out life. Even then he had begun to distrust the authority of tradition and his teachers.

Two years before he left school he was selected as one of the twenty-four gentlemen who went forth to receive the heart of the murdered king as it was borne to its resting-place at La Flèche. At the age of sixteen he went home to his father, who was now settled at Rennes, and had taken a second wife from Brittany. During the winter of 1612 he completed his preparations for the world by lessons in horsemanship and fencing; and then in the spring of 1613, he started as his own master to taste the pleasures of Parisian life. Fortunately the spirit of dissipation does not seem to have carried him any perilous lengths; the worst we hear of is a passion for gaming. Here, too, he made the acquaintance of Claude Mydorge, one of the foremost mathematicians of France, and renewed an early intimacy with Marin Mersenne, an old fellow-student, senior by some years, at La Flèche, and now become Father Mersenne, of the order of Minim Friars. The withdrawal of the latter in 1614 to a post in the provinces was the signal for Descartes to abandon social life and shut himself up for nearly two years in a secluded house of the Faubourg St Germain. Accident, however, betrayed the secret of his retirement; he was compelled to leave his mathematical investigations, and to take part in entertainments, where the only thing that chimed in with his theorizing reveries was the music. The scenes of horror and intrigue which marked the struggle for supremacy between the various leaders who aimed at guiding the politics of France made Paris no fit place for a student, and held out little honourable prospect for a soldier. Accordingly, in May 1617, Descartes, now twenty-one years of age, set out for the Netherlands and took service in the army of Prince Maurice of Orange, one of the greatest generals of the age, who had been engaged for some time in a war with the Spanish forces in Belgium. At Breda he enlisted as a volunteer, and the first and only pay which he accepted he kept as a curiosity through life. There was a lull in the war; and the Netherlands were distracted by the quarrels of Gomarists and Arminians. During the leisure thus arising, Descartes one day, as he roved through Breda, had his attention drawn to a placard in the Dutch tongue; and as the language, of which he never became perfectly master, was then strange to him, he asked a bystander to interpret it into either French or Latin. The stranger, who happened to be Isaac Beeckman, principal of the college of Dort, offered with some surprise to do so into Latin, if the inquirer would bring him a solution of the problem,—for the advertisement was one of those challenges which the mathematicians of the age, in the spirit of the tournaments of chivalry, were accustomed to throw down to all comers, daring them to discover a geometrical mystery known as they fancied to themselves alone. Descartes promised and fulfilled; and a friendship grew up between him and Beeckman—broken only by the literary dishonesty of the latter, who in later years took credit for the novelty contained in a small essay on music (*Compendium Musicæ*) which Descartes wrote at this period and intrusted to Beeckman.[1]

After thus spending two years in Holland as a soldier in a period of peace, Descartes, in July 1619, attracted by the news of the impending struggle between the house of Austria and the Protestant princes, consequent upon the election of the palatine of the Rhine to the kingdom of Bohemia, set out for Upper Germany, and volunteered into the Bavarian service. The winter of 1619, spent in quarters at Neuburg on the Danube, was the critical period in his life. Here, in his warm room (*dans un poêle*), he indulged those meditations which afterwards led to the *Discourse of Method*. It was here that, on the eve of St Martin's day, he "was filled with enthusiasm, and discovered the foundations of a marvellous science." He retired to rest with anxious thoughts of his future career, which haunted him through the night in three dreams, that left a deep impression on his mind. "Next day," he continues,[2] "I began to understand the first principles of my marvellous discovery." The date of his philosophical conversion is thus fixed to a day. But the light was as yet dim; he had only glimpses of a method which should invigorate the syllogism by the co-operation of ancient geometry and modern algebra. For during the year that elapsed before he left Swabia (and whilst he sojourned at Neuburg and Ulm), and amidst his geometrical studies, he would fain have gathered some knowledge of the mystical wisdom attributed to the Rosicrucians; but the Invisibles, as they called themselves, kept their secret, and he found them not. His restlessness of spirit is well shown by a vow (which he himself records with the date of September 23, 1620), to make a pilgrimage to Loretto—"if possible, on foot from Venice; if not, in the most devout manner he could."[3] Soon after the Bavarian troops were ordered into active service. He was present at the battle of Prague, where the hopes of the elector palatine were blasted (9th November 1620), passed the winter with the army in Southern Bohemia, and next year served under Count Boucquoi in Hungary. On the death of this general Descartes quitted the imperial service, and in July 1621 began a peaceful tour through Moravia, the borders of Poland, Pomerania, Brandenburg, Holstein, and Friesland, from which he re-appeared in February 1622 in Belgium, and betook himself directly to his father's home in Brittany. The sole incident recorded of this excursion is his danger, when crossing in a small boat to Dutch Friesland, from the cupidity of the crew, who had taken him for a rich merchant, but at once abandoned their murderous designs when they saw him rise with drawn sword, in all the dignity of a French gentleman.

At Rennes, where the young family of his stepmother was growing up, Descartes probably found little to interest him; and, after he had visited the maternal estate which his father now put him in possession of, he took the opportunity of running up to Paris, where he found the Rosicrucians the topic of the hour, and heard himself credited with partnership in their secrets. A short visit to Brittany enabled him, with his father's consent, to arrange for the sale of his property in Poitou. The proceeds were invested in such a way at Paris as to bring him in a yearly income of between 6000 and 7000 francs, a sum probably equal to more than £500 at the present day. Towards the end of the year Descartes was on his way to Italy. The natural phenomena of Switzerland, and the political complications in the Valtellina, where the Catholic inhabitants had thrown off the yoke of the Grisons and called in the Papal and Spanish troops to their assistance, delayed him some time; but he reached Venice in time to see the ceremony of the doge's wedlock with the Adriatic. After paying his vows at Loretto, he came to Rome, which was then on the eve of a year of jubilee—an occasion which Descartes seized to observe the variety of men and manners which the city then embraced within its walls. In the spring of 1625 he returned home by Mount Cenis, observing the avalanches,[4] instead of, as his relatives hoped, securing a post in the French army in Piedmont.

[1] It was only published after the author's death, and of it, besides the French version, there exists an English translation "by a Person of Quality."

[2] Œuvres Inédits, i. 8. [3] Œuvres Inédits, i. 12. [4] Œuvres, v. 255.



For an instant Descartes seems to have concurred in the plan of purchasing a post at Châtellerault, but easily gave up the idea, and settled in Paris (June 1625), in the quarter where he had sought seclusion before. By this time he had ceased to devote himself to pure mathematics, and in company with his friends Mersenne and Mydorge was deeply interested in the theory of the refraction of light, and in the practical work of grinding glasses of the best shape suitable for optical instruments. But all the while his aim was fixed on something beyond either mathematics or physics; he was engaged with reflections on the nature of man, of the soul, and of God; and it need cause no surprise that Descartes for a while remained invisible even to his most familiar friends. But their importunity made a hermitage in Paris impossible; and a graceless friend surprised the philosopher in bed at 11 o'clock in the morning meditating on some problem, and occasionally taking notes. In disgust at the apparent hopelessness of the position for a student, Descartes started for the west to take part in the siege of La Rochelle, and entered the famine-stricken city with the victorious troops on the 30th October 1628. A meeting at which he was present after his return to Paris decided his vocation. He had expressed an opinion that the true art of memory was not to be gained by technical devices, but by a philosophical apprehension of things; and the Cardinal de Berulle, the founder of the Congregation of the Oratory, was so struck by the tone of the remarks as to impress upon the speaker the duty of spending his life in the examination of truth. Descartes accepted the philosophic mission. In the end of 1628 he left Paris, and in the spring of 1629 he settled in Holland. His financial affairs he had intrusted to the care of the Abbé Picot, and as his literary and scientific representative he adopted Père Mersenne.

Between the ages of thirty-three and fifty-three (1629–1649) Descartes lived almost entirely in Holland. Thrice only did he revisit France during that period—in 1644, 1647, and 1648. The first of these occasions was in order to settle family affairs after the death of his father in 1640. The eldest brother seems to have been disposed to take all he could, and to have expected the philosopher to be yielding in money matters. So little notice did the family think it necessary to take of a brother who had sunk to the level of literature, that a letter of René to his father, affectionately excusing his long absence, reached Rennes only after that father was lying in the tomb. The second brief visit, in 1647, partly on literary, partly on family business, was signalized by the award of a pension of 3000 francs, obtained from the royal bounty by Cardinal Mazarin in consideration of the advantages which Descartes's investigations conferred upon mankind, and to aid him in continuing his experiments. The pension was punctually paid. The last visit in 1648 was less fortunate. A royal order summoned him to France for new honours—an additional pension and a permanent post—for his fame had by this time gone abroad, and it was the age when princes sought to attract genius and learning to their courts. But when Descartes arrived, he found Paris rent asunder by the civil war of the Fronde. He paid the costs of his royal parchment, and left for his Dutch home without a word of reproach. The only other occasions on which he was out of the Netherlands were in 1630, when he made a flying visit to England to observe for himself some alleged magnetic phenomena, and in 1634, when he took an excursion to Denmark.

During his residence in Holland he lived at thirteen different places, and changed his abode twenty-four times. In the choice of these spots two motives seem to have influenced him—the neighbourhood of a university or college, and the amenities of the situation. Franeker, one of the neatest towns in Friesland, was the seat of a university founded in 1585; Harderwyk contained a venerable gymnasium, of some note in the physical sciences and theology; Deventer possessed a seminary still well endowed, but less famous than it had been in the days of Erasmus;[1] Utrecht acquired a university so late as 1634; and Leyden had a notable one founded in 1575. Amersfoort, where he also lived, seems to be connected with a love affair,—the only one in his life; at least it was there that his daughter Francine died in 1640, at the age of five. Amsterdam, where he often lodged, Leeuwarden in Friesland, and Dort were also residences. He once settled near Utrecht, as well as in the town; but the three spots which seem to have been most attractive were—Endegeest, a country house more than a mile north-west of Leyden, of which Sorbière has given a pleasing description in one of his letters, and the two villages of Egmond op den Hoef and Egmond the Abbey, situated between Zaandam and the ocean, in one of the prettiest localities of North Holland.

The time thus spent seems to have been on the whole happy, even allowing for some warm discussions with the mathematicians and metaphysicians of France, and for some harassing controversies in the Netherlands. Friendly agents—chiefly Catholic priests—were the intermediaries who forwarded from Dort, Haarlem, Amsterdam, and Leyden his correspondence to his proper address, which he wished kept completely secret; and Father Mersenne was only too willing to send him loads of objections and questions. During the first twenty years of his life his health had been weak[2] and his complexion pale. After that time the disease in his frame seems to have worked itself off, not without some effervescence. This is the period of his camp life (due, as he himself says, to "heat in the liver"),[3] of his wanderings, enthusiasm, dreams, and vows. With his thirtieth year this struggle seems at an end; his health seems established; and the washed-out vermilion of his prime gives place to a dark olive complexion in his riper manhood. It is touching to hear his delight in the freedom from intruders. "I sleep here ten hours every night," he writes from Amsterdam, "and no care ever shortens my slumber." "I take my walk every day through the confusion of a great multitude with as much freedom and quiet as you could find in your rural avenues."[4] At his first coming to Franeker he arranged to get a cook acquainted with French cookery; but, to prevent misunderstanding, it may be added that his diet was mainly vegetarian, and that he rarely drank wine. New friends gathered round him who took a keen interest in his researches. Once only do we find him taking an interest in the affairs of his neighbours,—to ask pardon from the Government for a homicide.[5] He continued the profession of his religion. Sometimes from curiosity he went to the ministrations of anabaptists,[6] to hear the ranting of peasants and artisans. He carried few books to Holland with him, but a Bible and the *Summa* of Thomas Aquinas were amongst them.[7] One of the recommendations of Egmond the Abbey was the free exercise there allowed to the Catholic religion. At Franeker his house was a small château, "separated by a moat from the rest of the town, where the mass could be said in safety."[8] And one motive in favour of accepting an invitation to England lay in the alleged leanings of Charles I. to the older church.

The best account of Descartes's mental history during his life in Holland is contained in his letters, which extend

[1] Œuvr. vi. 214. [2] Œuvr. ix. 203. [3] Œuvr. viii. 70. [4] Œuvr. vi. 199. [5] Œuvr. viii. 59. [6] Œuvr. viii. 173. [7] Œuvr. viii. 181. [8] Œuvr. vi. 123.

over the whole period, and are particularly frequent in the latter half. The majority of them are addressed to Mersenne, and deal with problems of physics and musical theory (in which he took a special interest). Mathematical subjects are a common topic. Several letters between 1643 and 1649 are addressed to the Princess Elizabeth, the eldest daughter of the ejected elector palatine, who lived at the Hague, where her mother maintained the semblance of a royal court. The princess was obliged to quit Holland, but kept up a philosophical correspondence with Descartes. It is to her that the *Principles of Philosophy* were dedicated; and in her alone, according to Descartes, were united those generally separated talents for metaphysics and for mathematics which are so characteristically co-operative in the Cartesian system. Two Dutch friends, Zuylichem, the father of the more celebrated Huyghens, and Hoogheland, figure amongst the correspondents, not to mention various savants, professors, and churchmen (particularly Jesuits).

His residence in the Netherlands fell on the most prosperous and brilliant days of the Dutch state, under the stadtholdership of Frederick Henry (1625–1647). Abroad its navigators monopolized the commerce of the world, and explored unknown seas; at home the Dutch school of painting reached its acme in Rembrandt (1607–1669); and the philological reputation of the country was sustained by Grotius, Vossius, and the elder Heinsius. And yet, though Rembrandt's Nightwatch is dated the very year after the publication of the *Meditations*, not a word in Descartes breathes of any work of art or historical learning. The contempt of æsthetics and erudition is characteristic of the most typical members of the Cartesian school, especially Malebranche. Though Descartes probably read more than some of his admirers supposed he was not in any strict sense a reader. His wisdom grew mainly out of his own reflections and experiments, calmly yet ceaselessly pursued. Of mere learning and scholarship he had no esteem. The story of his disgust, when he found that Queen Christina devoted some time every day to the study of Greek under the tuition of Vossius, is at least true in substance.[1] It gives no evidence of science, he remarks, to possess a tolerable knowledge of the Roman tongue, such as once was possessed by the populace of Rome.[2] In all his travels, and in the different places at which he settled, his interest seems untouched either by art or history; he looks only to the phenomena of nature and the actual aspects of human life. He was a spectator rather than an actor on the stage of the world. If he entered the army, it was merely because the position gave a vantage-ground from which to make his observations. In the political interests which these contests involved he took no part; his favourite disciple, the Princess Elizabeth, was the daughter of the banished king, against whom he had served in Bohemia; and Queen Christina, his second royal follower, was the daughter of Gustavus Adolphus.

In many ways Descartes is a type of that self-reliant, harsh, and abstract spirit of science to which erudition and all the heritage of the past seem but elegant and unworthy trifling. The science of Descartes was physics in all its branches, but especially as applied to physiology. Science, he says, may be compared to a tree; metaphysics is the root, physics is the trunk, and the three chief branches are mechanics, medicine, and morals,—the three applications of our knowledge to the outward world, to the human body, and to the conduct of life.[3]

Such then was the work, and such the ends, that Descartes had in view in Holland. His residence was generally divided into two parts—one his workshop for science, the other his reception-room for society. "Here are my books," he is reported to have told a visitor, as he pointed to the animals he had dissected. "I am now," he writes in 1630, "studying chemistry and anatomy together; and every day I learn something which I could not find in books."[4] He is working hard at his book on refraction, and at the same time is busy dissecting the heads of different animals in order to explain imagination and memory, which he considers physical processes.[5] It need not from this be supposed that Descartes was a laborious student. "I can say with truth," he writes to the Princess Elizabeth,[6] "that the principle which I have always observed in my studies, and which I believe has helped me most to gain what knowledge I have, has been never to spend beyond a very few hours daily in thoughts which occupy the imagination, and a very few hours yearly in those which occupy the understanding, and to give all the rest of my time to the relaxation of the senses and the repose of the mind." But his expectations from the study of anatomy and physiology went a long way. "The conservation of health," he writes in 1646, "has always been the principle end of my studies."[7] In 1629 he asks Mersenne to take care of himself "till I find out if there is any means of getting a medical theory based on infallible demonstrations, which is what I am now inquiring."[8] And to Zuylichen he writes in 1638,—[9] "I have never taken so much care of myself as at present; and whereas I used to think that death could take from me only thirty or forty years at most, it could not overtake me now without depriving me of the hope of more than a century." And similar views seem to have been expressed by him to Sir Kenelm Digby, who visited him in Holland. Astronomical inquiries in connection with optics, meteorological phenomena, and, in a word, the whole field of natural laws, excited his desire to explain them. His own observation, and the reports of Mersenne, furnished his data. Of Bacon's demand for observation and collection of facts he is an imitator; and he wishes (in a letter of 1632) that "some one would undertake to give a history of celestial phenomena after the method of Bacon, and describe the sky exactly as it appears at present, without introducing a single hypothesis."[10]

He had several writings in hand during the early years of his residence in Holland, but the main work of this period was a physical doctrine of the universe which he termed *The World*. Shortly after his arrival he writes to Mersenne that it will probably be finished in 1633, but meanwhile asks him not to disclose the secret to his Parisian friends. Already anxieties appear as to the theological verdict upon two of his fundamental views—the infinitude of the universe, and the earth's rotation round the sun.[11] But towards the end of year 1633 we find him writing as follows:[12] "I had intended sending you my *World* as a New Year's gift, and a fortnight ago I was still minded to send you a fragment of the work, if the whole of it could not be transcribed in time. But I have just been at Leyden and Amsterdam to ask after Galileo's cosmical system, as I imagined I had heard of its being printed last year in Italy. I was told that it had been printed, but that every copy had been at the same time burnt at Rome, and that Galileo had been himself condemned to some penalty." He has also seen a copy of Galileo's condemnation at Liége (20th September 1633), with the words—"Although he professes that the (Copernican) theory was only adopted by him as a hypothesis." His friend Beeckman lent him a copy of Galileo's work,

[1] Œuvr. x. 375. [2] Œuvr. ix. 6. [3] Œuvr. iii. 24.
[4] Œuvr. vi. 101. [5] Œuvr. vi. 234. [6] Œuvr. ix. 131. [7] Œuvr. ix. 341. [8] Œuvr. vi. 89. [9] Œuvr. vii. 412. [10] Œuvr. vi. 210. [11] Œuvr. vi. 73. [12] Œuvr. vi. 239.



which he glanced through in his usual manner with other men's books; he found it good, and "failing more in the points where it follows received opinions than where it diverges from them."[1] The consequence of these reports of the hostility of the church to the doctrine on which his theory reposed led him to abandon all thoughts of publishing. The *World* was consigned to his desk; and although doctrines in all essential respects the same constitute the physical portion of his *Principia*, it was not till after the death of Descartes that fragments of the work, including *Le Monde*, or a treatise on light, and the physiological tracts *L'Homme* and *La Formation du Fœtus*, were given to the world by Clerselier, in 1664. Descartes was not disposed to be a martyr; he had a sincere respect for the church and for authority, and had no wish to shock prejudices, or to begin an open conflict with established doctrines.

In 1636 Descartes had resolved to publish some specimens of the fruits of his method, and some general observations on its nature which, under an appearance of simplicity, might sow the good seed of more adequate ideas on the world and man. "I should be glad," he says, when talking of a publisher,[2] "if the whole book were printed in good type, on good paper, and I should like to have at least 200 copies for distribution. The book will contain four essays, all in French, with the general title of 'Project of a Universal science, capable of raising our nature to its highest perfection; also Dioptrics, Meteors, and Geometry, wherein the most curious matters which the author could select as a proof of the universal science which he proposes are explained in such a way that even the unlearned may understand them.'" The work appeared anonymously at Leyden (published by Jean Maire) in 1637, under the modest title of *Essais Philosophiques;* and the project of a universal science becomes the *Discours de la méthode pour bien conduire sa raison et chercher la verité dans les sciences*. In 1644 it appeared in a Latin version, revised by Descartes, as *Specimina Philosophica*. A work so widely circulated by the author naturally attracted attention, but in France it was principally the mathematicians who took it up, and their criticisms were more pungent than complimentary. Fermat, Roberval, and Desargues took exception in their various ways to the methods employed in the geometry, and to the demonstrations of the laws of refraction given in the Dioptrics and the Meteors. The dispute on the latter point between Fermat and Descartes was continued, even after the philosopher's death, as late as 1662. In the virgin soil of the youthful Dutch universities the effect of the Cartesian essays was greater.

The first public teacher of Cartesian views was Henri Renery, a Belgian, who at Deventer and afterwards at Utrecht had introduced the new philosophy which he had learned from personal intercourse with Descartes. Renery only survived five years at Utrecht; and it was reserved for Regius (Henri De Roy),—who in 1638 had been appointed to the new chair of botany and theoretical medicine at Utrecht, and who visited Descartes at Egmond in order more thoroughly to learn his views,—to throw down the gauntlet to the adherents of the old methods. With more eloquence and vigour than judgment or prudence, he propounded and defended theses bringing into prominent relief the points in which the new doctrines clashed with the old. The attack was opened by Gisbert Voët, foremost among the theological professors and clergy of Utrecht, a preacher of note and a stronghold of orthodoxy. In 1639 he published a series of arguments against atheism, in which the Cartesian views were not obscurely indicated as perilous for the faith, though no name was mentioned. Next year he persuaded the magistracy to issue an order forbidding Regius to travel beyond the received doctrine; for Regius, contrary to the advice of Descartes, had formulated his view of Cartesianism in the phrase that man was a unity merely by accident, and meddled in his lectures with topics not usually associated with a chair of medicine. The magisterial views seem to have prevailed in the professoriate, which formally in March 1642 expressed its disapprobation of the new and pretended philosophy as well as of its expositors. As yet Descartes was not directly attacked. Voët now issued, through the medium and under the name of Martin Schoock, one of his pupils, a pamphlet with the title of *Methodus novæ philosophiæ Renati Descartes*, in which atheism and infidelity were openly declared to be the effect of the new teaching. Descartes replied to Voët directly in a long and vigorous letter, published at Amsterdam in 1643. Yet notwithstanding, he was summoned before the magistrates of Utrecht to defend himself against charges of irreligion and slander. What might have happened we cannot tell; but Descartes threw himself on the protection of the French ambassador and the prince of Orange, and the city magistrates, from whom he vainly demanded satisfaction in a dignified letter,[3] were snubbed by their superiors. About the same time (April 1645) Schoock was summoned before the university of Groningen, of which he was a member, and forthwith disavowed the more abusive passages in his book. So did the effects of the *odium theologicum*, for the meanwhile at least, die away.

In the *Discourse of Method* Descartes had sketched the main points in his new views, with a mental autobiography which might explain their origin, and with some suggestions as to their applications. His second great work, *Meditations on the First Philosophy*, which had been begun soon after his settlement in the Netherlands, expounded in more detail the foundations of his system, laying especial emphasis on the priority of mind to body, and on the absolute and ultimate dependence of mind as well as body on the existence of God. In 1640 a copy of the work in manuscript was despatched to Paris, and Mersenne was requested to lay it before as many thinkers and scholars as he deemed desirable, with a view to getting their views upon its argument and doctrine. Mersenne was not slack in submitting the work to criticism, and Descartes soon had a formidable list of objections to reply to. Accordingly, when the work was published at Paris in August 1641, under the title of *Meditationes de prima philosophia ubi de Dei existentia et Animæ immortalitate* (though it was in fact not the *immortality*, but the *immateriality* of the mind, or, as the second edition described it, *animæ humanæ a corpore distinctio*, which was maintained), the title went on to describe the larger part of the book as containing various objections of learned men, with the replies of the author. These objections in the first edition are arranged under six heads:—the first came from Caterus, a theologian of Louvain; the second and sixth are anonymous criticisms from various hands; whilst the third, fourth, and fifth belong respectively to Hobbes, Arnauld, and Gassendi. In the second edition appeared the seventh—objections from Père Bourdin, a Jesuit teacher of mathematics in Paris; and subsequently another set of objections known as those of *Hyperaspistes*, was included in the collection of Descartes's letters. The anonymous objections are very much the statement of common sense against philosophy; those of Caterus criticise the Cartesian argument from the traditional theology of the church; those of Arnauld are an appreciative inquiry into the bearings and consequences of the meditations for religion

[1] Œuvr. vi. 248. [2] Œuvr. vi. 276. [3] Œuvr. ix. 250.

and morality; while those of Hobbes and Gassendi—both somewhat senior to Descartes and with a dogmatic system of their own already formed—are a keen assault upon the spiritualism of the Cartesian position from a generally "sensational" stand-point. The criticisms of the last two are the criticisms of a hostile school of thought; those of Arnauld are the difficulties of a possible disciple.

In 1644 the third great work of Descartes, the *Principia Philosophiæ*, appeared at Amsterdam. Passing briefly over the conclusions arrived at in the *Meditations*, it deals in its second, third, and fourth parts with the general principles of physical science, especially the laws of motion, with the theory of vortices, and with the phenomena of heat, light, gravity, magnetism, electricity, &c., upon the earth. This work exhibits some curious marks of caution. Undoubtedly, says Descartes, the world was in the beginning created in all its perfection. "But yet as it is best, if we wish to understand the nature of plants or of men, to consider how they may by degrees proceed from seeds, rather than how they were created by God in the beginning of the world, so, if we can excogitate some extremely simple and comprehensible principles, out of which, as if they were seeds, we can prove that stars, and earth, and all this visible scene could have originated, although we know full well that they never did originate in such a way, we shall in that way expound their nature far better than if we merely described them as they exist at present."[1] The Copernican theory is rejected in name, but retained in substance. The earth, or other planet, does not actually move round the sun; yet it is carried round the sun in the subtle matter of the great vortex, where it lies in equilibrium,—carried like the passenger in a boat, who may cross the sea and yet not rise from his berth.

In 1647 the difficulties that had arisen at Utrecht were repeated on a smaller scale at Leyden. There the Cartesian innovations had found a patron in Adrian Heerebord, and were openly discussed in theses and lectures. The theological professors took the alarm at passages in the *Meditations*; an attempt to prove the existence of God savoured, as they thought, of atheism and heresy. When Descartes complained to the authorities of this unfair treatment,[2] the only reply was an order by which all mention of the name of Cartesianism, whether favourable or adverse, was forbidden in the university. This was scarcely what Descartes wanted, and again he had to apply to the prince of Orange, whereupon the theologians were asked to behave with civility, and the name of Descartes was no longer proscribed. But other annoyances were not wanting from unfaithful disciples and unsympathetic critics. The *Instantiæ* of Gassendi appeared at Amsterdam in 1644 as a reply to the reply which Descartes had published of his previous objections; and the publication by Regius of his work on Physical Philosophy gave the world to understand that he had ceased to be a thorough adherent of the philosophy which he had so enthusiastically adopted.

It was about 1648 that Descartes lost his friends Mersenne and Mydorge by death. The place of Mersenne as his Parisian representative was in the main taken by Claude Clerselier (the French translator of the Objections and Responses), whom he had become acquainted with in Paris. Through Clerselier he came to know Pierre Chanut, who in 1645 was sent as French ambassador to the court of Sweden. Queen Christina, the daughter of the great Gustavus, was not yet twenty, and took a lively, if a somewhat whimsical interest in literary and philosophical culture. Through Chanut, with whom she was on terms of familiarity, she came to hear of Descartes, and a correspondence which the latter nominally carried on with the ambassador was in reality intended for the eyes of the queen. The correspondence took an ethical tone. It began with a long letter on Love in all its aspects (February 1647),[3] a topic suggested by Chanut, who had been discussing it with the queen; and this was soon followed by another to Christina herself on the Chief Good. An essay on the Passions of the Mind (*Passions de l'Âme*), which had been written originally for the Princess Elizabeth, in development of some ethical views suggested by the *De Vita Beata* of Seneca, was inclosed at the same time for Chanut. It was a draft of the work published in 1650 under the same title. Philosophy, particularly that of Descartes, was becoming a fashionable *divertissement* for the queen and her courtiers, and it was felt that the presence of the sage himself was necessary to complete the good work of education. An invitation to the Swedish court was urged upon Descartes, and after much hesitation accepted; a vessel of the royal navy was ordered to wait upon him, and in September 1649 he left Egmond for the north.

The position on which he entered at Stockholm was certainly no sinecure, and utterly unsuited for a man who had always tried to be his own master. The young queen, full of plans and energy, wanted Descartes to draw up a code for a proposed academy of the sciences, and to give her an hour of philosophic instruction every morning at five. And in order to tie him down to the country she had already determined to create him a noble, and begun to look out an estate in the lately annexed possessions of Sweden on the Pomeranian coast. But these things were not to be. His friend Chanut fell dangerously ill; and Descartes, who devoted himself to attend in the sick-room, was obliged to issue from it every morning in the chill northern air of January, and spend an hour in the palace library. The ambassador recovered, but Descartes fell a victim to the same disease—an inflammation of the lungs. The last time he saw the queen was on the 1st of February 1650, when he handed to her the statutes he had drawn up for the proposed academy. Ten days after he was dead. The queen, in her first grief and enthusiasm, would have liked to bury him grandly at the feet of the Swedish kings, and to raise a costly mausoleum in his honour; but these plans were overruled, and a plain monument in the Catholic cemetery was all that marked the place of his rest. Sixteen years after his death the French treasurer D'Alibert made arrangements for the conveyance of the ashes to his native land; and in 1667 they were interred in the church of Ste Geneviève du Mont, the modern Pantheon. In 1819, after being temporarily deposited in a stone sarcophagus in the court of the Louvre during the Revolutionary epoch, they were transferred to St Germain-des-Près, where they now repose between Montfaucon and Mabillon. A monument was raised to his memory at Stockholm by Gustavus III.; and some years ago a statue was erected to him at Tours, with the inscription *Je pense, donc je suis* on the pedestal.

Descartes was never married, and probably had little of the amorous in his temperament. He has alluded to a childish fancy for a young girl with a slight obliquity of vision; but he only mentions it *à propos* of the consequent weakness which led him to associate such a defect with beauty.[4] Mythical rumours represent him as telling a belle that he found no beauty comparable to the beauty of truth. In person he was a little man, with large head, projecting brow, prominent nose, and eyes wide apart, with black hair coming down almost to his eyebrows. His voice was feeble. He usually dressed in black, with unobtrusive propriety.

[1] Princip. I. iii. S. 45. [2] Œuvr. x. 26. [3] Œuvr. x. 3. [4] Œuvr. x. 53.



The end of all study, says Descartes in one of his earliest writings, ought to be to guide the mind to form true and sound judgments on every thing that may be presented to it.[1] The sciences in their totality are but the intelligence of man; and all the details of knowledge have no value save as they strengthen the understanding. The mind is not for the sake of knowledge, but knowledge for the sake of the mind. This is the re-assertion of a principle which the Middle Ages had lost sight of—that knowledge, if it is to have any value, must be intelligence, and not erudition.

But how is intelligence, as opposed to erudition, possible? The answer to that question is the method of Descartes. That idea of a method grew up with his study of geometry and arithmetic,—the only branches of knowledge which he would allow to be "made sciences," those which the Jesuits best taught, and which he himself cultivated most zealously in early life. But they did not satisfy his demand for intelligence. "I found in them," he says, "different propositions on numbers of which, after a calculation. I perceived the truth; as for the figures, I had, so to speak, many truths put before my eyes, and many others concluded from them by analogy; but it did not seem to me that they told my mind with sufficient clearness why the things were as I was shown, and by what means their discovery was attained."[2] The mathematics of which he thus speaks included the geometry of the ancients, as it had been handed down to the modern world, and arithmetic with the developments it had received in the direction of algebra. The ancient geometry, as we know it, is a wonderful monument of ingenuity—a series of *tours de force*, in which each problem to all appearance stands alone, and, if solved, is solved by methods and principles peculiar to itself. Here and there particular curves, for example, had been obliged to yield the secret of their tangent; but the ancient geometers apparently had no consciousness of the general bearings of the methods which they so successfully applied. Each problem was something unique; the elements of transition from one to another were wanting; and the next step which mathematics had to make was to find some method of reducing, for instance, all curves to a common notation. When that was found, the solution of one problem would immediately entail the solution of all others which belonged to the same series as itself.

The arithmetical half of mathematics, which had been gradually growing into algebra, and had decidedly established itself as such in the *Logistica Speciosa* of Vieta (1540–1603), supplied to some extent the means of generalizing geometry. And the algebraists or arithmeticians of the 16th century, such as Lucas de Borgo, Cardan, and Tartaglia, had used geometrical constructions to throw light on the solution of particular equations. But progress was made difficult, in consequence of the clumsy and irregular nomenclature employed. With Descartes the use of exponents as now employed for denoting the powers of a quantity becomes systematic; and without some such step by which the homogeneity of successive powers is at once recognized, the binomial theorem could scarcely have been detected. The restriction of the early letters of the alphabet to known, and of the late letters to unknown quantities is also his work. In this and other details he crowns and completes, in a form henceforth to be dominant for the language of algebra, the work of numerous obscure predecessors, such as Étienne de la Roche, Stiefel, and others.

Having thus perfected the instrument, his next step was to apply it in such a way as to bring uniformity of method into the isolated and independent operations of geometry. "I had no intention," he says in the *Method*,"[3] of attempting to master all the particular sciences commonly called mathematics; but as I observed that, with all differences in their objects, they agreed in considering merely the various relations or proportions subsisting among these objects, I thought it best for my purpose to consider these relations in the most general form possible, without referring them to any objects in particular except such as would most facilitate the knowledge of them. Perceiving further, that in order to understand these relations I should sometimes have to consider them one by one, and sometimes only to bear them in mind or embrace them in the aggregate, I thought that, in order the better to consider them individually, I should view them as subsisting between straight lines, than which I could find no objects more simple, or capable of being more distinctly represented to my imagination and senses; and on the other hand that, in order to retain them in the memory or embrace an aggregate of many, I should express them by certain characters, the briefest possible." Such is the basis of the algebraical or modern analytical geometry. The problem of the curves is solved by their reduction to a problem of straight lines; and the locus of any point is determined by its distance from two given straight lines—the axes of co-ordinates. Thus Descartes gave to modern geometry that abstract and general character in which consists its superiority to the geometry of the ancients. In another question connected with this, the problem of drawing tangents to any curve, Descartes was drawn into a controversy with Fermat (1590–1663), Roberval (1602–1673), and Desargues (1593–1662). Fermat and Descartes agreed in regarding the tangent to a curve as a secant of that curve with the two points of intersection coinciding, while Roberval regarded it as the direction of the composite movement by which the curve can be described. Both these methods, differing from that now employed, are interesting as preliminary steps towards the method of fluxions and the differential calculus. In pure algebra Descartes expounded and illustrated the general methods of solving equations up to those of the fourth degree (and believed that his method could go beyond), stated the law which connects the positive and negative roots of an equation with the changes of sign in the consecutive terms, and introduced the method of indeterminate coefficients for the solution of equations.[4] Attempts have been recklessly made to claim some of these innovations for the English algebraists Oughtred and Harriot, and others for the mathematicians of the Continent; but such assertions are based upon no proof, and, if true, would only illustrate the genius of the man who could pick out from other works all that was productive, and state it with a lucidity which makes it look his own discovery.

The *Geometry* of Descartes, unlike the other parts of his essays, is not easy reading. It dashes at once into the middle of the subject with the examination of a problem which had baffled the ancients, and seems as if it were tossed at the heads of the French geometers as a challenge. An edition of it appeared subsequently, with notes by his friend De Beaune, calculated to smooth the difficulties of the work. All along mathematics was regarded by Descartes rather as the envelope than the foundation of his method; and the "universal mathematical science" which he sought after was only the prelude of a universal science of all-embracing character.[5]

The method of Descartes rests upon the proposition that all the objects of our knowledge fall into series, of which the members are more or less known by means of one

[1] Regulæ, Œuvr. xi. 202. [2] Œuvr. xi. 219. [3] Disc. de Méthode, part ii. [4] Géométrie, book iii. [5] Œuvres, xi. 224