

out taking into consideration the point that the machinery with which they do their calculating is a factor determining the products or proofs at which they eventually arrive. Considering also that the seeming importance of comprehensive theories is automatically derived from the nature of this machinery,² it seems likely that this machinery will more likely mislead us in the realm of higher mathematics than in ordinary arithmetic, though even in respect of the latter very little deviation from the normal is required to render the machinery incapable of calculating the correct change from a five-rupee note. But what it does then calculate is believed to be the truth! In contrast with this, the existence of lightning calculators, could be held to indicate that the normal machinery is a slow-motion affair.

A whole volume, in fact, could be written relative to the part played by the mental

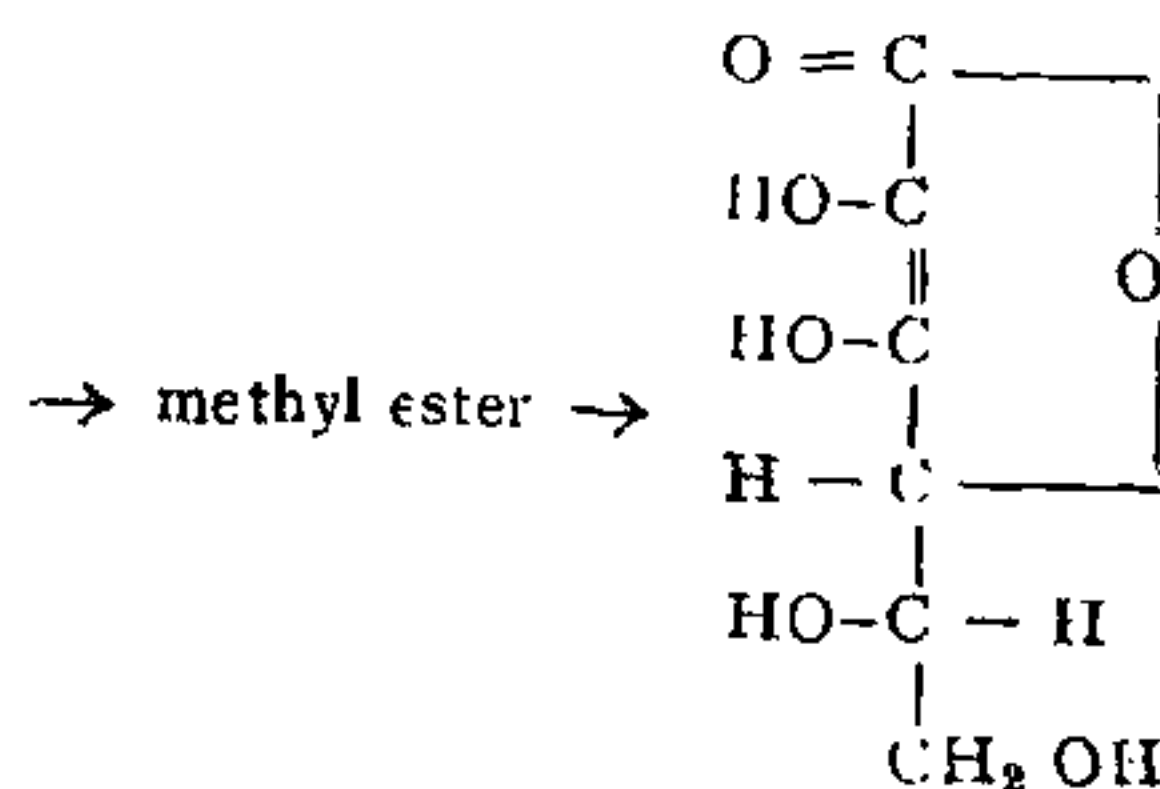
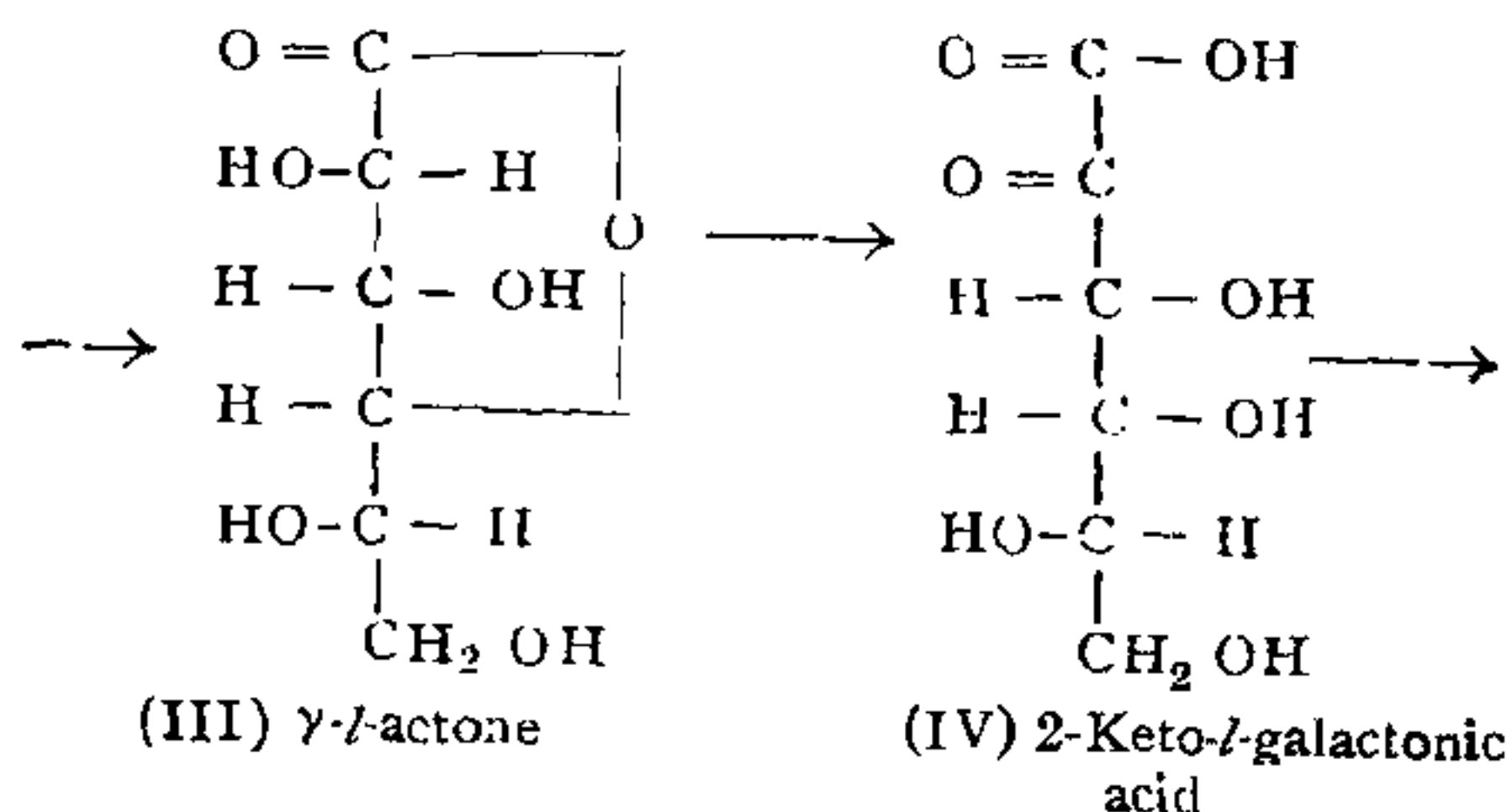
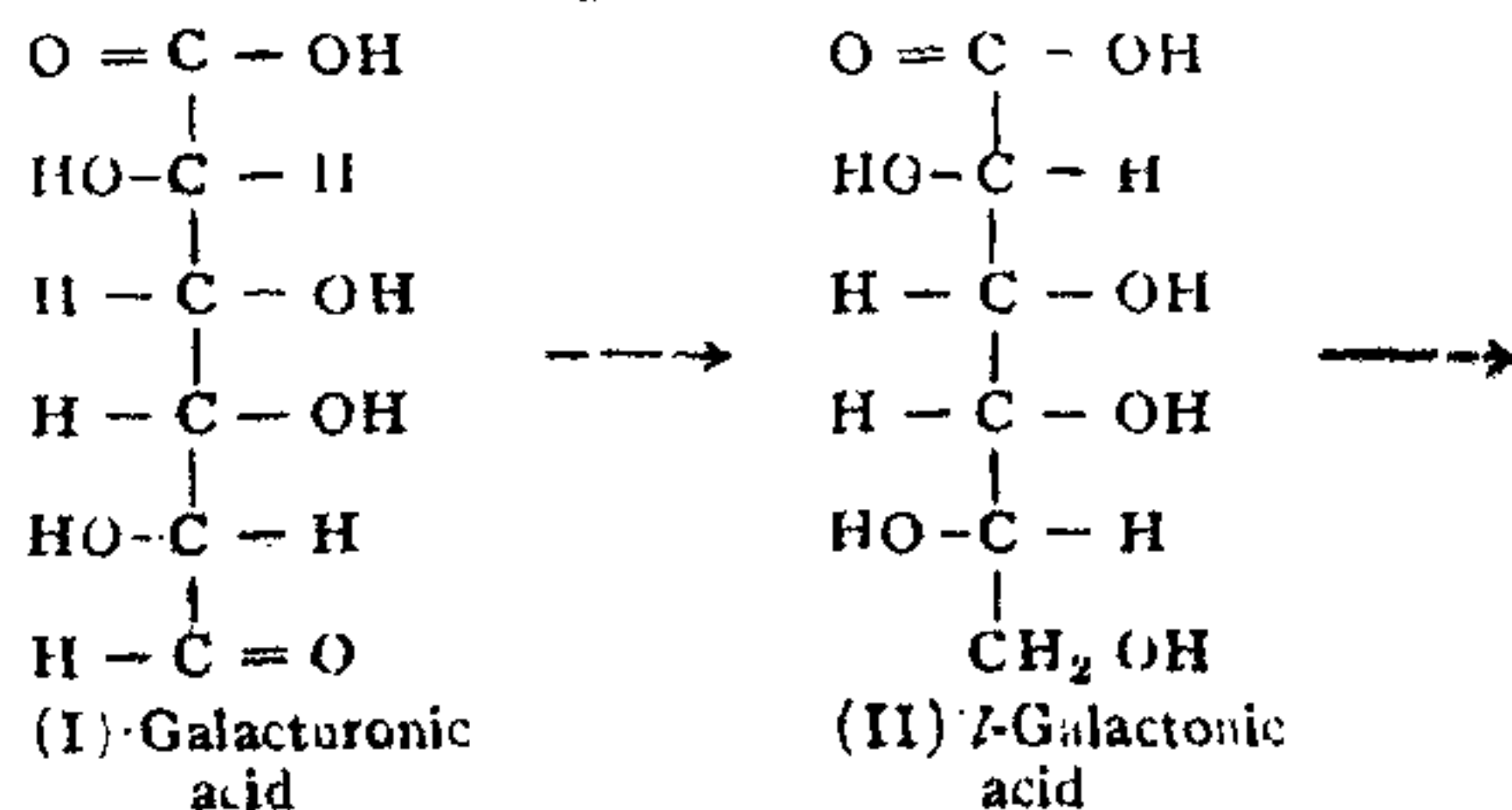
machinery in arriving at a mathematical result. It is enough, however, to observe here that the machinery does play a part. We have to observe further that the events taking place in the physiological nucleus are eventually expressed in the one form of altered momentum of satellites. It seems to me, therefore, that the machinery is also built as to lead its possessor eventually to 'discover' that time and space are one. Which point being noted, the reader is left to ponder over the possibility that the modern doctrine of relativity may illustrate the much more ancient Hindu doctrine of Maya.

1. Burridge, *Excitability*, Oxf. Univ. Press, 1932. 2. —, *A New Physiological Psychology*, Arnold, 1934. 3. —, *Proc. Ind. Sci. Cong.*, 1936. 4. —, *Arch. Internal de Pharmacod.*, 1938, 59, 450. 5. Macdonald, *Quart. J. Exp. Physiol.*, 1909, 2, 65.

SYNTHESIS OF VITAMIN C FROM PECTIC SUBSTANCES

THE present requirement of vitamin C or L-ascorbic acid (V) is met by isolating the substance from fresh fruits and vegetables or preparing it synthetically from sorbitol. A new and a comparatively easier process for the preparation of vitamin C from pectic substances like beet-pulp has recently¹ been developed. The pectic substance is hydrolysed with a commercial pectinase and the resulting galacturonic acid (I) is separated in the form of a difficultly soluble calcium or strontium salt (15-20 per cent. yield). This salt is almost quantitatively reduced with Raney nickel and hydrogen under pressure and the resulting salt of L-galactonic acid (II) is converted by subsequent treatment with oxalic acid to the corresponding γ -lactone (III) (m.p. 134°, $[\alpha]_D^{20} = 78^\circ$) in over 90 per cent. yield. The above lactone is then oxidised in presence of sodium chlorate and vanadium pentoxide to 2-keto-L-galactonic acid (IV) (m.p. 170°; $[\alpha]_D^{20} + 5.2^\circ$; 25-30 per cent. yield), which by usual treatment with anhydrous methyl alcohol and hydrogen chloride produces the methyl ester (m.p. 145-150°, $[\alpha]_D^{20} = +4.7^\circ$, over 90 per cent. yield); when the latter substance is treated with alcoholic sodium methylate and subsequently acidified with N-sulphuric acid, it is lactonised and enolised to L-ascorbic acid (vitamin C) (V), identical with the natural product.

The preparations of 2-keto-D-galactonic acid (m.p. 170°, $[\alpha]_D^{20} = 5.2^\circ$), its methyl ester



(V) L-ascorbic acid (Vitamin C)

(m.p. 145-150°, $[\alpha]_D^{20} = -4.6^\circ$ and D-ascorbic acid (m.p. 191°, $[\alpha]_D^{20} = -23.8^\circ$) have also been described in this paper.

It is very interesting to note that 2-keto-L-galactonic acid (IV) and its methyl ester on lactonisation and enolisation yield natural ascorbic acid rather than an isomer thereof.

Many of the reactions of this paper and also the formation of furfural and reductic acid from pentoses and heuronic acids have been interpreted in terms of electronic displacement.

The main importance of the paper lies in the fact that it opens a vast possibility for the utilisation of beet-pulp, obtained from sugar industry, as an easily available raw material for the manufacture of vitamin C. If the yield in the oxidation of L-galactono- γ -lactone (III) to 2-keto-L-galactonic acid (IV) is improved, the process will compare favourably with the sorbose process, now utilised for the synthetic production of this important compound.

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1. Isatell, H. S., *J. Research NBS*, 1944, 33, 45.