standing this process of emancipation, for they reflect the attitude the individual was expected to take towards the new social order.—Moreover, in the tradition of Western philosophy, the quest for happiness has always been a decisive outlet for the protest against the prevailing system of oppression and injustice, constituting a segment of militant, critical materialism.[1] The humanist position on happiness may thus yield a clue as to whether the Renaissance philosophy actually championed the right and freedom of the individual.

Trinkaus did not have to give an express refutation of the notion that the Renaissance was "the discovery of man and the world," because that notion has long been obsolete. Insofar as it has implied that there was a release of hitherto suppressed impulses and energies for the exploitation and enjoyment of this world, it may have been partly correct with respect to the exploitation, but it has certainly been misleading as regards the enjoyment. Trinkaus collects excellent material from the writings of the Humanists, especially from the numerous treatises on Nobility and on the Dignity of Man, all of which demonstrate the predominance of a new form of asceticism and escapism. The period, of course, contained a strong accenting of man's earthly goods and his right to enjoy them, but this was almost lost amid the general pessimism and other-worldliness. Trinkaus shows the manifold shadings of the transcendental attitude, the glorification of poverty, and of withdrawal from all every-day activity, the elevation of "knowledge in and for itself" to the rank of the highest virtue, the formation of a snobbish élite of intellectuals who despised the large mass of the "uneducated," the scorn of reason, and so on, and he summarizes humanistic philosophy in the felicitous phrase: "The new ideal is the medieval ideal of the world-flight made this-worldly."

The humanist doctrines consequently emerge as the first phase of the lengthy process of "introversion" whereby the rebellious drives and desires of the emancipated individuals were suppressed and diverted into the "inward" realm of Christian virtues. The Humanists thus essentially connect up with the work of the Reformation, as well as with Montaigne's rather conformist scepticism: they did their part in teaching men to submit to or comply with the forces which governed the rising order of capitalism.

Trinkaus does not dwell upon the far-reaching social implications of the "introversion." A shortcoming of his important study, therefore, is that he derives the attitude of the Humanists from the insecurity and competition of their personal existence.

HERBERT MARCUSE (Los Angeles).

Thorndike, Lynn, *A History of Magic and Experimental Science.* Vols. V and VI. The sixteenth Century. Columbia University Press. New York 1941. (695 and 766 pp.: $10.00)

With the appearance of these two volumes on the 16th century, a monumental series that began in 1923 comes to a conclusion. To give an idea of the prodigious research involved, the author's own compilation shows that in these last two volumes more than 3,000 names are cited—writers and men

[1]See *Zeitschrift für Sozialforschung,* ed. by the Institute of Social Research, VII (1938), p. 55.

of learning, printers, princes, prelates and lay figures in the play of ideas. The index includes some seventeen hundred items. Treated or mentioned are Biblical and Jewish writers, church fathers, early medieval Latin writers, and so on through the long list.

The material with which the present two volumes deal is organized in 48 chapters. After an introductory characterization of the century as a whole, the investigation opens with Leonardo da Vinci and proceeds according to individual subjects like Astrology, Anatomy, Alchemy, Medicine, Chiromancy, Natural Philosophy and Natural Magic, so that single chapters often bear in their titles the names of the leading personalities in the field under survey. One must marvel at the author's extensive reading and his knowledge of the vast material; he knows practically everything that was written during and concerning this time: books, manuscripts, pamphlets, and news articles. He lists not only all editions of the works he treats, but the translations and criticisms which they underwent or the discussions which they occasioned, their affinities with similar ideas of earlier writers or their open plagiarisms.

The examination that follows should offer an impression of the rich and interesting material that has gone into his work. We were informed of the extent of astrology, alchemy and occult arts before Thorndike published his work. For this reason it is of especial interest to learn from him what the adversaries of these arts had to say. We know that a papal decree against alchemists existed. But how little material interest the church had in combatting alchemy is disclosed by what Thorndike reports concerning Johannes Pantheus, a Venetian priest. Despite the papal decree Pantheus published in 1518 a work on alchemy, *Art of Metallic Transmutation,* and an edict of Pope Leo X gave him the exclusive right to print the work in the papal states! Subsequently, when someone called the attention of the papal court to the existence of a decree against alchemists, Pantheus quietly wrote another alchemist work (1530), a sort of "cabala of metals," only he was clever enough to say that this was not a work in alchemy but, as the title indicates, *Voarchadumia contra alchimiam: ars distincta ab alchimia et sophia.* Thereupon the apostolic legate again gave him permission to publish (V, p. 539).

Another "adversary" of occult arts, the Frenchman Symphorien Champier, criticizes magic, incantation, images, alchemy, and much of astrology, especially in medicine. His *Dialogue in Destruction of Magic Arts* (1500) enters into the power of demons in magic and shows him to be convinced that men can free themselves of diabolic magic through prayer, confession, and fasting. Good angels can help, as can exorcism, or sorcery which employs demons of a superior order. If a melancholy person speaks languages previously unknown to him, that is a sure sign he is possessed by a demon. Aristotle offers a natural explanation even for this phenomenon, but he may not have encountered people possessed by demons. The Bible and other early Christian works convinced Symphorien that demoniacs exist. He repeats Pico della Mirandola's arguments against astrology in general, but asserts that stars influence the weather, crops, disease, sedition and war, tempering this opinion with the observation that philosophers, farmers, and sailors can foresee these effects as well as astrologers can (V, pp. 111ff).

Despite his rich collection of materials, Thorndike does not offer a definitive picture of the epoch. He excludes from his investigation fields of knowledge that were extremely characteristic of the time with which he is

dealing: mathematics, physics, and especially mechanics, and justifies this procedure on the ground that it would "avoid duplication of what has already been brought out by investigations of others, particularly Pierre Duhem." If Thorndike nevertheless thinks that "sufficient ground has been covered to indicate amply the relations between the magical and the scientific interests and methods in the sixteenth century" (V, p. 12), he is laboring under an illusion. The most precise report out of a criminal court also gives only a picture of a section of life, not of life itself. As on the field of military conquest, so in the field of intellectual activity, not all provinces of knowledge are of equal weight. To hold sway, it is enough to take the key positions and it does not matter much that at many other points the enemy is still able to resist. During the 16th century such key positions were represented by mathematics, physics and above all mechanics. They constituted the basis for shaping the mechanistic conception which slowly emerged from the world of scholastic speculation to dominate the intellectual arena for four centuries. As a result of separating off this element that was so characteristic of the time, what remains—the province of astrology, alchemy, astrological medicine, and such—obtains an undue significance. For this reason, the very opening chapter on Leonardo da Vinci is not an accurate picture of the great scholar. Thorndike has a tendency to lay stress not on what was new in Leonardo but on what was old, what tied him in with the past, for example, "the fact that Leonardo was to a large extent interested in the same topics as his predecessors" (V, p. 23). Thorndike even goes so far as to say that "Leonardo's manuscripts are too disorderly and wanting in method to qualify as classified knowledge or science" (V, p. 18). The revolutionizing of science, however, often comes not from the "classified knowledge" of the university text book but precisely from the "disorderly" and unsystematic outsider. Thorndike does mention, though briefly, the pioneer activities of Leonardo in paleontology and geology, attributing to Leonardo "a determination to face all natural questions on a purely physical basis" (V, p. 36), but he underscores the more strongly that he "harbored many incorrect notions" and wishes to place these "in balance against his instances . . . of argument well sustained upon a strictly natural basis" (V, p. 29). An idle endeavor! We know, for instance, that Newton was largely interested and spent most time not in chemistry in the modern sense but in alchemy, that he was interested in the transmutation of metals, in the philosopher's stone and the elixir of life. And Newton's conception of matter, his atomic theory, made it possible that by rearrangement of these fundamental components one element could be transmuted into another. "The changing of bodies into light," he wrote, "and light into bodies, is very comfortable to the cause of nature which seems delighted with Transmutations."[1]

This was perhaps the reason why Newton's distinguished contemporaries, Huygens and Leibniz, who were aware of his alchemist leanings, suspected that he was seeking to revive occult faculties through his doctrine of attraction at a distance without the intermediary of matter. Huygens called the principle of attraction "absurd" (1690) and Leibniz wrote against Newton his article *Antibarbarus Physicus pro Philosophia reali contra renovationes qualitatum scholasticarum et intelligentiarum chimœricarum.* Newton's alchemy seems to have been connected less with his scientific than with his

[1]J. W. N. Sullivan, *Isaac Newton 1642-1727*, London 1938, p. 52.

mystical meditations. Should we therefore stamp him an avowed representative of the Paracelsian period, or should we rather not maintain that Newton's chemical knowledge was rudimentary and that despite the fact that he was encumbered with obsolete ideas in the field of chemistry, his trail-blazing doctrine of gravitation was to become indisputable master in the intellectual world of the next 200 years?

What applies to Leonardo da Vinci is repeated in many other chapters, for example, in the one on Paracelsus. Thorndike seems to have a predilection for painting the irrational aspects of the human mind while the rational ones interest him little. Thus, he says of Paracelsus that he may be regarded as a specialist in hysteria, mountain diseases and syphilis. On the last he had more medical knowledge than anyone who lived before 1850. It would have been interesting to hear the ideas of the 16th century on hysteria or syphilis, but nothing is said on this subject, while the slogan attributed to Paracelsus, "the sick should be doctors' books," (V, p. 441) receives an entire page of polemical criticism. From the slogan Thorndike deduces that Paracelsus wished to renounce book learning together with profit through the experience of others. Is such an interpretation of the text correct, however? Just at this time, when so many physicians were prone to follow the humanist trend of relying on ancient Greek medical authorities, as Thorndike himself reports (V, p. 435), one must see nothing else in the slogan than the principle, so often extolled elsewhere, that nature should be the ultimate source of our experience. This in no case would involve renouncing the profit to be derived from the experience others have stored in their books.

Thorndike mentions the book *Pirotechnia* (1540) written by Vanuccio Biringuccio, and remarks, "the text deals chiefly with metals and little with fireworks and artillery." One gets the impression that we are dealing here with an alchemist work. Thorndike does say that "the opening chapter is sceptical as to the possibility of transmutation," but he immediately adds, "in general the book impressed me as a sixteenth century version in Italian of what one might find in Latin works of the three previous centuries" (V, p. 544). This would lead to an incorrect impression. Biringuccio is not the belated associate of the middle ages, but on the contrary the representative of modern times, of that new type of man who takes his starting point from practice and enriches his practical experience through theory. He was no alchemist but an engineer, founder of modern metallurgy and practical manager of mines and iron works, as the title of his book, chiefly a treatise on mining and metallurgy, would indicate. "De La Pirotechnia . . . si tratta non solo di ogni sorte & diversita di Miniere ma anchora quanto si ricera intorno a la prattica di quelle cose di quel che si appartienne a l'arte de la fusione ouer gito de metalli . . ." By virtue of his better understanding of frictional laws, Biringuccio introduced into a north Italian iron works a new arrangement of machinery, discovered by him, for the better utilization of water power.

Thorndike sometimes presents facts without giving an explanation of the intellectual currents around them. For instance, he asserts that almost no alchemical treatises had been printed during the period of incunabula and that they appeared slowly in the 16th century, that "for the most part

alchemy remained relatively quiescent in laboratory and manuscripts until the Paracelsan revival of the second half of the century" (V, p. 532). The rise of Paracelsanism went hand in hand with the development of occult philosophy and a benevolent attitude to natural magic. We read that this tendency continued briskly into the 17th century until "by its excesses" it exhausted itself and was replaced by the sceptical rationalism and enlightenment of the 18th century (V, p. 14), though never uniformly in all provinces of knowledge. While Galileo, Descartes and Newton introduced clarity and precision into mathematics, physics and astronomy, the case was different in the fields of biology, chemistry, and medicine. Here, a good deal of the old feeling for occult nature persisted even in the Age of Reason (V, p. 14). Thorndike does not go beyond the assertion. We who are seeking an explanation already know from Duhem that for example as early as the 12th century a wave of rationalism arose and continued into the 13th century, that for example Thierry of the school of Chartre gives, in the 12th century, a rationalistic, purely physical theory of world genesis wherein the six days of the bible are interpreted as six stages of becoming. "L'oeuvre de six jours," Duhem says, "s'est donc déroulée sans aucune intervention direct du Dieu, par le jeu naturel des puissances du feu . . . Dieu créât la matière pour que cette matière, livrée à elle-même, produit le Monde tel qu'il est. Ni Descartes, ni Laplace ne dépasseront l'audacieux rationalisme de Thierry."[1]

Why did this rationalist upsurge of the 12th and 13th centuries give way to anti-rationalist currents, only to reappear, in partial form, in the 16th and, in larger measure, in the 17th century? Why does this age of Reason pursue its triumph only in a few strictly limited fields, in mathematics, physics, mechanics and astronomy, while the old forms of thinking continue to spread within the remaining provinces of knowledge? Thorndike leaves such questions open.

He establishes that about a quarter century after the death of Paracelsus a Paracelsian movement was growing. When Paracelsus' alchemist work, *Archidoxa*, appeared in Cracow in 1569, it was followed in one single year, in 1570, by six other editions, in Basle, Munich, Cologne, and Strassburg. As to how this Paracelsus renaissance is to be explained, Thorndike answers that Paracelsus corresponds to the same spirit which produced Telesio's *Natural Philosophy* in Italy at the same time (1565). This answer shifts the problem: one must inquire why in Italy, Poland and Germany during the second half of the 16th century a demand should arise for books of this kind, and that notwithstanding the most extravagant statements to be found in Paracelsus' *Archidoxa*, for example. Thus, Paracelsus avers that he had seen a man who lived without food for six months, and he adds that a man could live without food provided his feet are planted in the ground. And so on. There is no such thing for Paracelsus as a natural law or natural science. Even the most incurable disease can yield to magic rites. Mystery is everywhere; everywhere there is animism and invisible power, and all this at a time when Copernicus was endeavoring to restore the movements of heavenly bodies to circular regularity and uniformity. Thorndike ends his discussion with the declaration, "Such are the contrasts which are possible in the thought of the same period" (V, p. 629). But

[1]P. Duhem, *Le Système du Monde*, III, Paris 1915, p. 185.

instead of going on to clarify the trend and the contrast for us, he contents himself with the melancholy remark, "It was indeed a discouraging contrast in intellectual history, . . . the same half century which refused to digest and accept the solid demonstrations of *De Revolutionibus* of Copernicus . . . swallowed eagerly the innumerable . . . tomes of Paracelsus and his followers."

Thorndike's magnificent work is nevertheless a mighty contribution to an extension of our knowledge. He has assembled the most wonderful materials for building a cathedral—marble, porphyry, granite. We owe him thanks for this and admiration. But even the most beautiful materials are not yet the cathedral.

These latest two volumes will be indispensable as handbooks for every scholar of the medieval and modern history of science, just as the earlier volumes have been. But are they a history of science and magic in the 16th century?

HENRYK GROSSMAN (New York).

Ergang, Robert, *The Potsdam Führer, Frederick William I, Father of Prussian Militarism.* Columbia University Press. New York 1941 (290 pp.; $3.00)

Tims, Richard Wonser, *Germanizing Prussian Poland. The H-K-T Society and the Struggle for the Eastern Marches in the German Empire, 1894-1919.* Columbia University Press. New York 1941. (312 pp.; $4.25)

Crothers, George Dunlop, *The German Elections of 1907.* Columbia University Press. New York 1941. (277 pp.; $3.00)

Today is a fitting time for the historian to study the origins of Prussian Militarism and of German Imperialism. Ergang has written a good book on Frederick William I, but one with a misleading title, since the term Führer belongs to the modern Nazi movement. It is perfectly true, however, that Frederick William was the father of Prussian militarism and one of the most important men of German history, for the military machine he built survived all the crises and defeats of three centuries. Since Frederick is very little known to the American public, Ergang has done an exceedingly valuable service by bringing together the results of German specialists' studies on the militarist of Potsdam. He very carefully describes the activities of the king himself, but he has studied too little of the general background of Prussian social history. It is highly improbable that Frederick William would have achieved anything if fate had made him, for instance, ruler of Bavaria instead of Prussia. He was able to establish the Prussian body of military officers because in the countries on the Eastern side of the Elbe he found many thousands of poor agrarian noblemen, a type of the Junker which did not exist in Western and Southern Germany.

The development of cities, trade, and industries in Prussia during the 18th century was tremendous. The rise of Berlin from a poor little town to one of the centers of European civilization finds a parallel only in the