means the excitement is divided. The cure of this state consists in restoring the excitement, either by raising it by external applications, or by such internal powers as exert their influence principally upon that system of vessels. To prevent the vessels upon the surface from relapsing into their former atony, it will be found requisite in this state of the skin, to raise an higher tone than that which is the state of the same vessels in a state of health ; an indication which may often be effectually fulfilled by arsenic. But, one stimulus will not always answer the desired indication, although it may be sufficiently strong, it will therefore often be prudent to use them in succession. The want of a certain knowledge of the particular system, which a stimulus specifically affects, often renders its exhibition problematical.



The remaining state of cutaneous disease, is in every respect the reverse of that already delineated. In both the excitement is divided and unequal, but in the latter, its morbid force is concentrated in the skin, and may be denominated a *febris extroversa* with a propriety as strictly physiological, as the dysentery has been a *febris introversa* by Dr. Syddenham. This state is truly a local fever, and the indication of cure is to diminish the excitement in the extreme vessels, until it shall be reduced to an equality with the other parts of the system. It would be superfluous and perhaps hazardous in this state of the system to prescribe astringent topics, or to administer stimuli internally, unless some can be found sufficiently powerful to raise a superior action in the vessels, a thing not easily accomplished. As there is no medicine more stimulating than arsenic, there can consequently be none more improper in this state of the system. Agreeably to this idea of the inflammatory nature of some cutaneous diseases, we find a fact recorded by \*Sir William Jones, who observes, "The natives (of Indostan) cure the elephantiasis by one part of white arsenic united to six parts of black pepper ; but the remedy is more certain when gentle cathartics and bleeding are previously used." By this practice <sup>two</sup> advantages are gained ; first, the tone which prevented a more healthy action from being excited is removed ; secondly, the excita-

\* Jones's Asia, pages 479—80. Published 1793.



bility of the whole system is accumulated, by which means stimuli act with more force and certainty. The same author relates the case of a gentleman "so affected with a confirmed lues, (called in Asia, the Persian fire) with his hands and feet entirely ulcerated and almost corroded, that he became an object of disgust and abhorrence. Some blood was taken from his arm, and a cathartic administered on the next day; in a fortnight his recovery was complete." He farther adds, "But the power of this medicine has been chiefly tried in the cure of what has been called the Juzam, a disease affecting the whole mass of blood, attended in the last stage with an erosion of the fingers: It is also hereditary, and in that respect has been classed by medical writers with the gout, consumption and white leprosy." This learned author assures us, that this preparation of arsenic and black pepper was successful in every case in which it was used, and relates a great variety of cases, but from his having placed the cause of the disease in a contamination of the fluids, he has not developed the disease so clearly as to enable us to follow him in its investigation. The pathology of the fluids is so obscure a corner in the field of science, that I would not presume to determine what share they may have in the causes of diseases. Whatever might have been the precise meaning of physicians by that class of medicines called *alteratives*, I am persuaded, that arsenic merits



that character to a very eminent degree ; perhaps not by a direct operation upon the blood, but by changing the state of the excitement, by its sudden and energetic action on the several systems it affects. I should have suspected the accuracy of the author's observation on this solitary case of syphilis, had it not been corroborated by a case which lately came within my own notice. A medical gentleman from the West-Indies, having been baffled in his efforts to cure a cutaneous affection of a syphilitic origin, consulted Dr. Rush, who advised the internal use of ✓ arsenic with the most propitious result. Arsenic in such inveterate chronic cases, seems to act by its power in exciting the system insensible to other stimuli, for in this case, even mercury had been used in vain. In buboes, that after ulceration have become callous, and not disposed to heal, but put on a cancerous appearance, I can say, both from my own observation and that of others, that no remedy with which we are acquainted, is so powerful as the internal use of arsenic.

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In Diseases of the Glandular and Lymphatic System.

MUCH has been said concerning the use of arsenic in cancers, but from having seen it fairly tried in only two cases of ulcerated cancer, I can-



not say much of its virtues.\* It has been dogmatically asserted that arsenic is competent to the cure of every condition of cancer; an opinion which, so far as I can inform myself, is extremely presumptuous. Cancer, like all other diseases, is attended with different states of action, no one remedy can therefore cure every case. There is no disease whose pathology is involved in more obscurity than that of cancer, and every internal remedy that can be prescribed for it must be in some measure empirical, until its causes are better understood. If there should ever be a radical cure for cancer found, (and no doubt there will) it will probably be one that acts specifically powerful upon that system principally occupied by the disease, or by altering the condition of the whole system. The chimeras of fancy have often constituted a part of the theory of diseases, but none which I have ever read, are more visionary than the phantoms of Mr. Justamond's† imagination. This gentleman has by his boldness contributed in some measure to lessen the prejudices of physicians against the internal use of arsenic; but from his ludicrous hypothesis of the disease depending upon insects in

\* See remede eprove pour guerir radicalement le cancer occulte, et manifeste ou ulcère. Par Messire C. R. Le Febvre. Docteur en medicine, Paris.—and Med. Comment. Vol. 2, page 304, &c.

† Justamond's Tracts.



the cancer, he has detracted from the weight his observations might have carried with them; for his animalcules, like those of Liewenhoeck, have either never been demonstrated, nor ever seen by any but their authors. In both those cases in which I have seen this medicine tried in cancer, the disease had so totally contaminated the whole system, that little hope could be reasonably entertained from any remedy, for if even in such cases the ulcer should be healed, unless the predisposition could be eradicated, a return of the disease would still await the unfortunate patient. It must be acknowledged that in those cases wherein I attempted the use of arsenic in this disease, it was not altogether an inert medicine, the excruciating pains were mitigated, and the intolerable fœtor of the ulcers entirely corrected. These temporary alleviations, were of a very transitory duration, for those symptoms returned with their usual virulence as soon as the remedy was withheld. This medicine was persevered in six months in one case, and four in the other, yet no advantage was gained as to the healing or diminution of the ulcer. What might have been the issue of these cases under the use of arsenic at a more early period of the disease, I cannot venture to conjecture, but esteem it some consolation to possess a medicine that can, when death is inevitable, strew flowers on the borders of the tomb, From the penetrating nature of arsenic, it would seem to pro-



mise the most beneficial effects in all cases of schirous and obstruction in the glandular system: and from this property it has obtained the reputation of having cured the more inveterate states of cancer. It is often a desirable indication to rouse the torpid vessels of a part into vigorous action; under such circumstances, arsenic may be advised with more plausibility than any other remedy with which we are acquainted, provided it affect that system of vessels occupied by the disease.

As this mineral operates forcibly upon the lymphatic system, what would be its effects in Scrophula? Although I have not seen it experimented upon in this disease, I should, a priori, be induced to think favorably of its powers, more especially where the system had been sufficiently reduced to admit of its most extensive influence. Wherever the same indications of cure are to be fulfilled, in the cancerous, callous, or fungous state of ulcers, the internal use of arsenic in moderate doses, affords the fairest prospect of success. In many cases where its external application is proper, it may be found advantageous to conjoin its internal use. There is no fact in the science of medicine, of which I am more decidedly convinced, than that arsenic is an improper medicine in all cases where ulcers are accompanied with an inflammatory diathesis.



THE following letter from Dr. Martin may tend to corroborate some of the preceding observations, especially as it was written by a gentleman whose authority in medicine is inferior to none.

EASTON, *Feb.* 1<sup>st</sup>. 1796.

DEAR SIR,

I HAVE long promised you some observations on the use of arsenic, which I shall confine within the bounds of my own experience. I have been in the practice of prescribing arsenic, about five years, in cutaneous diseases and intermittents only.—My friend Dr. Birchhead first recommended the use of arsenic, and referred me to the dispensatory lately published, for some hints under the head of mineral solution. Here I found that arsenic was recommended in cutaneous diseases. As I had been baffled in a case, (which I had called *Lepra Græcorum*) after using every remedy which could be thought of by myself or others, I resolved to try the mineral solution of arsenic on my old patient, Thomas Mc. Namara, who had wearied out every physician and others, who would administer any thing for his relief. As he had retired to some unknown part of the country, I mentioned my intention to Dr. Johnson, who had witnessed his deplorable situation in the poor-house, while a student with me, and desired that he would administer the solution whenever he should find



him, engaging that I would do the same if I should see him first. The Dr. shortly after this fell in with him, and told him what ~~he~~<sup>we</sup> had agreed on. Poor Thomas was always eager to catch at any thing for relief. He was desired to take twelve or fifteen drops three times a day, but in a week or two the poor fellow had increased the dose to thirty drops, because he found his sores healing in a manner he had never before experienced, for at least five years, and I think, in less than four weeks, every sore or part affected, was healed up. Thus relieved, contrary to all expectation, Thomas began to make free with ardent spirits, when some appearance of the disease was again discovered, which was a second time relieved; but his intemperance soon brought on the disease with worse appearances, when he was once more admitted into the poor-house. I was astonished to observe how soon his sores began to heal, and to vanish entirely, except one up his nostrils, and even this to appearance was cured, when Thomas begged to be discharged. This winter he is a third time admitted, and it yet remains to be tried, whether he can be again relieved by arsenic. Quere, if arsenic had been used earlier, and this patient had been a temperate one, whether the predisposition to this disease might not have been entirely eradicated? A mulatto man in this county (Talbot) aged about forty years, had symptoms of the *Lepa Græcorum* before he was twenty one, and I am



well satisfied, when I saw him fifteen months ago, he had this disease with every characteristic <sup>sym</sup>ptom. The mineral solution of arsenic had a most astonishing effect in this case, for every symptom vanished in the course of a few weeks, except one sore on his leg or foot, and I have not seen him since last March. I once thought the mineral solution had a wonderful effect in a scirrhus breast, but the predisposition still remained, the woman was of a bad habit of body, and some hardness continued to her death.

IN agues and fevers I am sometimes induced to think this a valuable remedy, but like every other it is fallible, and I am frequently disappointed in its effects, yet I have known it to succeed, when the bark has failed. In some children in the ague and fever, it has an immediate effect. That it is a safe and useful remedy I am well convinced, and therefore give it to my own children without scruple. In my son it seemed to have no effect, good or bad, but has greatly relieved my little daughter in the ague and fever.

IN the periodical head-ach I have sometimes thought arsenic better entitled to infallibility than any other remedy in the materia medica.

THUS my dear Sir, I have summed up all that I can say about this safe, agreeable, and valuable acquisition to the materia medica. You are at liberty to make any use you may think proper,



of the above observations, with my best wishes  
for your success in life,

I am Your Friend,

ENNALLS MARTIN.

Of the External use of Arsenic,

HOWEVER much timidity and scepticism may have influenced the minds of practitioners respecting the internal use of arsenic, both empiricks and theorists have been less scrupulous in its external application. Two opinions have divided practitioners concerning its application to cancerous and other ulcers. Dr. Mosely\* condemns its use unequivocally and observes " That it will not produce the salutary  
" effects obtained by corrosive sublimate. It rots  
" indiscriminately the sound and unsound flesh  
" wherever it comes in contact. Corrosive sub-  
" limate is bounded in its corrosive action by  
" healthy flesh, or acts but slightly as a destroyer.  
" Arsenic has a tendency to destroy or deaden  
" the functions of organized parts: corrosive sub-  
" limate to inflame those parts." In the introduction to this essay, I adverted to the disastrous consequences of not attending particularly to the doses of medicine, and the state of the part to

\* See Treatise on Tropical Diseases, by Benjamin Mosely, M. D. pages 521-2-3.



which they may be applied; here we see it exemplified in a peculiar manner: we see prejudice co-operating with sophistry, producing a conclusion from false premises equally ridiculous and absurd. Every practitioner who has seen arsenic applied externally in different degrees of strength, must testify against the injustice of Dr. Moseley's criticisms. The principle upon which the operation of arsenic essentially depends, is the same that actuates corrosive sublimate, of which he has spoken so extravagantly. Arsenic in the state it is used externally, is a true metallic oxyde, or the semimetal united to vital air.—Corrosive sublimate is composed of the oxygenated muriatic acid and mercury, and owes its activity to the oxygene it contains, otherwise calomel which is composed of the same metal, united to the common muriatic acid, would prove equally corrosive. Red precipitate, which is a calx of mercury, or that metal united to vital air is likewise a caustic of considerable power, but if it be subjected to a strong heat, the oxygene will be dissipated, the metal will resume its native state, and is as innocent in actual contact with the most irritable surface as so much water. It would therefore appear that the operation of these medicines depend upon the oxygene they contain, and that their powers are accurately apportioned to their relative degrees of fixity and concentration. Nothing can illustrate this idea more clearly than what we must have often ob-



served; that caustics and escharotics in a state of dilution or division act as the most certain astringents. In this state arsenic and corrosive sublimate, produce the most salutary effects, and are nearly entitled to infallibility, in all cases of tinea, herpes and other states of the skin, not supported by fulness or inflammation. The particular condition of the part to which arsenic is to be applied, should be carefully observed; if much inflammation attend, it should be used in a very diluted state, and may then be advantageously applied to any part. At the request of Dr. Rush, I applied a solution of arsenic to a cancerous inflammation in the internal canthus of the eye, where the rapid progress of the disease menaced the erosion of the lachrymal sack, and probably the patient's life: we had the satisfaction of seeing the disease completely extirpated, and the man soon restored to health.

IN the year 1784 Dr. Rush\* detected the presence of arsenic in the celebrated cancer powder, so successfully administered by Dr. Hugh Martin; and has favored us with observations on the use of this caustic. He remarks, "I should suppose from the examination of the powder I made with the eye, that the proportion of arsenic to the vegetable powder could not be more than  $\frac{1}{40}$  part of the whole compound. The great art

\* See Rush's medical enquiries and observations, Vol. i. page 235.—or Philosophical Transactions.



of applying arsenic successfully is, to dilute and mix it in such a manner as to mitigate the violence of its action. Dr. Martin's preparation was happily calculated for this purpose. It excited a moderate inflammation, which separated the morbid from the sound parts, and promoted a plentiful afflux of humours to the fore during its application. It seldom produced an eschar, hence it insinuated itself into the deepest recesses of the cancers, and frequently separated those fibres in an unbroken state, which are generally called the roots of the cancer."—Thus we see, that however useful it may be to attend minutely to the state of the system in the internal use of arsenic, that it is equally indispensable in its external application. Its operation depends upon the same principles of excitability and excitement, and it must be obvious to all who are the least conversant in the practice, that so acrimonious a substance must require the most cautious attention. Upon a review of all the cases of the external use of arsenic that have been recorded, we find no discrimination of the different states of the parts to which it has been applied; but from all that we can learn on this subject, we are authorised to say, that its beneficial effects are principally confined to such as have been already enumerated.

IN the year 1783 an itinerant practitioner, who called himself Lafferti, travelled through



the state of Maryland ; he astonished the practitioners of that country by curing ulcers long deemed beyond the reach of the surgical art, and it is not to be controverted that his success was unparalleled. It was observable, that he refused to undertake the cure of recent ulcers, and, unlike most of his empirical brethren, candidly acknowledged, that he had no skill in such cases as others considered most curable. The author's deceased father, who at that time practiced physic and surgery in that country, left the following account of this practitioner, in a letter which he intended to have sent to a medical friend. " We have in this county (Caroline) a man who does wonders in the cure of obstinate old sores ; but he uses so much mystery, and applies his powder with so much secrecy, that he does not seem to intend to let us into the secret. However, I have just procured a small parcel of his medicine ; at first I thought it looked like corrosive sublimate, but upon trial found myself mistaken : I put some of it on the fire, which soon perfumed the room with the smell of garlic, from which it must be arsenic."—Mr. Justamond, who has recommended arsenic so strenuously in cancer, mentions the authority of Sir Hans Sloane for its good effects in schrophulous ulcers, and thinks it a valuable medicine in such cases. I have no doubt but that arsenic will remove the state of atony often attending such sores, or that cancerous state of callosity into



which they sometimes degenerate ; but to cure them radically the diathesis on which they depend should be removed. \*The muriate of barytes is said to have proved useful in schrophula, as it often contains a small portion of arsenic, it is not improbable that it may owe its virtues to this active mineral. What might be the effect of the arsenical acid, as a medicine, I leave future researches to instruct us.

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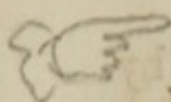
#### Pharmaceutic Treatment of Arsenic.

IT may perhaps be thought necessary to investigate the chymical properties of arsenic, but as all I could say on that head would be no more than plagiarism from authors already in general circulation, I shall content myself with as laconic an explanation as possible of the pharmaceutic treatment of that preparation, which appears to me to possess some advantages over all others, and which, so far as I am capable of judging, admits of no improvement.

The following receipt for making the mineral solution is translated from the Latin of Dr. Fowler, and the table of doses which we shall have occasion to mention, is taken from the same author ; both of which it may not be improper to insert, as arsenic is a medicine so little known.

\* See Bell on the venereal, and the Med. Comm. vol. 5.





“ Take of the powder of white arsenic, and of the purest vegetable alkali, each sixty four grains, of distilled water half a pound, apothecaries’ weight.—Put them into a vessel and submit them to a sand heat, let them boil moderately until the arsenic shall be perfectly dissolved : then add to the cold solution half a pound of the compound spirit of lavender, and so much distilled spring water as will make the whole accurately fifteen ounces.”

THE simplicity of this chymical preparation renders it preferable to more complex forms. The vegetable alkali has not the smallest effect in diminishing its virtues, for that proportion of the solution which we know to contain any given quantity of arsenic, will act as forcibly upon the system, as the same quantity in pills, or even in a state of pulverization. The almost infinite divisibility of this form renders its doses variable to the exigencies of all possible cases. The small proportion of compound spirit of lavender is added to give it a more medicinal appearance, not with a view of captivating the eye, by drawing the veil of mystery over the composition, but lest from its being colourless and insipid, those who may be entrusted with its exhibition should be tempted to use it with too much liberality, the consequences of which might prove troublesome, if not dangerous. To a pound of the solution, sixty four grains are added for



the purpose of a more accurate calculation, by which means the precise quantity of arsenic contained in any given number of drops may be ascertained. If the alkali should not be perfectly pure, it will be found inadequate to the production of a perfect solution; a circumstance which might occasion great confusion and uncertainty in the doses of the medicine. If therefore, the alkali cannot be obtained pure, a double proportion of purified nitre may be substituted, for there is a stronger attraction between the arsenic and the vegetable alkali, than between the same alkali and the nitric acid, which last, is therefore disengaged. The two solutions do not differ in point of efficacy, and, by attending to the preceding directions, they will be found to possess an uniform degree of strength; a circumstance of importance in the use of such an heroic medicine.

ALTHOUGH we cannot altogether approve of Dr. Fowler's mode of administering the solution, and must therefore observe, that his doses are rather larger than we prefer (at least in this country). His table may be useful in graduating the doses for different ages.

PATIENTS are to take, according to their ages, the following doses of the solution:

YEARS.		DROPS.	
From 2 to 4	-	from 2 or 3 to 5.	
— 5 — 7	-	— 5 — 7.	
— 8 — 12	-	— 7 — 10.	



— 13—18	-	— 10—12.
— 18 and upwards	-	12.

THUS from five to seven years the dose may be apportioned by allowing a drop for each year, but a drop for each year under that period will be insufficient, and soon becomes too much beyond it, as twelve drops are a medium dose for an adult.

THIS medicine may be administered with considerable latitude to adults, but a very general rule may be established which will often prevent most of those unwelcome consequences which follow the use of large doses. It will generally be found most advantageous in the end, to begin with an under dose, and to increase it until it shall affect the stomach slightly, unless a cure be obtained. If the system should be much disordered by the solution, it will be proper to discontinue it a day or two, and instead of ten drops, three times a day, five drops six times a day may be administered, which will often agree with the stomach, and perform a cure as certainly, though not as expeditiously, as a larger dose. It will often be necessary to continue the medicine for some time after the cure is apparently complete; by this practice a relapse may often be effectually prevented. Where nausea, vomiting, or pains in the bowels arise from the solution, they may not only be mitigated, but often prevented,



by combining a few drops of laudanum with the solution, and this will seldom interfere with the virtues of the medicine, as the former is generally admissible where the latter is proper. A combination of their stimulant effects will sometimes be found more powerful than either of them alone, especially in curing intermittents. In some cases instead of diluting the dose by a tea-cup full of cold water (the usual vehicle) in case of turbulent symptoms supervening, a larger proportion of water will be a successful method of obviating them. This observation applies more particularly to the use of the solution among \*children, whose tender organs are often molested by a very small dose of the solution: instead therefore of giving the medicine in a tea-spoon or table-spoon full of water, double the quantity may be used to advantage. The disease for which the medicine is prescribed, will likewise require to be noticed, both with respect to the quantity of the dose, and the times of administering it. In intermittent fevers and periodical head-achs most advantage will result from the administration of as large a dose as the system can conveniently bear, as nearly preceding the paroxysm as possible. In the treatment of cancers and many diseases of chronic debility, it may be necessary to continue the use of the solution for weeks, and

\* It is nevertheless worthy observation, that children often bear larger doses in proportion to age and other circumstances than adults.



even months, to obtain all its advantages. Under such circumstances, the solution must frequently be gradually increased, for the system becomes so habituated to its stimulus, that an ordinary dose will be altogether inert. I have gone as high as thirty drops three times a day, in a case of cancer, without producing one disagreeable sensation. In the exhibition of this medicine, little is to be learned from an apparent delicacy of constitution, for women whose appearance would lead us most to expect irritable frames, often bear the medium dose of an adult with the greatest composure; whereas the most robust men frequently feel very sensibly the commotions excited by a smaller dose. I have given this medicine to pregnant women laboring under intermittents, with safety, in very considerable doses, but cannot avoid observing, that although these cases were such as in every respect (their gravid state excepted) might from common experience be supposed most easily cured, I was less fortunate than in any equal number of cases that came within the sphere of my notice. The tension imparted to the arterial system by the stimulus of distension, or that artificial inflammatory diathesis which accompanies a state of pregnancy, must have prevented the medicine from exciting an action sufficient to cure the disease.

It has been alledged against the internal use of arsenic, that it destroys the tone of the stomach,



thereby laying a foundation of dyspepsia and general debility. If this objection should be founded on truth, it will alone be sufficient to exclude arsenic from the materia medica, and to banish from the mind of every reasonable physician all thoughts of advocating its character. To determine this important question beyond the possibility of a controversy, I examined all those cases wherein I was under the necessity of persisting long in the use of arsenic. Out of forty persons whom I interrogated touching this point, I found but two who discovered dyspeptic symptoms, both of whom were notorious for their attachment to ardent spirits, by which the disease had been produced years before they had taken arsenic. Even dogs that had been poisoned by it and recovered, exhibited no marks of indigestion.

It has moreover been objected to arsenic, that both from its internal and external use, it has sometimes produced paralytic symptoms and a vertiginous disposition in the brain; but in all the cases where I have seen it used, even where, from a long protracted external application, an absorption might have been thought probable, no such consequence followed. Such effects have doubtless followed the poisonous influence of arsenic, but those who cannot draw the line of distinction between its medicinal and poisonous degrees, would do well not to interfere



with the feelings of mankind. \*Mr. William Gaskill, an ingenious surgeon, at Rotherhythe, instituted a series of experiments upon the external absorption of arsenic, from which he proved decisively that no symptoms of a disordered economy were even perceptible. He has not taken notice of its diuretic qualities, although they are dwelt upon with so much emphasis by †Mr. John Sherwin, surgeon, who performed the same experiments with tartarized arsenic, and attributes the diuretic effects it produced upon himself and four others, exclusively to the operation of arsenic. But the conclusion he has drawn is by no means just, and a very superficial knowledge of chymistry will be required to detect its fallacy. By the union of the chrystals of tartar and arsenic, the tartarized arsenic is formed, a substance which, although it partakes in some measure of an arsenical nature, is yet widely different from the pure semi-metallic oxyde, and possesses properties peculiar to itself.

DR. Fowler has recorded many unpleasant effects of the solution; such as nausea, vomiting, swellings of the face, and sometimes of the abdomen, all which, he says, vanish from the use of gentle aperients, and most of them by a temporary omission of the medicine. Doctors Arnold

\* See a pamphlet entitled, Experiments on the external absorption of arsenic and emetic tartar.

† Medical commentaries, vol. xv. page 220 et sequent.



and Withering, although much in the habit of using the solution, have not mentioned such effects; and even Dr. Clark, who inveighs with so much acrimony against arsenic, has been silent on this particular. I first began the use of the solution in the doses prescribed by Dr. Fowler, and experienced many of the painful sensations which he has ascribed to it. I afterwards found it easy to prevent them in most cases, by diminishing the dose, and observing the precautions already mentioned.

ONE of the most characteristic properties which we have attributed to arsenic, is, its power of accumulating the stimulability of the system, a circumstance of much importance to be attended to in practice, especially in a state of convalescence, inasmuch as both medicine and diet are to be regulated accordingly, either of which, in over doses, might be productive of the most alarming consequences. This caution cannot be better enforced than in the emphatical words of the elegant Dr. Armstrong.

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“When the vital fire  
Burns feebly, heap not the green fuel on;  
But prudently foment the wand’ring spark  
With what the soonest feels its kindred touch:  
Be frugal even of that, a little give  
At first; that kindled, add a little more,  
’Till by deliberate nourishing, the flame  
Reviv’d, with all its wonted vigor glows.”



## Of the Deleterious Qualities of Arsenic.

HITHERTO we have viewed Arsenic as a remedy capable of abstracting from that portion of pain and disease to which the frailty of human nature is subjected. But as this mineral, like all other things destined for the use of man, is liable to abuse, and subject to a deviation from that order which was originally imposed upon it; we are constrained to the melancholy necessity of reversing the picture, and of contemplating human nature in the most deplorable state that the imagination can possibly conceive. Happily for mankind, such catastrophes as this poison is capable of producing do not often occur, but as physicians are sometimes summoned to arrest the progress of death from this cause, the most effectual antidote becomes a desideratum of the highest importance.

It would far exceed the limits of this Essay to detail all the experiments from which we have deduced the following conclusions, we shall therefore give the result of the most important, in as concentrated a form, as the nature of the subject will admit of.

WE have already hinted at some of the formidable consequences of this poison, and where its medical effects end, we may date the commencement of its deleterious qualities. This Stygian draught when taken into the stomach in quan-



tities disproportioned to the excitability of the system, is productive of nausea, vomiting, purging, hiccough, gastrodynia, convulsions, subfulties tendinum, increased flow of saliva, hematuria, thirst, gnashing of the teeth, syncope, asphyxia, and death, unless a speedy remedy is administered. As some peculiarities attend the operation of this poison, it may be useful to trace them to their remotest consequences. A gentleman whom I saw, and with whom I conversed, soon after he had been nearly deprived of his life by this poison, exhibited the following phenomena. From having been remarkable for his athletic powers, he became fallow, emaciated, and enervated. Previous to this accident he had enjoyed an uninterrupted series of good health, for ten years. In the autumn after this misfortune, he was attacked by an obstruction of his liver, which left him in a state of paralysis, from which he with difficulty recovered, during the winter. He has been subject to jaundice four or five times every year since that memorable event, and his teeth before remarkable for their whiteness, became incrusted with a black scale, and some of them have decayed without pain. It has sometimes been observable that arsenic, even in small quantities, like the vegetable and other acids, has set the teeth on edge, and in some of the dogs who recovered from the poisonous effects of arsenic lost their teeth, an occurrence I apprehend to be very unusual in these animals.



Whether arsenic produces this effect by a general operation inducing a general debility in consequence of which the teeth decay, or whether its peculiar acid acts specifically upon the calcarious earth of the teeth, I shall not presume to determine.

\* MR. WILLIAM LEMPRIERE, an intelligent English surgeon, has drawn the picture of a case from the poisonous effects of arsenic, which is sufficient to demonstrate, that even in some cases where a recovery is obtained, life is under such circumstances the most intolerable of human burdens. He observes, “ I was desired to visit the emperor’s favourite wife, who had been poisoned by arsenic, conveyed into her food by the machinations of her rivals. After a tedious conflict between life and death the effects of the poison in part abated, but the unhappy lady was left in a dreadful state of debility and irritation. Her beauty, the fatal cause of her misfortune, was completely destroyed, and her enemies, though disappointed in their aim at destroying her life, yet enjoyed the malignant triumph of seeing those charms which had excited their jealousy, reduced below the standard of other women. Her digestion was so weak, that every species of food, after remaining a few hours on her stomach, was returned perfectly crude and undigested. Her body was reduced to a shadow,



and her strength so far exhausted that she could not walk without assistance. Her skin, from being naturally clear and fair, was changed to a sickly brown, which joined to a ruined set of teeth and ghastly countenance, effaced every trace of that beauty which she might once have possessed."

VARIOUS antidotes have been proposed to counteract the poisonous effects of arsenic. Oils and such other substances as seemed best calculated to obtund the acrimony of the metallic particles, have been supposed adequate to the relief of the pernicious effects of all saline poisons. Sceptical on this subject I instituted a series of experiments upon dogs, the result of which clearly demonstrated, that no oleaginous substance is equal to the prevention of evil from such causes. In cases where the portion of poison was inconsiderable, mucilaginous and oily matters seemed in some measure to protract and mitigate the symptoms, but never afforded entire relief; for such as recovered had taken so small a quantity as scarcely to be capable of doing mischief if no remedy had been attempted. I used for these experiments the oil of almonds, train oil, linseed and castor oils, all of which proved insufficient. The castor oil, where it was given in quantities so large as to operate speedily, seemed to procrastinate life, by translating the seat of the disease from the stomach to



a less vital part, the lower intestines. When the arsenic was given mixt with the oils its virulent effects were not obviated, unless the quantity of the poison was so small as to remain suspended, and not to come in contact with the stomach and intestines. Conformable to this idea of the insufficiency of oils to prevent the effects of arsenic on the stomach, we may regard a custom authorised by the superstition of the Hindoos. \* One of the nine modes of trial by the ordeal consists in compelling the accused to eat from the hand of a Brahman a preparation composed of sixty-four parts of clarified butter, mixt with two parts and an half of pure arsenic; if the poison produce no visible effect, he is absolved, otherwise condemned.

MILK has been proposed as an antidote against arsenic and other poisons, but proved inert in every instance, although I gave it the fairest trials, and never produced the smallest benefit, only in proportion as it diluted or washed off the poison concentrated in the stomach. Whoever will observe the specific gravity of arsenic, must readily conceive the difficulty of defending the stomach against its corrosive qualities: The impracticability of such an hypothesis is farther augmented by reflecting, that the arsenic is always in actual contact with the stomach before the antidote can possibly be administered, and that



all attempts for relief must be superfluous, unless the poison be instantaneously removed. The premature exhibition of viscid substances may moreover interfere with the operation of that remedy which we shall say hereafter affords the only rational prospect of relief. Where the poison has been evacuated, and a slight inflammation still remains, oils may prove useful by their lubricating quality.

I ATTEMPTED the relief of those devoted victims by a variety of diluents, given copiously immediately after the poison; but they all proved futile, and their synchronous exhibition was attended with the same fate.

CHYMISTRY has furnished a variety of substances which have been thought equal to the neutralization of arsenic. Vinegar has been extolled by Mr. Sage; but whatever appearances the combination of these agents may exhibit to the eye, I can assert, from repeated experiments, that when they meet in the stomach they do not rescue the body from destruction.

MR. NAVIER, an ingenious French physician and chymist, has proposed to decompose arsenic by a direct combination of the liver of sulphur. We know that orpiment, although it contains a large proportion of arsenic united to sulphur, may be taken into the stomach in a considerable quantity with impunity. This would at first



fight seem to favour the idea that sulphur alone might neutralize arsenic, but from a variety of experiments we can assert the contrary. The *hepar sulphuris* is a most rapacious solvent of some metals, and might therefore aptly obtrude itself upon the prolific imagination of a speculative chymist. Whoever will be at the trouble of mixing arsenic and the liver of sulphur, will be amply satisfied of their slow and feeble influence upon each other. Their action is so slow (even out of the body) that a man might die a thousand deaths before a single particle of arsenic could be neutralized. Every experiment tended to confirm me in the opinion, that chymistry has yet invented no power capable of neutralizing arsenic. The animals upon which the experiments were made individually died, although in many cases a few grains only had been taken, and the proportion of *hepar* mentioned by the fanciful Mr. Navier immediately administered. The proportions of each were varied, and the experiments repeated, with a result equally unpropitious. Whatever effect the alkali may have in the formation of the *hepar*, I am satisfied that sulphur alone will do as much towards effecting a cure as in their combined state; for death will ever be the inevitable consequence of the arsenic, although they may both be used with ever so much liberality and expedition. No remedy can ever alleviate these melancholy preludes of death, unless it operate



with the velocity of light as a solvent, or evacuate the poison from its contact with the stomach. I defy the imagination to conceive of a poison more irresistible in its operation than a large dose of arsenic; it will therefore be irrational to indulge a hope of averting its instantaneous effects, unless a remedy can be invented that shall equal it in the rapidity of its operation. I will not dogmatically affirm that chymistry does not possess a substance adequate to the instantaneous neutralization of arsenic, but can safely say, that none of the great variety upon which I have so repeatedly experimented, is equal to this important indication. History has recorded an antidote for this Herculean poison, which we are *seriously* informed is infallible. \* “The best antidote against the poisonous effects of arsenic are the scrapings of leather reduced to ashes: if the quantity taken be accurately known, four times as much of these ashes mixt with water, and drunk by the patient, will sheathe and counteract the poison.”

Baffled in every attempt to prevent the fatal effects of arsenic taken into the body, I attempted it by the use of the most powerful emetics that could be obtained. In every case where the quantity was not so great as to destroy life suddenly, or to render the stomach altogether in-

\* History of Indostan, page 481.



sensible, an effectual relief was obtained. If the length of time between the taking the poison and the exhibition of the emetic shall be considerable, all attempts for relief will be in vain. The strongest emetics that can be obtained should be administered as soon as the accident shall be discovered, and however copious their effects may be, large quantities of warm water should be immediately taken, and persisted in, until it may be supposed that the whole be evacuated. The warm water not only washes off the acrimonious particles of the poison, but accelerates the operation of the emetic. Amongst the variety of emetics of which I made trial, I found the vitriol of Zinc the most certain: indeed I can say with certainty that it afforded complete relief in all cases where the excitability was not nearly extinguished. After a partial evacuation of the stomach, I endeavoured to finish the cure by such substances as might be judged most powerful on account of their inviscating qualities; the uniform consequence of which was, to retain the poisonous particles in closer contact with the stomach, and to expedite the approach of death.

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#### Tests for discovering the presence of Arsenic.

IT may often be a desirable thing to determine satisfactorily what poison has been the cause of such distressing symptoms. The presence of



arsenic may be detected in two ways.—1. If the least particle can be perceived and burnt, it will emit white fumes, and an evident smell of garlic. 2. Confine a small quantity of arsenic between two plates of copper, and subject them to a strong heat, a white appearance will be communicated to the copper. These methods are sufficient to detect the presence of arsenic, even where it may be diffused among the contents of the stomach, or present in a very minute proportion; but whoever shall feel himself dissatisfied on this point, may use a method communicated by Mr. Bergman. Infuse a small portion of the powder in a solution of vegetable alkali in water, after standing an hour or two, pour upon it a solution of the sulphate of copper in water, the colour of the vitriol will be immediately converted into an elegant green, and will soon be precipitated. The same experiment may be used to detect its presence in water.

ARSENIC is a substance which is copiously diffused through the bowels of the earth; it is a component part of many metallic products, and may, by its latent distribution among them, become the unsuspected cause of the most serious calamities. Tin (as we have already observed) contains a considerable portion of arsenic; we ought therefore to be cautious in admitting it into the composition of culinary utensils, especially such as may be intended to contain acids, or to be much exposed to great heat.



PEWTER likewise sometimes contains a small portion of arsenic, but the quantity is so insignificant as not to be justly an object of terror: It is nevertheless, a duty incumbent on the manufacturers of these metals, to ascertain with precision what proportion of arsenic their materials contain. If we dissolve tin which contains this substance, in the muriatic acid, the solution will exhibit a black powder, which consists of the arsenic separated from the tin. This experiment renders the smallest particle conspicuous.

THE property which arsenic possesses of being soluble in water, multiplies and facilitates its destructive powers; springs and rivulets are sometimes impregnated by flowing over this noxious mineral, and those who inhabit their vicinity may fall victims to their insidious influence before a suspicion of the fatal cause shall arise. Besides the method we have already described, for discovering the presence of arsenic in water, it may be accomplished with more simplicity and equal certainty, by evaporating the water in a clean iron vessel: a portion of the arsenic will be deposited on the sides and bottom of the vessel, and when thrown upon burning coals, will emit the well known garlic-like odor. If a copper vessel be used, the inside of the vessel will become white.

THE same end may be attained more expeditiously by evaporating the water rapidly from



an ignited iron; but this method is liable to a deception, for no odor will be emitted unless the water be strongly impregnated by the semi-metal. These methods may however, prove less accurate than others devised by the ingenuity of chymists. The most infallible with which we are acquainted are the following.

1. IF a solution of the hepar sulphuris be poured into water adulterated with arsenic, a colour more or less yellow will be produced, and if the sulphur superabound orpiment will be deposited.

2. \*IF boiling lime-water be poured upon water holding arsenic in solution, a white precipitate of difficult solubility in water, will fall down. This precipitate is soluble in the acetous acid, and in a solution of arsenic: when mixt with oil and laid upon the fire, it yields the garlic-like smell peculiar to arsenic.

3. CUPRUM Ammoniacum affords an excellent means of detecting the presence of arsenic in any liquid; it produces with it a yellowish green precipitate, which if separated from the superincumbent liquor, dried and put upon ignited coals, manifests the same garlic-like odour.

OTHER tests might be devised to ascertain the presence of arsenic by different reagents, but it

\* Chymical tests, invented by J. F. A. Gotling, Professor of Chymistry at Jena, in Saxony.



would be a work of supererrogation, as those already described are deemed amply sufficient to detect it in its almost infinite variety of combinations.

It has been the object of the preceding essay to collect such information as could in any wise tend to illustrate a subject as yet in its infancy. As an impartial investigator, the author has, unbiassed by prepossession or prejudice, extolled or condemned it agreeably to the suggestions of his own judgment. It may perhaps be observed, by those who have experienced the difficulties of adapting medicines to particular exigencies and to the various conditions of disease, that more minuteness and precision are necessary in the use of so active a medicine: but whoever will attend to the principles that govern the operations of this medicine, as they are laid down in the progress of the subject, will find its management both practicable and easy. It would have been easy to have decorated every page with the tinsel phantoms of the imagination, but as the theory which has been contemplated is the inevitable consequence of the phenomena of diseases, or the obvious operation of the medicine, the author ought in justice to be rescued from the implication of vanity or presumption. Should any thing have escaped him which shall be hereafter found erroneous, it shall be retracted with unspeakable pleasure; for, whether his efforts



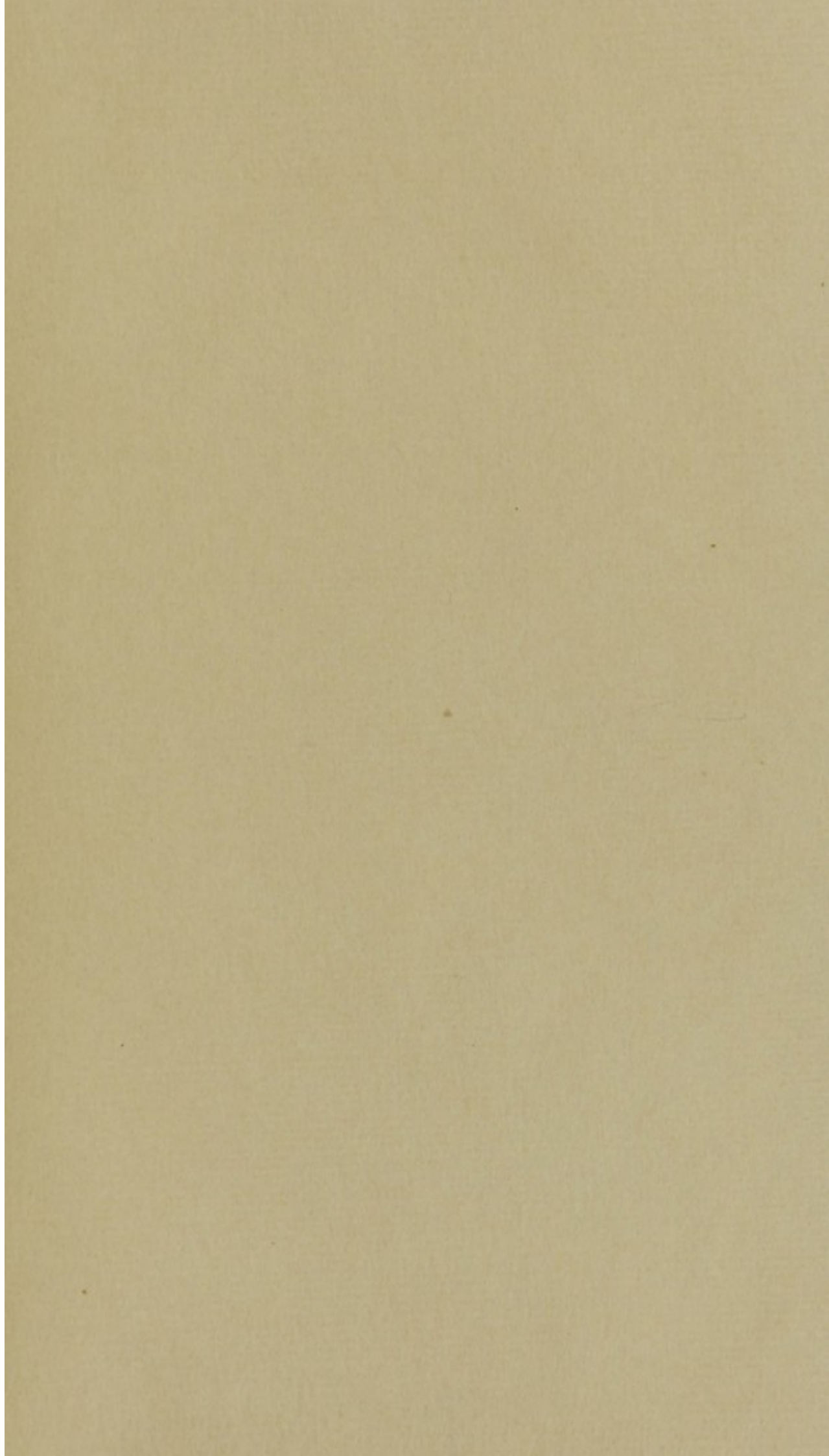
should lead to truth directly or indirectly, through the medium of error, they will afford a gratification not to be conceived by any but those who have felt the pleasure of doing good.

If we take a retrospective view of the agency of this mineral as a medicine, we shall see that nature hath made nothing in vain, or, to speak more philosophically, that the Author of nature has acted most benevolently in its formation; for if we view impartially even its most destructive attributes, we shall see, that they are no more than deviations from that order, which was imposed upon the universe from the beginning, affording us additional reason to exult with the poet,

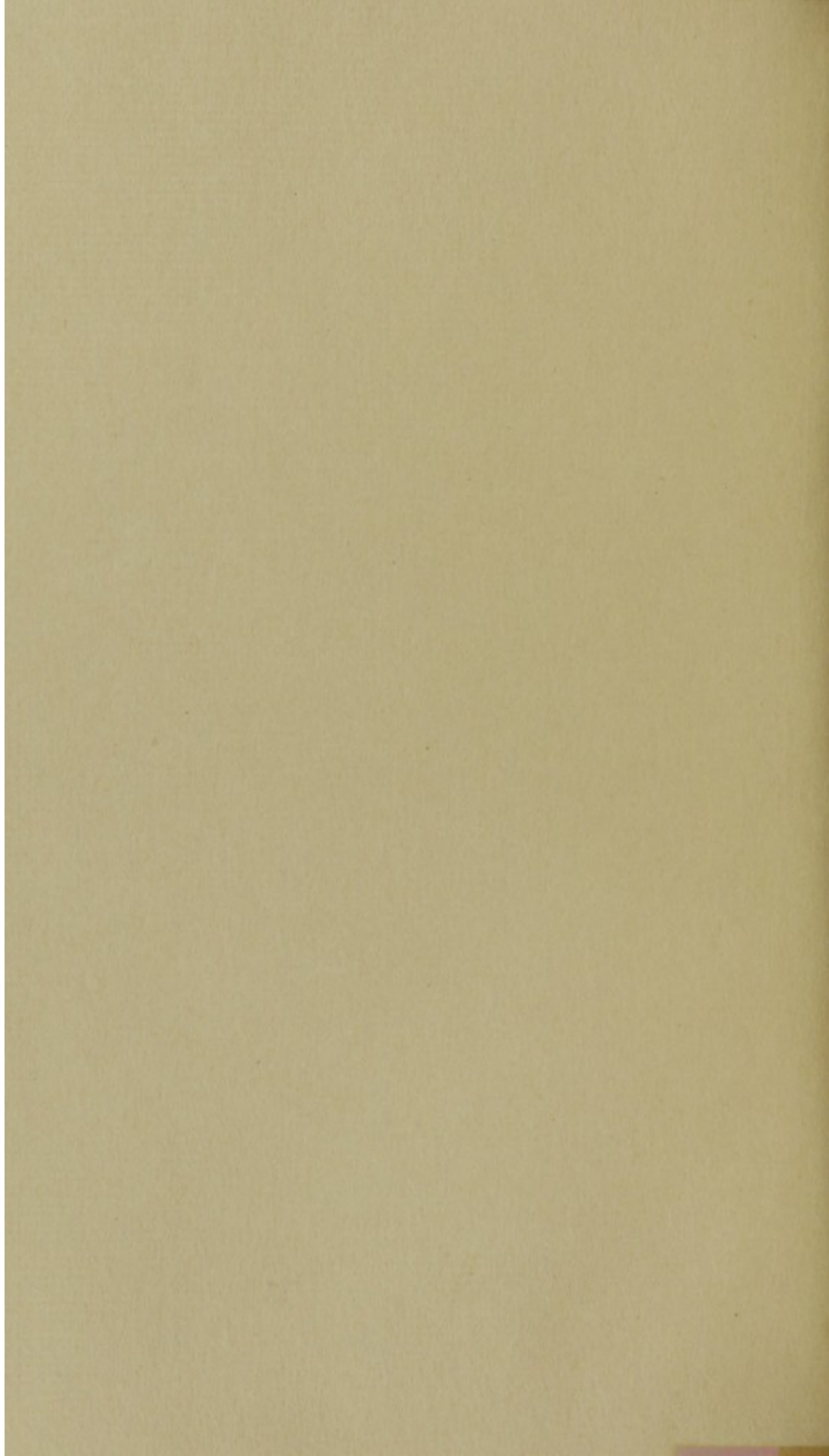
“ All partial evils universal good,  
“ All discord harmony misunderstood.”

THE END.











Med. Hist.

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