DESCARTES, RENÉ (1596-1650), French philosopher, was born at La Haye, in Touraine, midway between Tours and Poitiers, on the 31st of March 1596, and died at Stockholm on the 11th of February 1650. The house where he was born is still shown, and a métairie about 3 miles off retains the name of Les Cartes. His family on both sides was of Poitevin descent. Joachim Descartes, his father, having purchased a commission as counsellor in the parlement of Rennes, introduced the family into that demi-noblesse of the robe which, between the bourgeoisie and the high nobility, maintained a lofty rank in French society. He had three children, a son who afterwards succeeded to his father in the parlement, a daughter who married a M. du Crevis, and René, after whose birth the mother died.

Descartes, known as Du Perron, from a small estate destined for his inheritance, soon showed an inquisitive mind. From 1604 to 1612 he studied at the school of La Flèche, which Henry IV. had lately founded and endowed for the Jesuits. He enjoyed exceptional privileges; his feeble health excused him from the morning duties, and thus early he acquired the habit of reflection in bed, which clung to him throughout 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 who went forth to receive the heart of Henry IV. 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 married again. During the winter of 1612 he completed his preparations for the world by lessons in horsemanship and fencing; and then started as his own master to taste the pleasures of Parisian life. Fortunately he went to no 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 (qv.), now Father Mersenne, of the order of Minim friars. The withdrawal of Mersenne 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 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. French politics were at that time characterized by violence and intrigue to such an extent that Paris was no fit place for a student, and there was little honorable prospect for a soldier. Accordingly, in May 1617, Descartes set out for the Netherlands and took service in the army of Prince Maurice of Orange. 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 was distracted by the quarrels of Gomarists and Arminians. During the leisure thus arising, Descartes one day had his attention drawn to a placard in the Dutch tongue; 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, Isaac Beeckman, principal of the college of Dort, offered 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 were accustomed to throw down to all corners, 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 dishonesty of the latter, who in later years took credit for the novelty contained in a small essay on music (Compendium Musicae) which Descartes wrote at this period and entrusted to Beeckman. [fn: 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."]

After 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 on Method*. It was here that, on the eve of St Martin’s day, he “was filled with enthusiasm, and discovered the foundations of a marvelous 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. The date of his philosophical conversion is thus fixed to a day. But as yet he had only glimpses of a logical method which should invigorate the syllogism by the cooperation of ancient geometry and modern algebra. For during the year that elapsed before he left Swabia (and while 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. He was present at the battle of Weisser Berg (near Prague), where the hopes of the elector palatine were blasted (November 8, 1620), passed the winter with the army in southern Bohemia, and next year served in Hungary under Karl Bonaventura de Longueval, Graf von Buquoy or Bouquoi (1571-1621). 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 reappeared in February 1622 in Belgium, and betook himself directly to his father’s home at Rennes in Brittany.

At Rennes Descartes found little to interest him; and, after he had visited the maternal estate of which his father now put him in possession, he went 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 (equal now to more than £500). 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 doges’ 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 Mont Cenis, observing the avalanches [fn: Oeuvres v. 255], instead of, as his relatives hoped, securing a post in the French army in Piedmont.

For an instant Descartes seems to have concurred in the plan of purchasing a post at Châtellerault, but he 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 he was engaged with reflections on the nature of man, of the soul and of God, and for a while he remained invisible even to his most familiar friends. But their importunity made a hermitage in Paris impossible; a graceless friend even surprised the philosopher in bed at eleven in the morning meditating and taking notes. In disgust, Descartes started for the west to take part in the siege of La Rochelle, and entered the city with the troops (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, and in the spring of 1629 he settled in Holland. His financial affairs he had entrusted to the care of the Abbé Picot, and as his literary and scientific representative he adopted Mersenne.

Until 1649 Descartes lived in Holland. Thrice only did he revisit France—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 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. The last visit in 1648 was less fortunate. A royal order summoned him to France for new honors—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 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 neighborhood of a university or college, and the amenities of the situation. Among these towns were Franeker in Friesland, Harderwyk, Deventer, Utrecht, Leiden, Amersfoort, Amsterdam, Leeuwarden in Friesland. His favorite residences were Endegeest, Egmond op den Hoef, and Egmond the Abbey (west of Zaandam).

The time thus spent seems to have been on the whole happy, even allowing for warm discussions with the mathematicians and metaphysicians of France, and for harassing controversies in the Netherlands. Friendly agents—chiefly Catholic priests—were the intermediaries who forwarded his correspondence from Dort, Haarlem, Amsterdam and Leiden to his proper address, which he kept completely secret; and Father Mersenne sent him objections and questions. His health, which in his youth had been bad, improved. “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” [fn: Oeuvres vi. 199]. At his first coming to Franeker he arranged to get a cook acquainted with French cookery; but, [81] 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 neighbors, to ask pardon from the government for a homicide [fn: Oeuvres vii. 59]. He continued the profession of his religion. Sometimes from curiosity he went to the ministrations of Anabaptists [fn: Oeuvres vii. 173], to hear the preaching of peasants and artisans. He carried few books to Holland with him, but a Bible and the *Summa* of Thomas Aquinas were amongst them [fn: Oeuvres
vii., 181] 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” [fn: Oeuvres vi. 123]. And one motive in favor of accepting an invitation to England lay in the alleged leanings of Charles I. to the older church.

The best account of Descartes’ mental history during his life in Holland is contained in his letters, which extend 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, musical theory (in which he took a special interest), and mathematics. 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 cooperative in the Cartesian system. Two Dutch friends, Constantijn Huygens (von Zuylichem), father of the more celebrated Huygens, and Hoogheland, figure amongst the correspondents, not to mention various savants, professors and churchmen (particularly Jesuits).

His residence in the Netherlands fell in 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 aesthetics and erudition is characteristic of the most typical members of what is known as the Cartesian school, especially Malebranche. Descartes was not in any strict sense a reader. His wisdom grew mainly out of his own reflections and experiments. 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 [fn: Oeuvres x., 375]. 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 [fn: Oeuvres ix., 6]. In all his travels he studied only the phenomena of nature and human life. He was a spectator rather than an actor on the stage of the world. He entered the army, 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 favorite 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.

Thus Descartes is a type of that spirit of science to which erudition and all the heritage of the past seem but elegant 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 [fn: Oeuvres iii. 24].

Such then was the work 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. He worked hard at his book on refraction, and dissected the heads of animals in order to explain imagination and memory, which he considered physical processes [fn: Oeuvres vi., 234]. But he was not a laborious student. “I can say with truth,” he writes to the princess Elizabeth [fn: Oeuvres ix, 131], “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 expectation a from the study of anatomy and physiology went a long way. “The conservation of health,” he writes in 1646, “has always been the principal end of my studies” [fn: Oeuvres ix, 341]. 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” [fn: Oeuvres vi., 89]. 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” [fn: Oeuvres vi., 210].

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 [revolution] round the sun [fn: Oeuvres vi., 73]. But towards the end of year 1633 we find him writing as follows:--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 hate 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” [fn: Oeuvres vi., 239]. He has also seen a copy of Galileo’s condemnation at Liége (September 20, 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, 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” [fn: Oeuvres vi., 248]. The consequence of these reports of the hostility of the church 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 until 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 foetus*, were given to the world by his admirer Claude Clerselier (1614-1684) in 1664. Descartes was not disposed to be a martyr; he had a sincere respect for the church, and had no wish 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 [82] 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 [fn: *Oeuvres* vi., 276], “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 Leiden (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 vérité 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 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 youthful Dutch universities the effect of the 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 of from personal intercourse with Descartes. Renery only survived five years at Utrecht, and it was reserved for Heinrich Regius (van 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 than judgment, he propounded theses bringing into relief the points in which the new doctrines clashed with the old. The attack was opened by Gisbert Voët, foremost among the orthodox theological professors and clergy of Utrecht. 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. The magisterial views seem to have prevailed in the professoriate, which formally in March 1642 expressed its disapprobation of the new philosophy as well as of its expositors. As yet Descartes was not directly attacked. Voët now issued, under the name of Martin Schoock, one of his pupils, a pamphlet with the title of Methodus novae philosophiae 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 letter, published at Amsterdam in 1643. 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 [fn: Oeuvres ix., 250] 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 on Method Descartes had sketched the main points in his new views, with a mental autobiography which Discourse might explain their origin, and with some suggestions 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 dispatched 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. 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 animae immortalitate* (though it was in fact not the immortality but the immateriality of the mind, or, as the second edition described it, *animae humanae 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’ letters. The anonymous objections are very much the statement of common-sense against philosophy; those of Caterus criticize 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 and morality; while those of Hobbes (q.v.) 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” standpoint. 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 philosophiae*, 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” [fn: Princip. L. iii. S. 45.]. 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 Leiden. 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 Mediations; an attempt to prove the existence of God savored, as they thought, of atheism and heresy. When Descartes complained to the authorities of this unfair treatment [fn: Oeuvres x., 26.] the only reply was an order by which all mention of the name of Cartesianism, whether favorable 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 [83] civility, and the name of Descartes was no longer proscribed. But other annoyances were not wanting from unfaithful disciples and unsympathetic critics. The Instantiae 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 Heinrich Regius of his work on physical philosophy (Fundamenta physices, 1646) 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 Clereslier (the French translator of the Objections and Responses), whom he had become acquainted with in Paris. Through Clereslier he came to know Pierre Chanut, who in 1645 was sent as French ambassador to the court of Sweden. Queen Christina 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) [fn: *Oeuvres* x., 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 enclosed 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 unsuited for a man who wished to be his own master. The young queen 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. 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, 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. On the 11th of February he died. The queen wished to bury him at the feet of the Swedish kings, and to raise a costly mausoleum in his honor; 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 a modern statue has been erected to him at Tours, with an inscription on the pedestal: “Je pense, donc je suis.” [I think, therefore I am; Latin: Cogito ergo sum].

Descartes never married, and 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 [fn Oeuvres x., 53.]. In person he was small, 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.

Philosophy.—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 [fn: Regulae, Oeuvres xi., 202.]. 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 reassertion 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.” 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” [fn: Oeuvres xi., 219]. 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 *Ad logisticae speciosam notae prior* of François Viète (1540-1603), supplied to some extent the means of generalizing geometry. And the algebraists or arithmeticians of the 16th century, such as Luca Pacioli (Lucas de Borgo), Geronimo or Girolamo Cardano (1501-1576), and Niccola Tartaglia (1506-1559), 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, Michael Stifel or Stiefel (1487-1567), 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,” [fn: *Disc. de méthode*, part ii.]
he says in the *Method*, “of attempting to master all [84] 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 algebraic 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 coordinates. 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 Pierre (de) Fermat (1601-1663), Gilles Personne de Roberval (1602-1675), and Girard Desargues (1593-1661). 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. These innovations have been attributed on inadequate evidence to other algebraists, e.g. William Oughtred (1575-1660) and Thomas Harriot (1560-1621).
The *Geometry* of Descartes, unlike the other parts of his essays, is not easy reading. It dashes at once into the middle of the subjects 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 Florimond de Beaune (1601-1652), 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 [fn: *Oeuvres* xi., 224].

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 another. In every such series or group there is a dominant element, simple and irresoluble, the standard on which the rest of the series depends, and hence, so far as that group or series is concerned, absolute. The other members of the group are relative and dependent, and only to be understood as in various degrees subordinate to the primitive conception. The characteristic by which we recognize the fundamental element in a series is its intuitive or self-evident character; it is given by “the evident conception of a healthy and attentive mind so clear and distinct that no doubt is left” [fn *Oeuvres* xi., 212.]. Having discovered this prime or absolute member of the group, we proceed to consider the degrees in which the other members enter into relation with it. Here deduction comes into play to show the dependence of one term upon the others; and, in the case of a long chain of intervening links, the problem for intelligence is so to enunciate every element, and so to repeat the connection that we may finally grasp all the links of the chain in one. In this way we, as it were, bring the causal or primal term and its remotest dependent immediately together, and raise a derivative knowledge into one which is primary and intuitive. Such are the four points of Cartesian method:-- (1) Truth requires a clear and distinct conception of its object, excluding all doubt; (2) the objects of knowledge naturally fall into series or groups; (3) in these groups investigation must begin with a simple and indecomposable element, and pass from it to the more complex and relative elements; (4) an exhaustive and immediate grasp of the relations and interconnection of these elements is necessary for knowledge in the fullest sense of that word [fn: *Disc. de méthode*, part. ii.].
“There is no question,” he says in anticipation of Locke and Kant, “more important to solve than that of knowing what human knowledge is and how far it extends.” “This is a question which ought to be asked at least once in their lives by all who seriously wish to gain wisdom. The inquirer will find that the first thing to know is intellect, because on it depends the knowledge of all other things. Examining next what immediately follows the knowledge of pure intellect, he will pass in review all the other means of knowledge, and will find that they are two (or three), the imagination and the senses (and the memory). He will therefore devote all his care to examine and distinguish these three means of knowledge; and seeing that truth and error can, properly speaking, be only in the intellect, and that the two other modes of knowledge are only occasions, he will carefully avoid whatever can lead him astray” [fn: Oeuvres xi., 243.]. This separation of intellect from sense, imagination, and memory is the cardinal precept of the Cartesian logic; it marks off clear and distinct (i.e. adequate and vivid) from obscure, fragmentary and incoherent conceptions.

The Discourse of Method and the Meditations apply what the Rules for the Direction of the Mind had regarded in particular instances to our conceptions of the world as a whole. They propose, that is, to find a simple and indecomposable point, or absolute element, which gives to the world and thought their order and systematization. The grandeur of this attempt is perhaps unequalled in the annals of philosophy. The three main steps in the argument are the veracity of our thought when that thought is true to itself, the inevitable uprising of thought from its fragmentary aspects in our habitual consciousness to the infinite and perfect existence which God is, and the ultimate reduction of the material universe to extension and local movement. There are the central dogmas of logic, metaphysics, and physics, from which start the subsequent inquiries of Locke, Leibniz, and Newton. They are also the direct antitheses to the skepticism of Montaigne and Pascal, to the materialism of Gassendi and Hobbes, and to the superstitious anthropomorphism which defaced the reawakening sciences of nature. Descartes laid down the lines on which modern philosophy and science were to build. But himself no trained metaphysician, and unsusceptible to the lessons of history, he gives but fragments of a system which are held together, not by their intrinsic consistency, but by the vigor of his personal conviction
transcending the weaknesses and collisions of his several arguments. “All my opinions,” he says, “are so conjoined, and depend so closely upon one another, that it would be impossible to appropriate one without knowing them all” [fn: Oeuvres vii., 381.]. Yet every disciple of Cartesianism seems to disprove the dictum by his example.

The very moment when we begin to think, says Descartes, when we cease to be merely receptive, when we draw back and fix our attention on any point whatever of our belief,—that moment doubt begins. If we even stop for an instant to ask ourselves how a word ought to be spelled, the deeper we ponder that one word by itself the more hopeless grows the hesitation. The doubts thus awakened must not be stifled, but pressed systematically on to the point, if such a point there be, where doubt confutes itself. The doubt as to the details is natural; it [85] is no less natural to have recourse to authority to silence the doubt. The remedy proposed by Descartes is (while not neglecting our duties to others, ourselves and God) to let doubt range unchecked through the whole fabric of our customary convictions. One by one they refuse to render any reasonable account of themselves; each seems a mere chance, and the whole tends to elude us like a mirage which some malignant power creates for our illusion. Attacked in detail, they vanish one after another into as many teasing spectra of uncertainty. We are seeking from them what they cannot give. But when we have done our worst in unsettling them, we come to an ultimate point in the fact that it is we who are doubting, we who are thinking. We may doubt that we have hands or feet, that we sleep or wake, and that there is a world of material things around us; but we cannot doubt that we are doubting. We are certain that we are thinking, and in so far as we are thinking we are. Je pense, donc je suis. In other words, the criterion of truth is a clear and distinct conception, excluding all possibility of doubt.

The fundamental point thus established is the veracity of consciousness when it does not go beyond itself, or does not postulate something which is external to itself. At this point Gassendi arrested Descartes and addressed his objections to him as pure intelligence, O mens! [RAH: O Mind! = Descartes; O Flesh! = Gassendi] But even this mens, or mind, is but a point—we have found no guarantee as yet for its continuous existence. The analysis must be carried deeper, if we are to gain any further conclusions.
Amongst the elements of our thought there are some which we can make and unmake at our pleasure; there are others which come and go without our wish; there is also a third class which is of the very essence of our thinking, and which dominates our conceptions. We find that all our ideas of limits, sorrows and weaknesses presuppose an infinite, perfect and ever-blessed something beyond them and including them, that all our ideas, in all their series, converge to one central idea, in which they find their explanation. The formal fact of thinking is what constitutes our being; but this thought leads us back, when we consider its concrete contents, to the necessary presupposition on which our ideas depend, the permanent cause on which they and we as conscious beings depend. We have therefore the idea of an infinite, perfect and all-powerful being—an idea which cannot be the creation of ourselves, and must be given by some being who really possesses all that we in idea attribute to him. Such a being he identifies with God. But the ordinary idea of God can scarcely be identified with such a conception. “The majority of men,” he says himself, “do not think of God as an infinite and incomprehensible being, and as the sole author from whom all things depend; they go no further than the letters of his name” [fn: Oeuvres vi., 132.]. The vulgar almost imagine him as a finite thing.

The God of Descartes is not merely the creator of the material universe; he is also the father of all truth in the intellectual world. “The metaphysical truths,” he says, “styled eternal have been established by God, and, like the rest of his creatures, depend entirely upon him. To say that these truths are independent of him is to speak of God as a Jupiter or a Saturn,—to subject him to Styx and the Fates” [fn: Oeuvres vi., 109.]. The laws of thought, the truths of number, are the decrees of God. The expression is anthropomorphic, no less than the dogma of material creation; but it is an attempt to affirm the unity of the intellectual and the material world. Descartes establishes a philosophic monotheism, by which the medieval polytheism of substantial forms, essences and eternal truths fades away before God, who is the ruler of the intellectual world no less than of the kingdom of nature and of grace.

To attach a clear and definite meaning to the Cartesian doctrine of God, to show how much of it comes from the Christian theology and how much from the logic of idealism, how far the conception of a personal being as
creator and preserver mingles with the pantheistic conception of an
infinite and perfect something which is all in all, would be to go beyond
Descartes and to ask for a solution of difficulties of which he was scarcely
aware. It seems impossible to deny that the tendency of his principles and
his arguments is mainly in the line of a metaphysical absolute, as the
necessary completion and foundation of all being and knowledge.
Through the truthfulness of that God as the author of all truth he derives a
guarantee for our perceptions in so far as these are clear and distinct. And
it is in guaranteeing the veracity of our dear and distinct conceptions that
the value of his deduction of God seems in his own estimate to rest. All
conceptions which do not possess these two attributes—of being vivid in
themselves and discriminated from all others—cannot be true. But the
larger part of our conceptions are in such a predicament. We think of
things not in the abstract elements of the things themselves, but in
connection with, and in language which presupposes, other things. Our
idea of body, e.g., involves color and weight, and yet when we try to think
carefully, and without assuming anything, we find that we cannot attach
any distinct idea to these terms when applied to body. In truth therefore
these attributes do not belong to body at all; and if we go on in the same
way testing the received qualities of matter, we shall find that in the last
resort we understand nothing by it but extension, with the secondary and
derivative characters of divisibility and mobility.

But it would again be useless to ask how extension as the characteristic
attribute of matter is related to mind which thinks, and how God is to be
regarded in reference to extension. The force of the universe is swept up
and gathered in God, who communicates motion to the parts of extension,
and sustains that motion from moment to moment; and in the same way
the force of mind has really been concentrated in God. Every moment one
expects to find Descartes saying with Hobbes that mans thought has
created God, or with Spinoza and Malebranche that it is God who really
thinks in the apparent thought of man. After all, the metaphysical
theology of Descartes, however essential in his own eyes, serves chiefly as
the ground for constructing his theory of man and of the universe. His
fundamental hypothesis relegates to God all forces in their ultimate origin.
Hence the world is left open for the free play of mechanics and geometry.
The disturbing conditions of will, life and organic forces are eliminated
from the problem; he starts with the clear and distinct idea of extension,
figured and moved, and thence by mathematical laws he gives a hypothetical explanation of all things. Such explanation of physical phenomena is the main problem of Descartes, and it goes on encroaching upon territories once supposed proper to the mind. Descartes began with the certainty that we are thinking beings; that region remains untouched; but up to its very borders the mechanical explanation of nature reigns unchecked.

The physical theory, in its earlier form in *The World*, and later in the *Principles of Philosophy* (which the present account follows), rests upon the metaphysical conclusions of the *Mediations*. It proposes to set forth the genesis of the existing universe from principles which can be plainly understood, and according to the acknowledged laws of the transmission of movement. The idea of force is one of those obscure conceptions which originate in an obscure region, in the sense of muscular power. The true physical conception is motion, the ultimate ground of which is to be sought in God’s infinite power. Accordingly the quantity of movement in the universe, like its mover, can neither increase nor diminish. The only circumstance which physics has to consider is the transference of movement from one particle to another, and the change of its direction. Man himself cannot increase the sum of motion; he can only alter its direction. The whole conception of force may disappear from a theory of the universe; and we can adopt a geometrical definition of motion as the shifting of one body from the neighborhood of those bodies which immediately touch it, and which are assumed to be at rest, to the neighborhood of other bodies. Motion, in short, is strictly locomotion, and nothing else.

Descartes has laid down three laws of nature, and seven secondary laws regarding impact. The latter are to a large extent incorrect. The first law affirms that every body, so far as it is altogether unaffected by extraneous causes, always [86] perseveres in the same state of motion or of rest; and the second law that simple or elementary motion is always in a straight line. These doctrines of inertia, and of the composite character of curvilinear motion, were scarcely apprehended even by Kepler or Galileo; but they follow naturally from the geometrical analysis of Descartes.
Extended body has no limits to its extent, though the power of God has divided it in lines discriminating its parts in endless ways. The infinite universe is infinitely full of matter. Empty space, as distinguished from material extension, is a fictitious abstraction. There is no such thing really as a vacuum, any more than there are atoms or ultimate indivisible particles. In both these doctrines of à priori science Descartes has not been subverted, but, if anything, corroborated by the results of experimental physics; for the so-called atoms of chemical theory already presuppose, from the Cartesian point of view, certain aggregations of the primitive particles of matter. Descartes regards matter as uniform in character throughout the universe; he anticipates, as it were, from his own transcendental ground, the revelations of spectrum analysis as applied to the sun and stars. We have then to think of a full universe of matter (and matter = extension) divided and figured with endless variety, and set (and kept) in motion by God; and any sort of division, figure and motion will serve the purposes of our supposition as well as another. “Scarcely any supposition,” [fn: Princip. Part iii., 47.] he says, “can be made from which the same result, though possibly with greater difficulty, might not be deduced by the same laws of nature; for since, in virtue of these laws, matter successively assumes all the forms of which it is capable, if we consider these forms in order, we shall at one point or other reach the existing form of the world, so that no error need here be feared from a false supposition.” As the movement of one particle in a closely-packed universe is only possible if all other parts move simultaneously, so that the last in the series steps into the place of the first; and as the figure and division of the particles varies in each point in the universe, there will inevitably at the same instant result throughout the universe an innumerable host of more or less circular movements, and of vortices or whirlpools of material particles varying in size and velocity. Taking for convenience a limited portion of the universe, we observe that in consequence of the circular movement, the particles of matter have their corners pared off by rubbing against each other; and two species of matter thus arise, one consisting of small globules which continue their circular motion with a (centrifugal) tendency to fly off from the center as they swing round the axis of rotation, while the other, consisting of the fine dust—the filings and parings of the original particles—gradually becoming finer and finer, and losing its velocity, tends (centripetally) to accumulate in the center of the vortex, which has been gradually left free
by the receding particles of globular matter. This finer matter which collects in the center of each vortex is the first matter of Descartes—it constitutes the sun or star. The spherical particles are the second matter of Descartes, and their tendency to propel one another from the center in straight lines towards the circumference of each vortex is what gives rise to the phenomenon of light radiating from the central star. This second matter is atmosphere or firmament, which envelops and revolves around the central accumulation of first matter.

A third form of matter is produced from the original particles. As the small filings produced by friction seek to pass through the interstices between the rapidly revolving spherical particles in the vortex, they are detained and become twisted and channeled in their passage, and when they reach the edge of the inner ocean of solar dust they settle upon it as the froth and foam produced by the agitation of water gathers upon its surface. These form what we term spots in the sun. In some cases they come and go, or dissolve into an aether round the sun; but in other cases they gradually increase until they form a dense crust round the central nucleus. In course of time the star, with its expansive force diminished, suffers encroachments from the neighboring vortices, and at length they catch it up. If the velocity of the decaying star be greater than that of any part of the vortex which has swept it up, it will ere long pass out of the range of that vortex, and continue its movement from one to another. Such a star is a comet. But in other cases the encrusted star settles in that portion of the revolving vortex which has a velocity equivalent to its own, and so continues to revolve in the vortex, wrapped in its own firmament. Such a reduced and impoverished star is a planet; and the several planets of our solar system are the several vortices which from time to time have been swept up by the central sun-vortex. The same considerations serve to explain the moon and other satellites. They too were once vortices, swallowed up by some other, which at a later day fell a victim to the sweep of our sun.

Such in mere outline is the celebrated theory of vortices, which for about twenty years after its promulgation reigned supreme in science, and for much longer time opposed a tenacious resistance to rival doctrines. It is one of the grandest hypotheses which ever have been formed to account by mechanical processes for the movements of the universe. While
chemistry rests in the acceptance of ultimate heterogeneous elements, the vortex-theory assumed uniform matter through the universe, and reduced cosmic physics to the same principles as regulate terrestrial phenomena. It ended the old Aristotelian distinction between the sphere beneath the moon and the starry spaces beyond. It banished the spirits and genii, to which even Kepler had assigned the guardianship of the planetary movements; and, if it supposes the globular particles of the envelope to be the active force in carrying the earth round the sun, we may remember that Newton himself assumed an aether for somewhat similar purposes. The great argument on which the Cartesian opposition to the Newtonian doctrine was that attraction was an occult quality, not wholly intelligible by the aid of mere mechanics. The Newtonian theory is an analysis of the elementary movements which in their combination determine the planetary orbits, and gives the formula of the proportions according to which they act. But the Cartesian theory, like the later speculations of Kant and Laplace, proposes to give a hypothetical explanation of the circumstances and motions which in the normal course of things led to the state of things required by the law of attraction. In the judgment of D’Alembert the Cartesian theory was the best that the observations of the age admitted; and its explanation of gravity was one of the most ingenious hypotheses which philosophy ever imagined. That the explanation fails in detail is undoubted: it does not account for the ellipticity of the planets; it would place the sun, not in one focus, but in the center of the ellipse; and it would make gravity directed towards the center only under the equator. But these defects need not blind us to the fact that this hypothesis made the mathematical progress of Hooke, Borelli, and Newton much more easy and certain. Descartes professedly assumed a simplicity in the phenomena which they did not present. But such a hypothetical simplicity is the necessary step for solving the more complex problems of nature. The danger lies not in forming such hypotheses, but in regarding them as final, or as more than an attempt to throw light upon our observation of the phenomena. In doing what he did, Descartes actually exemplified that reduction of the processes of nature to mere transposition of the particles of matter, which in different ways was a leading idea in the minds of Bacon, Hobbes, and Gassendi. The defects of Descartes lie rather in his apparently imperfect apprehension of the principle of movements uniformly accelerated which his contemporary Galileo had illustrated and insisted upon, and in the
indistinctness which attaches to his views of the transmission of motion in cases of impact. It should be added that the modern theory of vortex-atoms (Lord Kelvin’s) to explain the constitution of matter has but slight analogy with Cartesian doctrine, and finds a parallel, if anywhere, in a modification of that doctrine by Malebranche.

Besides the last two parts of the Principles of Philosophy, the physical writings of Descartes include the Dioptrics and Meteors, as well as passages in the letters. His optical investigations are perhaps the subject in which he most contributed to the progress [87] of science; and the lucidity of exposition which marks his Dioptrics stands conspicuous even amid the generally luminous style of his works. Its object is a practical one, to determine by scientific considerations the shape of lens best adapted to improve the capabilities of the telescope, which had been invented not long before. The conclusions at which he arrives have not been so useful as he imagined, in consequence of the mechanical difficulties. But the investigation by which he reaches them has the merit of first prominently publishing and establishing the law of the refraction of light. Attempts have been made, principally founded on some remarks of Huygens, to show that Descartes had learned the principles of refraction from the manuscript of a treatise by Willebrord Snell, but the facts are uncertain; and, so far as Descartes founds his optics on any one, it is probably on the researches of Kepler. In any case the discovery is to some extent his own, for his proof of the law is founded upon the theory that light is the propagation of the aether in straight lines from the sun or luminous body to the eye (see Light). Thus he approximates to the wave theory of light, though he supposed that the transmission of light was instantaneous. The chief of his other contributions to optics was the explanation of the rainbow—an explanation far from complete, since the unequal refrangibility of the rays of light was yet undiscovered—but a decided advance upon his predecessors, notably on the De radiis visus et lucis (1611) of Marc-Antonio de Dominis, archbishop of Spalato.

If Descartes had contented himself with thus explaining the phenomena of gravity, heat, magnetism, light and similar forces by means of the molecular movements of his vortices, even such a theory would have excited admiration. But he did not stop short in the region of what is usually termed physics. Chemistry and biology are alike swallowed up in
the one science of physics, and reduced to a problem of mechanism. This theory, he believed, would afford an explanation of every phenomenon whatever, and in nearly every department of knowledge he has given specimens of its power. But the most remarkable and daring application of the theory was to account for the phenomena of organic life, especially in animals and man. “If we possessed a thorough knowledge,” he says [fn: *Oeuvres* iv., 494.], “of all the parts of the seed of any species of animal (e.g. man), we could from that alone, by reasons entirely mathematical and certain, deduce the whole figure and conformation of each of its members, and, conversely, if we knew several peculiarities of this conformation, we could from these deduce the nature of its seed.” The organism in this way is regarded as a machine, constructed from the particles of the seed, which in virtue of the laws of motion have arranged themselves (always under the governing power of God) in the particular animal shape in which we see them. The doctrine of the circulation of the blood, which Descartes adopted from Harvey, supplied additional arguments in favor of his mechanical theory, and he probably did much to popularize the discovery. A fire without light, compared to the heat which gathers in a haystack when the hay has been stored before it was properly dry—heart, in short, as an agitation of the particles—is the motive cause of the contraction and dilatations of the heart. Those finer particles of the blood which become extremely rarefied during this process pass off in two directions—one portion, and the least important in the theory, to the organs of generation, the other portion to the cavities of the brain. There not merely do they serve to nourish the organ, they also give rise to a fine ethereal flame or wind through the action of the brain upon them, and thus form the so-called “animal” spirits. From the brain these spirits are conveyed through the body by means of the nerves, regarded by Descartes as tubular vessels, resembling the pipes conveying the water of a spring to act upon the mechanical appliances in an artificial fountain. The nerves conduct the animal spirits to act upon the muscles, and in their turn convey the impressions of the organs to the brain.

Man and the animals as thus described are compared to automata, and termed machines. The vegetative and sensitive souls which the Aristotelians had introduced to break the leap between inanimate matter, and man are ruthlessly swept away; only one soul, the rational, remains, and that is restricted to man. One hypothesis supplants the various
principles of life; the rule of absolute mechanism is as complete in the animal as in the cosmos. Reason and thought, the essential quality of the soul, do not belong to the brutes; there is an impassable gulf fixed between man and the lower animals. The only sure sign of reason is the power of language—i.e. of giving expression to general ideas; and language in that sense is not found save in man. The cries of animals are but the working of the curiously-contrived machine, in which, when one portion is touched in a certain way, the wheels and springs concealed in the interior perform their work, and, it may be, a note supposed to express joy or pain is evolved; but there is no consciousness or feeling. “The animals act naturally and by springs, like a watch” [fn: Oeuvres ix., 426]. “The greatest of all the prejudices we have retained from our infancy is that of believing that the beasts think” [fn: Oeuvres x., 204.] If the beasts can properly be said to see at all, “they see as we do when our mind is distracted and keenly applied elsewhere; the images of outward objects paint themselves on the retina, and possibly even the impressions made in the optic nerves determine our limbs to different movements, but we feel nothing of it all, and move as if we were automata” [fn: Oeuvres vi., 339.]. The sentience of the animal to the lash of his tyrant is not other than the sensitivity of the plant to the influences of light and heat. It is not much comfort to learn further from Descartes that “he denies life to no animal, but makes it consist in the mere heat of the heart. Nor does he deny them feeling in so far as it depends on the bodily organs” [fn: Oeuvres x., 208.].

Descartes, with an unusual fondness for the letter of Scripture, quotes oftener than once in support of this monstrous doctrine the dictum, “the blood is the life”; and he remarks, with some sarcasm possibly, that it is a comfortable theory for the eaters of animal flesh. And the doctrine found acceptance among some whom it enabled to get rid of the difficulties raised by Montaigne and those who allowed more difference between animal and animal than between the higher animals and man. It also encouraged vivisection—a practice common with Descartes himself [fn: Oeuvres v., 452 & 454.]. The recluses of Port Royal seized it eagerly, discussed automatism, dissected living animals in order to show to a morbid curiosity the circulation of the blood, were careless of the cries of tortured dogs, and finally embalmed the doctrine in a syllogism of their logic,—No matter thinks; every soul of beast is matter: therefore no soul of beast thinks.
But whilst all the organic processes in man go on mechanically, and though by reflex action he may repel attack unconsciously, still the first affirmation of the system was that man was essentially a thinking being; and, while we retain this original dictum, it must not be supposed that the mind is a mere spectator, or like the boatman in the boat. Of course a unity of nature is impossible between mind and body so described. And yet there is a unity of composition, a unity so close that the compound is "really one and in a sense indivisible. You cannot in the actual man cut soul and body asunder; they interpenetrate in every member. But there is one point in the human frame—a point midway in the brain, single and free, which may in a special sense be called the seat of the mind. This is the so-called carnion, or pineal gland, where in a minimized point the mind on one hand and the vital spirits on the other meet and communicate. In that gland the mystery of creation is concentrated; thought meets extension and directs it; extension moves towards thought and is perceived. Two clear and distinct ideas, it seems, produce an absolute mystery. Mind, driven from the field of extension, erects its last fortress in the pineal gland. In such a state of despair and destitution there is no hope for spiritualism, save in God; and Clauberg, Geulinex and Malebranche all take refuge under the shadow of his wings to escape the tyranny of extended matter.

In the psychology of Descartes there are two fundamental modes of thought,—perception and volition. "It seems to me," he says, "that in receiving such and such an idea the mind is passive, and that it is active only in volition; that its ideas are put in it partly by the objects which touch the senses, partly by the impressions in the brain, and partly also by the dispositions which have preceded in the mind itself and by the movements of its will" [fn: Oeuvres ix., 166.]. The will, therefore, as being more originative, has more to do with true or false judgments than the understanding. Unfortunately, Descartes is too lordly a philosopher to explain distinctly what either understanding or will may mean. But we gather that in two directions our reason is bound up with bodily conditions, which make or mar it, according as the will, or central energy of thought, is true to itself or not. In the range of perception, intellect is subjected to the material conditions of sense, memory, and imagination; and in infancy, when the will has allowed itself to assent precipitately to the conjunctions presented to it by these material processes, thought has
become filled with obscure ideas. In the moral sphere the passions or emotions (which Descartes reduces to the six primitive forms of admiration, love, hatred, desire, joy, and sadness) are the perceptions or sentiments of the mind, caused and maintained by some movement of the vital spirits, but specially referring to the mind only. The presentation of some object of dread, for example, to the eye has or may have a double effect. On one hand the animal spirits “reflected” [fn: Passions de l’âme, 36.] from the image formed on the pineal gland proceed through the nervous tubes to make the muscles turn the back and lift the feet, so as to escape the cause of the terror. Such is the reflex and mechanical movement independent of the mind. But, on the other hand, the vital spirits cause a movement in the gland by which the mind perceives the affection of the organs, learns that something is to be loved or hated, admired or shunned. Such perceptions dispose the mind to pursue what nature dictates as useful. But the estimate of goods and evils which they give is indistinct and unsatisfactory. The office of reason is to give a true and distinct appreciation of the values of goods and evils; or firm and determinate judgments touching the knowledge of good and evil are our proper arms against the influence of the passions [fn: Passions de l’âme, 48]. We are free, therefore, through knowledge: ex magna luce in intellectu sequitur magna propensio in voluntate, and omnis peccans est ignorans. “If we clearly see that what we are doing is wrong, it would be impossible for us to sin, so long as we saw it in that light’ [fn: Oeuvres ix., 170.]. Thus the highest liberty, as distinguished from mere indifference, proceeds from clear and distinct knowledge, and such knowledge can only be attained by firmness and resolution, i.e. by the continued exercise of the will. Thus in the perfection of man, as in the nature of God, will and intellect must be united. For thought, will is as necessary as understanding. And innate ideas therefore are mere capacities or tendencies,--possibilities which apart from the will to think may be regarded as nothing at all.

The Cartesian School.—The philosophy of Descartes fought its first battles and gained its first triumphs in the country of his adoption. In his lifetime his views had been taught in Utrecht and Leiden. In the universities of the Netherlands and of lower Germany, as yet free from the conservatism of the old-established seats of learning, the new system gained an easy victory over Aristotelianism, and, as it was adapted for lectures and examinations, soon became almost as scholastic as the
doctrines it had supplanted. At Leiden, Utrecht, Groningen, Franeker, Breda, Nimeguen, Harderwyk, Duisburg and Herborn, and at the Catholic university of Louvain, Cartesianism was warmly expounded and defended in seats of learning, of which many are now left desolate, and by adherents whose writings have for the most part long lost interest for any but the antiquary.

The Cartesianism of Holland was a child of the universities, and its literature is mainly composed of commentaries upon the original texts, of theses discussed in the schools, and of systematic expositions of Cartesian philosophy for the benefit of the student. Three names stand out in this [89] Cartesian professoriate,—Wittich, Clauberg, and Geulincx. Christoph Wittich (1625-1687), professor at Duisburg and Leiden, is a representative of the moderate followers who professed to reconcile the doctrines of their school with the faith of Christendom and to refute the theology of Spinoza. Johann Clauberg (q.v.) commented clause by clause upon the Meditations of Descartes; but he specially claims notice for his work *De corporis et animae in homine conjunctione*, where he maintains that the bodily movements are merely procatactarctic causes (i.e. antecedents, but not strictly causes) of the mental action, and sacrifices the independence of man to the omnipotence of God. The same tendency is still more pronounced in Arnold Geulincx (q.v.). With him the reciprocal action of mind and body is altogether denied; they resemble two clocks, so made by the artificer as to strike the same hour together. The mind can act only upon itself; beyond that limit, the power of God must intervene to make any seeming interaction possible between body and soul. Such are the half-hearted attempts at consistency in Cartesian thought, which eventually culminate in the pantheism of Spinoza (see CARTESIANISM).

Descartes occasionally had not scrupled to interpret the Scriptures according to his own tenets, while still maintaining, when their letter contradicted him, that the Bible was not meant to teach the sciences. Similar tendencies are found amongst his followers. Whilst Protestant opponents put him in the list of atheists like Vanini, and the Catholics held him as dangerous as Luther or Calvin, there were zealous adherents who ventured to prove the theory of vortices in harmony with the book of Genesis. It was this rationalistic treatment of the sacred writings which helped to confound the Cartesians with the allegorical school of John
Cocceius, as their liberal doctrines in theology justified the vulgar identification of them with the heresies of Socinian and Arminian. The chief names in this advanced theology connected with Cartesian doctrines are Ludwig Meyer, the friend and editor of Spinoza, author of a work termed *Philosophia scripturae interpres* (1666); Balthasar Bekker, whose *World Bewitched* helped to discredit the superstitious fancies about the devil; and Spinoza, whose *Tractatus theologico-politicus* is in some respects the classical type of rational criticism up to the present day. Against this work and the *Ethics* of Spinoza the orthodox Cartesians (who were in the majority), no less than skeptical hangers-on like Bayle, raised an all but universal howl of reprobation, scarcely broken for about a century.

In France Cartesianism won society and literature before it penetrated into the universities. Clerselier (the friend of Descartes and his literary executor), his son-in-law Rohault (who achieved that relationship through his Cartesianism), and others, opened their houses for readings to which the intellectual world of Paris—its learned professors not more than the courtiers and the fair sex, flocked to hear the new doctrines explained, and possibly discuss their value. Grand seigneurs, like the prince of Condé, the duc de Nevers, and the marquis de Vardes, were glad to vary the monotony of their feudal castles by listening to the eloquent rehearsals of Malebranche or Regis. And the salons of Mme de Sévigné, of her daughter Mme de Grignan, and of the duchesse de Maine for a while gave the questions of philosophy a place among the topics of polite society, and furnished to Molière the occasion of his *Femmes savantes*. The Château of the duc de Luynes, the translator of the *Meditations*, was the home of a Cartesian club, that discussed the questions of automatism and of the composition of the sun from filings and parings, and rivaled Port Royal in its vivisections. The cardinal de Retz in his leisurely age at Commercy found amusement in presiding at disputations between the more moderate Cartesians and Don Robert Desgabets, who interpreted Descartes in an original way of his own. Though rejected by the Jesuits, who found peripatetic formulae a faithful weapon against the enemies of the church, Cartesianism was warmly adopted by the Oratory, which saw in Descartes something of St Augustine, by Port Royal, which discovered a connection between the new system and Jansenism, and by some amongst the Benedictines and the order of Ste Geneviève.
The popularity which Cartesianism thus gained in the social and literary circles of the capital was largely increased by the labors of Pierre-Sylvain Regis (1632-1707). On his visit to Toulouse in 1665, with a mission from the Cartesian chiefs, his lectures excited boundless interest; ladies threw themselves with zeal and ability into the study of philosophy; and Regis himself was made the guest of the civic corporation. In 1671 scarcely less enthusiasm was roused in Montpellier; and in 1680 he opened a course of lectures at Paris, with such acceptance that hearers had to take their seats in advance. Regis, by removing the paradoxes and adjusting the metaphysics to the popular powers of apprehension, made Cartesianism popular, and reduced it to a regular system.

But a check was at hand. Descartes, in his correspondence with the Jesuits, had shown an almost cringing eagerness to have their powerful organization on his side. Especially he had written to Père Mesland, one of the order, to show how the Catholic doctrine of the eucharist might be made compatible with his theories of matter. But his undue haste to arrange matters with the church only served to compromise him more deeply. Unwise admirers and malicious opponents exaggerated the theological hearings of his system in this detail; and the efforts of the Jesuits succeeded in getting the works of Descartes, in November 1663, placed upon the index of prohibited books, donec corrigantur. Thereupon the power of church and state enforced by positive enactments the passive resistance of old institutions to the novel theories. In 1667, the oration at the interment was forbidden by royal order. In 1669, when the chair of philosophy at the Collège Royal fell vacant, one of the four selected candidates had to sustain a thesis against the pretended new philosophy of Descartes. In 1671 the archbishop of Paris, by the kings order, summoned the heads of the university to his presence, and enjoined them to take stricter measures against philosophical novelties dangerous to the faith. In 1673 a decree of the parlement against Cartesian and other unlicensed theories was on the point of being issued, and was only checked in time by the appearance of a burlesque mandamus against the intruder Reason, composed by Boileau and some of his brother-poets. Yet in 1675 the university of Angers was empowered to repress all Cartesian teaching within its domain, and actually appointed a commission charged to look for such heresies in the theses and the students note-books of the college of Anjou belonging to the Oratory. In 1677 the university of Caen
adopted not less stringent measures against Cartesianism. And so great was the influence of the Jesuits, that the congregation of St Maur, the canons of Ste Geneviève, and the Oratory laid their official ban on the obnoxious doctrines. From the real or fancied *rapprochements* between Cartesianism and Jansenism, it became for a while impolitic, if not dangerous, to avow too loudly a preference for Cartesian theories. Regis was constrained to hold back for ten years his *System of Philosophy*; and when it did appear, in 1690, the name of Descartes was absent from the title-page. There were other obstacles besides the mild persecutions of the church. Pascal and other members of Port Royal openly expressed their doubts about the place allowed to God in the system; the adherents of Gassendi met it by resuscitating atoms; and the Aristotelians maintained their substantial forms as of old; the Jesuits argued against the arguments for the being of God, and against the theory of innate ideas; whilst Pierre-Daniel Huet (1630-1721), bishop of Avranches, once a Cartesian himself, made a vigorous onslaught on the contempt in which his former comrades held literature and history, and enlarged on the vanity of all human aspirations after rational truth.

The greatest and most original of the French Cartesians was Malebranche (q.v.). His *Recherche de la vérité*, in 1674, was the baptism of the system into a theistic religion which borrowed its imagery from Augustine; it brought into prominence the metaphysical base which Louis Delaforge, Jacques Rohault, and Regis had neither cared for nor understood. But this doctrine was a criticism and a divergence, no less than a consequence, from the principles in Descartes; and it brought upon Malebranche the opposition, not merely of the Cartesian physicists, but also of Arnauld, Fénélon, and Bossuet, who found, or hoped to find, in the *Meditations*, as properly understood, an ally for theology. Popular enthusiasm, however, was with Malebranche, as twenty years before it had been with Descartes; he was the fashion of the day; and his disciples rapidly increased both in France and abroad.

In 1705 Cartesianism was still subject to prohibitions from the authorities; but in a project of new statutes, drawn up for the faculty of arts at Paris in 1720, the *Method* and *Meditations* of Descartes were placed beside the *Organon* and the *Metaphysics* of Aristotle as text-books for philosophical study. And before 1725, readings, both public and private, were given
from Cartesian texts in some of the Parisian colleges. But when this happened, Cartesianism was no longer either interesting or dangerous; its theories, taught as ascertained and verified truths, were as worthless as the systematic verbiage which preceded them. Already antiquated, it could not resist the wit and raillery with which Voltaire, in his *Lettres sur les Anglais* (1728), brought against it the principles and results of Locke and Newton. The old Cartesians, Jean Jacques Dortous de Mairan (1678-1771) and especially Fontenelle, with his *Théorie des tourbillons* (1752), struggled in vain to refute Newton by styling attraction an occult quality. Fortunately the Cartesian method had already done its service, even where the theories were rejected. The Port Royalists, Pierre Nicole (1625-1695) and Antoine Arnauld (1612-1694), had applied it to grammar and logic; Jean Domat or Daumat (1625-1696) and Henri François Dauguesseau (1668-1751) to jurisprudence: Fontenelle, Charles Perrault (1628-1703), and Jean Terrasson (1670-1750) to literary criticism, and a worthier estimate of modern literature. Though it never ceased to influence individual thinkers, it had handed on to Condillac its popularity with the masses. A Latin abridgment of philosophy, dated 1784, tells us that the innate ideas of Descartes are founded on no arguments, and are now universally abandoned. The ghost of innate ideas seems to be all that it had left.

In Germany a few Cartesian lecturers taught at Leipzig and Halle, but the system took no root, any more than in Switzerland, where it had a brief reign at Geneva after 1669. In Italy the effects were more permanent. What is termed the iatro-mechanical school of medicine, with G.A. Borelli (1608-1679) as its most notable name, entered in a way on the mechanical study of anatomy suggested by Descartes, but was probably much more dependent upon the positive researches of Galileo. At Naples there grew up a Cartesian school, of which the best known members are Michel Angelo Fardella (1650-1708) and Cardinal Gerdil (1718-1802), both of whom, however, attached themselves to the characteristic views of Malebranche.

In England Cartesianism took but slight hold. Henry More, who had given it a modified sympathy in the lifetime of the author, became its opponent in later years; and Cudworth differed from it in most essential points. Antony Legrand, from Douai, attempted to introduce it into Oxford, but failed. He is the author of several works, amongst others a
system of Cartesian philosophy, where a chapter on “Angels” revives the methods of the schoolmen. His chief opponent was Samuel Parker (1640-1688), bishop of Oxford, who, in his attack on the irreligious novelties of the Cartesian, treats Descartes as a fellow-criminal in infidelity with Hobbes and Gassendi. Rohault’s version of the Cartesian physics was translated into English; and Malebranche found an ardent follower in John Norris (1667-1711). Of Cartesianism towards the close of the 17th century the only remnants were an overgrown theory of vortices, which received its death-blow from Newton, and a dubious phraseology anent innate ideas, which found a witty executioner in Locke.

For an account of the metaphysical doctrines of Descartes, in their connections with Malebranche and Spinoza, see CARTESIANISM.

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