Discourse on the Method of Rightly Conducting the Reason and Seeking for Truth in the Sciences

By Descartes

Based on the translation by Elizabeth Haldane, with minor emendations by Daniel Kolak.

If this Discourse appears too long to be read all at once, it may be separated into six portions. And in the first these will be found various considerations respecting the sciences; in the second, the principal rules regarding the method which the author has sought out; while in the third are some of the rules of morality which he has derived from this method. In the fourth are the reasons by which he proves the existence of God and of the human soul, which farm the foundation of his metaphysics. In the fifth, the order of the questions regarding physics which he has investigated, and particularly the explanation of the movement of the heart, and of some other difficulties which pertain to medicine, as also the difference between the soul of man and that of the brutes. And in the last part the questions raised relate to those matters which the author believes to be essential in order to advance further in the investigation of nature, in addition to the reasons that caused him to write.

PART I

Good sense is of all things in the world the most equally distributed, for everybody thinks himself so abundantly provided with it that even those most difficult to please in all other matters do not commonly desire more of it than they already possess. It is unlikely that this is an error on their part; it seems rather to be evidence in support of the view that the power of forming a good judgment and of distinguishing the true from the false, which is properly speaking what is called good sense or reason, is by nature equal in all men. Hence too it will show that the diversity of our opinions does not proceed from some men being more rational than others, but solely from the fact that our thoughts pass through diverse channels and the same objects are not considered by all. For to be possessed of good mental powers is not sufficient; the principal matter is to apply them well. The greatest minds are capable of the greatest vices as well as of the greatest virtues, and those who proceed very slowly may, provided they always follow the straight road, really advance much faster than those who, though they run, forsake it.

For myself I have never ventured to presume that my mind was in any way more perfect than that of the ordinary man; I have even longed to possess thought as quick, or an imagination as accurate and distinct, or a memory as comprehensive or ready, as some others. And besides these I do not know any other qualities that make for the perfection of the human mind. For as to reason or sense, inasmuch as it is the only thing that constitutes us men and distinguishes us from the brutes, I would fain believe that it is to be found complete in each individual, and in this I follow the common opinion of the philosophers, who say that the question of more or less occurs only in the sphere of the *accidents* and does not affect the *forms* or natures of the *individuals* in the same *species*.

But I shall not hesitate to say that I have had great good fortune from my youth up, in lighting upon and pursuing certain paths which have conducted me to considerations and maxims from which I have formed a method by whose assistance it appears to me I have the means of gradually increasing my knowledge and of little by little raising it to the highest possible point which the mediocrity of my talents and the brief duration of my life call permit me to reach. For I have already reaped from it fruits of such a nature that, even though I always try in the judgments I make on myself to lean to the side of self-depreciation rather than to that of arrogance, and though, looking with the eye of a philosopher on the diverse actions and enterprises of all mankind, I find scarcely any which do not seem to me vain and useless, I do not cease to receive extreme satisfaction in the progress which I seem to have already made in the search after truth, and to form such hopes for the future as to venture to believe that, if amongst the occupations of men, simply as men, there is some one in particular that is excellent and important, that is the one which I have selected.

It must always be recollected, however, that possibly I deceive myself, and that what I take to be gold and diamonds is perhaps no more than copper and glass. I know how subject we are to delusion in whatever touches ourselves, and also how much the judgments of our friends ought to be suspected when they are in our favor. But in this Discourse I shall be very happy to show the paths I have followed, and to set forth my life as in a picture, so that everyone may judge of it for himself; and thus in learning from the common talk what are the opinions which are held of it, a new means of obtaining self-instruction will be reached, which I shall add to those which I have been in the habit of using.

Thus my design is not here to teach the method which everyone should follow in order to promote the good conduct of his Reason, but only to show in what manner I have endeavored to conduct my own. Those who set about giving precepts must esteem themselves more skillful than those to whom they advance them, and if they fall short in the smallest matter they must of course take the blame for it. But regarding this Treatise simply as a history, or, if you prefer it, a fable in which, amongst certain things which may be imitated, there are possibly others also which it would not be right to follow, I hope that it will be of use to some without being hurtful to any, and that all will thank me for my frankness.

I have been nourished on letters since my childhood, and since I was given to believe that by their means a clear and certain knowledge could be obtained of all that is useful in life, I had an extreme desire to acquire instruction. But so soon as I had achieved the entire course of study at the close of which one is usually received into the ranks of the learned, I entirely changed my opinion. For I found myself embarrassed with so many doubts and errors that it seemed to me that the effort to instruct myself had no effect other than the increasing discovery of my own ignorance. And yet I was studying at one of the most celebrated Schools in Europe, where I thought that there must be men of learning if they were to be found anywhere in the world. I learned there all that others learned; and not being satisfied with the sciences that we were taught, I even read through all the books which fell into my hands, treating of what is considered most curious and rare. Along with this I knew the judgments that others had formed of me, and I did not feel that I was esteemed inferior to my fellow students, although there were amongst them some destined to fill the places of our masters. And finally our century seemed to me as flourishing, and as fertile in great minds, as any which had preceded. And this made me take the

liberty of judging all others by myself and of coming to the conclusion that there was no learning in the world such as I was formerly led to believe there to be.

I did not omit, however, always to hold in esteem those exercises which are the occupation of the Schools. I knew that the Languages which one learns there are essential for the understanding of all ancient literature; that fables with their charm stimulate the mind and histories of memorable deeds exalt it; and that, when read with discretion, these books assist in forming a sound judgment. I was aware that the reading of all good books is indeed like a conversation with the noblest men of past centuries who were the authors of them, nay a carefully studied conversation, in which they reveal to us none but the best of their thoughts. I deemed eloquence to have a power and beauty beyond compare; that poesy has most ravishing delicacy and sweetness; that in mathematics there are the subtlest discoveries and inventions which may accomplish much, both in satisfying the curious, and in furthering all the arts, and in diminishing man's labor; that those writings that deal with morals contain much that is instructive, and many exhortations to virtue which are most useful; that theology points out the way to heaven; that philosophy teaches us to speak with an appearance of truth on all things, and causes us to be admired by the less learned; that jurisprudence, medicine and all other sciences bring honor and riches to those who cultivate them; and finally that it is good to have examined all things, even those most full of superstition and falsehood, in order that we may know their just value, and avoid being deceived by them.

But I considered that I had already given sufficient time to languages and likewise even to the reading of the literature of the ancients, both their histories and their fables. For to converse with those of other centuries is almost the same thing as to travel. It is good to know something of the customs of different peoples in order to judge more sanely of our own, and not to think that everything of a fashion not ours is absurd and contrary to reason, as do those who have seen nothing. But when one employs too much time in traveling, one becomes a stranger in one's own country, and when one is too curious about things which were practiced in past centuries, one is usually very ignorant about those which are practiced in our own time. Besides, fables make one imagine many events possible which in reality are not so, and even the most accurate of histories, if they do not exactly misrepresent or exaggerate the value of things in order to render them more worthy of being read, at least omit in them all the circumstances which are basest and least notable; and from this fact it follows that what is retained is not portrayed as it really is, and that those who regulate their conduct by examples which they derive from such a source, are liable to fall into the extravagances of the knights-errant of romance, and form projects beyond their power of performance.

I esteemed eloquence most highly and I was enamored of poesy, but I thought that both were gifts of the mind rather than fruits of study. Those who have the strongest power of reasoning, and who most skillfully arrange their thoughts in order to render them clear and intelligible, have the best power of persuasion even if they can bat speak the language of Lower Brittany and have never learned rhetoric. And those who have the most delightful original ideas and who know how to express them with the maximum of style and suavity, would not fail to be the beat poets even if the art of poetry were unknown to them.

Most of all was I delighted with mathematics because of the certainty of its demonstrations and the evidence of its reasoning; but I did not yet understand its true use and, believing that it was of service only in the mechanical arts, I was astonished that, seeing how firm and solid was its

basis, no loftier edifice had been reared thereupon. On the other hand I compared the works of the ancient pagans which deal with morals to palaces most superb and magnificent, which are yet built on sand and mud alone. They praise the virtues most highly and show them to be more worthy of being prized than anything else in the world, but they do not sufficiently teach us to become acquainted with them, and often that which is called by a fine name is nothing but insensibility, or pride, or despair, or parricide.

I honored our theology and aspired as much as anyone to reach to heaven, but having learned to regard it as a most highly assured fact that the road is not less open to the most ignorant than to the most learned, and that the revealed truths which conduct farther are quite above our intelligence, I should not have dared to submit them to the feebleness of my reasonings; and I thought that, in order to undertake to examine them and succeed in so doing, it was necessary to have some extraordinary assistance from above and to be more than a mere man.

I shall not say anything about philosophy, but that seeing that it has been cultivated for many centuries by the best minds that have ever lived, and that nevertheless no single thing is to be found in it which is not subject of dispute, and consequently which is not dubious, I had not enough presumption to hope to fare better there than other men had done. And also, considering how many conflicting opinions there may be regarding identical matters, all supported by learned people, while there can never be more than one which is true, I esteemed as well-nigh false all that only went as far as being probable.

Then as to the other sciences, inasmuch as they derive their principles from philosophy, I judged that one could have built nothing solid on foundations so far from firm. And neither the honor nor the promised gain was sufficient to persuade me to cultivate them, for, thanks be to God, I did not find myself in a condition which obliged me to make a merchandise of science for the improvement of my fortune; and, although I did not pretend to scorn all glory like the cynics, I yet had very small esteem for what I could not hope to acquire, excepting through fictitious titles. And, finally, as to false doctrines, I thought that I already knew well enough what they were worth to be subject to deception neither by the promises of an alchemist, the predictions of an astrologer, the impostures of a magician, the artifices or the empty boastings of any of those who make a profession of knowing that of which they are ignorant.

This is why, as soon as age permitted me to emerge from the control of my tutors, I entirely quit the study of letters. And resolving to seek no other science than that which could be found in myself, or at least in the great book of the world, I employed the rest of my youth in travel, in seeing courts and armies, in intercourse with men of diverse temperaments and conditions, in collecting varied experiences, in proving myself in the various predicaments in which I was placed by fortune, and under all circumstances bringing my mind to bear on the things which came before it, so that I might derive some profit from my experience. For it seemed to me that I might meet with much more truth in the reasonings that each man makes on the matters that specially concern him, and the issue of which would very soon punish him if he made a wrong judgment, than in the case of those made by a man of letters in his study touching speculations which lead to no result, and which bring about no other consequences to himself excepting that he will be all the more vain the more they are removed from common sense, since in this case it proves him to have employed so much the more ingenuity and skill in trying to make them seem probable. And I always had an excessive desire to learn to distinguish the true from the false, in order to see clearly in my actions and to walk with confidence in this life.

It is true that while I only considered the manners of other men I found in them nothing to give me settled convictions; and I remarked in them almost as much diversity as I had formerly seen in the opinions of philosophers. So much was this the case that the greatest profit which I derived from their study was that, in seeing many things which, although they seem to us very extravagant and ridiculous, were yet commonly received and approved by other great nations, I learned to believe nothing too certainly of which I had only been convinced by example and custom. Thus little by little I was delivered from many errors which might have obscured our natural vision and rendered us less capable of listening to reason. But after I had employed several years in thus studying the book of the world and trying to acquire some experience, I one day formed the resolution of also making myself an object of study and of employing all the strength of my mind in choosing the road I should follow. This succeeded much better, it appeared to me, than if I had never departed either from my country or my books.

PART II

I was then in Germany, to which country I had been attracted by the wars which are not yet at an end. And as I was returning from the coronation of the Emperor to join the army, the setting in of winter detained me in a quarter where, since I found no society to divert me, while fortunately I had also no cares or passions to trouble me, I remained the whole day shut up alone in a stove-heated room, where I had complete leisure to occupy myself with my own thoughts. One of the first of the considerations that occurred to me was that there is very often less perfection in works composed of several portions, and carried out by the hands of various masters, than in those on which one individual alone has worked. Thus we see that buildings planned and carried out by one architect alone are usually more beautiful and better proportioned than those which many have tried to put in order and improve, making use of old walls which were built with other ends in view. In the same way also, those ancient cities which, originally mere villages, have become in the process of time great towns, are usually badly constructed in comparison with those which are regularly laid out on a plain by a surveyor who is free to follow his own ideas. Even though, considering their buildings each one apart, there is often as much or more display of skill in the one case than in the other, the former have large buildings and small buildings indiscriminately placed together, thus rendering the streets crooked and irregular, so that it might be said that it was chance rather than the will of men guided by reason that led to such an arrangement. And if we consider that this happens despite the fact that from all time there have been certain officials who have had the special duty of looking after the buildings of private individuals in order that they may be public ornaments, we shall understand how difficult it is to bring about much that is satisfactory in operating only upon the works of others. Thus I imagined that those people who were once half-savage, and who have become civilized only by slow degrees, merely forming their laws as the disagreeable necessities of their crimes and quarrels constrained them, could not succeed in establishing so good a system of government as those who, from the time they first came together as communities, carried into effect the constitution laid down by some prudent legislator. Thus it is quite certain that the constitution of the true religion whose ordinances are of God alone is incomparably better regulated than any other. And, to come down to human affairs, I believe that if Sparta was very flourishing in former times, this was not because of the excellence of each and every one of its laws, seeing that many were very strange and even contrary to good morals, but because, being drawn up by one individual, they all tended towards the same end. And similarly I thought that the sciences found in books-in those at least whose reasonings are only probable and which have no

demonstrations, composed as they are of the gradually accumulated opinions of many different individuals--do not approach so near to the truth as the simple reasoning which a man of common sense can quite naturally carry out respecting the things which come immediately before him. Again, I thought that since we have all been children before being men, and since it has for long fallen to us to be governed by our appetites and by our teachers (who often enough contradicted one another, and none of whom perhaps counseled us always for the best), it is almost impossible that our judgments should be so excellent or solid as they should have been had we had complete use of our reason since our birth, and had we been guided by its means alone.

It is true that we do not find that all the houses in a town are raised to the ground for the sole reason that the town is to be rebuilt in another fashion, with streets made more beautiful; but at the same time we see that many people cause their own houses to be knocked down in order to rebuild them, and that sometimes they are forced so to do where there is danger of the houses falling of themselves, and when the foundations are not secure. From such examples I argued to myself that there was no plausibility in the claim of any private individual to reform a state by altering everything, and by overturning it throughout, in order to set it right again. Nor is it likewise probable that the whole body of the Sciences, or the order of teaching established by the Schools, should be reformed. But as regards all the opinions which up to this time I had embraced, I thought I could not do better than endeavor once for all to sweep them completely away, so that they might later on be replaced, either by others which were better, or by the same, when I had made them conform to the uniformity of a rational scheme. And I firmly believed that by this means I should succeed in directing my life much better than if I had only built on old foundations, and relied on principles of which I allowed myself to be in youth persuaded without having inquired into their truth. For although in so doing I recognized various difficulties, these were at the same time not insurmountable, nor comparable to those which are found in reformation of the most insignificant kind in matters which concern the public. In the case of great bodies it is too difficult a task to raise them again when they are once thrown down, or even to keep them in their places when once thoroughly shaken; and their fall cannot be otherwise than very violent. Then as to any imperfections that they may possess (and the very diversity that is found between them is sufficient to tell us that these in many cases exist) custom has doubtless greatly mitigated them, while it has also helped us to avoid, or insensibly corrected a number against which mere foresight would have found it difficult to guard. And finally the imperfections are almost always more supportable than would be the process of removing them, just as the great roads which wind about amongst the mountains become, because of being frequented, little by little so well-beaten and easy that it is much better to follow them than to try to go more directly by climbing over rocks and descending to the foot of precipices.

This is the reason why I cannot in any way approve of those turbulent and unrestful spirits who, being called neither by birth nor fortune to the management of public affairs, never fail to have always in their minds some new reforms. And if I thought that in this treatise there was contained the smallest justification for this folly, I should be very sorry to allow it to be published. My design has never extended beyond trying to reform my own opinion and to build on a foundation which is entirely my own. If my work has given me a certain satisfaction, so that I here present to you a draft of it, I do not so do because I wish to advise anybody to imitate it. Those to whom God has been most beneficent in the bestowal of His graces will perhaps form designs which are more elevated; but I fear much that this particular one will seem too venturesome for many. The

simple resolve to strip oneself of all opinions and beliefs formerly received is not to be regarded as an example that each man should follow, and the world may be said to be mainly composed of two classes of minds neither of which could prudently adopt it. There are those who, believing themselves to be cleverer than they are, cannot restrain themselves from being precipitate in judgment and have not sufficient patience to arrange their thoughts in proper order; hence, once a man of this description had taken the liberty of doubting the principles he formerly accepted, and had deviated from the beaten track, he would never be able to maintain the path which must be followed to reach the appointed end more quickly, and he would hence remain wandering astray all through his life. Secondly, there are those who having reason or modesty enough to judge that they are less capable of distinguishing truth from falsehood than some others from whom instruction might be obtained, are right in contenting themselves with following the opinions of these others rather than in searching better ones for themselves.

For myself I should doubtless have been of these last if I had never had more than a single master, or had I never known the diversities which have from all time existed between the opinions of men of the greatest learning. But I had been taught, even in my College days, that there is nothing imaginable so strange or so little credible that it has not been maintained by one philosopher or other, and I further recognized in the course of my travels that all those whose sentiments are very contrary to ours are yet not necessarily barbarians or savages, but may be possessed of reason in as great or even a greater degree than ourselves. I also considered how very different the self-same man, identical in mind and spirit, may become, according as he is brought up from childhood amongst the French or Germans, or has passed his whole life amongst Chinese or cannibals. I likewise noticed how even in the fashions of one's clothing the same thing that pleased us ten years ago, and which will perhaps please us once again before ten years are passed, seems at the present time extravagant and ridiculous. I thus concluded that it is much more custom and example that persuade us than any certain knowledge, and yet in spite of this the voice of the majority does not afford a proof of any value in truths a little difficult to discover, because such truths are much more likely to have been discovered by one man than by a nation. I could not, however, put my finger on a single person whose opinions seemed preferable to those of others, and I found that I was, so to speak, constrained myself to undertake the direction of my procedure.

But like one who walks alone and in the twilight I resolved to go so slowly, and to use so much circumspection in all things, that if my advance was but very small, at least I guarded myself well from falling. I did not wish to set about the final rejection of any single opinion which might formerly have crept into my beliefs without having been introduced there by means of reason, until I had first of all employed sufficient time in planning out the task which I had undertaken, and in seeking the true method of arriving at a knowledge of all the things of which my mind was capable.

Among the different branches of philosophy, I had in my younger days to a certain extent studied logic; and in those of mathematics, geometrical analysis and algebra--three arts or sciences which seemed as though they ought to contribute something to the design I had in view. But in examining them I observed in respect to logic that the syllogisms and the greater part of the other teaching served better in explaining to others those things that one knows (or like the art of Lully, in enabling one to speak without judgment of those things of which one is ignorant) than in learning what is new. And although in reality logic contains many precepts which are very

true and very good, there are at the same time mingled with them so many others which are hurtful or superfluous, that it is almost as difficult to separate the two as to draw a Diana or a Minerva out of a block of marble which is not yet roughly hewn. And as to the analysis of the ancients and the algebra of the moderns, besides the fact that they embrace only matters the most abstract, such as appear to have no actual use, the former is always so restricted to the consideration of symbols that it cannot exercise the Understanding without greatly fatiguing the imagination; and in the latter one is so subjected to certain rules and formulas that the result is the construction of an art which is confused and obscure, and which embarrasses the mind, instead of a science which contributes to its cultivation. This made me feel that some other method must be found, which, comprising the advantages of the three, is yet exempt from their faults. And as a multiplicity of laws often furnishes excuses for evil-doing, and as a State is hence much better ruled when, having but very few laws, these are most strictly observed; so, instead of the great number of precepts of which Logic is composed, I believed that I should find the four which I shall state quite sufficient, provided that I adhered to a firm and constant resolve never on any single occasion to fail in their observance.

The first of these was to accept nothing as true which I did not clearly recognize to be so: that is to say, carefully to avoid precipitation and prejudice in judgments, and to accept in them nothing more than what was presented to my mind so clearly and distinctly that I could have no occasion to doubt it.

The second was to divide up each of the difficulties which I examined into as many parts as possible, and as seemed requisite in order that it might be resolved in the best manner possible.

The third was to carry on my reflections in due order, commencing with objects that were the most simple and easy to understand, in order to rise little by little, or by degrees, to knowledge of the most complex, assuming an order, even if a fictitious one, among those which do not follow a natural sequence relatively to one another.

The last was in all cases to make enumerations so complete and reviews so general that I should be certain of having omitted nothing.

Those long chains of reasoning, simple and easy as they are, of which geometricians make use in order to arrive at the most difficult demonstrations, had caused me to imagine that all those things which fall under the cognizance of man might very likely be mutually related in the same fashion; and that, provided only that we abstain from receiving anything as true which is not so, and always retain the order which is necessary in order to deduce the one conclusion from the other, there can be nothing so remote that we cannot reach to it, nor so recondite that we cannot discover it. And I had not much trouble in discovering which objects it was necessary to begin with, for I already knew that it was with the most simple and those most easy to apprehend. Considering also that, of all those who have hitherto sought for the truth in the sciences, it has been the mathematicians alone who have been able to succeed in making any demonstrations, that is to say producing reasons which are evident and certain, I did not doubt that it had been by means of a similar kind that they carried on their investigations. I did not at the same time hope for any practical result in so doing, except that my mind would become accustomed to the nourishment of truth and would not content itself with false reasoning. But for all that I had no intention of trying to master all those particular sciences that receive in common the name of mathematics; but observing that, although their objects are different, they do not fail to agree in

this, that they take nothing under consideration but the various relationships or proportions which are present in these objects, I thought that it would be better if I only examined these proportions in their general aspect, and without viewing them otherwise than in the objects which would serve most to facilitate a knowledge of them. Not that I should in any way restrict them to these objects, for I might later on all the more easily apply them to all other objects to which they were applicable. Then, having carefully noted that in order to comprehend the proportions I should sometimes require to consider each one in particular, and sometimes merely keep them in mind, or take them in groups, I thought that in order the better to consider them in detail I should picture them in the form of lines, because I could find no method more simple nor more capable of being distinctly represented to my imagination and senses. I considered, however, that in order to keep them in my memory or to embrace several at once, it would be essential that I should explain them by means of certain formulas, the shorter the better. And for this purpose it was requisite that I should borrow all that is best in geometrical analysis and algebra, and correct the errors of the one by the other.

As a matter of fact, I can venture to say that the exact observation of the few precepts which I had chosen gave me so much facility in sifting out all the questions embraced in these two sciences, that in the two or three months which I employed in examining them -- commencing with the most simple and general, and making each truth that I discovered a rule for helping me to find others -- not only did I arrive at the solution of many questions which I had hitherto regarded as most difficult but, towards the end, it seemed to me that I was able to determine in the case of those of which I was still ignorant, by what means and in how far it was possible to solve them. In this I might perhaps appear to you to be very vain if you did not remember that having but one truth to discover in respect to each matter, whoever succeeds in finding it knows in its regard as much as can be known. It is the same as with a child, for instance, who has been instructed in arithmetic and has made an addition according to the rule prescribed; he may be sure of having found as regards the sum of figures given to him all that the human mind can know. For, in conclusion, the method which teaches us to follow the true order and enumerate exactly every term in the matter under investigation contains everything which gives certainty to the rules of arithmetic.

But what pleased me most in this method was that I was certain by its means of exercising my reason in all things, if not perfectly, at least as well as was in my power. And besides this, I felt in making use of it that my mind gradually accustomed itself to conceive of its objects more accurately and distinctly; and not having restricted this method to any particular matter, I promised myself to apply it as usefully to the difficulties of other sciences as I had done to those of algebra. Not that on this account I dared undertake to examine just at once all those that might present themselves; for that would itself have been contrary to the order which the method prescribes. But having noticed that the knowledge of these difficulties must be dependent on principles derived from philosophy in which I yet found nothing to be certain, I thought that it was requisite above all to try to establish certainty in it. I considered also that since this endeavor is the most important in all the world, and that in which precipitation and prejudice were most to be feared, I should not try to grapple with it till I had attained to a much riper age than that of three and twenty, which was the age I had reached. I thought, too, that I should first of all employ much time in preparing myself for the work by eradicating from my mind all the wrong opinions which I had up to this time accepted, and accumulating a variety of experiences fitted

later on to afford matter for my reasonings, and by ever exercising myself in the method which I had prescribed, in order more and more to fortify myself in the power of using it.

PART III

And finally, as it is not sufficient, before commencing to rebuild the house which we inhabit, to pull it down and provide materials and an architect (or to act in this capacity ourselves, and make a careful drawing of its design), unless we have also provided ourselves with some other house where we can be comfortably lodged during the time of rebuilding, so in order that I should not remain irresolute in my actions while reason obliged me to be so in my judgments, and that I might not omit to carry on my life as happily as I could, I formed for myself a code of morals for the time being which did not consist of more than three or four maxims, which maxims I should like to enumerate to you.

The first was to obey the laws and customs of my country, adhering constantly to the religion in which by God's grace I had been instructed since my childhood, and in all other things directing my conduct by opinions the most moderate in nature, and the farthest removed from excess in all those which are commonly received and acted on by the most judicious of those with whom I might come in contact. For since I began to count my own opinions as naught, because I desired to place all under examination, I was convinced that I could not do better than follow those held by people on whose judgment reliance could be placed. And although such persons may possibly exist amongst the Persians and Chinese as well as amongst ourselves, it seemed to me that it was most expedient to bring my conduct into harmony with the ideas of those with whom I should have to live; and that, in order to ascertain that these were their real opinions, I should observe what they did rather than what they said, not only because in the corrupt state of our manners there are few people who desire to say all that they believe, but also because many are themselves ignorant of their beliefs. For since the act of thought by which we believe a thing is different from that by which we know that we believe it, the one often exists without the other. And amongst many opinions all equally received, I chose only the most moderate, both because these are always most suited for putting into practice, and probably the best (for all excess has a tendency to be bad), and also because I should have in a less degree turned aside from the right path, supposing that I was wrong, than if, having chosen an extreme course, I found that I had chosen amiss. I also made a point of counting as excess all the engagements by means of which we limit in some degree our liberty. Not that I hold in low esteem those laws which, in order to remedy the inconstancy of feeble souls, permit, when we have a good object in our view, that certain vows be taken, or contracts made, which oblige us to carry out that object. This sanction is even given for security in commerce where designs are wholly indifferent. But because I saw nothing in all the world remaining constant, and because for my own part I promised myself gradually to get my judgments to grow better and never to grow worse, I should have thought that I had committed a serious sin against commonsense if, because I approved of something at one time, I was obliged to regard it similarly at a later time, after it had possibly ceased to meet my approval, or after I had ceased to regard it in a favorable light.

My second maxim was that of being as firm and resolute in my actions as I could be, and not to follow less faithfully opinions the most dubious, when my mind was once made up regarding them, than if these had been beyond doubt. In this I should be following the example of travelers who, finding themselves lost in a forest, know that they ought not to wander first to one side and then to the other, nor, still less, to stop in one place, but understand that they should continue to

walk as straight as they can in one direction, not diverging for any slight reason, even though it was possibly chance alone that first determined them in their choice. By this means if they do not go exactly where they wish, they will at least arrive somewhere at the end, where probably they will be better off than in the middle of a forest. And thus since often enough in the actions of life no delay is permissible, it is very certain that, when it is beyond our power to discern the opinions which carry most truth, we should follow the most probable; and even although we notice no greater probability in the one opinion than in the other, we at least should make up our minds to follow a particular one and afterwards consider it as no longer doubtful in its relationship to practice, but as very true and very certain, inasmuch as the reason, which caused us to determine upon it is known to be so. And henceforward this principle was sufficient to deliver me from all the penitence and remorse which usually affect the mind and agitate the conscience of those weak and vacillating creatures who allow themselves to keep changing their procedure, and practice as good, things which they afterwards judge to be evil.

My third maxim was to try always to conquer myself rather than fortune, and to alter my desires rather than change the order of the world, and generally to accustom myself to believe that there is nothing entirely within our power but our own thoughts: so that after we have done our best in regard to the things that are without us, our ill-success cannot possibly be failure on our part. And this alone seemed to me sufficient to prevent my desiring anything in the future beyond what I could actually obtain, hence rendering me content; for since our will does not naturally induce us to desire anything but what our understanding represents to it as in some way possible of attainment, it is certain that if we consider all good things which are outside of us as equally outside of our power, we should not have more regret in resigning those goods which appear to pertain to our birth, when we are deprived of them for no fault of our own, than we have in not possessing the kingdoms of China or Mexico. In the same way, making what is called a virtue out of a necessity, we should no more desire to be well if ill, or free, if in prison, than we now do to have our bodies formed of a substance as little corruptible as diamonds, or to have wings to fly with like birds. I allow, however, that to accustom oneself to regard all things from this point of view requires long exercise and meditation often repeated; and I believe that it is principally in this that is to be found the secret of those philosophers who, in ancient times, were able to free themselves from the empire of fortune or, despite suffering or poverty, to rival their gods in their happiness. For, ceaselessly occupying themselves in considering the limits which were prescribed to them by nature, they persuaded themselves so completely that nothing was within their own power but their thoughts, that this conviction alone was sufficient to prevent their leaving any longing for other things. And they had so absolute a mastery over their thoughts that they had some reason for esteeming themselves as more rich and more powerful, and more free and more happy than other men, who, however favored by nature or fortune they might be, if devoid of this philosophy, never could arrive at all at which they aim.

And last of all, to conclude this moral code, I felt it incumbent on me to make a review of the various occupations of men in this life in order to try to choose out the best; and without wishing to say anything of the employment of others I thought that I could not do better than continue in the one in which I found myself engaged, that is to say, in occupying my whole life in cultivating my reason, and in advancing myself as much as possible in the knowledge of the truth in accordance with the method which I had prescribed myself. I had experienced so much satisfaction since beginning to use this method, that I did not believe that any sweeter or more innocent could in this life be found, every day discovering by its means some truths which

seemed to me sufficiently important, although commonly ignored by other men. The satisfaction had so filled my mind that all else seemed of no account. And, besides, the three preceding maxims were founded solely on the plan which I had formed of continuing to instruct myself. For since God has given to each of us some light with which to distinguish truth from error, I could not believe that I ought for a single moment to content myself with accepting the opinions held by others unless I had in view the employment of my own judgment in examining them at the proper time; and I could not have held myself free of scruple in following such opinions, if nevertheless I had not intended to lose no occasion of finding superior opinions, supposing them to exist; and finally, I should not have been able to restrain my desires nor to remain content, if I had not followed a road by which, thinking that I should be certain to be able to acquire all the knowledge of which I was capable, I also thought I should likewise be certain of obtaining all the best things which could ever come within my power. And inasmuch as our will impels us neither to follow after nor to flee from anything, excepting as our understanding represents it as good or evil, it is sufficient to judge wisely in order to act well, and the best judgment brings the best action--that is to say, the acquisition of all the virtues and all the other good things that it is possible to obtain. When one is certain that this point is reached, one cannot fail to be contented.

Having thus assured myself of these maxims, and having set them on one side along with the truths of religion which have always taken the first place in my creed, I judged that as far as the rest of my opinions were concerned, I could safely undertake to rid myself of them. And inasmuch as I hoped to be able to reach my end more successfully in converse with man than in living longer shut up in the warm room where these reflections had come to me, I hardly awaited the end of winter before I once more set myself to travel. And in all the nine following years I did naught but roam hither and thither, trying to be a spectator rather than an actor in all the comedies the world displays. More especially did I reflect in each matter that came before me as to anything which could make it subject to suspicion or doubt, and give occasion for mistake, and I rooted out of my mind all the errors which might have formerly crept in. Not that indeed I imitated the skeptics, who only doubt for the sake of doubting, and pretend to be always uncertain; for, on the contrary, my design was only to provide myself with good ground for assurance, and to reject the quicksand and mud in order to find the rock or clay. In this task it seems to me I succeeded pretty well, since in trying to discover the error or uncertainty of the propositions which I examined, not by feeble conjectures but by clear and assured reasonings, I encountered nothing so dubious that I could not draw from it some conclusion that was tolerably secure, if this were no more than the inference that it contained in it nothing that was certain. And just as in pulling down an old house we usually preserve the debris to serve in building up another, so in destroying all those opinions which I considered to be ill-founded, I made various observations and acquired many experiences, which have since been of use to me in establishing those which are more certain. And more than this, I continued to exercise myself in the method which I had laid down for my use; for besides the fact that I was careful as a rule to conduct all my thoughts according to its maxims, I set aside some hours from time to time which I more especially employed in practicing myself in the solution of mathematical problems according to the method, or in the solution of other problems which though pertaining to other sciences, I was able to make almost similar to those of mathematics, by detaching them from all principles of other sciences which I found to be not sufficiently secure. You will see the result in many examples which are expounded in this volume. And hence, without living to all appearance in any way differently from those who, having no occupation beyond spending their lives in ease and innocence, study to separate pleasure from vice and who, in order to enjoy their leisure

without weariness, make use of all distractions that are innocent and good, I did not cease to prosecute my design, and to profit perhaps even more in my study of truth than if I had done nothing but read books or associate with literary people.

These nine years thus passed away before I had taken any definite part in regard to the difficulties as to which the learned are in the habit of disputing, or had commenced to seek the foundation of any philosophy more certain than the vulgar. And the example of many excellent men who had tried to do the same before me but, as it appears to me, without success, made me imagine it to be so hard that possibly I should not have dared to undertake the task, had I not discovered that someone had spread abroad the report that I had already reached its conclusion. I cannot tell on what they based this opinion; if my conversation has contributed anything to it, this must have arisen from my confessing my ignorance more ingenuously than those who have studied a little usually do. And perhaps it was also due to my having shown forth my reasons for doubting many things which were held by others to be certain, rather than from having boasted of any special philosophic system. But being at heart honest enough not to desire to be esteemed as different from what I am, I thought that I must try by every means in my power to render myself worthy of the reputation which I had gained. And it is just eight years ago that this desire made me resolve to remove myself from all places where any acquaintances were possible, and to retire to a country such as this, where the long-continued war has caused such order to be established that the armies which are maintained seem only to be of use in allowing the inhabitants to enjoy the fruits of peace with so much the more security; and where, in the crowded throng of a great and very active nation, which is more concerned with its own affairs than curious about those of others, without missing ally of the conveniences of the most populous towns, I can live as solitary and retired as in deserts the most remote.

PART IV

I do not know that I ought to tell you of the first meditations there made by me, for they are so metaphysical and so unusual that they may perhaps not be acceptable to everyone. And yet at the same time, in order that one may judge whether the foundations which I have laid are sufficiently secure, I find myself constrained in some measure to refer to them. For a long time I had remarked that it is sometimes requisite in common life to follow opinions which one knows to be most uncertain, exactly as though they were indisputable, as has been said above. But because in this case I wished to give myself entirely to the search after truth, I thought that it was necessary for me to take an apparently opposite course, and to reject as absolutely false everything as to which I could imagine the least ground of doubt, in order to see if afterwards there remained anything in my belief that was entirely certain. Thus, because our senses sometimes deceive us, I wished to suppose that nothing is just as they cause us to imagine it to be; and because there are men who deceive themselves in their reasoning and fall into paralogisms, even concerning the simplest matters of geometry, and judging that I was as subject to error as was any other, I rejected as false all the reasons formerly accepted by me as demonstrations. And since all the same thoughts and conceptions which we have while awake may also come to us in sleep, without any of them being at that time true, I resolved to assume that everything that ever entered into my mind was no more true than the illusions of my dreams. But immediately afterwards I noticed that whilst I thus wished to think all things false, it was absolutely essential that the "I" who thought this should be somewhat, and remarking that this truth "*I think, therefore I am*" was so certain and so assured that all the most extravagant suppositions brought forward by the

skeptics were incapable of shaking it, I came to the conclusion that I could receive it without scruple as the first principle of the philosophy for which I was seeking.

And then, examining attentively that which I was, I saw that I could conceive that I had no body, and that there was no world nor place where I might be; but yet that I could not for all that conceive that I was not. On the contrary, I saw from the very fact that I thought of doubting the truth of other things, it very evidently and certainly followed that I was; on the other hand if I had only ceased from thinking, even if all the rest of what I had ever imagined had really existed, I should have no reason for thinking that I had existed. From that I knew that I was a substance the whole essence or nature of which is to think, and that for its existence there is no need of any place, nor does it depend on any material thing; so that this "me," that is to say, the soul by which I am what I am, is entirely distinct from body, and is even more easy to know than is the latter; and even if body were not, the soul would not cease to be what it is.

After this I considered generally what in a proposition is requisite in order to be true and certain; for since I had just discovered one which I knew to be such, I thought that I ought also to know in what this certainty consisted. And having remarked that there was nothing at all in the statement "*I think, therefore I am*," which assures me of having thereby made a true assertion, excepting that I see very clearly that to think it is necessary to be, I came to the conclusion that I might assume, as a general rule, that the things which we conceive very clearly and distinctly are all true--remembering, however, that there is some difficulty in ascertaining which are those that we distinctly conceive.

Following upon this, and reflecting on the fact that I doubted, and that consequently my existence was not quite perfect (for I saw clearly that it was a greater perfection to know than to doubt), I resolved to inquire whence I had learned to think of anything more perfect than I myself was; and I recognized very clearly that this conception must proceed from some nature which was really more perfect. As to the thoughts which I had of many other things outside of me, like the heavens, the earth, light, heat, and a thousand others, I had not so much difficulty in knowing whence they came because, remarking nothing in them which seemed to render them superior to me, I could believe that, if they were true, they were dependencies upon my nature, in so far as it possessed some perfection; and if they were not true, that I held them from naught, that is to say, that they were in me because I had something lacking in my nature. But this could not apply to the idea of a being more perfect than my own, for to hold it from naught would be manifestly impossible; and because it is no less contradictory to say of the more perfect that it is what results from and depends on the less perfect, than to say that there is something which proceeds from nothing, it was equally impossible that I should hold it from myself. In this way it could but follow that it had been placed in me by a nature which was really more perfect than mine could be, and which even had within itself all the perfections of which I could form any idea -- that is to say, to put it in a word, which was God. To which I added that since I knew some perfections which I did not possess, I was not the only being in existence (I shall here use freely, if you will allow, the terms of the School); but that there was necessarily some other more perfect being on which I depended, or from which I acquired all that I had. For if I had existed alone and independent of any others, so that I should have had from myself all that perfection of being in which I participated to however small an extent, I should have been able for the same reason to have had all the remainder which I knew that I lacked; and thus I myself should have been infinite, eternal, immutable, omniscient, all-powerful, and, finally, I should have all the

perfections which I could discern in God. For, in pursuance of the reasonings which I have just carried on, in order to know the nature of God as far as my nature is capable of knowing it, I had only to consider in reference to all these things of which I found some idea in myself, whether it was a perfection to possess them or not. And I was assured that none of those which indicated some imperfection were in Him, but that all else was present; and I saw that doubt, inconstancy, sadness, and such things, could not be in Him considering that I myself should have been glad to be without them. In addition to this, I had ideas of many things which are sensible and corporeal for, although I might suppose that I was dreaming and that all that I saw or imagined was false, I could not at the same time deny that the ideas were really in my thoughts. But because I had already recognized very clearly in myself that the nature of the intelligence is distinct from that of the body, and observing that all composition gives evidence of dependency, and that dependency is manifestly an imperfection, I came to the conclusion that it could not be a perfection in God to be composed of these two natures, and that consequently He was not so composed. I judged, however, that if there were any bodies in the world, or even any intelligences or other natures which were not wholly perfect, their existence must depend on His power in such a way that they could not subsist without Him for a single moment.

After that I desired to seek for other truths, and having put before myself the object of the geometricians, which I conceived to be a continuous body, or a space indefinitely extended in length, breadth, height or depth, which was divisible into various parts, and which might have various figures and sizes, and might be moved or transposed in all sorts of ways (for all this the geometricians suppose to be in the object of their contemplation), I went through some of their simplest demonstrations, and having noticed that this great certainty which everyone attributes to these demonstrations is founded solely on the fact that they are conceived of with clearness, in accordance with the rule which I have just laid down, I also noticed that there was nothing at all in them to assure me of the existence of their object. For, to take an example, I saw very well that if we suppose a triangle to be given, the three angles must certainly be equal to two right angles; but for all that I saw no reason to be assured that there was any such triangle in existence, while on the contrary, on reverting to the examination of the idea which I had of a perfect being, I found that in this case existence was implied in it in the same manner in which the equality of its three angles to two right angles is implied in the idea of a triangle; or in the idea of a sphere, that all the points on its surface are equidistant from its center, or even more evidently still. Consequently it is at least as certain that God, who is a being, so perfect, is, or exists, as any demonstration of geometry can possibly be.

What causes many, however, to persuade themselves that there is difficulty in knowing this truth, and even in knowing the nature of their soul, is the fact that they never raise their minds above the things of sense, or that they are so accustomed to consider nothing excepting by imagining it, which is a mode of thought specially adapted to material objects, that all that is not capable of being imagined appears to them not to be intelligible at all. This is manifest enough from the fact that even the philosophers in the Schools hold it as a maxim that there is nothing in the understanding which has not first of all been in the senses, in which there is certainly no doubt that the ideas of God and of the soul have never been. And it seems to me that those who desire to make use of their imagination in order to understand these ideas, act in the same way as if, to hear sounds or smell odors, they should wish to make use of their eyes: excepting that there is indeed this difference, that the sense of sight does not give us less assurance of the truth of its

objects, than do those of seeing or of hearing, while neither our imagination nor our senses can ever assure us of anything, if our understanding does not intervene.

If there are finally any persons who are not sufficiently persuaded of the existence of God and of their soul by the reasons which I have brought forward, I wish that they should know that all other things of which they perhaps think themselves more assured (such as possessing a body, and that there are stars and an earth and so on) are less certain. For, although we have a moral assurance of these things which is such that it seems that it would be extravagant in us to doubt them, at the same time no one, unless he is devoid of reason, can deny, when a metaphysical certainty is in question, that there is sufficient cause for our not having complete assurance, by observing the fact that when asleep we may similarly imagine that we have another body, and that we see other stars and another earth, without there being anything of the kind. For how do we know that the thoughts that come in dreams are more false than those that we have when we are awake, seeing that often enough the former are not less lively and vivid than the latter? And though the wisest minds may study the matter as much as they will, I do not believe that they will be able to give any sufficient reason for removing this doubt, unless they presuppose the existence of God. For to begin with, that which I have just taken as a rule, that is to say, that all the things that we very clearly and very distinctly conceive of are true, is certain only because God is or exists, and that He is a Perfect Being, and that all that is in us issues from Him. From this it follows that our ideas or notions, which to the extent of their being clear or distinct are ideas of real things issuing from God, cannot but to that extent be true. So that though we often enough have ideas which have an element of falsity, this can only be the case in regard to those which have in them somewhat that is confused or obscure, because in so far as they have this character they participate in negation -- that is, they exist in us as confused only because we are not quite perfect. And it is evident that there is no less repugnance in the idea that error or imperfection, inasmuch as it is imperfection, proceeds from God, than there is in the idea of truth or perfection proceeding from naught. But if we did not know that all that is in us of reality and truth proceeds from a perfect and infinite Being, however clear and distinct were our ideas, we should not have any reason to assure ourselves that they had the perfection of being true.

But after the knowledge of God and of the soul has thus rendered us certain of this rule, it is very easy to understand that the dreams which we imagine in our sleep should not make us in any way doubt the truth of the thoughts which we have when awake. For even if in sleep we had some very distinct idea such as a geometrician might have who discovered some new demonstration, the fact of being asleep would not militate against its truth. And as to the most ordinary error in our dreams, which consists in their representing to us various objects in the same way as do our external senses, it does not matter that this should give us occasion to suspect the truth of such ideas, because we may be likewise often enough deceived in them without our sleeping at all, just as when those who have the jaundice see everything as yellow, or when stars or other bodies which are very remote appear much smaller than they really are. For, finally, whether we are awake or asleep, we should never allow ourselves to be persuaded excepting by the evidence of our reason. And it must be remarked that I speak of our reason and not of our imagination nor of our senses; just as though we see the sun very clearly, we should not for that reason judge that it is of the size of which it appears to be; likewise we could quite well distinctly imagine the head of a lion on the body of a goat, without necessarily concluding that a chimera exists. For reason does not insist that whatever we see or imagine thus is a truth, but it tells us clearly that all our ideas or notions must have some foundation of truth. For otherwise it could not be possible that

God, who is all perfection and truth, should have placed them within us. And because our reasonings are never so evident nor so complete during sleep as during wakefulness, although sometimes our imaginations are then just as lively and acute, or even more so, reason tells us that since our thoughts cannot possibly be all true, because we are not altogether perfect, that which they have of truth must infallibly be met with in our waking experience rather than in that of our dreams.

PART V

I should be very glad to proceed to show forth the complete chain of truths which I have deduced from these first, but because to do this it would have been necessary now to speak of many matters of dispute among the learned, with whom I have no desire to embroil myself, I think that it will be better to abstain. I shall only state generally what these truths are, so that it may be left to the decision of those best able to judge whether it would be of use for the public to be more particularly informed of them or not. I always remained firm in the resolution which I had made, not to assume any other principle than that of which I have just made use, in order to demonstrate the existence of God and of the soul, and to accept nothing as true which did not appear to be more clear and more certain than the demonstrations of the geometricians had formerly seemed. And nevertheless I venture to say that not only have I found the means of satisfying myself in a short time as to the more important of those difficulties usually dealt with in philosophy, but I have also observed certain laws which God has so established in Nature, and of which He has imprinted such ideas on our minds, that, after having reflected sufficiently upon the matter, we cannot doubt their being accurately observed in all that exists or is done in the world. Further, in considering the sequence of these laws, it seems to me that I leave discovered many truths more useful and more important than all that I had formerly learned or even hoped to learn.

But because I tried to explain the most important of these in a Treatise which certain considerations prevented me from publishing, I cannot do better, in making them known, than here summarize briefly what that Treatise contains. I had planned to comprise in it all that I believed myself to know regarding the nature of material objects, before I set myself to write. However, just as the painters who cannot represent equally well on a plain surface all the various sides of a solid body, make selection of one of the most important, which alone is set in the light, while the others are put in shadow and made to appear only as they may be seen in looking at the former, so, fearing that I could not put in my Treatise all that I had in my mind, I undertook only to show very fully my conceptions of light, Later on, when occasion occurred, I resolved to add something about the sun and fixed stars, because light proceeds almost entirely from them; the heavens would be dealt with because they transmit light, the planets, the comets and the earth because they reflect it, and more particularly would all bodies which are on the earth, because they are either colored or transparent, or else luminous; and finally I should deal with man because he is the spectator of all. For the very purpose of putting all these topics somewhat in shadow, and being able to express myself freely about them, without being obliged to adopt or to refute the opinions which are accepted by the learned, I resolved to leave all this world to their disputes, and to speak only of what would happen in a new world if God now created, somewhere in an imaginary space, matter sufficient where-with to form it, and if He agitated in diverse ways, and without any order, the diverse portions of this matter, so that there resulted a chaos as confused as the poets ever feigned, and concluded His work by merely lending His

concurrence to Nature in the usual way, leaving her to act in accordance with the laws which He had established. So, to begin with, I described this matter and tried to represent it in such a way, that it seems to me that nothing in the world could be more clear or intelligible, excepting what has just been said of God and the soul. For I even went so far as expressly to assume that there was in it none of these forms or qualities which are so debated in the Schools, nor anything at all the knowledge of which is not so natural to our minds that none could even pretend to be ignorant of it. Further I pointed out what are the laws of nature and, without resting my reasons on any other principle than the infinite perfections of God, I tried to demonstrate all those of which one could have any doubt, and to show that they are of such a nature that even if God had created other worlds, He could not have created any in which these laws would fail to be observed. After that, I showed how the greatest part of the matter of which this chaos is constituted must, in accordance with these laws, dispose and arrange itself in such a fashion as to render it similar to our heavens; and how meantime some of its parts must form an earth, some planets and comets, and some others a sun and fixed stars. And, enlarging on the subject of light, I here explained at length the nature of the light which would be found in the sun and stars, and how from these it crossed in an instant the immense space of the heavens, and how it was reflected from the planets and comets to the earth. To this I also added many things touching the substance, situation, movements, and all the different qualities of these heavens and stars, so that I thought I had said enough to make it clear that there is nothing to be seen in the heavens and stars pertaining to our system which must not, or at least may not, appear exactly the same in those of the system which I described. From this point I came to speak more particularly of the earth, showing how, though I had expressly presupposed that God had not placed any weight in the matter of which it is composed, its parts did not fail all to gravitate exactly to its center; and how, having water and air on its surface, the disposition of the heavens and of the stars, more particularly of the moon, must cause a flux or reflux, which in all its circumstances is similar to that which is observed in our seas, and besides that, a certain current both of water and air from east to west, such as may also be observed in the tropics. I also showed how the mountains, seas, fountains and rivers, could naturally be formed in it, how the metals came to be in the mines and the plants to grow in the fields; and generally how all bodies, called mixed or composite, might arise. And because I knew nothing but fire which could produce light, excepting the stars, I studied amongst other things to make very clear all that pertains to its nature, how it is formed, how nourished, how there is sometimes only heat without light, and sometimes light without heat; I showed, too, how different colors might by it be induced upon different bodies and qualities of diverse kinds, how some of these were liquefied and others solidified, bow nearly all can be consumed or converted into ashes and smoke by its means, and finally how of these ashes, by the intensity of its action alone, it forms glass. Since this transformation of ashes into glass seemed to me as wonderful as any other process in nature, I took particular pleasure in describing it.

I did not at the same time wish to infer from all these facts that this world has been created in the manner which I described; for it is much more probable that at the beginning God made it such as it was to be. But it is certain, and it is an opinion commonly received by the theologians, that the action by which He now preserves it is just the same as that by which He at first created it. In this way, although He had not, to begin with, given this world any other form than that of chaos, provided that the laws of nature had once been established and that He had lent His aid in order that its action should be according to its wont, we may well believe, without doing outrage to the miracle of creation, that by this means alone all things which are purely material might in course

of time have become such as we observe them to be at present; and their nature is much easier to understand when we see them coming to pass little by little in this manner, than were we to consider them as all complete to begin with.

From a description of inanimate bodies and plants I passed on to that of animals, and particularly to that of men. But since I had not yet sufficient knowledge to speak of them in the same style as of the rest, that is to say, demonstrating the effects from the causes, and showing from what beginnings and in what fashion nature must produce them, I contented myself with supposing that God formed the body of man altogether like one of ours, in the outward figure of its members as well as in the interior conformation of its organs, without making use of any matter other than that which I had described, and without at the first placing in it a rational soul, or any other thing which might serve as a vegetative or as a sensitive soul; excepting that He kindled in the heart one of these fires without light, which I have already described, and which I did not conceive of as in any way different from that which makes the hay heat when shut up before it is dry, and which makes new wine grow frothy when it is left to ferment over the fruit. For, examining the functions which might in accordance with this supposition exist in this body, I found precisely all those which might exist in us without our having the power of thought, and consequently without our soul -- that is to say, this part of us, distinct from the body, of which it has just been said that its nature is to think -- contributing to it, functions which are identically the same as those in which animals lacking reason may be said to resemble us. For all that, I could not find in these functions any which, being dependent on thought, pertain to us alone, inasmuch as we are men; while I found all of them afterwards, when I assumed that God had created a rational soul and that He had united it to this body in a particular manner which I described.

But in order to show how I there treated of this matter, I wish here to set forth the explanation of the movement of heart and arteries which, being the first and most general movement that is observed in animals, will give us the means of easily judging as to what we ought to think about all the rest. And so that there may be less difficulty in understanding what I shall say on this matter, I should like that those not versed in anatomy should take the trouble, before reading this, of having out up before their eyes the heart of some large animal which has lungs (for it is in all respects sufficiently similar to the heart of a man), and cause that there be demonstrated to them the two chambers or cavities which are within it. There is first of all that which is on the right side, with which two very large tubes or channels correspond, viz. the *vena cava*, which is the principal receptacle of the blood, and so to speak the trunk of a tree of which all the other veins of the body are the branches; and there is the arterial vein which has been badly named because it is nothing but an artery which, taking its origin from the heart, divides, after having issued from it, into many branches which proceed to disperse themselves all through the lungs. Then there is secondly the cavity on the left side with which there again correspond two tubes which are as large or larger than the preceding, viz. the venous artery, which has also been badly named, because it is nothing but a vein which comes from the lungs, where it is divided into many branches, interlaced with those of the arterial vein, and with those of the tube which is called the windpipe, through which enters the air which we breathe; and the great artery which, issuing from the heart, sends its branches throughout the body. I should also wish that the eleven little membranes, which, like so many doors, open and shut the four entrances which are in these two cavities, should be carefully shown. There are of these three at the entrance of the *vena cava*, where they are so arranged that they can in no way prevent the blood which it contains from

flowing into the right cavity of the heart and yet exactly prevent its issuing out; there are three at the entrance to the arterial vein, which, being arranged quite the other way, easily allow the blood which is in this cavity to pass into the lungs, but not that which is already in the lungs to return to this cavity. There are also two others at the entrance of the venous artery, which allow the blood in the lungs to flow towards the left cavity of the heart, but do not permit its return; and three at the entrance of the great artery, which allow the blood to flow from the heart, but prevent its return. There is then no cause to seek for any other reason for the number of these membranes, except that the opening of the venous artery being oval, because of the situation where it is met with, may be conveniently closed with two membranes, while the others, being round, can be better closed with three. Further, I should have my readers consider that the grand artery and the arterial vein are much harder and firmer than are the venous artery and the *vena cava*; and that these two last expand before entering the heart, and there form so to speak two pockets called the auricles of the heart, which are composed of a tissue similar to its own; and also that there is always more heat in the heart than in any other part of the body; and finally that this heat is capable of causing any drop of blood that enters into its cavities promptly to expand and dilate, as liquids usually do when they are allowed to fall drop by drop into some very hot vessel.

After this I do not need to say anything with a view to explaining the movement of the heart, except that when its cavities are not full of blood there necessarily flows from the *vena cava* into the right cavity, and from the venous artery into the left, enough blood to keep these two vessels always full, and being full, that their orifices, which are turned towards the heart, cannot then be closed. But as soon as two drops of blood have thus entered, one into each of the cavities, these drops, which cannot be otherwise than very large, because the openings by which they enter are very wide and the vessels from whence they come are very full of blood, rarefy and dilate because of the heat which they find there. By this means, causing the whole heart to expand, they force home and close the five little doors which are at the entrances of the two vessels whence they flow, thus preventing any more blood from coming down into the heart and becoming more and more rarefied, they push open the six doors which are in the entrances of the two other vessels through which they make their exit, by this means causing all the branches of the arterial vein and of the great artery to expand almost at the same instant as the heart. This last immediately afterward contracts as do also the arteries, because the blood which has entered them has cooled; and the six little doors close up again, and the five doors of the *vena cava* and of the venous artery re-open and make a way for two other drops of blood which cause the heart and the arteries once more to expand, just as we saw before. And because the blood which then enters the heart passes through these two pouches which are called auricles, it comes to pass that their movement is contrary to the movement of the heart, and that they contract when it expands. For the rest, in order that those who do not know the force of mathematical demonstration and are unaccustomed to distinguish true reasons from merely probable reasons, should not venture to deny what has been said without examination, I wish to acquaint them with the fact that this movement which I have just explained follows as necessarily from the very disposition of the organs, as can be seen by looking at the heart, and from the heat which can be felt with the fingers, and from the nature of the blood of which we can learn by experience, as does that of a clock from the power, the situation, and the form, of its counterpoise and of its wheels.

But if we ask how the blood in the veins does not exhaust itself in thus flowing continually into the heart, and how the arteries do not become too full of blood, since all that passes through the

heart flows into them, I need only reply by stating what has already been written by an English physician, to whom the credit of having broken the ice in this matter must be ascribed, as also of being the first to teach that there are many little tubes at the extremities of the arteries whereby the blood that they receive from the heart enters the little branches of the veins, whence it returns once more to the heart; in this way its course is just a perpetual circulation. He proves this very clearly by the common experience of surgeons, who, by binding the arm moderately firmly above the place where they open the vein, cause the blood to issue more abundantly than it would have done if they had not bound it at all; while quite a contrary result would occur if they bound it below, between the hand and the opening, or if they bound it very firmly above. For it is clear that when the bandage is moderately tight, though it may prevent the blood already in the arm from returning to the heart by the veins, it cannot for all that prevent more blood from coming anew by the arteries, because these are situated below the veins, and their walls, being stronger, are less easy to compress; and also that the blood which comes from the heart tends to pass by means of the arteries to the band with greater force than it does to return from the band to the heart by the veins. And because this blood escapes from the arm by the opening which is made in one of the veins, there must necessarily be some passages below the ligature, that is to say, towards the extremities of the arm, through which it can come thither from the arteries. This physician likewise proves very clearly the truth of that which he says of the course of the blood, by the existence of certain little membranes or valves which are so arranged in different places along the course of the veins, that they do not permit the blood to pass from the middle of the body towards the extremities, but only to return from the extremities to the heart; and further by the experiment which shows that all the blood which is in the body may issue from it in a very short time by means of one single artery that has been cut, and this is so even when it is very tightly bound very near the heart, and cut between it and the ligature, so that there could be no ground for supposing that the blood which flowed out of it could proceed from any other place but the heart.

But there are many other things which demonstrate that the true cause of this motion of the blood is that which I have stated. To begin with, the difference which is seen between the blood which issues from the veins, and that which issues from the arteries, can only proceed from the fact that, being rarefied, and so to speak distilled by passing through the heart, it is more subtle and lively, and warmer immediately after leaving the heart (that is to say, when in the arteries) than it is a little while before entering it (that is, when in the veins). And if attention be paid, we shall find that this difference does not appear clearly, excepting in the vicinity of the heart, and is not so clear in those parts which are further removed from it. Further, the consistency of the coverings of which the arterial vein and the great artery are composed, shows clearly enough that the blood beats against them with more force than it does in the case of the veins. And why should the left cavity of the heart and the great artery be larger and wider than the right cavity and the arterial vein, if it is not that the blood of the venous artery having only been in the lungs since it had passed through the heart, is more subtle and rarefies more effectively and easily than that which proceeds immediately from the *vena cava*? And what is it that the physicians can discover in feeling the pulse, unless they know that, according as the blood changes its nature, it may be rarefied by the warmth of the heart in a greater or less degree, and more or less quickly than before ? And if we inquire how this heat is communicated to the other members, must it not be allowed that it is by means of the blood which, passing through the heart, is heated once again and thence is spread throughout all the body? From this it happens that if we take away the blood from any particular part, by that same means we take away from it the heat; even if the heart

were as ardent as a red hot iron it would not suffice to heat up the feet and hands as it actually does, unless it continually sent out to them new blood. We further understand from this that the true use of respiration is to carry sufficient fresh air into the lungs to cause the blood -- which comes there from the right cavity of the heart, where it has been rarefied and so to speak transformed into vapors -- to thicken and become anew converted into blood before falling into the left cavity, without which process it would not be fit to serve as fuel for the fire which there exists. We are confirmed in this statement by seeing that the animals which have no lungs have also but one cavity in their hearts, and that in children, who cannot use them while still within their mother's wombs, there is an opening by which the blood flows from the *vena cava* into the left cavity of the heart, and a conduit through which it passes from the arterial vein into the great artery without passing through the lung. Again, how could digestion be carried on in the stomach if the heart did not send heat there by the arteries, and along with this some of the more fluid parts of the blood which aid in dissolving the foods which have been there placed? And is not the action which converts the juice of foods into blood easy to understand if we consider that it is distilled by passing and repassing through the heart possibly more than one or two hundred times in a day? What further need is there to explain the process of nutrition and the production of the different humors which are in the body, if we can say that the force with which the blood, in being rarefied, passes from the heart towards the extremities of the arteries, causes some of its parts to remain among those of the members where they are found and there to take the place of others which they oust; and that according to the situation or form or smallness of the little pores which they encounter, certain ones proceed to certain parts rather than others, just as a number of different sieves variously perforated, as everyone has probably seen, are capable of separating different species of grain? And finally what in all this is most remarkable of all, is the generation of the animal spirits, which resemble a very subtle wind, or rather a flame which is very pure and very vivid and which, continually rising up in great abundance from the heart to the brain, from there proceeds through the nerves to the muscles, thereby giving the power of motion to all the members. And it is not necessary to suppose any other cause to explain how the particles of blood which, being most agitated and most penetrating, are the most proper to constitute these spirits, proceed towards the brain rather than elsewhere, than that the arteries which carry them there are those which proceed from the heart in the most direct lines, and that according to the laws of mechanics, which are identical with those of nature, when many objects tend to move together to the same point, where there is not room for all (as is the case with the particles of blood which issue from the left cavity of the heart and tend to go towards the brain), the weakest and least agitated parts must necessarily be turned aside by those that are stronger, which by this means are the only ones to reach it.

I had explained all these matters in some detail in the Treatise which I formerly intended to publish. And afterwards I had shown there, what must be the fabric of the nerves and muscles of the human body in order that the animal spirits therein contained should have the power to move the members, just as the heads of animals, a little while after decapitation, are still observed to move and bite the earth, notwithstanding that they are no longer animate; what changes are necessary in the brain to cause wakefulness, sleep and dreams; how light, sounds, smells, tastes, heat and all other qualities pertaining to external objects are able to imprint on it various ideas by the intervention of the senses; how hunger, thirst and other internal affections can also convey their impressions upon it; what should be regarded as the "common sense" by which these ideas are received, and what is meant by the memory which retains them, by the fancy which can change them in diverse ways and out of them constitute new ideas and which, by the same

means, distributing the animal spirits through the muscles, can cause the members of such a body to move in as many diverse ways, and in a manner as suitable to the objects which present themselves to its senses and to its internal passions, as can happen in our own case apart from the direction of our free will. And this will not seem strange to those who, knowing how many different automata or moving machines can be made by the industry of man, without employing in so doing more than a very few parts in comparison with the great multitude of bones, muscles, nerves, arteries, veins, or other parts that are found in the body of each animal. From this aspect the body is regarded as a machine which, having been made by the hands of God, is incomparably better arranged, and possesses in itself movements which are much more admirable, than any of those which can be invented by man. Here I specially stopped to show that if there had been such machines, possessing the organs and outward form of a monkey or some other animal without reason, we should not have had any means of ascertaining that they were not of the same nature as those animals. On the other hand, if there were machines which bore a resemblance to our body and imitated our actions as far as it was morally possible to do so, we should always have two very certain tests by which to recognize that, for all that, they were not real men. The first is, that they could never use speech or other signs as we do when placing our thoughts on record for the benefit of others. For we can easily understand a machine's being constituted so that it can utter words, and even emit some responses to action on it of a corporeal kind, which brings about a change in its organs; for instance, if it is touched in a particular part it may ask what we wish to say to it; if in another part it may exclaim that it is being hurt, and so on. But it never happens that it arranges its speech in various ways, in order to reply appropriately to everything that may be said in its presence, as even the lowest type of man can do. And the second difference is, that although machines can perform certain things as well as or perhaps better than any of us can do, they infallibly fan short in others, by the which means we may discover that they did not act from knowledge, but only from the disposition of their organs. For while reason is a universal instrument which can serve for all contingencies, these organs have need of some special adaptation for every particular action. From this it follows that it is morally impossible that there should be sufficient diversity in any machine to allow it to act in all the events of life in the same way as our reason causes us to act.

By these two methods we may also recognize the difference that exists between men and brutes. For it is a very remarkable fact that there are none so depraved and stupid, without even excepting idiots, that they cannot arrange different words together, forming of them a statement by which they make known their thoughts; while, on the other hand, there is no other animal, however perfect and fortunately circumstanced it may be, which can do the same. It is not the want of organs that brings this to pass, for it is evident that magpies and parrots are able to utter words just like ourselves, and yet they cannot speak as we do, that is, so as to give evidence that they think of what they say. On the other hand, men who, being born deaf and dumb, are in the same degree, or even more than the brutes, destitute of the organs which serve the others for talking, are in the habit of themselves investing certain signs by which they make themselves understood by those who, being usually in their company, have leisure to learn their language. And this does not merely show that the brutes have less reason than men, but that they have none at all, since it is clear that very little is required in order to be able to talk. And when we notice the inequality that exists between animals of the same species, as well as between men, and observe that some are more capable of receiving instruction than others, it is not credible that a monkey or a parrot, selected as the most perfect of its species, should not in these matters equal the stupidest child to be found, or at least a child whose mind is clouded, unless in the case of the

brute the soul were of an entirely different nature from ours. And we ought not to confound speech with natural movements which betray passions and may be imitated by machines as well as be manifested by animals; nor must we think, as did some of the ancients, that brutes talk, although we do not understand their language. For if this were true, since they have many organs which are allied to our own, they could communicate their thoughts to us just as easily as to those of their own race. It is also a very remarkable fact that although there are many animals which exhibit more dexterity than we do in some of their actions, we at the same time observe that they do not manifest any dexterity at all in many others. Hence the fact that they do better than we do, does not prove that they are endowed with mind, for in this case they would have more reason than any of us, and would surpass us in all other things. It rather shows that they have no reason at all, and that it is nature which acts in them according to the disposition of their organs, just as a clock, which is only composed of wheels and weights is able to tell the hours and measure the time more correctly than we can do with all our wisdom.

I had described after this the rational soul and shown that it could not be in any way derived from the power of matter, like the other things of which I had spoken, but that it must be expressly created. I showed, too, that it is not sufficient that it should be lodged in the human body like a pilot in his ship, unless perhaps for the moving of its members, but that it is necessary that it should also be joined and united more closely to the body in order to have sensations and appetites similar to our own, and thus to form a true man. In conclusion, I have here enlarged a little on the subject of the soul, because it is one of the greatest importance. For next to the error of those who deny God, which I think I have already sufficiently refuted, there is none which is more effectual in leading feeble spirits from the straight path of virtue, than to imagine that the soul of the brute is of the same nature as our own, and that consequently, after this life we have nothing to fear or to hope for, any more than the flies and ants. As a matter of fact, when one comes to know how greatly they differ, we understand much better the reasons which go to prove that our soul is in its nature entirely independent of body, and consequently that it is not liable to die with it. And then, inasmuch as we observe no other causes capable of destroying it, we are naturally inclined to judge that it is immortal.

PART VI

It is three years since I arrived at the end of the Treatise which contained all these things; and I was commencing to revise it in order to place it in the hands of a printer, when I learned that certain persons, to whose opinions I defer, and whose authority cannot have less weight with my actions than my own reason has over my thoughts, had disapproved of a physical theory published a little while before by another person. I will not say that I agreed with this opinion, but only that before their censure I observed in it nothing which I could possibly imagine to be prejudicial either to religion or the state, or consequently which could have prevented me from giving expression to it in writing, if my reason had persuaded me to do so: and this made me fear that among my own opinions one might be found which should be misunderstood, notwithstanding the great care which I have always taken not to accept any new beliefs unless I had very certain proof of their truth, and not to give expression to what could tend to the disadvantage of any person. This sufficed to cause me to alter the resolution which I had made to publish. For, although the reasons for my former resolution were very strong, my inclination, which always made me hate the profession of writing books, caused me immediately to find plenty of other reasons for excusing myself from doing so. And these reasons, on the one side

and on the other, are of such a nature that not only have I here some interest in giving expression to them, but possibly the public may also have some interest in knowing them.

I have never made much of those things which proceed from my own mind, and so long as I culled no other fruits from the method which I use, beyond that of satisfying myself respecting certain difficulties which pertain to the speculative sciences, or trying to regulate my conduct by the reasons which it has taught me, I never believed myself to be obliged to write anything about it. For as regards that which concerns conduct, everyone is so confident of his own common sense, that there might be found as many reformers as heads, if it were permitted that others than those whom God has established as the sovereigns of his people, or at least to whom He has given sufficient grace and zeal to be prophets, should be allowed to make any changes in that. And, although my speculations give me the greatest pleasure, I believed that others also had speculations which possibly pleased them even more. But so soon as I had acquired some general notions concerning physics, and as, beginning to make use of them in various special difficulties, I observed to what point they might lead us, and how much they differ from the principles of which we have made use up to the present time, I believed that I could not keep them concealed without greatly sinning against the law which obliges us to procure, as much as in us lies, the general good of all mankind. For they caused me to see that it is possible to attain knowledge which is very useful in life, and that, instead of that speculative philosophy which is taught in the Schools, we may find a practical philosophy by means of which, knowing the force and the action of fire, water, air, the stars, heavens and all other bodies that environ us, as distinctly as we know the different crafts of our artisans, we can in the same way employ them in all those uses to which they are adapted, and thus render ourselves the masters and possessors of nature. This is not merely to be desired with a view to the invention of an infinity of arts and crafts which enable us to enjoy without any trouble the fruits of the earth and all the good things which are to be found there, but also principally because it brings about the preservation of health, which is without doubt the chief blessing and the foundation of all other blessings in this life. For the mind depends so much on the temperament and disposition of the bodily organs that, if it is possible to find a means of rendering men wiser and cleverer than they have hitherto been, I believe that it is in medicine that it must be sought. It is true that the medicine which is now in vogue contains little of which the utility is remarkable; but, without having any intention of decrying it, I am sure that there is no one, even among those who make its study a profession, who does not confess that all that men know is almost nothing in comparison with what remains to be known; and that we could be free of an infinitude of maladies both of body and mind, and even also possibly of the infirmities of age, if we had sufficient knowledge of their causes, and of all the remedies with which nature has provided us. But, having the intention of devoting all my life to the investigation of a knowledge which is so essential, and having discovered a path which appears to me to be of such a nature that we must by its means infallibly reach our end if we pursue it unless, indeed, we are prevented by the shortness of life or by lack of experience, I judged that there was no better provision against these two impediments than faithfully to communicate to the public the little which I should myself have discovered, and to beg all well-inclined persons to proceed further by contributing, each one according to his own inclination and ability, to the experiments which must be made, and then to communicate to the public all the things which they might discover, in order that the last should commence where the preceding had left off; and thus, by joining together the lives and labors of many, we should collectively proceed much further than any one in particular could succeed in doing.

I remarked also respecting experiments, that they become so much the more necessary the more one is advanced in knowledge, for to begin with it is better to make use simply of those which present themselves spontaneously to our senses, and of which we could not be ignorant provided that we reflected ever so little, rather than to seek out those which are more rare and recondite; the reason for this is that those which are more rare often mislead us so long as we do not know the causes of the more common, and the fact that the circumstances on which they depend are almost always so particular and so minute that it is very difficult to observe them. But in this the order which I have followed is as follows. I have first tried to discover generally the principles or first causes of everything that is or that can be in the world, without considering anything that might accomplish this end but God Himself who has created the world, or deriving them from any source excepting from certain germs of truths which are naturally existent in our souls. After that I considered which were the primary and most ordinary effects which might be deduced from these causes, and it seems to me that in this way I discovered the heavens, the stars, an earth, and even on the earth, water, air, fire, the minerals and some other such things, which are the most common and simple of any that exist, and consequently the easiest to know. Then, when I wished to descend to those which were more particular, so many objects of various kinds presented themselves to me, that I did not think it was possible for the human mind to distinguish the forms or species of bodies which are on the earth from an infinitude of others which might have been so if it had been the will of God to place them there, or consequently to apply them to our use, if it were not that we arrive at the causes by the effects, and avail ourselves of many particular experiments. In subsequently passing over in my mind all the objects which have ever been presented to my senses, I can truly venture to say that I have not there observed anything which I could not easily explain by the principles which I had discovered. But I must also confess that the power of nature is so ample and so vast, and these principles are so simple and general, that I observed hardly any particular effect as to which I could not at once recognize that it might be deduced from the principles in many different ways; and my greatest difficulty is usually to discover in which of these ways the effect does depend upon them. As to that, I do not know any other plan but again to try to find experiments of such a nature that their result is not the same if it has to be explained by one of the methods, as it would be if explained by the other. For the rest, I have now reached a position in which I discern, as it seems to me, sufficiently clearly what course must be adopted in order to make the majority of the experiments which may conduce to carry out this end. But I also perceive that they are of such a nature, and of so great a number, that neither my hands nor my income, though the latter were a thousand times larger than it is, could suffice for the whole; so that just in proportion as henceforth I shall have the power of carrying out more of them or less, shall I make more or less progress in arriving at a knowledge of nature. This is what I had promised myself to make known by the Treatise which I had written, and to demonstrate in it so clearly the advantage which the public might receive from it, that I should induce all those who have the good of mankind at heart--that is to say, all those who are really virtuous in fact, and not only by a false semblance or by opinion--both to communicate to me those experiments that they have already carried out, and to help me in the investigation of those that still remain to be accomplished.

But I have since that time found other reasons which caused me to change my opinion, and consider that I should indeed continue to put in writing all the things which I judged to be of importance whenever I discovered them to be true, and that I should bestow on them the same care as I should have done had I wished to have them printed. I did this because it would give me so much the more occasion to examine them carefully (for there is no doubt that we always

scrutinize more closely what we think will be seen by many, than what is done simply for ourselves, and often the things which have seemed true to me when I began to think about them, seemed false when I tried to place them on paper); and because I did not desire to lose any opportunity of benefiting the public if I were able to do so, and in order that if my works have any value, those into whose hands they will fall after my death, might have the power of making use of them as seems best to them. I, however, resolved that I should not consent to their being published during my lifetime, so that neither the contradictions and controversies to which they might possibly give rise, nor even the reputation, such as it might be, which they would bring to me, should give me any occasion to lose the time which I meant to set apart for my own instruction. For although it is true that each man is obliged to procure, as much as in him lies, the good of others, and that to be useful to nobody is popularly speaking to be worthless, it is at the same time true that our cares should extend further than the present time, and that it is good to set aside those things which may possibly be adapted to bring profit to the living, when we have in view the accomplishment of other ends which will bring much more advantage to our descendants. In the same wry I should much like that men should know that the little which I have learned hitherto is almost nothing in comparison with that of which I am ignorant, and with the knowledge of which I do not despair of being able to attain. For it is much the same with those who little by little discover the truth in the sciences, as with those who, commencing to become rich, have less trouble in obtaining great acquisitions than they formerly experienced, when poorer, in arriving at those much smaller in amount. Or we might compare them to the generals of our armies, whose forces usually grow ill proportion to their victories, and who require more leadership in order to hold together their troops after the loss of a battle, than is needed to take towns and provinces after having obtained a success. For he really gives battle who attempts to conquer all the difficulties and errors which prevent him from arriving at a knowledge of the truth, and it is to lose a battle to admit a false opinion touching a matter of any generality and importance. Much more skill is required in order to recover the position that one beforehand held, than is necessary to make great progress when one already possesses principles which are assured. For myself, if I have succeeded in discovering certain truths in the sciences (and I hope that the matters contained in this volume will show that I have discovered some), I may say that they are resultant from, and dependent on, five or six principal difficulties which I have surmounted, and my encounter with these I look upon as so many battles in which I have had fortune on my side. I will not even hesitate to say that I think I shall have no need to win more than two or three other victories similar in kind in order to reach the accomplishment of my plans. And my age is not so advanced but that, in the ordinary course of nature, I may still have sufficient leisure for this end. But I believe myself to be so much the more bound to make the most of the time which remains, as I have the greater hope of being able to employ it well. And without doubt I should have many chances of being robbed of it, were I to publish the foundations of my physics; for though these are nearly all so evident that it is only necessary to understand them in order to accept them, and although there are none of them as to which I do not believe myself capable of giving demonstration, yet because it is impossible that they should accord with all the various opinions of other men, I foresee that I should often be diverted from my main design by the opposition which they would bring to birth.

We may say that these contradictions might be useful both in making me aware of my errors and, supposing that I had reached some satisfactory conclusion in bringing others to a fuller understanding of my speculations; and, as many can see more than can a single man, they might help in leading others who from the present time may begin to avail themselves of my system, to

assist me likewise with their discoveries. But though I recognize that I am extremely liable to err, and though I almost never trust the first reflections that I arrive at, the experience which I have had of the objections which may be made to my system prevents my having any hope of deriving profit from them. For I have often had experience of the judgments both of those whom I have esteemed as my friends, and of some others to whom I believed myself to be indifferent, and even, too, of some whose ill-feeling and envy would, I felt sure, make them endeavor to reveal what affection concealed from the eyes of my friends. But rarely has it happened that any objection has been made which I did not in some sort foresee, unless where it was something very far removed from my subject. In this way hardly ever have I encountered any censor of my opinions who did not appear to me to be either less rigorous or less judicial than myself. And I certainly never remarked that by means of disputations employed by the Schools any truth has been discovered of which we were formerly ignorant. And so long as each side attempts to vanquish his opponent, there is a much more serious attempt to establish probability than to weigh the reasons on either side; and those who have for long been excellent pleaders are not for that reason the best judges.

As to the advantage which others may receive from the communication of my reflections, it could not be very great, inasmuch as I have not yet carried them so far as that it is not necessary to add many things before they can be brought into practice. And I think I can without vanity say that if anyone is capable of doing this, it should be myself rather than another--not, indeed, that there may not be in the world many minds incomparably superior to my own, but because no one can so well understand a thing and make it his own when learned from another as when it is discovered for himself. As regards the matter in hand there is so much truth in this, that although I have often explained some of my opinions to persons of very good intelligence who, while I talked to them appeared to understand them very clearly, yet when they recounted them I remarked that they had almost always altered them in such a manner that I could no longer acknowledge them as mine. On this account I am very glad to have the opportunity here of begging my descendants never to believe that what is told to them proceeded from myself unless I have myself divulged it. And I do not in the least wonder at the extravagances attributed to all the ancient philosophers whose writings we do not possess, nor do I judge from these that their thoughts were very unreasonable, considering that theirs were the best minds of the time they lived in, but only that they have been imperfectly represented to us. We see, too, that it hardly ever happens that any of their disciples surpassed them, and I am sure that those who most passionately follow Aristotle today would think themselves happy if they had as much knowledge of nature as he had, even if this were on the condition that they should never attain to any more. They are like the ivy that never tries to mount above the trees which give it support, and which often even descends again after it has reached their summit; for it appears to me that such men also sink again--that is to say, somehow render themselves more ignorant than they would have been had they abstained from study altogether. For, not content with knowing all that is intelligibly explained in their author, they wish in addition to find in him the solution of many difficulties of which he says nothing, and in regard to which he possibly had no thought at all. At the same time their mode of philosophizing is very convenient for those who have abilities of a very mediocre kind, for the obscurity of the distinctions and principles of which they make use, is the reason of their being able to talk of all things as boldly as though they really knew about them, and defend all that they say against the most subtle and acute, without any one having the means of convincing them to the contrary. In this they seem to me like a blind man who, in order to fight on equal terms with one who sees, would have the latter to come into the bottom of a

very dark cave. I may say, too, that it is in the interest of such people that I should abstain from publishing the principles of philosophy of which I make use, for, being so simple and evident as they are, I should, in publishing them, do the same as though I threw open the windows and caused daylight to enter the cave into which they have descended in order to fight. But even the best minds have no reason to desire to be acquainted with these principles, for if they wish to be able to talk of everything and acquire a reputation for learning, they will more readily attain their end by contenting themselves with the appearance of truth which may be found in all sorts of things without much trouble, than in seeking for truth which only reveals itself little by little in certain spheres, and which, when others come into question, obliges one to confess one's ignorance. If, however, they prefer the knowledge of some small amount of truth to the vanity of seeming to be ignorant of nothing, which knowledge is doubtless preferable, or if they desire to follow a course similar to my own, it is not necessary that I should say any more than what I have already said in this Discourse. For if they are capable of passing beyond the point I have reached, they will also so much the more be able to find by themselves all that I believe myself to have discovered; since, not having examined anything but in its order, it is certain that what remains for me to discover is in itself more difficult and more recondite than anything that I have hitherto been able to meet with, and they would have much less pleasure in learning from me than from themselves. Besides, the habit which they will acquire of seeking first things that are simple and then little by little and by degrees passing to others more difficult, will be of more use than could be all my instructions. For, as regards myself, I am persuaded that if from my youth up I had been taught all the truths of which I have since sought the demonstrations, or if I had not had any difficulty in learning them, I should perhaps never have known any others, or at least I should never have acquired the habit or facility which I think I have obtained, of ever finding them anew, in proportion as I set myself to seek for them. And, in a word, if there is any work at all which cannot be so well achieved by another as by him who has begun it, it is that at which I labor.

It is true as regards the experiments which may conduce to this end, that one man could not possibly accomplish all of them. But yet he could not, to good advantage, employ other hands than his own, excepting those of artisans or persons of that kind whom he could pay, and whom the hope of gain--which is a very effectual incentive--might cause to perform with exactitude all the things they were directed to accomplish. As to those who, whether by curiosity or desire to learn, might possibly offer him their voluntary assistance, not only are they usually more ready with promises than with performance, planning out fine sounding projects, none of which are ever realized, but they will also infallibly demand payment for their trouble by requesting the explanation of certain difficulties, or at least by empty compliments and useless talk, which could not occupy any of the student's time without causing it to be lost. And as to the experiments already made by others, even if they desired to communicate these to him--which those who term them secrets would never do--they are for the most part accompanied by so many circumstances or superfluous matter, that it would be very difficult for him to disentangle the truth. In addition to this he would find nearly all so badly explained, or even so false (because those who carried them out were forced to make them appear to be in conformity with their principles), that if there had been some which might have been of use to him, they would hardly be worth the time that would be required in making the selection. So true is this, that if there were anywhere in the world a person whom one knew to be assuredly capable of discovering matters of the highest importance and those of the greatest possible utility to the public, and if for this reason all other men were eager by every means in their power to help him in reaching the

end which he set before him, I do not see that they could do anything for him beyond contributing to defray the expenses of the experiments which might be requisite, or, for the rest, seeing that he was not deprived of his leisure by the importunities of anyone. But, in addition to the fact that I neither esteem myself so highly as to be willing to promise anything extraordinary, nor give scope to an imagination so vain as to conceive that the public should interest itself greatly in my designs, I do not yet own a soul so base as to be willing to accept from anyone whatever a favor which it might be supposed I did not merit.

All those considerations taken together were, three years ago, the cause of my not desiring to publish the Treatise which I had on hand, and the reason why I even formed the resolution of not bringing to light during my life any other of so general a kind, or one by which the foundations of physics could be understood. But since then two other reasons came into operation which compelled me to bring forward certain attempts, as I have done here, and to render to the public some account of my actions and designs. The first is that if I failed to do so, many who knew the intention I formerly had of publishing certain writings, might imagine that the causes for which I abstained from so doing were more to my disadvantage than they really were; for although I do not care immoderately for glory, or, if I dare say so, although I even hate it, inasmuch as I judge it to be antagonistic to the repose which I esteem above all other things, at the same time I never tried to conceal my actions as though they were crimes, nor have I used many precautions against being known, partly because I should have thought it damaging to myself, and partly because it would have given me a sort of disquietude which would again have militated against the perfect repose of spirit which I seek. And for as much as having in this way always held myself in a condition of indifference as regards whether I was known or was not known, I have not yet been able to prevent myself from acquiring some sort of reputation, I thought that I should do my best at least to prevent myself from acquiring an evil reputation. The other reason which obliged me to put this in writing is that I am becoming every day more and more alive to the delay which is being suffered in the design which I have of instructing myself, because of the lack of an infinitude of experiments, which it is impossible that I should perform without the aid of others: and although I do not flatter myself so much as to hope that the public should to any large degree participate in my interest, I yet do not wish to be found wanting, both on my own account, and as one day giving occasion to those who will survive me of reproaching me for the fact that I might have left many matters in a much better condition than I have done, had I not too much neglected to make them understand in what way they could have contributed to the accomplishment of my designs.

And I thought that it was easy for me to select certain matters which would not be the occasion for many controversies, nor yet oblige me to propound more of my principles than I wish, and which yet would suffice to allow a pretty clear manifestation of what I can do and what I cannot do in the sciences. In this I cannot say whether I have succeeded or have not succeeded, and I do not wish to anticipate the judgment of any one by myself speaking of my writings; but I shall be very glad if they will examine them. And in order that they may have the better opportunity of so doing, I beg all those who have any objections to offer to take the trouble of sending them to my publishers, so that, being made aware of them, I may try at the same time to subjoin my reply. By this means, the reader, seeing objections and reply at the same time, will the more easily judge of the truth; for I do not promise in any instance to make lengthy replies, but just to avow my errors very frankly if I am convinced of them; or, if I cannot perceive them, to say simply

what I think requisite for the defense of the matters I have written, without adding the exposition of any new matter, so that I may not be endlessly engaged in passing from one side to the other.

If some of the matters of which I spoke in the beginning of the *Dioptrics* and *Meteors* should at first sight give offense because I call them hypotheses and do not appear to care about their proof, let them have the patience to read these in entirety, and I hope that they will find themselves satisfied. For it appears to me that the reasonings are so mutually interwoven, that as the later ones are demonstrated by the earlier, which are their causes, the earlier are reciprocally demonstrated by the later which are their effects. And it must not be imagined that in this I commit the fallacy which logicians name arguing in a circle for, since experience renders the greater part of these effects very certain, the causes from which I deduce them do not so much serve to prove their existence as to explain them; on the other hand, the causes are explained by the effects. And I have not named them hypotheses with any other object than that it may be known that while I consider myself able to deduce them from the primary truths which I explained above, yet I particularly desired not to do so, in order that certain persons may not for this reason take occasion to build up some extravagant philosophic system on what they take to be my principles, and thus cause the blame to be put on me. I refer to those who imagine that in one day they may discover all that another has arrived at in twenty years of work, so soon as he has merely spoken to them two or three words on the subject; while they are really all the more subject to err, and less capable of perceiving the truth as they are the more subtle and lively. For as regards the opinions that are truly mine I do not apologize for them as being new, inasmuch as if we consider the reasons of them well, I assure myself that they will be found to be so simple and so conformable to common sense, as to appear less extraordinary and less paradoxical than any others which may be held on similar subjects. And I do not even boast of being the first discoverer of any of them, but only state that I have adopted them, not because they have been held by others, nor because they have not been so held, but only because reason has persuaded me of their truth.

Even if artisans are not at once able to carry out the invention explained in the *Dioptrics*, I do not for that reason think that it can be said that it is to be condemned; for, inasmuch as great address and practice is required to make and adjust the mechanism which I have described without omitting any detail, I should not be less astonished at their succeeding at the first effort than I should be supposing someone were in one day to learn to play the guitar with skill, just because a good sheet of musical notation were set up before him. And if I write in French which is the language of my country, rather than in Latin which is that of my teachers, that is because I hope that those who avail themselves only of their natural reason in its purity may be better judges of my opinions than those who believe only in the writings of the ancients; and as to those who unite good sense with study, whom alone I crave for my judges, they will not, I feel sure, be so partial to Latin as to refuse to follow my reasoning because I expound it in a vulgar tongue.

For the rest, I do not desire to speak here more particularly of the progress which I hope in the future to make in the sciences, nor to bind myself as regards the public with any promise which I shall not with certainty be able to fulfill. But I will just say that I have resolved not to employ the time which remains to me in life in any other matter than in endeavoring to acquire some knowledge of nature, which shall be of such a kind that it will enable us to arrive at rules for medicine more assured than those which have as yet been attained; and my inclination is so strongly opposed to any other kind of pursuit, more especially to those which can only be useful

to some by being harmful to others, that if certain circumstances had constrained me to employ them, I do not think that I should have been capable of succeeding. In so saying I make a declaration that I know very well cannot help me to make myself of consideration in the world, but to this end I have no desire to attain; and I shall always hold myself to be more indebted to those by whose favor I may enjoy my leisure without hindrance, than I shall be to any who may offer me the most honorable position in all the world.