them are, like poets, born not made. It is true, of course, that works of art endure, whereas even the best of scientific theories do not. The latter are for ever yielding place to less imperfect successors. But for all that, "power and beauty" are shared by art and science alike, in mutual reverence.

Dr. Martin Johnson himself starts with a series of essays, dealing with those features of the arts and sciences which show marked resemblances and contrasts. He traces the function of pattern, structure and form, and finds that, without metaphysical complications, the paramount need is for communication. To a work of art there is obviously an infinity of emotional patterns registered by different observers, whereas all mental judgments of a scientific theory tend necessarily to identity.

We are next presented with a number of examples of imaginative stimulus. Perhaps these are the most revealing pages of the book, and indeed they are entrancing. Beethoven's last years, and his music, are pictured with sensibility and yet with restraint. In a few sentences the author casts upon this scene of distress what Whitehead meant when he defined religion as "what the individual does with his own solitariness". It is all too likely that the great musician could but point others to the skies, chained and bound to earth as he was himself.

From such quests of the imaginative, Dr. Martin Johnson turns squarely to apply the historical method in his descriptions of Persian, Arab, Greek, Moslem and Chinese investigations relative to mathematics and the design of scientific instruments. It is well done, if a trifle heavy compared with the rest. These chapters end with an able discussion of symbolism and its place in some future conciliation between science, religion and art. Of course, this theme has been attempted before. One has only to recollect such diverse names as Otto, Streeter, Collingwood, to realize how 'pontifical' (in the correct sense of the word) an approach this is. Seldom can synthesis have been more effective.

The last five chapters are devoted to Leonardo da Vinci. Considering the weight of scholarship which has already descended upon the elucidation of this remarkable personality, this new contribution is fresh in outlook and distinguished in presentation. Leonardo had no love for pure mathematics, and even less for metaphysics. His experimental genius derives fundamentally from Archimedes, for whose works, by the way, he sought long and patiently, against enormous odds. There is little doubt that, consummate artist as he was, he became ever more and more engrossed in scientific work, which led him on to a type of extreme veneration for natural law.

In general, the historical point of view is suited to the aim of this volume; its constant use, however, tends to exclude completely certain modern aspects of the relations between the arts and sciences which are much to the point. Maybe the future will provide opportunities for ventilating them; in any event, such a background as we have here is a necessary pre-condition for their appreciation.

Incidentally, there are a few odd little mannerisms; readers' memories may be short, but it seems needless to repeat the dates of the Chou dynasty three times in six pages. The index is strangely capricious: sometimes proper names are entered, sometimes not, without any apparent reason. Occasionally the missing reference is much more interesting than the one which is listed.

Finally, this is certainly the moment to discern—and perhaps even the place to rejoice in—the author's abundant charity, which seeketh not her own [and] is not easily provoked. Dr. Martin Johnson has produced something of great price, and of engaging modesty; of that wisdom, in fact, which stoops to conquer.

F. IAN G. RAWLINS.

PHILOSOPHY AND PHYSICS

Fact and Fiction in Modern Science

By Henry V. Gill. Pp. vi+194. (Dublin: M. H. Gill and Son, Ltd., 1943.) 8*s*. 6*d*.

THIS book is substantially a reprint of essays which have appeared at different times in various journals. The author has the advantage of a more profound knowledge of philosophy than most popular writers on science, and his comments are more sober and orthodox than might perhaps be anticipated from the somewhat flamboyant title. The scope is sufficiently indicated by chapter-headings such as "The Nature of Scientific Knowledge", "From Physics to Philosophy", "Logic and Modern Science", and "Determinism, Uncertainty, and Free Will".

An interesting suggestion (p. 24) is that "the philosophy of Eddington would seem to approximate to that of the scholastics". To justify this affiliation, one may start from Eddington's affirmations that "all that physical science reveals to us in the external world is group-structure" and "Physical Knowledge is structural knowledge". But if we try to develop the Eddingtonian philosophy consistently beyond the point to which Eddington himself has carried it, we are led to inquire what (if anything) is this structure the structure *of*? What would, so to speak, be left behind if all structure could be imagined as annihilated? Clearly it cannot be ordinary matter, for ordinary matter even in its most elemental form as electrons, protons, etc., has qualities which must be included in the category of structure: the ultimate residuum which is wholly devoid of structure must be a limiting conception, a pure potentiality, something not capable of existing alone; and surely this is nothing other than the *materia prima* of the scholastics, Eddington's 'structure' being equivalent to the scholastic 'form'.

The author makes a curious slip when he says (p. 178), "To *prove* to one who denies it that two and two could not in any condition of things make five is beyond the power of any philosopher". Although this particular problem does not figure explicitly in Whitehead and Russell's "Principia Mathematica", a demonstration could undoubtedly be provided by the methods of that work.

The treatment is, generally speaking, well informed on the purely scientific side, the only noteworthy exception being that the author misconceives Heisenberg's uncertainty principle. In one place (p. 111, last three lines), he seems to be under the impression that the uncertainty is merely a consequence of the inadequacy of experimental methods now available, instead of being, as it actually is, an uncertainty *in principle*. Elsewhere (p. 24, lines 9–11) he seems to confuse it with the lack of detailed information about individuals which is characteristic of all statistical systems. But these are minor blemishes in a readable and instructive book.

E. T. WHITTAKER.