of the kieselguhr are absent in that of the catalyst. It is therefore concluded that during deposition of metallic nickel and thoria on the kieselguhr the crystalline portion of silica (at least, a major part of it) becomes amorphous, while the structure and the crystallinity of ferric oxide present in the kieselguhr remain unchanged. The broadness of the lines, however, indicates that the crystal particles of ferric oxide have been disintegrated, yielding crystallites of smaller size.

At first it was thought that heating of kieselguhr in hydrogen during deposition of nickel and thoria was responsible for the change in its structure. To test this a powder photograph of the sample of kieselguhr previously heated at 450° C. in an atmosphere of hydrogen was taken. This photograph was exactly similar to that of kieselguhr taken before it was heated. This proves that heating alone is not responsible for the change of structure on deposition of the nickel–thoria. A photograph of kieselguhr on which only thoria was deposited according to the Fischer – Meyer method (*loc. cit.*) shows a pattern similar to that on which the nickel–thoria was deposited. The change in the kieselguhr, therefore, was brought about by the disintegration caused by the decomposition of the carbonates of nickel and thorium deposited as an initial step in the preparation of the catalyst.

The powder photograph of the sample of the nickel–thoria–kieselguhr catalyst after it has been used in catalysing higher hydrocarbon synthesis at 180° C. at atmospheric pressure is identical with the X-ray powder diagram of the same sample before use. The presence of nickel lines in the photographs proves that nickel is present in crystalline form in these samples. From the measurement of the glancing angles of reflexion of the nickel lines observed in these photographs, it appears that the lattice constant of nickel has not changed appreciably during its deposition on the kieselguhr. It may, therefore, be concluded that the atomic diameter of the nickel does not change during deposition or during the process of catalysing the Fischer – Tropsch synthesis under our experimental conditions.

The presence of two weak lines of thoria in the thoria–kieselguhr sample proves, on the other hand, the crystallinity of thoria deposited on the kieselguhr.

The X-ray data for the nickel–thoria–kieselguhr catalyst are given in Table 2.

TABLE 2

Bragg angles of reflexion for copper $K\alpha$ corresponding to diffraction lines	Spacings corresponding to diffraction lines	Eye-estimated intensity	Calculated spacings of possible reflecting planes of Ni	Spacings of ferric oxide	Eye-estimated intensity
17° 44′	2·537	m.w.		2·533	v.st.
22 18	2·029	m.	2·029 (111)		
25 53	1·759	m.w.	1·757 (200)		
30 32	1·520	v.v.w.		1·485	m.s.
38 25	1·239	v.w.	1·243 (220)		
46 40	1·059	v.w.	1·060 (311)		

Our thanks are due to Prof. K. Banerjee for the interest he took in this investigation.

K. M. CHAKRAVARTY
RANJIT SEN

Dacca University, Dacca,
and
Indian Association for the
Cultivation of Science,
Calcutta, India.
July 1.

[1] *Brenn.-Chem.*, **12**, 225 (1931).

The Measurable and the Non-measurable

IN the interesting address by Prof. H. Dingle, which appeared in *Nature* of July 26, 1947, there is one section about which considerable difference of opinion may exist. He quotes with disapproval the statement of Eddington ("Nature of the Physical World", p. 275), "The cleavage between the scientific and the extra-scientific domain of experience is not a cleavage between the concrete and the transcendental but between the metrical and the non-metrical", and he names the theory of evolution as completely confounding Eddington's assertion, because the theory of evolution is undeniably a scientific theory but it "has nothing whatever to do with measurement . . . it is concerned with qualitative changes alone . . . yet intelligent and learned men say and believe that science is concerned only with measurement !"

Surely it is not a quibble to deny that science is concerned only with measurement and yet to affirm that the domain of science is the measurable, that is, all the phenomena and experiences for which the fundamental units mass, length, time have relevance. The domain of ethics, æsthetics, the entire realm of values and significance is the non-measurable in the sense that the units [*M*], [*L*], [*T*] are not applicable and have no relevance. The theory of evolution lies within the domain of science because it deals, though in a qualitative manner, with differences which are essentially measurable. There would be no theory of evolution if in the vegetable and animal kingdoms there were no observable differences in factors for which [*M*], [*L*], [*T*] have relevance. An observer notes the difference between a ginkgo tree and an oak, between a crocodile, a horse and a man, without recourse to ruler and scales, but the differences are measurable and their existence has led to a theory which implies a time sequence. No one would suggest that if the time scale were accurately known, it would be entirely irrelevant to the theory of evolution.

The distinction between inquiries in the realm of the measurable and of the non-measurable has helped many people to place science in its right perspective relative to other approaches to knowledge and to truth. Such a generalization may be open to argument, but is it of so dangerous and vicious a nature that "the mask of comedy drops from it and it appears tragical" ?

The domain of the non-measurable is a matter of concern for everyone, and very particularly for the man of science who must step outside the domain of his own discipline to play an active part in this matter of ethics, because it is the misuse of science that confronts the present generation with a problem of first magnitude.

A. VIBERT DOUGLAS

Queen's University,
Kingston, Canada.

I CANNOT accept Dr. Douglas's view that because one could, but does not, measure the objects with which biology is concerned, one can therefore claim that the domain of biology is metrical. On those lines one could claim music and painting and poetry as sciences. However, our views do not matter, because Eddington himself has settled the question. He claimed to derive the ultimate laws of Nature from the *nature of measurement*, not from the character of the objects to which measurement was applied, and in his article on the cosmical number, reprinted in his posthumous work "Fundamental Theory", he