

A short essay written for the service of the proprietors of cotton mills.

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Publication/Creation

Manchester : Printed by C. Wheeler, 1784

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A SHORT

ESSAY

WRITTEN FOR THE

SERVICE

OF THE

PROPRIETORS

OF

COTTON-MILLS,

AND THE

PERSONS EMPLOYED IN THEM.

By Mr John Bill, Surgeon

MANCHESTER: PRINTED BY C. WHEELER, 1784.

PRICE THREE-PENCE.

1852

ESSAYS

BY

W. H. W. W.

AND

BY OTHERS

EDITED BY

W. H. W. W.

NEW YORK

W. H. W. W.



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S H O R T E S S A Y, &c.

THAT the superiority of this county over many others, both with regard to riches and population, is in a great measure to be ascribed to its Cotton Manufactory, is a truth which must be universally acknowledged. The advancement of this branch of commerce has therefore, for many years past, been sought by every means which ingenuity could devise; and among the various inventions that have been made for this purpose, there are many which have separately contributed very essentially to it. Of all these, none have been so successful in answering the end proposed, as the late discoveries in the art of Spinning and Carding, which are now united and perfected in the several cotton mills that have been erected, and which have proved so greatly advantageous, both to their proprietors and the county in general.

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Though

Though the Author of this little Essay professes himself, generally speaking, to be unacquainted with the nature of that art which is the source of so much affluence to this town and county, he heartily wishes success and increasing improvement to every invention which can tend to its perfection, and would be happy to remove any objections to the cotton mills which may be supposed to arise from their pernicious influence on the health of the persons employed in them.

That there has been a contagious disorder in a cotton mill in the neighbourhood of Manchester, which has destroyed many persons, and endangered the lives of more, is a well known fact. No apology therefore can be necessary for an attempt to investigate the cause of it, as the pre-requisite of its removal, and future prevention.

With respect to the nature of the disease, it can only be necessary to observe in a few words, that it was a malignant fever—that it generally ran through whole families, equally affecting people of all ages, but most fatal to the men—and that it was similar to the fevers that frequently rage in jails, ships, and hospitals. From hence it is evident, that the cause of the former, must also resemble that of the latter; and though it may not be easy, in any case, infallibly to demonstrate, that any particular circumstance was certainly, and singly, productive of any particular effect; (especially where a
similar

similar effect might possibly proceed from various sources) it will be abundantly sufficient to my present purpose, if I can point out a cause, which not only may, but which it is highly probable might, and which in its own nature, in a course of time, *must* produce it. To be rather more particular. It is impossible for any man to say, with respect to a contagious disorder, whether in a mill or a jail, that it was not communicated by infection; but if he can prove, that it certainly might, and probably did arise, from any thing wrong in the construction or management of either, or that it undoubtedly must do so in a course of time, he has certainly sufficient reason to adopt this manner of accounting for it, and to justify any probable plan of redressing the inconvenience, which is founded upon the idea.

Now, nothing can be more certain, than that a fever of the kind we have been speaking of, may, and in time *must* be produced from the effluvia which arise from a number even of healthy bodies, long confined in an unventilated place.

Many authentic facts may be adduced to prove the pernicious consequences which arise from the stagnation of the air, in cases where it may possibly be aggravated by uncleanness and disease: one or two of which it may not be improper to recite.

‘ At the fatal Assizes held at Oxford in the year 1577, there was arraigned and condemned

' demned Rowland Jenkins, for a seditious
 ' tongue; at which time there arose such a
 ' damp,' that is a noxious effluvia, ' amidst the
 ' people, that almost all were smothered. Very
 ' few escaped that were not taken. There died
 ' in Oxon, three hundred persons; and sicken-
 ' ed, but died in other places, two hundred
 ' and odd.'

' In the year 1750, on the 11th of May, the
 ' Sessions began at the Old Bailey, and conti-
 ' nued for some days; in which time a great
 ' number of criminals were tried, and there
 ' was present in the court a greater multitude
 ' than usually attends. The hall in the Old
 ' Bailey is a room of no more than about 30
 ' feet square. Now, whether the air was at
 ' first tainted from the bar, by some of the pri-
 ' soners, then ill of the jail-distemper, or by
 ' the general uncleanness of such persons, is
 ' uncertain; since, from the latter cause it will
 ' be easy to account for its corruption; especi-
 ' ally as it was so much vitiated by the foul
 ' steams of the Bail-dock, and of the two
 ' rooms opening into the court, in which the
 ' prisoners were the whole day crowded toge-
 ' ther, till they were brought out to be tried:
 ' and, it appeared afterwards, that these places
 ' had not been cleaned for some years. The
 ' poisonous quality of the air was still aggra-
 ' vated by the heat and closeness of the court,
 ' and by the perspirable matter of a great num-
 ' ber of all sorts of people, penned up for
 most

most part of the day, without breathing the free air, or receiving any refreshment. The bench consisted of six persons, whereof four died, together with two or three of the counsel, one of the under sheriffs, several of the Middlesex jury, and others present, to the amount of above forty in the whole; without making allowance for those of a lower rank, whose death may not have been heard of, or including any that did not sicken within a fortnight after the sessions.' See Sir J. Pringle's Obs. on the diseases of the army.

Sir John Pringle has observed a malignant fever to have arisen in foul and crowded barracks, and in transport ships when filled beyond a due number, and detained by long and contrary winds; or where the men were kept up at sea, under close hatches, during stormy weather.

The Guinea Merchants, it is well known, often experience great losses in their trade, from the number of slaves they lose in their voyages, which must be attributed to the polluted air they are compelled to breathe. The Merchants, being aware of the cause of their deaths, have attempted to remove it; but so many negroes are still crowded in the holds of the ships, that the measures they take to preserve them, often prove ineffectual. They have been known to lose all, except four, before they got to the place of destination.

Such are the consequences of the want of
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a free ventilation, when it may *possibly* be accompanied by other disadvantageous circumstances. But the proposition I have laid down goes much farther, affirming (and the idea is founded upon experiment) that the nicest cleanliness, and most perfect health, though they may postpone, cannot finally prevent, the bad effects of a stagnant air.

Many accurate experiments which have been made upon air respired from the lungs of healthy persons, prove it to be a poison extremely destructive to the lives of animals. One man in health pollutes a gallon of air in a minute; and animals, even the most tenacious of life, sooner expire in air thus made foul, than from the total want of it.

From these well-known facts, which are founded upon indisputable evidence, it must appear very plain, that if air made foul by respiration in any given degree produces death, the various other degrees of it, must be productive of various, proportionably, pernicious consequences; and amongst others, as all those acquainted with medical subjects will allow, of contagious fevers.

It might, indeed, as has been before intimated, be no easy matter to produce particular instances which will absolutely prove, that ill effects have arisen *solely* from the circumstance of confining a number of healthy people in places not properly ventilated, because in such cases it must always be impossible to say
that

that no other cause co-operated with it: but the remarks which have been made are sufficient to render the foregoing proposition absolutely certain—that if the effluvia arising from the bodies of men, even in health, be not diffused in the atmosphere, they must at length occasion a contagious fever: and further—that in all cases where such an effect is produced, and there is no more immediate cause of it apparent, it may reasonably be attributed to this.

Now let us apply the general principle to the case immediately under consideration.

The Cotton Mills are large buildings, but so constructed as to employ the greatest possible number of persons. That no room may be lost, the several stories are built as low as possible. Most of the rooms are crowded with machines, about which it is necessary to employ a considerable quantity of oil, in order to facilitate their motion. From the nature of the manufacture, a great deal of cotton dust is constantly flying about, which adhering to the coil, and heated by the friction, occasions a strong and disagreeable smell. The number of people who work in the mill must certainly be proportioned to the size of it. In a large one I am informed there are several hundreds: from whence it is evident, a very considerable division must be allotted to each apartment. The manufacturers, in many instances, constantly

stantly labour day and night.* Of course a great number of candles must be used, and scarce any opportunity for ventilation afforded. From hence it is evident that there is a considerable effluvia constantly arising from the bodies of a large number of persons, (well, or in a degree indisposed, just as it happens) from the oil and cotton dust; and from the candles used in the night, without any considerable supply of fresh air. There are, indeed, trifling casements, sometimes opened, and sometimes not; but totally insufficient to subserve any valuable purpose.

Now, if the mere confinement of a number of healthy bodies produce the effect above attributed to it, what consequences must we expect from so many concomitant pernicious circumstances?

What are the consequences which have actually proceeded from them?—As we have already observed, it is well known, that there has been a contagious disorder in a cotton mill in the neighbourhood of Manchester which has been fatal to many, and infected more: indeed, it spread itself throughout the village; and perhaps, for a similar disorder was prevalent, extended itself much further.

Most of the patients that were ill, having
most

* It should be observed, that the Proprietors of some Cotton Mills, alarmed by the consequences of obliging their servants to work incessantly, have shut up their mills in the night.

been asked where they caught the fever, either replied that they caught it themselves at the cotton mill, or were infected by others that had. Several were asked what kind of labour they followed, who were first seized with the disorder. They all replied, they were the people that worked in the cotton mill; and if we admit the justice of the sentiments already advanced, we shall find little difficulty in affording our assent to their idea of the source of the disorder. Nothing less could be expected from such causes, nor is there any other method of accounting for it, that is founded on the smallest degree of comparative probability.

If we attend to the natural effects of a merely stagnant air to those who breathe it, and especially if we reflect upon the consequences that are sure to result from it when rendered more pernicious by a noxious effluvia of any kind, we must acknowledge, as has been already shewn, that there is no affixing a limit to its dreadful influences.

But it may be asked, why was not the fever produced sooner, and why did any escape it? To the first of these enquiries we may reply, that the effect depends upon a variety of circumstances. The mill might be kept cleaner at one time than another; and the number of persons employed in it might be different; &c. &c. and after all, it must require some time to produce a degree of contamination, especially in a new mill, which would be so extremely
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prejudicial. To the second of the above queries we may answer, that some people seem to be proof against the plague itself, and therefore their escape from it is far from being a sufficient evidence that no danger existed.

The cause of the disorder, which it is presumed has been sufficiently explained and established, will suggest the method of its own removal and prevention. And as stagnant, contaminated air is the cause of the disease, the most obvious remedy is a free, constant, ventilation. It is not sufficient to admit a scanty supply of air through a few small windows, the building must be purified by a *full current*, which must be uniformly admitted at stated seasons, and suffered to flow for a certain time, notwithstanding any slight inconvenience to which it may expose the manufactory. This time should not be less than six or eight hours in the four and twenty; and if the allowance could be increased, so much the better. Various methods might be adopted for the ventilation of a mill, some of which it may not be improper to notice.

The first and best seems to be the following one; especially as it is peculiarly adapted to the construction of the cotton mills. In every window the sashes should be so formed, that the lower of them may be raised, and the upper let down. Upon this plan, a room will *comparatively* soon be purified from its tainted air. For as it is well known that noxious vapour ascends,

ascends, it will certainly escape through the higher aperture, while the fresh air rushes in through that beneath. If this mode of ventilation cannot be adopted so frequently, or for so long a time, as is necessary to produce the desired effect, a considerable number of large ventilators, correspondently situated, would prevent the injury the work might receive from an uninterrupted stream, and would, in some degree, supply its place; though they would by no means render it altogether unnecessary.

Frequent fires in open grates may also be of great service in ventilating the mills; though stoves cannot be equally beneficial, because they do not produce an equal current of air. But this is a method, which if it can be employed at all, must rather be used in aid of another, than singly adopted, because in any small, and therefore safe degree, it would be insufficient to the production of the desired effect.

But though ventilation may be sufficient to prevent the cause of disease in new mills, it will scarcely alone either remove it in them, or afford a good security against it, and still less expel it, in old ones. It will be necessary therefore to have recourse to some other methods of prevention and redress.

Wherever the contagious matter is thoroughly imbibed either in cotton wool or other porous substances, even in wood itself, other means must be made use of to eradicate it.

The ingenious Dr. Lind tells us that he ‘ seldom knew a proper application of fire and smoke to prove unsuccessful in producing the happy consequence of effectually purifying all tainted places, materials, and substances.’

‘ There are several methods commonly practised for purifying ships, hospitals, or other places, after the company has been removed out of them.’

One of them is by the burning of tobacco—
 ‘ A quantity of tobacco is spread on several fires made with such old pieces of ropes, as are called junk. These fires dispersed into different places of the ship, their heat or smoke is afterwards closely confined below for a considerable time.’

Another method is, by burning wood and other vegetable productions that yield a subtil volatile acid, such as pitch and tar, &c. in different parts of a building.

‘ The third method is, by charcoal fires, strewed with brimstone. The heat and steam of those burning substances for this purpose must likewise be long and close shut up. This fume properly applied hath been experienced to purify effectually all tainted apartments, ships, cloaths, &c.’

‘ The fourth method of purification is performed by the burning of gunpowder. Of the many fumes recommended for the emendation of the air none are more effectual to eradicate an infection out of any place, than the

' the confined smoke of gunpowder.' The ven-
 tilators must be stopt, and as little air as
 possible admitted into the apartments, dur-
 ing the time small quantities of gunpowder
 are fired off, in different parts of the build-
 ing. ' A paste may be made by thoroughly
 ' wetting the gunpowder with water. A small
 ' quantity of this paste, is to be thrown into the
 ' bottom of a broad and deep ladle, or an old ket-
 ' tle or sauce-pan, containing live coals, suffici-
 ' ently secured by standing in a deep bucket,
 ' or large tub of water. This precaution, with
 ' that of throwing only very small quantities at
 ' a time of loose powder on the wet paste to
 ' promote its taking fire, will effectually secure
 ' against any danger. The operation is to be
 ' repeated, as long as the operator can stand
 ' the smoke (which by the bye is quite harm-
 ' less to the lungs) and until the hold and all the
 ' parts between decks are sufficiently replete
 ' with it. They ought to set fire to the last
 ' train just as they leave the gun-deck in ascend-
 ' ing the last ladder, when the hatchway by
 ' which they came up, is without delay to be
 ' shut. The smoke must be confined for at least
 ' two hours, until all the contents of the ships,
 ' &c. are sufficiently penetrated and purified with
 ' this vapour.'

The ventilators are afterwards to be played
 off, and all the windows and doors are to be set
 open, so that the apartments may receive a full
 stream of fresh and wholesome air.

' From

‘ From the known and experienced efficacy
 ‘ of the processes which have been described it
 ‘ appears that fire and smoke are the most pow-
 ‘ erful agents for annihilating infection.’

Although the methods of purifying tainted places, which are above recited, may be adequate to the purpose, yet as the contagious matter is of so subtil a nature, it will be highly expedient to white-wash the rooms three or four times every year; and one afternoon in the week should be employed in scraping the floors and the frames of the machines, which should afterwards be washed with *vinegar*, or some *vegetable acid*.

It is necessary also to be very careful that the oil which is used be perfectly sweet; for if it be offensive at first, it will become still more so when heated by friction, and mingled with cotton dust. We may add too, that it will be extremely proper frequently to cleanse the spindles to which it is applied.

Air pipes are sometimes used in large buildings pretty full of inhabitants, which, if they could be conveniently introduced, might probably be of considerable use in the mills.

It is further necessary to observe, that the Proprietors of Cotton Mills would do well to recommend it to their servants, to take great care, that the cloaths which have been exposed to the matter of contagion, be thoroughly aired and cleansed. For it is the opinion of several

several eminent physicians, that the effluvia arising from tainted cloaths, are much stronger than those which proceed from the bodies, even of infected persons.

We are assured on the best authority, that an infected belt was transported several thousand miles, and communicated the disease to some Indians.

The best manner of purifying tainted cloaths is to put them in cold water or in cold soap lees for several hours, and then to fumigate them in the house where the infected person has lain, with charcoal fires and brimstone, in the manner already directed for the purification of cotton mills. By these means both the house and the cloaths will be completely purified.

These modes of purification are recommended by Dr. Lind.

From the foregoing observations it is very evident that it must be much for the interest of every gentleman, as well as the neighbourhood in which he lives, to attend to the health of all his servants: neither to admit any that are diseased, nor to suffer others who are admitted to work in the manufactory, till they be perfectly cured.

It is true humanity will not permit them to suffer much from the want of employment in the interval of sickness; but upon the slightest degree of reflexion it must appear, that they
ought

ought on no account to be permitted to enter the mills.

The observations which have been already made, if they answer the purpose for which they were designed, will be fully sufficient to remove, or in future to prevent the cause of that evil (the fever in the mills) which was the occasion of them.

Were this trifle to be swelled to the size of a volume, it could with propriety contain but little more, than the different modes of ventilating this kind of buildings, and keeping them clean.

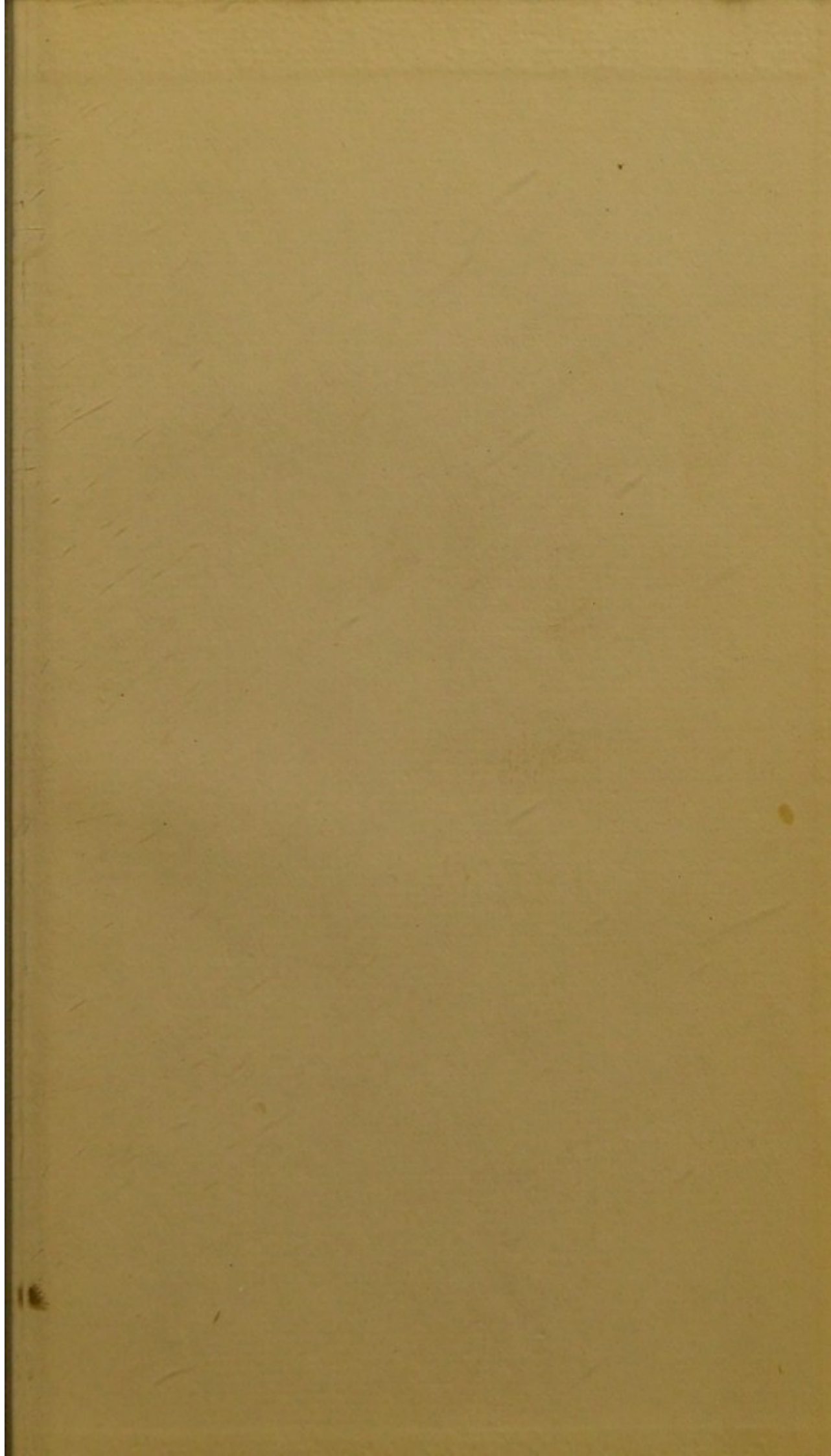
It may be useful however to remark the particular impropriety of exposing children, to the pernicious consequences of breathing a foul air, or of obliging them to work in the night.

Youth is the time in which, if ever, the foundation of health must be laid, and strength of constitution acquired; and nothing can more powerfully tend to prevent either, than the want of pure air, and loss of proper sleep, at proper hours. With respect to the latter circumstance, every one knows that sleep in the day is not so refreshing or strengthening, as sleep in the night: And it may also be added that their bodies being on this account rendered more weak and irritable, are probably more liable to receive the matter of contagion, if any exists. From hence it appears, that though children should not imbibe a poison sufficiently strong to produce a fever,

ver, they will lose the vigour of health, and become sickly, feeble, comparatively unserviceable, and perhaps deformed; for the tone of the system being once destroyed, the bones may become soft and flexible and at length crooked.*

Cold bathing, provided other circumstances do not forbid the use of it, would be extremely serviceable to children who have already suffered, or may be liable to suffer from any of the above-mentioned causes; and perhaps it would be no less so to those, who have yet received no injury in their health—Their parents should also give them food before they send them to their work; by which means they will become much less likely to suffer from noxious effluvia or to be injured in other respects. Though this advice is peculiarly important to children; it by no means follows that it is of trifling consequence to persons of any age. In every case where health is possessed its observance will, generally speaking, tend to its preservation, and wherever it is injured or lost, will have a proportionable tendency to the restoration of it.

* The Author of this Essay has been informed, that the children who work in the night, frequently sleep in the same beds as those who work in the day: if so, they alternately go out of a close mill into a dirty bed, and into a room contaminated with noxious air. It can only be necessary to mention this circumstance; the bad consequences of it are sufficiently obvious.





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