

ABSTRACTS ✓

DEPARTMENT OF PHYSICS

28. THE OPTICAL PROPERTIES OF TITANIUM DIOXIDE. T. Radhakrishnan, *Proc. Ind. Acad. Sci.*, 1952, **35**, 117-25.

Dispersion formulæ valid in the visible region are offered for rutile, anatase and brookite. These incorporate a characteristic frequency at 2870 Å in all the cases. The value of dn/dt in the three crystals are explained by large transfers of transition probability and moderate shifts towards larger wave-lengths of this frequency as the temperature is raised. In addition, a calculation is made of the refractive indices and birefringence of rutile on the basis of Bragg's theory and the results are in good accord with the observed data.

29. X-RAY ANTI-REFLECTIONS IN CRYSTALS. G. N. Ramachandran and Gopinath Kartha, *Proc. Ind. Acad. Sci.*, 1952, **35**, 145-58.

The paper deals with the theory of an interesting phenomenon (which has been designated as "anti-reflection") that the intensity of the transmitted beam may exhibit a peak larger than the background when a Bragg reflection occurs in an absorbing crystal. The theory is based on the dynamical theory of Ewald and Laue. It comes out that the effect is due to a decrease in the effective absorption coefficient of the crystal near the Bragg reflection, and to the consequent increase in the transmitted intensity predominating over the loss of energy by reflection. The anti-reflection peak becomes more prominent, the greater the thickness of the crystal. The results of the theory are found to be in accord with the previous observations of Borrmann and Campbell. The theory further predicts that the peaks in the reflected and transmitted beams would not be coincident and this requires further verification.

30. A NEW METHOD OF OBTAINING FOCUSED IMAGES WITH X-RAYS. G. N. Ramachandran, *Phys. Rev.*, 1952, **85**, 378.

A method is described whereby focussed images can be obtained by means of X-rays making use of Laue reflections. It is based on the fact that the Laue reflection obeys the same geometrical law as optical reflection with respect to the crystallographic planes. If therefore the latter could be deformed to be parallel to the surface of a sphere, they would give images

just as concave mirrors do. A schematic description of the experimental arrangement and of the methods of curving the lattice planes are also given.

31. THE RELATION BETWEEN THERMO-OPTIC AND PIEZO-OPTIC PHENOMENA IN CRYSTALS. G. N. Ramachandran and T. Radhakrishnan, *Phil. Mag.*, 1952, **43**, 317.

It is pointed out that the change in refractive index with temperature of a crystal is different from what is calculated from the accompanying change in volume and the piezo-optic coefficients. The difference which is a pure temperature effect, is explained as being due to the change in polarizability of the atoms produced by a change in the amplitude of vibration. Making use of the experimental data, the value of the polarizability and its first two derivatives with respect to the distance between the atoms can be determined. These values are found to be of the same order as those deduced from the intensities of Rayleigh and Raman scattering of light. The theory predicts that dn/dT should vary as the coefficient of cubical expansion at different temperatures and this is verified to be true. Finally, calculations are made of the thermo- and piezo-optic coefficients, considering the electrostatic interaction between the atoms. These do not adequately explain the observed facts, since no provision is made for the distortion of electron atmospheres around the atoms and the consequent changes in polarizability.

32. SPACE GROUP OF MAGNESIUM AND SODIUM ACETATES. V. M. Padmanabhan, *Curr. Sci.*, April 1952, **21**, 97.

Magnesium acetate tetrahydrate is found to belong to the monoclinic space-group $C_{2h}^2 - P2_1/m$ with cell constants $a = 8.5$, $b = 11.7$, $c = 4.7$ Å and $\beta = 94.9^\circ$. Z number of molecules per unit cell is 2. Sodium acetate trihydrate also belongs to monoclinic class, space-group being $C_{2h}^2 - C2/m$ unit cell dimensions are $a = 12.4$, $b = 10.5$, $c = 10.3$ Å and $\beta = 112.1^\circ$. The number of molecules per unit cell was found to be 8.

33. MAGNETO-OPTIC ROTATION IN BIREFRINGENT MEDIA—APPLICATION OF THE POINCARÉ SPHERE. G. N. Ramachandran and S. Ramaseshan, *Journ. Opt. Soc. Am.*, 1952, **42**, 49.

It is pointed out that the concept of the Poincaré sphere appreciably simplifies the mathematical treatment of phenomena accompanying the passage of polarised light through a medium which exhibits birefringence, optical activity or both simultaneously. This is exemplified by using the Poincaré sphere to evolve techniques which could be used for determining

the true Faraday rotation in the presence of birefringence. When birefringence is present, measurements made with the half-shade at the polariser and analyser ends are not equivalent. In either arrangement, the errors introduced due to birefringence are largely reduced by taking the mean of two measurements for opposite directions of the field. Formulæ are also derived by which the magnitudes of the error can be calculated for the particular experimental set-up, knowing the value of the birefringence. In certain cases, even this need not be known, and the true rotation can be determined purely from measurements of the apparent rotations for two different azimuths of the incident plane of polarisation.

DEPARTMENT OF GENERAL CHEMISTRY

1. CHEMISORPTION OF HYDROGEN ON ZINC OXIDE-MOLYBDENUM OXIDE CATALYST. EVIDENCE OF HETEROGENEITY OF THE SURFACE. M. V. C. Sastri and K. V. Ramanathan, *J. Phys. Chem.*, 1952, **56**, 220.

The chemisorption of hydrogen by zinc oxide-molybdenum oxide has been studied between 186° and 375° C. employing the temperature variation technique of Taylor and Liang. Temperature variations above 250° gave rise to desorption and readsorption phenomenon typical of surface heterogeneity. No such effect was noticed for temperature changes below 250°. The rate of adsorption on the bare surface has been determined at four temperatures between 186° and 350°. Equations have been derived for estimating the point of minimum adsorption following a temperature increase. The value calculated for the minimum adsorption by applying these equations agrees closely with that actually observed. The energies of activation of adsorption are calculated for three temperature ranges. The abnormal variations noticed at the higher temperatures are explained on the basis of heterogeneity of the surface. It is pointed out that isothermal determinations of adsorption on bare surfaces do not give a correct estimate of the active area of the adsorbent. The surface area of the adsorbent has been determined by the application of the Brunauer, Emmett and Teller and the Harkins-Jura equations to the adsorption isotherm of nitrogen at the temperature of liquid air.

2. THE CHEMICAL BEHAVIOUR OF SULPHUR COMPOUNDS. PART III. KINETICS OF THE GASEOUS REACTION BETWEEN HYDROGEN SULPHIDE AND SULPHUR DIOXIDE. A. R. Vasudeva Murthy and B. Sanjiva Rao, *Proc. Ind. Acad. Sci.*, 1951, **34**, 283.

Certain sulphides, in presence of a small amount of moisture, were found to catalyse the reaction between hydrogen sulphide and sulphur dioxide. The kinetics of this reaction were studied in a closed system, using an all-glass, gas circulation pump. The partial pressure of water in the reacting system was maintained constant with the aid of a hygrostat. The higher the partial pressure of water, the greater was the velocity of reaction, for a given catalyst. Of the sulphides employed, cobalt thiomolybdate was found to be the best catalyst. Cobalt sulphide and molybdenum sulphide were less efficient. Next in order of efficiency, was silver sulphide. Boron trifluoride and anhydrous aluminium chloride were found to have no catalytic effect on the union between hydrogen sulphide and sulphur dioxide.

The mechanism of the reaction could be explained on the basis of the formation of thiosulphurous acid, as the primary product.

3. OXIDATION BY CHLORAMINE-T. PART I. REACTION BETWEEN HYDROGEN SULPHIDE AND CHLORAMINE-T. A. R. Vasudeva Murthy and B. Sanjiva Rao, *Proc. Ind. Acad. Sci.*, 1952, 35, 7.

When hydrogen sulphide is oxidised by chloramine-T, the sulphide may yield sulphur, or sulphate, or both the products. The relative proportion of the two products of oxidation depends on the pH of the solution and on the presence of certain catalysts. At low pH, sulphate is produced in relatively high amounts, while at higher pH values, sulphur formation is greater. Presence of molybdate increases sulphate yield, while tungstate on the other hand diminishes it. It is suggested that the primary product of oxidation of hydrogen sulphide is dihydrogen sulphoxide (H_2SO) which, being analogous to hydrogen peroxide and hydrogen persulphide, is likely to be more stable at low pH values. The sulphoxide undergoes two simultaneous reactions: (a) decomposition into water and sulphur and (b) oxidation to sulphate. This accounts for the greater production of sulphate at low pH values and of elemental sulphur in alkaline solutions.

4. OXIDATION BY CHLORAMINE-T. PART II. REDOX POTENTIAL OF CHLORAMINE-T-SULPHONAMIDE SYSTEMS. A. R. Vasudeva Murthy and B. Sanjiva Rao, *Proc. Ind. Acad. Sci.*, 1952, 35, 69.

The redox potentials of the chloramine-T-sulphonamide system have been determined. With an increase in pH, the oxidation potential decreases. Depending on the pH of the solution, the oxidation of hydrogen sulphide by chloramine-T yields varying proportions of sulphur and sulphate. Reagents like osmic acid, sodium tungstate and sodium molybdate are also found to affect the ratio of sulphur to sulphate, formed by the oxidation of hydrogen sulphide.

A complete explanation for the observed results cannot be based on the effect of pH on the redox potential, as these reagents do not alter the potential. The specific effect of these reagents is probably due to their influence on dihydrogen sulphoxide, the primary product of oxidation of hydrogen sulphide.

5. PHYSICO-CHEMICAL INVESTIGATIONS OF SOME MYSORE CLAY SAMPLES. M. S. Narasinga Rao, A. R. Vasudeva Murthy and M. R. A. Rao, *Curr. Sci.*, 1951, 20, 323.

The properties of clays depend to a large extent on their clay mineral composition. The base exchange capacity and the differential thermal

analysis of representative samples of Mysore clays were investigated in this laboratory with a view to classify the samples according to their clay mineral composition. The results indicated that the samples collected from Gullahalli, Bageshpur and Tirthahalli were kaolinities. Gollahalli sample was found to be halloysite and that from Hebbur was found to be a mixture of kaolinite and montmorillonite.

6. MODE OF DECOMPOSITION OF SULPHUR SESQUIOXIDE. A. R. Vasudeva Murthy, *Nature*, 1951, **168**, 475.

A dilute solution of sulphur sesquioxide was prepared in carbon tetrachloride by passing sulphur trioxide vapours into the solvent containing adequate quantities of sulphur. The hydrolysis of the oxide was carried out at the interface between the carbon tetrachloride solution and aqueous alkali, in the presence of cadmium hydroxide. It was noticed that sulphide, sulphite, thiosulphate and sulphur were formed. The production of sulphide during the hydrolysis of sulphur sesquioxide was observed for the first time and this was attributed to the production of sulphur monoxide as the primary product during the hydrolysis.

7. DEFLUORINATION OF PHOSPHATIC NODULES BY CHLORINE. V. V. Dadap and M. R. A. Rao, *Curr. Sci.*, 1951, **20**, 324.

The removal of fluorine from rock phosphate has attracted a good deal of attention during recent years. Investigations on the chlorination of phosphatic nodules ($F = 3\%$, $P_2O_5 = 25\%$) from Trichinopoly area indicated that considerable quantities of fluorine could be removed from the nodules at comparatively low temperature in presence of carbon and silica.

8. SURFACE CHEMISTRY OF CONGORUBIN SOLUTIONS. R. S. Subrahmanya, M. R. A. Rao and B. Sanjiva Rao, *Proc. Ind. Acad. Sci.*, 1952, **35A**, 194.

The accumulation of congorubin molecules at an air-water interface has been investigated under varying conditions of concentration and pH. The rate of accumulation increases with the increase in the concentration of the congorubin solution. Addition of valeric acid, saccharose, and amyl alcohol decreases the accumulation whilst acetic acid and Nekal BX increase the same. The presence of sodium stearate does not influence accumulation. These results are explained on the basis of orientation of the molecule of the dye. Formation of a complex by the congorubin with valeric acid, saccharose, amyl alcohol and Nekal BX is responsible for the departure from the normal behaviour of the dye.

The trough method has been employed to study the variation of surface tension with time. The surface tension shows no variation during the first fifteen minutes, but after this period shows a lowering with time. The lowering becomes less as ageing proceeds and tends to reach an equilibrium value. It is not affected by the presence of a stearic acid film on the surface of congorubin solution. The area of cross-section of the congorubin molecule has been determined by the trough method. This value also supports the view that there is orientation of the congorubin molecule at the interface.

9. A SIMPLE METHOD FOR THE STUDY OF VARIATION OF BOUNDARY TENSION WITH TIME. R. S. Subrahmanya, M. R. A. Rao and B. Sanjiva Rao, *Proc. Ind. Acad. Sci.*, 1952, **35A**, 136.

A new method for the determination of variation of interfacial and surface tensions with time has been developed. In this method the advantages of the pendant drop method are combined with those of drop weight method, thus, simplifying the experimental procedure. Using this method the variation of interfacial and surface tensions, were determined. At the air-liquid interface a solid film is formed and at the solution-benzene interface a gaseous film is formed. The effect of concentration of the dyestuff, effect of salts, and the effect of pH, have been studied. The slow variation of interfacial tension has been accounted for on the basis of changes in zeta-potential.

10. STUDIES ON CHROME-MORDANTING OF WOOL. G. N. Bhat and M. R. A. Rao, *J. Sci. Ind. Res.*, 1952, **11B**, 67.

A comparative study has been made on the chrome-mordanting of 4 varieties of wool and the effects of wool quality, scouring methods, temperature and wetting agents on dichromate adsorption have been examined.

Merino wool (degree of wooliness, 100 per cent.) exhausts the mordant bath more rapidly than coarse wool (degree of wooliness, 4 per cent.): Wool samples scoured by solvents show high dichromate adsorption. Dichromate adsorption is adversely affected in the presence of wetting agents. The adsorption of dichromate by wool in acid baths increases with rise in temperature, and is highest when hydrochloric acid is employed for acidifying the bath. The use of hydrochloric acid in place of sulphuric acid, which is commonly employed in industry, is recommended.

11. CHLORINATION OF ILMENITE. D. P. KHARKAR AND C. C. PATEL, *Curr. Sci.*, 1952, **21**, 98.

The production of titanium tetrachloride by the chlorination of ilmenite is of particular importance to India since this country possesses large deposits

of the ilmenite ore. A systematic work on the chlorination of Travancore ilmenites is undertaken in this laboratory and following are the important features of the investigation:

The reaction for the chlorination of ilmenite has been carried out at various temperatures (200°–800°) and it is found that high temperatures (above 700° C.) bring about chlorination practically quantitatively. The effect of varying quantities of carbon on the reaction indicates that 33% carbon on the weight of ilmenite is the optimum for the production of titanium tetrachloride. The study on the effect of catalysts on the chlorination indicates that the chlorination can be effectively carried out even at 400° C.; while the temperature given in the literature ranges from 600° to 1,200° C. The reduction of chlorinating temperature is of very great importance since high temperature favours the corrosion of the equipment by the chlorine gas.

12. STUDIES ON OXO-PROCESS. PART I. SYNTHESIS OF PROPIONALDEHYDE FROM ETHYLENE, CARBON MONOXIDE AND HYDROGEN IN THE GAS PHASE IN PRESENCE OF COBALT CATALYSTS AT HIGH PRESSURES. S. K. Bhattacharyya and B. C. Subba Rao, *J. Sci. Ind. Res.*, 1952, V, **11B**, 80.

The oxonation of ethylene in the gas phase was studied at 50–600 atm. and at 100°–200° C. by the static method, using a number of catalyst compositions containing cobalt. Besides propionaldehyde, varying amounts of *n*-propanol and liquid hydrocarbons were also produced during the reaction. A temperature of 150° C. and a pressure of 150 atm. were the optimum conditions for the synthesis. A gas mixture of composition $C_2H_4/CO/H_2 = 1:1:1$ gave the maximum yields of propionaldehyde. Oxonation was retarded in presence of both water and ammonia. By using a catalyst containing 30 per cent. cobalt on kieselguhr and a gas mixture $C_2H_4:CO:H_2 = 1:1:1$, a conversion of 29 per cent. of ethylene to propionaldehyde was obtained under 150 atm. at 150° C. in a residence period of 3 hours.

13. SYNTHESIS OF ACETIC ACID FROM METHANOL AND CARBON MONOXIDE IN VAPOUR PHASE IN PRESENCE OF NICKEL CATALYSTS AT HIGH PRESSURE. S. K. Bhattacharyya and S. Sourirajan, *J. Sci. Ind. Res.*, 1952, V, **11B**, 123.

The reaction between methanol and carbon monoxide in the vapour phase was studied by the static method under a pressure of 80–400 atm. at 150–250° C. Various catalyst compositions containing nickel in various forms were tested. Nickel iodide, supported on silica gel, showed the

highest catalytic activity. Using 95 per cent. methanol, 5 per cent. H_2O and a catalyst containing 84.2 per cent. NiI_2 on silica gel, under a pressure of about 260 atm. at $180^\circ C.$, a total conversion of 59.2 per cent. of methanol in a period of 2 hours was obtained, of which free acetic acid was 45.9 per cent., methyl acetate 3.7 per cent. and gaseous by-products 9.6 per cent.

14. SYNTHESIS OF PROPIONIC ACID FROM ETHYLENE, CARBON MONOXIDE AND WATER IN THE VAPOUR PHASE IN PRESENCE OF COBALT CATALYSTS AT HIGH PRESSURES. S. K. Bhattacharyya and S. Sourirajan, *J. Sci. Ind. Res.*, 1952, V, **11B**, 124.

The reaction of ethylene with carbon monoxide and water using cobalt catalysts was studied in the vapour phase by the static method. A catalyst with the composition Co: Fe: ThO_2 : MgO: Silica gel (30: 1: 2: 2: 65) was reduced for 2 hours in a current of hydrogen at $400^\circ C.$ before use. A liquid product containing mainly propionic acid, small quantities of aldehydes, alcohols and esters, but no hydrocarbons, was obtained. Using a gas mixture C_2H_4 : CO = 1: 1, under 340 atm. at $180^\circ C.$, a conversion of 9.6 per cent. of ethylene to propionic acid was obtained in a period of 3 hours. When the catalyst was heated for 4 hours at $300^\circ C.$ in a current of air, and then reduced in a current of hydrogen for the same period at $300^\circ C.$, the yield of propionic acid increased by about 50%. In addition, liquid hydrocarbons (about 15%) were also formed. With the above treatment of the catalyst a conversion of 13.3 per cent. of ethylene to propionic acid was reached under 320 atm. and at $180^\circ C.$ in a residence period of 3 hours.

15. SYNTHESIS OF ACETIC ACID FROM METHANOL AND CARBON MONOXIDE IN THE VAPOUR PHASE IN PRESENCE OF COBALT CATALYSTS AT HIGH PRESSURES. S. Sourirajan and S. K. Bhattacharyya, *J. Sci. Ind. Res.*, 1952, **11B**, 263.

The reaction between methanol and carbon monoxide in the vapour phase in the presence of cobalt catalysts under a pressure of 80–400 atm. and at 150 – $250^\circ C.$ was investigated. Among the catalyst compositions tested, cobalt iodide supported on silica gel showed the highest activity. Cobalt iodide-silica gel catalyst gave lower yields of acetic acid and a higher yield of gaseous decomposition products than the nickel iodide silica gel catalyst. Using 95% methanol (5% H_2O) and a catalyst containing 84.2 per cent. cobalt iodide on silica gel, under a pressure of 260 atm. at $180^\circ C.$, a total conversion of 39.7 per cent. of methanol was obtained of which free acetic acid was 17.8 per cent., methyl acetate 3.6 per cent. and gaseous by-products 18.3 per cent.

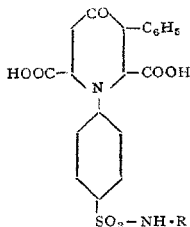
16. STUDIES IN CATALYTIC OXIDATION OF ETHYLENE TO ETHYLENE OXIDE. N. Venkataraman, I. B. Gulati and S. K. Bhattacharyya, *Curr. Sci.*, 1952, **21**, 9.

Though the catalytic oxidation of ethylene to ethylene oxide, employing a static bed of catalysts has been the subject of a number of patents and a few publications, there is no comprehensive data on the performance of catalysts deposited on non-metallic supports. With the advent of the fluidized bed technique which is particularly suited for the above reaction, it was felt necessary to study the behaviour of the catalyst deposited on the more commonly employed non-metallic supports. Precipitated silver oxide promoted with 6% barium peroxide was employed as the catalyst. The supports employed were natural corundum, pumice, kieselguhr, activated alumina, alumina gel and quartz. The quartz-supported catalysts were found to be superior to all the others giving a conversion of about 49% with a selectivity of 58% at a space velocity of 1,500 c.c./hr./c.c. and an air-ethylene ratio of 11:1. Pumice was moderately good while activated alumina, alumina gel and kieselguhr proved to be unsuitable. The general behaviour of the catalyst was found to be independent of the nature of the support employed.

DEPARTMENT OF ORGANIC CHEMISTRY

1. STUDIES IN ANTIMALARIALS, PART XIII: SULPHA DERIVATIVES OF 3-PHENYL CHELIDAMIC ACID. L. Neelakantan, B. H. Iyer and P. C. Guha, *J. Indian Chem. Soc.*, 1952, **29**, 61.

In view of the established antimalarial activity of some sulpha drugs and the presence of pyridine nucleus in many antimalarial drugs, six new derivatives of 3-phenyl chelidamic acid have been synthesised as possible antimalarials by reacting 3-phenyl chelidonic acid with sulpha drugs like sulphanilamide sulphapyridine, sulphathiazole, sulpha pyrimidine, sulphamerazine and sulphamethazine. With sulphanilamide N-(*p*-sulphonamido-phenyl-4-(*p*-aminophenylsulphonimino-3-phenyl-pyridine-2, 6-dicarboxylic acid (I) is formed. The other sulpha drugs lead to compounds of the formula



R = 2-Pyridyl, 2-thiazolyl, 2-pyrimidyl,
4-methyl-2-pyrimidyl and
4, 6-dimethyl-2-pyrimidyl.

Compound (I) showed some suppressive activity against *P. gallinaceum* in chicks.

2. STUDIES IN ANTIMALARIALS, PART XIV: BIGUANIDE DERIVATIVES OF 3-PHENYL PYRIDINE DICARBOXYLIC ACID. L. Neelakantan, B. H. Iyer and P. C. Guha, *J. Indian Chem. Soc.*, 1952, **29**, 131.

The preparation of twelve aryl biguanide derivatives from 3-phenyl chelidonic and 3-phenyl chelidamic acids as possible antimalarials is described in this paper. When tested pharmacologically, 1-(*p*-chlorophenyl-biguanyl)-4-*p*-chlorophenyl biguanido-2, 6-bis (*p*-chlorophenyl biguanido formyl)-3-phenyl pyridine showed some suppressive activity against *P. gallinaceum* in chicks.

3. ACRIDYL-BIGUANIDES, PART II: 5-BIGUANIDYL-SUBSTITUTED-2-CHLORO-7-METHOXY-ACRIDINES. P. R. Gupta and P. C. Guha, *Sci. and Cult.*, 1951, **16**, 475.

Eleven compounds possessing the essential structural features of "Atebrin" and "Paludrine" have been synthesised as potential antimalarials,

by reacting 2, 5-dichloro-7-methoxy acridine with the mono-substituted biguanides either as free base or hydrochloride in phenolic medium.

4. BIGUANIDO DERIVATIVES OF DIARYL SULFONES AND SULPHIDES. B. N. Jayasimha, S. C. Bhattacharyya and P. C. Guha, *Curr. Sci.*, 1951, 20, 158.

This paper reports the preparation of a number of biguanido derivatives of diaryl sulphones and sulphides. Some of the compounds have shown very encouraging anti-tubercular properties in *in vitro* tests.

5. GUANIDO DERIVATIVES OF DIARYL SULPHONES AND SULPHIDES. B. N. Jayasimha, S. C. Bhattacharyya and P. C. Guha, *Curr. Sci.*, 1951, 20, 184.

Guanido derivatives of 4, 4'-diamino diphenyl sulphide and sulphone and 4-nitro-4'-amino diphenyl sulphide and sulphone have been synthesised with a view to studying their pharmacological properties. These compounds have been obtained by refluxing the amine hydrochloride with various aryl cyanamides in alcohol.

6. THIOCARBAMIDO DERIVATIVES DIARYL SULPHONES AND SULPHIDES. J. R. Iyengar, S. C. Bhattacharyya and P. C. Guha, *Curr. Sci.*, 1951, 20, 184.

This paper describes the preparation of seventeen mono- and bis-thiocarbamido-derivatives of 4-nitro-4'-amino-diphenyl sulphide and sulphone, and bis-(4-aminophenyl)-sulphide and sulphone, by reacting the amines with the corresponding mustard oil in ethyl alcohol. Some of the compounds have shown marked antibacterial properties in *in vitro* tests.

7. ANTI-TUBERCULOUS COMPOUNDS. I. THIOSEMICARBAZONES. M. Raghavan, *Curr. Sci.*, 1952, 21, 10.

Ten Schiff's bases of *p*-aminobenzaldehyde thiosemicarbazone, the acetyl derivative of which is known as "Tibione" or "Conteben", have been synthesised as potential anti-tuberculous compounds and tested for activity.

8. ESSENTIAL OIL FROM THE LEAVES OF *Atlantia monophylla* (D. C. PRODOR. FLOURBINDAWIGHT), WILD LIME OIL. U. G. Nayak and P. C. Guha, *J. Indian Chem. Soc.*, 1951, 28, 713.

The essential oil from the leaves of *Atlantia monophylla* has been isolated in 0.4 to 0.6 per cent. yield calculated on dry leaves. The physical and chemical constants of the oil have been determined. The oil has been analysed and the presence of *l*-sabinene 38 per cent., *l*-linalol 14 per cent., and

l-linalylacetate 17 per cent. has been established. The oil also contains unidentified higher terpene esters (29%) of the azulene group.

9. SYNTHETICS IN PERFUMERY. P. C. Guha and Sukh Dev, *Indian Soap Journal*, 1952, **17**, 181.

The paper entitled "Synthetics in Perfumery" presents a brief review (36 references) of some of the recent advances in the field of synthetic organic compounds used in perfumery. The synthetics have been classified under several heads like alcohols, esters, ethers, aldehydes, ketones, lactones, nitromusks and miscellaneous and dealt separately.

10. ESSENTIAL OIL FROM *Hyptis suaveolens* POIT. U. G. Nayak and P. C. Guha, *J. Indian Chem. Soc.*, 1952, **29**, 183.

The oil distils between 155° and 270° C. The low boiling fractions contain chiefly *l*-sabinene and *d*-limonene. The sesquiterpene fraction contains chiefly an azulene-yielding sesquiterpene. The constituents of the oil are *l*-sabinene, 31%, *d*-limonene 12%, azulenic sesquiterpene 17%, and unidentified sesquiterpenes and sesquiterpene alcohols 40 per cent.

11. ESSENTIAL OIL FROM *Hymenatherum Tenhifolium* CASS.: ISOLATION OF HYMENATHERENE—A NEW ACYLIC MONOTERPENE. U. G. Nayak, Sukh Dev and P. C. Guha, *J. Indian Chem. Soc.*, 1952, **29**, 23.

The essential oil isolated in a yield of 0.12 per cent. from the plants consists chiefly of a hydrocarbon "hymenatherene", a new acyclic monoterpene. This hydrocarbon which accounts for 50 per cent. of the oil has been shown to have the structure



12. ESSENTIAL OIL FROM *Ocimum killimanjaricum* GUERKE. U. G. Nayak and P. C. Guha, *J. Indian Chem. Soc.*, 1952, **29**, 112.

This paper reports the isolation of the oil in a yield of 3.3 per cent. *d*- α -Pinene 10 per cent., *d*-limonene 6 per cent., terpinolene 5 per cent., and *d*-camphor 70 per cent., have been identified as the constituents.

13. STRUCTURE OF HUMULENE. Sukh Dev, *Curr. Sci.*, 1951, **20**, 296.

Humulene on treatment with *p*-toluene sulphonic acid gives a bicyclohumulene, which on dehydrogenation over Pd-C at 325–35° C. gives an azulene. A structural formula for humulene has been suggested.

14. SESQUITERPENES FROM *Piper cubeba* LINN. R. K. Razdan and S. C. Bhattacharyya, *Curr. Sci*, 1952, **21**, 68.

It has been shown that the sesquiterpene hydrocarbon fraction, b.p. 111–12°/9 mm., is not cadinene as reported by Simonsen and co-workers, but a mixture of the tricyclic hydrocarbon coprene with another new hydrocarbon with two conjugated double bonds. A tentative formula for the hydrocarbon has been suggested.

15. ESSENTIAL OIL FROM *Ocimum gratissimum* ROXB. U. G. Nayak and P. C. Guha, *J. Indian Chem. Soc.*, 1952, **29**, 203.

The plants on steam distillation gave an essential oil in a yield of 0.53 per cent. The oil consists of ocimene 15 per cent., eugenol 61.8 per cent. and unidentified alcohol 10 per cent.

DEPARTMENT OF BIOCHEMISTRY

CHROMATOGRAPHY

32. CIRCULAR PAPER CHROMATOGRAPHY FOR THE SEPARATION OF AMINO ACIDS (with Two Figs.). K. V. GIRI, *Curr. Sci.*, 1951, **20**, 295.

A method for the separation of amino acids by paper chromatography using circular filter paper discs as the inert support and butanol-acetic acid-water (40:10:50) as the developing solvent has been described. Rf values of some of the amino acids are tabulated.

33. A TECHNIQUE FOR THE IDENTIFICATION OF AMINO ACIDS SEPARATED BY CIRCULAR PAPER CHROMATOGRAPHY (with One Fig.). K. V. GIRI and N. A. N. Rao, *Nature*, 1952, **163**, 923.

A new technique, which permits the identification of amino acids separated by circular paper chromatographic technique, by reference to the chromatogram of the known amino acids run on the same paper has been described. Some of the free amino acids present in papaya latex have been identified by this newly developed paper chromatographic technique.

34. SEPARATION AND IDENTIFICATION OF AMINO ACIDS FROM PROTEIN HYDROLYSATES BY CIRCULAR PAPER CHROMATOGRAPHY (with Two Figs.). K. V. GIRI, K. Krishnamurthy and T. A. Venkitasubramanian, *Curr. Sci.*, 1952, **21**, 11.

Circular paper chromatography technique has been applied to the amino acid analysis of casein.

35. QUANTITATIVE DETERMINATION OF AMINO ACIDS SEPARATED BY CIRCULAR PAPER CHROMATOGRAPHY. K. V. GIRI, K. Krishnamurthy and T. A. Venkitasubramanian, *Curr. Sci.*, 1952, **21**, 44.

A simple method for the quantitative determination of amino acids separated on circular paper chromatograms has been described. The method is based on the extraction of the colour of the ninhydrin stained bands with 75% alcohol and comparison of the colour intensity with a known sample of amino acid similarly treated. Using this method, circular paper chromatograms of threonine and isoleucine mixture run with *n*-butanol acetic acid-water as the solvent gave recoveries of 98-100% for threonine and iso-leucine, valine and glycine in the range of 3.2-12.8 g. showed direct proportionality between optical density and concentration.

36. CIRCULAR PAPER CHROMATOGRAPHIC ANALYSIS OF THE AMINO ACIDS OF TEA AND COFFEE INFUSIONS (with One Fig.). K. Krishnamurthy, T. A. Venkitasubramaniam and K. V. Giri, *Curr. Sci.*, 1952, **21**, 133.

The circular paper chromatographic technique has been applied to the separation and identification of amino acids present in tea and coffee infusions. The presence of aspartic acid, glutamic acid, leucine, isoleucine, phenylalanine, valine, alanine, serine, asparagine, tyroxine, arginine, histidine, lysine, proline and monoester of glutamic acid were identified in tea infusion. Coffee infusion was found to contain very insignificant amounts of amino acids compared to tea infusion.

ENZYMES

37. A DILATOMETRIC STUDY OF THE SOYABEAN INHIBITORS. T. Viswanatha and R. Rajagopalan, *Curr. Sci.*, 1952, **21**, 104.

The process of digestion of casein by trypsin, in the presence and absence of the inhibitor, was followed dilatometrically. The release of amino acid was also observed by Formal titration procedure. The results indicated a close correlation between the amino nitrogen released and the dilatometric readings. These studies have confirmed the view that the inhibitor acts by facilitating an aggregation of the intermediate products.

38. A TECHNIQUE FOR THE IDENTIFICATION AND SEPARATION OF ENZYMES BY PAPER CHROMATOGRAPHY (with Five Figs.). K. V. Giri, A. L. N. Prasad S. Gowri Devi and J. Sri Ram, *Biochemical Journal*, 1952, **51**, 123.

A technique for the identification and separation of enzymes by paper chromatography is described. The application of this technique to the study of the movement of amylases, phosphorylases and phosphatases on paper has been examined and Rf values for these enzymes, prepared from various plant and animal tissues have been presented.

Aqueous acetone, aqueous ethanol and sodium chloride solutions have proved useful as solvents for the study of the movement of the enzymes on paper.

Some examples of the separation of enzymes by means of this technique are given. The usefulness and potentialities of this technique in the study of the chromatographic behaviour of enzymes are discussed.

39. SEPARATION OF ENZYMES BY PAPER CHROMATOGRAPHY (with One Fig.). K. V. Giri and A. L. N. Prasad, *Nature*, 1951, **168**, 786.

The separation of amylase from the proteinase trypsin has been achieved by the application of paper chromatographic technique. The chromato-

grams were run at low temperature (0–5° C.), the developing solvent being 50% aqueous acetone containing 1.5 per cent. sodium chloride.

40. INTERACTION OF VITAMIN C AND UREASE. P. S. Rao and K. V. Giri, *Proc. Ind. Acad. Sci.*, 1952, **35**, 132.

The inhibition of urease activity by vitamin C is not due to dehydroascorbic acid as the degree of inhibition produced by the latter is negligible compared to that produced by vitamin C at the same concentration. 8-Hydroxy-quinoline, sodium diethyl dithiocarbamate and potassium cyanide, which protect vitamin C against oxidation catalysed by Cu are shown to protect the urease from inactivation by vitamin C and vitamin C–Cu complex, thereby showing that the inactivation of urease by vitamin C is related to the oxidation of the vitamin. It is suggested that the inactivation of urease by vitamin C catalysed by Cu may be due to intermediate products like Cu_2O formed during the oxidation.

41. STUDIES ON MOULD LIPASE. C. V. Ramakrishnan and B. N. Banerjee, *Research*, 1951, 434.

Lipases prepared from the moulds *Rhizopus C₁*, *A. flavus C₂*, *A. oryzae C₃* and *A. oryzae C₄* grown on cotton-seeds as well as cotton-seed cakes were shown to possess appreciable lipolytic activity.

42. MOULD LIPASE: EFFECT OF ADDITION OF VITAMINS AND STEROL TO THE CAKE MEDIUM ON THE GROWTH AND THE ACTIVITY OF THE LIPOLYTIC MOULD. C. V. Ramakrishnan and B. N. Banerjee, *Nature*, 1951, **168**, 917.

The lipolytic mould *A. niger* was shown to grow well in the medium when cholesterol, vitamin B₂ or α -tocopherol was added. Addition of digitonin inhibited the growth.

43. STUDIES ON MOULD LIPASE II: INVESTIGATION ON THE SUITABILITY OF THE CAKE MEDIUM TO GROW THE LIPOLYTIC MOULD. C. V. Ramakrishnan and B. N. Banerjee, *Enzymologia*, 1951, **15**, No. 2, 98–102.

A groundnut cake medium containing 15% oil-free groundnut cake, 10% groundnut oil and 200 c.c. water adjusted to pH 4.2 was shown to be suitable for the growth of the lipolytic mould *A. niger*, the optimum temperature and period of ageing being 35° C. and 4 days respectively.

44. STUDIES ON MOULD LIPASE: COMPARATIVE STUDY OF LIPASES OBTAINED FROM MOLDS GROWN ON SAFFLOWER SEED. C. V. Ramakrishnan and B. N. Banerjee, *Journal of the University of Bombay*, 1951, **20**, 11.

Different strains, viz., yellow mold S₁, *A. funigatus* S₂, *A. flavus* S₃, *A. oryzae* S₄, *Penicillium* S₅ were shown to possess appreciable lipolytic activity at their optimum pH of 6.2.

45. STUDIES ON MOLD LIPASE: COMPARATIVE STUDY OF LIPASES OBTAINED FROM MOLDS GROWN ON COCOANUT. C. V. Ramakrishnan and B. N. Banerjee, *Experientia*, 1951, 7, 434.

Strain of *A. flavus*, *A. oryzae* and *A. niger* isolated from moulds grown on cocoanut were shown to be lipolytically active.

46. STUDIES ON MOLD LIPASE. C. V. Ramakrishnan and B. N. Banerjee, *Indian Soap Journal*, 1951, 17, 65.

Different strains isolated from molds grown on Mysore oilseed were shown to have lipolytic activity.

FOOD AND NUTRITION

47. INFLUENCE OF DIETARY SUPPLEMENTATION OF MILK AND CURD ON THE INTESTINAL SYNTHESIS OF THIAMINE IN RATS. S. Balakrishnan and R. Rajagopalan, *Curr. Sci.*, 1952, 21, 135.

Rats receiving curd as a vitamin B₁ supplement excreted more vitamin B₁ than did the rats having pure vitamin B₁ or milk as supplement.

It has been concluded that curds provide a more favourable medium for the bacterial synthesis of vitamin B₁ by elaborating coliform organisms.

48. INTESTINAL THIAMINE SYNTHESIS AS INFLUENCED BY DIETARY LEVELS OF PROTEIN. S. Balakrishnan and R. Rajagopalan, *Curr. Sci.*, 1952, 21, 134.

The study of the urinary and faecal excretion of vitamin B₁ in rats receiving completely vitamin B₁-deficient diets varying in protein contents indicated that the lower protein level enhances the intestinal synthesis of vitamin B₁ in rats.

49. EFFECT OF CALCIUM AND PHOSPHORUS ON THE INTESTINAL SYNTHESIS OF VITAMIN B₁. S. Balakrishnan and S. S. De, *Indian Journal of Physiology and Allied Sciences*, 1951, 5, 123.

A low phosphorus diet has been shown to favour the intestinal synthesis of vitamin B₁ as compared to the higher levels of phosphorus.

The effects of different levels of calcium are not very significant.

50. EFFECT OF LEVELS OF PROTEIN ON THE EXCRETION OF VITAMIN B₁ BY RATS. S. Balakrishnan and S. S. De, *Indian Journal of Physiology, and Allied Sciences*, 1951, 5, 90.

It has been shown that contribution of vitamin B₁ due to intestinal synthesis is more when the daily intake of the animal was 5 g than at an intake of 10 g.

The low protein level has been shown to favour the bacterial synthesis of thiamine.

51. THE INFLUENCE OF LEVELS OF FAT AND PROTEIN ON THE INTESTINAL SYNTHESIS OF VITAMIN B₁ IN RATS. S. Balakrishnan and S. S. De, *Indian Journal of Physiology and Allied Sciences*, 1952, 6, 1.

A high fat diet is shown to increase the intestinal synthesis of vitamin B₁ and a high protein level is also helpful in that direction in combination with a high fat diet.

52. STUDIES ON BALANCED FOOD. B. M. Lal and S. S. De, *Indian Journal of Physiology and Allied Sciences*, 1952, 6, 8.

A pilot plant procedure for alcohol extraction of the oil-cake is discussed. A supplementary food using groundnut cake and tapioca flour has been processed. Experiments with albino rats have shown that the food is fairly well balanced and would serve as a good source of supplement to a poor South Indian diet.

53. EFFECT OF LACTOSE AND GALACTOSE ON THE UTILISATION OF FATS. T. A. Venkitasubramanian and S. S. De, *Indian Journal of Physiology and Allied Sciences*, 1952, 6, 1.

With lactose as the carbohydrate fed to rats along with groundnut oil, the survival time was significantly longer in both sexes, though males survived for a longer time than the females. This may in part be attributed to a larger food intake. No differences in survival period were found between 1% and 5% lactose diets.

54. EFFECT OF MILLING OF RICE ON THE UTILISATION OF CALCIUM AND PHOSPHORUS IN GROWING RATS. (Srimathi) Vanamala Sathe, T. A. Venkitasubramanian and S. S. De, *Indian Journal of Physiology and Allied Sciences*, 1952, 6, 80.

With greater intakes of calcium and phosphorus, the rice diet could give very good growth. From the point of view of conserving the maximum amount of vitamins and at the same time having the optimum of phytic acid so as not to interfere to a marked degree with the utilisation of calcium, 7% milling seems to be desirable.

55. RELATIVE AVAILABILITY OF CYSTINE AND METHIONINE IN THE RAW, GERMINATED AND AUTOCLAVED SOYABEANS AND SOYABEAN MILK. T. Viswanatha and S. S. De, *Indian Journal of Physiology and Allied Sciences*, 1951, 5, 61.

Autoclaved soyabean has the maximum availability of methionine and raw soyabean has the minimum, while the germinated bean and soya milk

occupy intermediary positions. Conversion of soyabean into milk has only a slight effect on methionine availability. The causes for the low utilisation of methionine in the raw bean have been discussed.

56. STREPOGENIN IN SOME INDIAN PULSES. K. Krishna Murthy and S. S. De, *Indian Journal of Physiology and Allied Sciences*, 1951, 5, 83.

Streptogenin concentrates from four common Indian pulses were assayed for their activity by microbiological assays and animal experiments. Horsegram and green gram were found to have more activity than casein.

57. 'IN VITRO' STUDIES ON THE NUTRITIVE VALUE OF SOYABEANS. T. Viswanatha and S. S. De, *Indian Journal of Physiology and Allied Sciences*, 1951, 5, 130.

Rate of release of methionine and lysine has been studied in the raw, germinated, and autoclaved soyabeans and egg white. Methionine release is increased by germination and autoclaving. Methionine is liberated at a slower rate than lysine in all the cases of soyabeans, while the reverse is the case in egg white during the early stages of digestion.

58. MUTUAL SUPPLEMENTATION IN VEGETABLE PROTEINS. B. M. Lal and R. Rajagopalan, *Curr. Sci.*, 1952, 21, 45.

Determination of the biological value of a number of mixtures consisting of oilseed proteins were carried out. The results point out that oilseed (peanut) globulins are supplemented adequately either by cereal proteins, like those of wheat, or by the proteins from a legume, like soya. A mixture consisting of only oilseed proteins does not supplement peanut proteins. It is also observed that wherever yeast formed one of the constituents of the mixture, the biological value is invariably lowered.

59. STUDIES ON A CHEAP SUPPLEMENTARY FOOD OF HIGH NUTRITIVE VALUE. B. M. Lal and R. Rajagopalan, *Science and Culture*, 1952.

Trials carried out to process a supplementary food that could bring about a marked influence on growth and maintenance of health from materials which are normally not considered as foodstuffs, have given very useful results. Enriched with vitamins and minerals, the food when given at a low level of 2 oz. per day would supply valuable nutrients.

60. COMPARATIVE SUPPLEMENTARY VALUE OF PROCESSED SOYA PRODUCTS, GROUNDNUT, BENGAL GRAM AND WHEAT GRAM. R. Rajagopalan. *Science and Culture*, 1952, 17, 294.

A significant increase in the supplementary value of soyabean on germination is observed, the value ranging very close to Bengal gram and

wheat gram. Thus, germination of soyabeans brings about almost the same beneficial effect as autoclaving.

61. LOSS OF FLAVOUR AND DEVELOPMENT OF RANCIDITY IN ROASTED COFFEE POWDER DURING STORAGE. C. R. Harihara Iyer, R. Rajagopalan, M. S. Ramaswamy and S. C. Pillai, *Science and Culture*, 1952, 17, 296-98.

With a view of studying the loss of flavour from packed coffee powder, a number of samples of the products marketed by certain firms in India were examined and analytical results for moisture, water extract, ash, alkalinity, nitrogen and fat were collected. Certain samples contained relatively more moisture, less of cold water extractable substances and also some foreign matter which, when separated and boiled with water, was found to give off a smell somewhat resembling the oil of cinnamon, and these factors appeared to facilitate the development of rancidity in the coffee samples studied.

62. AMINO ACID COMPOSITION OF INDIAN FOODSTUFFS. PART I. TRYPTOPHAN, LEUCINE, ISOLEUCINE AND VALINE CONTENT OF SOME CEREALS. S. C. Balasubramanian, M. Ramachandran, T. Viswanatha and S. S. De, *Indian Journal of Medical Research*, 1952, 40, 73.

Tryptophan, leucine, isoleucine and valine contents of rice, cholam, cumbu, ragi and wheat have been determined microbiologically using *Lactobacillus arabinosus*.

63. STUDIES ON THE REFRACTIVE INDEX OF MILK. C. V. Ramakrishnan and B. N. Banerjee, *Indian Journal of Dairy Science*, 1952, 5, 25.

The effect of feed, processing, addition of skim milk, water and sucrose to milk on its density, refractive index and refractive constant has been determined.

64. REFRACTIVE INDEX AND FLUORESCENCE OF DIFFERENT SAMPLES OF MILK. T. A. Venkitasubramanian and C. V. Ramakrishnan, *Science and Culture*, 1951, 17, 260.

The Refractive constants and Fluorescence of milk from various sources were determined and tabulated.

SANITATION BIOCHEMISTRY

65. INFLUENCE OF ACTIVATED SLUDGE ON CERTAIN PATHOGENIC BACTERIA. S. C. Pillai, M. I. Gurbaxani and K. P. Menon, *Indian Medical Gazette*, 1952, 87, 117-19.

Experiments are described in this paper which show that *B. typhosus*, *B. dysenteriae* and *V. cholera* are eliminated during the activated sludge process of sewage purification.

66. TREATMENT AND DISPOSAL OF THE EFFLUENT FROM DIGESTERS IN PAPER MILLS. C. R. Harihara Iyer, R. Rajagopalan and S. C. Pillai, *Science and Culture*, 1952, **17**, 382-83.

The character and composition of the effluent from a certain paper mill and observations on the pre-treatment of the effluent before it is diluted with domestic sewage and purified by the activated sludge process are given.

67. EFFECT OF THE EFFLUENTS FROM VEGETABLE GHEE FACTORY, SUGAR FACTORY AND WOOD GROUND MILL ON ACTIVATED SLUDGE. C. R. Harihara Iyer, R. Rajagopalan and S. C. Pillai, *Science and Culture*, 1952, **17**, 521-22.

The character and composition of the effluents from the vegetable ghee factory, sugar factory and wood ground mill at a certain centre and observations on the purification of these effluents along with domestic sewage by the activated sludge process are given. It was observed that the purification was dependent on the reaction of the mixture of the industrial wastes and domestic sewage which should be nearly neutral.

68. THE USE OF SYNTHETIC ION EXCHANGE RESINS FOR THE ISOLATION AND SEPARATION OF AMINO ACIDS. N. Krishnaswamy and K. V. Giri, *Science and Culture*, 1952, **17**, 369.

In this review an attempt is made to focus the attention on methods using synthetic ion exchange resins for the isolation and separation of amino acids.

ANTIBIOTICS

69. ANTIBIOTIC PRINCIPLE OF *Garcinia morella*. PART II. CHEMISTRY OF MORELLIN. P. L. Narasimha Rao and S. C. L. Verma, *Journal of Scientific and Industrial Research*, 1952, **11 B**, 206-09.

The possible hydration during the chromatographic purification of morellin in silica gel columns is indicated. The octahydro derivatives of morellin, O-dimethyl-morellin and iso-morellin have been prepared by catalytic hydrogenation and it was shown those of morellin and iso-morellin differ only in optical rotation but otherwise identical and so it was postulated that epimerisation of groups about asymmetric centre or a reshuffling of double bonds is involved in the morellin-isomorellin transformation. By treatment of octa-hydro-O-dimethyl-morellin, with alcoholic potash, a phenol $C_{32}H_{46}O_6$ is formed and it is shown that lactonic structure for morellin is included. The absorption spectra in the visible range as well as number of colour reactions of morellin, isomorellin, and the substances derived from

them are described in the paper. These observations provide a basis for assigning a substituted hydro-xanthone structure for morellin.

70. A NOTE ON TOXICITY OF MORELLIN AND ITS SUITABILITY FOR TOPICAL APPLICATIONS. P. L. Narasimha Rao and S. C. L. Verma, *Curr. Sci.*, 1952, **21**, 219.

It is shown that olive oil solutions of morellin when administered subcutaneously to mice are nonlethal, and also in doses below 400 mg./kg. weight no necrosis results. If the drug is given in the form of emulsions there is the risk of its settling down in the tissues causing local irritation and may even result in the formation of necrotic lesions.

The suitability of the drug for topical application to septic wounds is indicated.

CYTOGENETICS

71. FURTHER EVIDENCE FOR MITOSIS IN YEASTS. S. Duraiswami and M. K. Subramaniam, *Experientia*, 1951, **7**, 422.

In a previous work the mitosis of a Brewery Yeast with only two chromosomes was described. This finding can now be illustrated with photomicrographs also. All the phases of mitosis without any deformation through other phenomena can be observed if the yeast is cultured in a galactose medium.

72. ALLELES AND THEIR TIME OF EXPRESSION IN YEASTS. M. K. Subramaniam, *Proc. Nat. Inst. Sci. India*, 1951, **17**, 367-71.

The various types of sculpturing observed in giant colonies of the two chromosome brewery yeast could be classified into distinct types in an ascending grade of complexity. This classification is shown to be a natural one on the basis of observations on types exhibiting finally a complex sculpturing. The simpler types appear as orderly stages during the development of complex ones. The multiple alleles occurring at the locus governing the nature of sculpturing appear to be related to one another as hypo- and hypermorphs. It is indicated diagrammatically how with increasing complexity of final expression the earlier types are not only pushed farther and farther but that there is also a corresponding shortening of the duration of each stage.

73. CRITICAL EVIDENCE FOR SOMATIC DOUBLING OF CHROMOSOMES IN A TOP YEAST. (Miss) S. Royan and M. K. Subramaniam. *Nature*, 1952, **169**, 932.

Critical cytological evidence for the occurrence of somatic doubling of chromosomes in a top yeast having an unequal pair has been presented

in the form of photomicrographs of early and late anaphase. There is no strict synchronisation of the timing of cytokinesis and karyokinesis. Somatic doubling of chromosomes is as common in yeasts as in higher organisms.

74. STUDIES ON THE MUTAGENIC ACTION OF CHEMICAL AND PHYSICAL AGENCIES ON YEASTS. IV. THE EFFECT OF CAMPHOR ON FERMENTING YEAST CULTURES. M. K. Subramaniam and S. K. Sreepathi Rao, *Proc. Ind. Acad. Sci.*, 1952, **35 B**, 1-27.

The effect of camphor on fermenting yeast cultures is described. The necessity for a clear differentiation of the effect of camphor on aerobically growing cultures from that on fermenting cells is emphasized. The changes in the population of the gene mutants in the culture of the control and that growing in the presence of one or two drops of camphor solution are not parallel. Camphor accelerates the mutation rate at the locus governing the nature of sculpturing of the colony. It is suggested that stable tetraploids arise only when the doubling of the chromosome complement is preceded by a specific stabilizing gene mutation. Since camphor induces gene mutations, all tetraploids induced by camphor need not have identical genic constitution. If one assumes the probability that a series of alleles at a particular locus govern the harmonious working of haploid, diploid and polyploid chromosome numbers treatment with polyploidogens instead of doubling the chromosome complement may even lead to production of forms with reduced chromosome numbers.

75. STUDIES ON THE MUTAGENIC ACTION OF CHEMICAL AND PHYSICAL AGENCIES ON YEASTS. V. EFFECT OF ULTRA-VIOLET IRRADIATION ON A DIPLOID BREWERY YEAST. S. Duraiswami and M. K. Subramaniam, *Proc. Ind. Acad. Sci.*, 1952, **35 B**, 155-66.

Investigations in this laboratory indicated that polyploidogens are also mutagenic and that mutagens may induce polyploidy. Doubling of the chromosomes leading to viable tetraploid races is sporadic and as such an induction was observed after ultra-violet irradiation. The evidence recorded in this paper confirmed the suspicion that induction of tetraploidy being conditioned by a specific gene mutation and induced gene mutations being sporadic, treatment with ultra-violet rays does not always lead to the production of tetraploidy. The existence of multiple alleles at the locus governing the nature of sculpturing of the giant colonies is confirmed. A theory of the mode of action of the various biologically effective physical and chemical agencies on living organisms is considered.

76. TETRAPLOIDY IN YEASTS. M. K. Subramaniam, *Cellule*, 1951, **54**, 145-148.

Critical cytological evidence for an induction of auto-tetraploidy in a two chromosome yeast strain is presented in the form of photomicrographs. Meta- and anaphases of (1) the diploid during normal aerobic growth, (2) the induced tetraploid during the progress of treatment with acenaphthene and (3) the stable autotetraploid isolated after exposure for 90 days are illustrated. Technical difficulties do not preclude satisfactory chromosome counts as asserted by Winge and Roberts. Polyploidy could satisfactorily explain the phenomena described by them in their recent paper.

77. STUDIES ON A RIBOFLAVIN EXCRETING YEAST. PART I. THE INFLUENCE OF SOME ENVIRONMENTAL FACTORS ON THE GROWTH AND RIBOFLAVIN PRODUCTION. K. K. Mitra, *J. Sci. and Ind. Res.*, 1952, **11 B**, 109-15.

The factors influencing the performance of a riboflavin excreting mutant yeast strain, BY 2, have been investigated. Biotin is the only vitamin essential for the growth of the organism and for the production of riboflavin. A synthetic medium containing glucose, 4%; Difco yeast extract, 0.04%; and salts gave satisfactory growth of the organism and a yield of 65.2 μ g. of riboflavin per c.c. of culture medium after 7 days incubation. Better growth was observed when the concentration of yeast extract in the medium was increased, but the yield of riboflavin was markedly decreased. The growth and production capacity of the organism increased up to a limit, with the increase in the surface area per unit volume of the culture medium.

78. PHYSIOLOGICAL CONSEQUENCES OF POLYPLIIDY IN YEASTS. 1. FERMENTATION CHARACTERISTICS OF A DIPLOID BREWERY YEAST AND ITS AUTOTETRAPLOID. K. K. MITRA, *Biochem. et Biophys. Acta*, 1952, **8**, 615-24.

Yeast strains belonging apparently to the same species vary widely in their fermentation characteristics and the cause of these variations has not been established on any scientific basis. There is the possibility that this difference is purely governed by the chromosomal constitution of the different strains. A diploid strain of bottom brewery yeast and an auto-tetraploid obtained from it by treatment with acenaphthene were used as experimental material. The data presented show that under a variety of conditions the tetraploid strain shows a faster rate of fermentation—the acceleration being about 30% over that given by the diploid. Data on sugar-alcohol balance indicate that the tetraploid has got a slightly better fermentative efficiency. Although the rate of fermentation varies widely, the

final amount of alcohol produced by the two strains is identical. There has been no change in the sugar tolerance on duplication of the chromosome complement.

79. SOMATIC CHROMOSOMAL REDUCTION IN YEAST. L. S. Prahlada Rao and M. K. Subramaniam, *Arch. f. Mikrobiol.*, 1952, **17**, 160-65.

An abnormal type of segregation by which endopolyploid cells give rise to buds having the normal diploid complement of two chromosomes, is described in five-day old fermenting liquid cultures. Photomicrographs are presented to show that the above phenomenon is not confined to liquid cultures alone but occurs also in endopolyploid cells from agar slants. It is suggested that the mode of segregation described above is a type of somatic reduction in chromosome number by which the yeast strain can survive in an unfavourable environment wherein the population consists predominantly of endopolyploid cells of varying complexity.

SECTION OF ECONOMICS AND SOCIAL SCIENCES

1. PRESENCE OF TENSION AND FEELING OF INSECURITY. N. S. N. Sastry, *Indian Journal of Psychology*.

Tension handicaps free psychological locomotion in the self-society configuration; this is expressed by the creation of 'barriers'; and is productive of a feeling of insecurity. Diagnosis of tension must proceed by analysis of the sense of security in the important aspects of the 'life-space' of the individual.

2. SECURITY INDEX—A FURTHER NOTE. N. S. N. Sastry and S. K. Ramachandra Rao, *Indian Journal of Psychology*.

Theoretical foundations of the concept of Security Index were investigated. The concept has been defined in terms of the personality organization of the individual. The general sense of security is a structure of several aspects, physical, social, etc. The employment of a scale to measure the Index is also justified. The factor of "intensity of opinion" has been introduced and explained. The validity and reliability of the Questionnaire have been statistically analysed.

3. TESTING IMAGINATION BY PROJECTIVE TECHNIQUE. N. S. N. Sastry and S. K. Ramachandra Rao, *Indian Journal of Psychology*.

In order to get at the most effective type of employing the well-known Ink-blot method of testing imagination, an experiment was conducted upon four varieties of blots, *viz.*, whole-filled, whole-empty, part-filled, and part-empty, and two ways of administering them, passive interpretation and active projection. 400 observations were made; the null hypothesis regarding the influence of various methods on the subjects in so far as the number of interpretations are concerned, was borne out. But out of the several modes, whole-empty interpretation was found to be most fruitful; whole-filled in both interpretation and projection was significantly inferior to whole-empty. In effect, whole-empty appears the best in occasioning imagination.

4. A PROLEGOMENON TO MATHEMATICAL PSYCHOLOGY. S. K. Ramachandra Rao, *Experientia*, 1952, 8, fasc. 6.

This paper attempts to develop an independent mathematical discipline for understanding psychological phenomena. The principles of axiomatics and point-set theory have been made applicable; three axioms of inclusion, attribution and action have been tentatively stated and some lemmas and deductions worked out. The field of psychologic object has been defined.

5. UEBER DAS MESSEN DES INDUSTRIALLEN WIRKUNGSGRADES (MEASUREMENT OF INDUSTRIAL EFFICIENCY: METHODOLOGY). M. C. Munshi, *Textil Praxis, Hiedelberg*, January 1952.

It discusses the concept of Efficiency as a fundamental of the theory of economic change such as Scarcity. It points out the various forms in which it is sought to be expressed and the need for its measurement. It shows how productivity (of labour) is now measured and expressed in official and non-official publications in the form of productivity indices. The paper then proceeds to suggest how this measurement should be extended to other sectors of the industrial unit. This could be done by building up management-ratios, input-output-ratios and by cost analysis. These four parts could then be integrated so that the analysis would result in objective criteria for measuring the effectiveness of a productive unit. A scheme of co-operative research—especially with the help of chemical engineers—is suggested for the initial stages of such a task in industries like sugar or cement.

6. THE PLACE OF ENERGY IN INDUSTRIAL PROGRESS. M. C. Munshi, *Industrial Review*, February 1952.

It begins by pointing out how, since the advent of the Industrial Revolution, inanimate energy has been replacing the animate and how this rate of substitution has been greatly accelerated since the turn of the present century. Discussing the relative development of hydel power in the last three decades in relation to its potential in the different countries, it shows the new role that it has come to play in industrial as well as agricultural advance. At the same time, however, its utilisation and expansion in a co-operative endeavour for world economic development raises several economic issues.