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BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

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DECEMBER, 1943

A., II.—ORGANIC CHEMISTRY

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A., II.—Organic Chemistry

DECEMBER, 1943.

I.—ALIPHATIC.

Conception of the outcome of chemical reactions. Its origin, operation, and limits. M. Trautz (*J. pr. Chem.*, 1943, [ii], **162**, 121—147).—A general historical review of the author's views. It is stressed that the activated state involves formation of a new and chemically distinct entity which is an intermediate common to reactants and products. R. S. C.

Proton mobility and influence of substituents, especially carbonyl and sulphonyl. F. Arndt and B. Eistert (*Ber.*, 1941, **74**, [*B*], 423—454).—Theoretical. The following are discussed: characteristics of proton mobility; proton mobility and constitution; simple hydrides and the field effect; increase in acid nature by substituents; mesomerism and resonance; H exchange and the change in acid nature by substituents; kinetics and energy balance of proton mobility; electronic theory of the SO_2 group. H. B.

Preparation of β-chloro-Δ$^{\beta}$-butene.—See B., 1943, II, 337.

Macromolecular compounds. CCCXII. Caoutchouc. LV. Halogen derivatives of rubber hydrocarbons. Hermann Staudinger and Hansjürgen Staudinger (*J. pr. Chem.*, 1943, [ii], **162**, 148—180; cf. A., 1942, II, 293).—K_m (determined by η at 20°) for squalene in PhMe and for squalene hexahydrochloride in PhMe, $CHCl_3$, or tetrahydrofuran are $4{\cdot}2$ and $5{\cdot}4 \times 10^{-4}$ or, after allowance for the differing sp. gr., $3{\cdot}6$ and $5{\cdot}9 \times 10^{-4}$ respectively. The reason for the increase due to halogen is obscure. Hydrochlorides of balata (**I**) and caoutchouc (**II**) are prepared having mol. wts. (determined osmotically) 45,000—410,000 and K_m (in PhMe) $0{\cdot}42$—$0{\cdot}79$ and $1{\cdot}0$—$1{\cdot}3 \times 10^{-4}$, respectively; since (**I**) and (**II**) have K_m $1{\cdot}2$—$1{\cdot}3$ and $1{\cdot}7 \times 10^{-4}$, respectively, the decrease due to halogen is due to ring-shortening by cyclisation of uncertain nature; the cyclisation is also evidenced by low Cl contents, this deficiency being larger for (**I**) than for (**II**) in agreement with the respective K_m. A pronounced fall in K_m with increasing mol. wt. is shown. Interaction of $ZnEt_2$ with the hydrochlorides of (**I**) and (**II**) in PhMe–N_2 at −20°, raised later in steps to 40°, gives ethylpolypranes, from which some HCl has been lost and which have only about half the original degree of polymerisation; products having mol. wt. 50,000—165,000 have K_m $0{\cdot}72$—$0{\cdot}95 \times 10^{-4}$, changes from the hydrochlorides being relatively slight. If the decrease in K_m for the hydrochlorides had been due to crumpling of a long chain under the influence of the Cl, replacement of the Cl by Et should have returned K_m to approx. its original val. Absence of such a return confirms the view that the hydrochlorides are cyclised products. The product formed from (**I**) and HBr at 0° is very unstable; a "dibromide" ($56{\cdot}16\%$ Br; theory 70%) had K_m $0{\cdot}61 \times 10^{-4}$, indicating cyclisation also in this case. Chloroprene, having mol. wt. 115,000, has K_m $1{\cdot}65 \times 10^{-4}$, thus resembling (**I**), (**II**), and Buna, and further confirming the cyclisation of the hydrochlorides. Laboratory preps. of chloro-caoutchouc, -balata, and -Buna 85, and three technical chloro-rubbers, having $54{\cdot}90$—$65{\cdot}92\%$ of Cl and mol. wt. 82,000—410,000, have K_m $0{\cdot}30$—$0{\cdot}49 \times 10^{-4}$ in PhMe; the very low K_m, similar to that of *cyclo*caoutchouc, indicates much cyclisation, in which the side-chains probably participate; this is confirmed by inactivity of the Cl-products towards LiMe, LiPh, and $ZnEt_2$ (cf. the pinene hydrochloride derivative, $C_{10}H_8Cl_{10}$); this polycyclic polyterpene structure explains also the stability of the chloro-rubbers and thus their suitability for use in varnishes. K_m for various rubber derivatives are compared and low vals. explained as due to cyclisation in all cases. η increases with concn., particularly for the long mols. (high K_m). When rubber and its derivatives are stretched, the small aggregates of long mols. are compressed laterally into large aggregates, which then act as crystals under *X*-rays; plasticisers function by easing the sliding of these aggregates over one another. The elasticity is due to deformation of the side-chains during stretching (compression); its extent thus depends on the nature of the branching and side-chains. Purification of the products examined is described. R. S. C.

Configuration of Δ$^{\alpha\gamma}$-butadiene.—See A., 1943, I, 295.

Absorption of light by organic molecules and ions according to quantum mechanics.—See A., 1943, I, 295.

Assignment of absorption bands in conjugated systems of chromophores.—See A., 1943, I, 296.

Effect of acidifying substituents on chromophoric systems.—See A., 1943, I, 296.

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Conjugation of chromophores and constitution of organic compounds.—See A., 1943, I, 296.

Production of carbon tetrachloride.—See B., 1943, II, 306.

Influence of oxygen and sulphur atoms on the velocity of hydrolysis of the carbon–halogen bond.—See A., 1943, I, 310.

Catalytic action of activated silica–alumina. Action of activated clay on *n*-octyl alcohol and *cyclo*hexanone. A. V. Frost (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **37**, 223—225).—Boiling *n*-C_8H_{17}·OH and activated Caucasian clay with removal of H_2O gives C_8H_{16} 33%, C_8H_{18} 4%, $C_{16}H_{34}$ 6%, $C_{16}H_{32}$ 4%, higher saturated (2%) and unsaturated hydrocarbons 13%, tar 2%, H_2O 11%, gas and losses 17%, and other products 5%. Boiling *cyclo*hexanone with the clay gives C_6H_6 (~5%), *cyclo*hexane, methyl*cyclo*pentane, and PhOH. R. S. C.

Marine products. XIV. Astrol.—See A., 1943, III, 895.

Diphenylurethane of nerol. Y. R. Naves and A. V. Grampoloff (*Helv. Chim. Acta*, 1943, **26**, 1393).—Contrary to the suggestion of Palfray *et al.* (*Bull. Soc., chim.*, 1943, [v], **10**, 131), the diphenylurethane of nerol, m.p. 52°, is a well-defined individual. H. W.

Benzoylation of erythritol and preparation of derivatives of *O*-benzoylglycollaldehyde. H. Ohle and G. A. Melkonian (*Ber.*, 1941, **74**, [*B*], 291—294; cf. A., 1943, II, 393).—*meso*-Erythritol (**I**) and 5 mols. of BzCl in C_5H_5N afford 98% of meso-*erythritol tetrabenzoate* (**II**), m.p. 188—188·5°. (**I**) and 2 mols. of BzCl afford some (**II**), with the 1 : 4-*di*- (**III**), m.p. 148°, and 1 : 2 : 4(?)-*tri-benzoate*, m.p. 108—108·5°. (**III**) and $Pb(OAc)_4$ in C_6H_6 afford OBz·CH_2·CHO [*phenylhydrazone* (unstable), m.p. 80—81°; 2 : 4-*dinitrophenylhydrazone*, m.p. 185°] and an isomeric *erythritol* 1 : 3(?)-*dibenzoate*, m.p. 142°, already present in the (**III**) used. J. Wa.

Synthesis of optically active β-phosphatidic acids. E. Baker, I. B. Cushing, and H. O. L. Fischer (*Canad. J. Res.*, 1943, **21**, **B**, 119—124).—*dl*- and l(−)-*Glyceryl α-benzoate*, m.p. 66·5—67°, $[\alpha]_D$ −16·8° in EtOH [from *d*(+)-*iso*propylideneglycerol benzoate and aq. AcOH at 80°], with CPh_3Cl in quinoline at 100°, then at room temp., yield respectively *dl*-, m.p. 124—125°, and l-*γ-triphenylmethylglyceryl α-benzoate*, m.p. 89—90°, $[\alpha]_D$ −12·6° in EtOH, −22·1° in C_5H_5N, −11·5° in C_6H_6, which with $POCl_3$ in C_5H_5N, then K_2CO_3 under Et_2O, yield *K* dl-, m.p. 174—175° (bath preheated to 145°, then heated at 10° per min.), and l-*α-benzoyl-γ-triphenylmethyl-β-glycerophosphate*, m.p. 174—175°, converted by reduction (H_2, Pd) or hydrolysis (dil. HCl at room temp.) into K *dl*- and (impure) *l*-*α*-benzoyl-*β*-glycerophosphate, $[\alpha]_D$ +9° in H_2O, respectively. A. Li.

Production of sodium formate.—See B., 1943, II, 307.

Thermal decomposition of *n*- and *iso*-propyl formates.—See A., 1943, I, 309.

Catalytic oxidation of hydroxylated and unsaturated fatty acids.—See B., 1943, II, 339.

Inhibitors of the enzymic oxidation of unsaturated fatty acids.—See A., 1943, III, 915.

Investigation of the metabolism of fats with deuterium as indicator. II. Formation of oleic acid from carbohydrates.—See A., 1943, III, 904.

Esters of glycollic acid.—See B., 1943, II, 307.

Preparation of lactic acid.—See B., 1943, II, 338.

Effect of citrate on rotation of molybdate complexes of malate, citramalate, and *iso*citrate. H. A. Krebs and L. V. Eggleston (*Biochem. J.*, 1943, **37**, 334—338; cf. Auerbach and Krüger, A., 1923, ii, 884; B., 1924, 32).—The optical rotation of the molybdate complexes of malic, citramalic, and *iso*citric acid is increased by citrate, the magnitude of the increase (sometimes >100%) depending on the concn. of the substances. Account must be taken of this in the polarimetric determination of the acids by the molybdate

method. A procedure for determining malic and *iso*citric acid polarimetrically in presence of molybdate and citrate is described. The equilibrium mixture of citrate, *iso*citrate, and *cis*-aconitate which exists in presence of liver- or muscle-aconitase (at 38° and pH 6·8) contains 89·5, 6·2, and 4·3% respectively of these acids. The proportions are but little affected by increasing the pH to 7·4. Addition of $MgCl_2$ shifts the equilibrium in favour of citrate.

W. McC.

Ether-like compounds. XXIV. Synthesis and reaction velocities of higher ether-acids. M. H. Palomaa [with S. Lehtimäki and A. Valkola] (*Ber.*, 1941, **74**, [*B*], 294—298; cf. A., 1939, I, 206).—The acids, $OMe{\cdot}[CH_2]_n{\cdot}CO_2H$ with $n = 1$—4, have previously been studied and the series is now extended to $n = 5$—8. When $n = 2$, the velocities of (MeOH) esterification and acid hydrolysis of the ester are a min. due to intramol. factors. The temp. coeffs. for esterification and hydrolysis throughout are ~2·5, indicating similar energies of activation. Kinetic results are tabulated. $OMe{\cdot}[CH_2]_5{\cdot}Cl$ (**I**), $KNa(CN)_2$, and KI afford ε-methoxyhexonitrile, b.p. 76—78°/2·5 mm., hydrolysed to ε-methoxyhexoic acid, b.p. 131—132°/5—6 mm. ζ-Methoxyheptoic acid, b.p. 160—162°/16—17 mm., is obtained from (**I**) by a malonic ester synthesis. $OMe{\cdot}[CH_2]_5{\cdot}MgCl$ and $(CH_2)_2O$ afford *η-methoxyheptyl alcohol*, b.p. 96—97°/3 mm., converted into the *chloride* (**II**), b.p. 77—78°/6·5 mm., with $SOCl_2$ and C_5H_5N, and then into η-methoxyoctonitrile, b.p. 107—108°/6·5 mm., which is hydrolysed (KOH in aq. MeOH) to η-methoxyoctoic acid, b.p. 144—145°/3 mm., m.p. 7°. θ-Methoxynonoic acid, b.p. 146—147°/1 mm., m.p. 10°, is obtained from (**II**) by a malonic ester synthesis.

J. Wa.

Keto-acids, enol-lactones, and cyclic ketones. I. Reaction of succinyl chloride with ethyl sodiomalonate. I. So-called "ethyl succinylmalonate" (ethyl 2-butanolidenemalonate) and ethyl succinyldimalonate. II. Reaction of succinyl chloride with ethyl sodiomalonate. P. Ruggli and A. Maeder (*Helv. Chim. Acta*, 1943, **26**, 1476—1498; 1499—1501).—I. The product of the action of $(CH_2{\cdot}COCl)_2$ (**I**) on $CHNa(CO_2Et)_2$ is shown to be Et 2-butanolidenemalonate [Et 5-keto-2-tetrahydrofurylidenemalonate] (**II**), $\begin{matrix}CH_2{\cdot}CH_2\\ CO\text{——}O\end{matrix}\!>\!C{:}C(CO_2Et)_2$. $CO_2Et{\cdot}CH_2{\cdot}CO{\cdot}[CH_2]_2{\cdot}CO_2Me$ (**III**) is condensed only to a very small extent by Na in boiling C_6H_6 but gives mainly the salt $CO_2Et{\cdot}CH{:}C(ONa){\cdot}[CH_2]_2{\cdot}CO_2Me$, which regenerates (**III**) when acidified. With KOH in abs. MeOH at room temp. (**III**) affords the salt $CO_2K{\cdot}[CH_2]_2{\cdot}C(OK){:}CH{\cdot}CO_2Et$, which, when acidified, gives *Et β-keto-δ-carboxy*-n-*valerate*, m.p. 57—58°, which gives a violet colour with $FeCl_3$ and does not yield an enol-lactone when its aq. solution is evaporated. It is characterised by the labile *semicarbazone*, m.p. 180—181° (decomp.), which passes into 1-carbamylpyrazol-5-one-3-propionic acid, decomp. 195°, when kept in the reaction mixture. Gradual addition of (**I**) [modified prep. best by treatment of $(CH_2{\cdot}CO)_2O$ with $SOCl_2$ in presence of $ZnCl_2$] to a well-cooled suspension of $CHNa(CO_2Et)_2$ in anhyd. Et_2O gives as main product (**II**), m.p. 68°, which gradually gives a red colour with $FeCl_3$ due to scission of the enol-lactone ring and ultimately a ppt. of basic Fe^{III} succinate. With KOAc or NEt_3 in abs. EtOH (**II**) gives an intense blue colour which soon becomes green and ultimately pale yellow; if H_2O is added to the green solution the blue colour reappears temporarily and a blue oil is pptd. The constitution of (**II**) is established by its hydrogenation (PtO_2 in EtOH at room temp.) followed by hydrolysis to $CO_2H{\cdot}[CH_2]_3{\cdot}CH(CO_2Et)_2$, m.p. 139°, decarboxylated to $([CH_2]_2{\cdot}CO_2H)_2$. H_2O at 100° hydrolyses (**II**) to $CH_2(CO_2Et)_2$, $(CH_2{\cdot}CO_2H)_2$ and the viscous $CO_2H{\cdot}[CH_2]_2{\cdot}CO{\cdot}CH(CO_2Et)_2$ (**IV**) characterised by its transformation by $NH_2{\cdot}CO{\cdot}NH{\cdot}NH_2{,}HCl$ and KOAc into the *K* salt of 1-carbamyl-4-carbethoxypyrazol-5-one-3-propionic acid, $NH_2{\cdot}CO{\cdot}N\!<\!\begin{matrix}N\text{═══}C{\cdot}CH_2{\cdot}CH_2{\cdot}CO_2H\\ \|\qquad\qquad\quad|\\ C(OK){:}C{\cdot}CO_2Et\end{matrix}$, decomp. 206—207°. (**II**) is hydrolysed by conc. aq. Na_2CO_3 at 10—15° to nearly homogeneous (**III**), which cannot be distilled unchanged under diminished pressure and slowly decomposes when kept. The *salt*, $\begin{matrix}C[{:}C(CO_2Et)_2]{\cdot}O\\ CH_2{\cdot}CH_2{\cdot}CO\text{——}O\end{matrix}\!>\!Cu$, gradual decomp. >250°, is described. Under strictly defined conditions, purified (**IV**) affords a *semicarbazone*, m.p. 153—154° (decomp.), softens at 150°. (**IV**) is transformed by anhyd. NaOAc in boiling C_6H_6 into (**II**). With NH_2Me in abs. EtOH at 0° (**II**) gives $(CH_2{\cdot}CO{\cdot}NHMe)_2$, m.p. 174—175°, and with NH_2Ph at 40° it yields $(CH_2{\cdot}CO{\cdot}NHPh)_2$, m.p. 226°. With $NH_2{\cdot}CO{\cdot}NH{\cdot}NH_2{,}HCl$ and KOAc in aq. EtOH at room temp. (**II**) affords *succindisemicarbohydrazide*, m.p. 195—197°, softens at 192°; if the time of reaction is reduced and the solution is treated with NH_3 the *K* salt, decomp. 224°, of 1-carbamyl-4-carbethoxypyrazol-5-one-3-propionsemicarbohydrazide is obtained.

$CHNa(CO_2Et)_2$ and (**II**) in warm Et_2O afford *Et_4 succinyldimalonate* [*Et_4 βε-diketohexane-αηη-tetracarboxylate*] (**V**), m.p. 67—68° [mixed m.p. with (**II**), 51—55°]. (**V**) gives an immediate, permanent red colour with $FeCl_3$ but no colour with KOAc. It is relatively stable towards strong mineral acids. The *Cu* and $Hg^{\cdot\cdot}$ compounds are described. With $NH_2{\cdot}CO{\cdot}NH{\cdot}NH_2$ (**V**) affords *αβ-di-*(1-*carbamyl*-4-*carbethoxy*-3-*pyrazol*-5-*onyl*)*ethane*, decomp. 207—209°, and with $NHPh{\cdot}NH_2$ in aq. AcOH at 100° it gives *αβ-di-*(4-*carbethoxy*-1-*phenyl*-3-*pyrazol*-5-*onyl*)*ethane*, m.p. 188—189°. (**V**) is converted by anhyd. NEt_3 in abs. Et_2O at room temp. into (**II**) and $CH_2(CO_2Et)_2$.

II. Subjection of the non-cryst. material left after the isolation of (**II**) to distillation in a high vac., intense cooling, and cautious treatment with NH_3, $Cu(OAc)_2$, and $Hg(OAc)_2$ leads to the isolation of further quantities of (**II**), its hydrolytic product (**IV**), and a small amount of (**V**) arising from the interaction of (**II**) and $CHNa(CO_2Et)_2$. As new product is obtained *Et_4 2 : 5-furylidenedimalonate* (**VI**), $\begin{matrix}CH{:}C(CHR_2)\\ CH{:}C(CHR_2)\end{matrix}\!>\!O$ or $\begin{matrix}CH_2{\cdot}C(:CR_2)\\ CH_2{\cdot}C(:CR_2)\end{matrix}\!>\!O$ (R = CO_2Et), m.p. 82—83°. Very slowly (**VI**) gives a red colour with $FeCl_3$ which is ultimately converted into a red-brown ppt. of basic Fe^{III} succinate. With KOH or NaOH in EtOH (**VI**) gives an immediate, intensely yellow colour; the K salt is hygroscopic and decomposes readily on exposure to air. (**V**) could not be converted into (**VI**) by dehydrating agents such as NaOAc in boiling C_6H_6 or by the action of Ac_2O on the Na_2 compound of (**V**). Towards the end of the condensation of (**I**) with $CHNa(CO_2Et)_2$ more or less dark colours are produced in the pptd. Na compounds which according to alkalinity vary from red through dark violet to greenish-black and on neutralisation and extraction with Et_2O pass as a red colour into the oil. In presence of a slight excess of mineral acid the colour is yellow. Treatment of the oil with a little NH_3, amine, $NaHCO_3$, or dil. alkali or even with $NHPh_2$ gives indicator-like, dark violet colours which disappear on addition of acid. These colours are not given by pure (**V**), but the violet, blue, and green tones are invariably observed when weak bases act on (**II**) in org. media. They are probably due to the true Et_2 succinylmalonate, $\begin{matrix}CH_2{\cdot}CO\\ CH_2{\cdot}CO\end{matrix}\!>\!C(CO_2Et)_2$, which was possibly obtained on two occasions by shaking the "residual oil" with Na_2CO_3. It has m.p. 109°, gives yellow solutions with alkalis and org. bases and is transformed by $NHPh{\cdot}NH_2$ into $(CH_2{\cdot}CO{\cdot}NH{\cdot}NHPh)_2$. A reaction mass with typical indicator properties is best obtained from (**I**) or (**II**) and $CHNa(CO_2Et)_2$ in mol. ratio 1 : 3 or 1 : 1 respectively.

H. W.

Autoxidation of *l*-ascorbic acid.—See A., 1943, III, 667.

Effect of protoporphyrin on autoxidation of *l*-ascorbic acid.—See A., 1943, III, 667.

Antigenic properties of hyaluronic acid.—See A., 1943, III, 925.

New steroid glucuronide from human urine.—See A., 1943, III, 656.

Ring structures and mutarotations of the modifications of *D*-galacturonic acid. H. S. Isbell and H. L. Frush (*J. Res. Nat. Bur. Stand.*, 1943, **31**, 33—44).—In nature of mutarotation α- (**I**) and β- (**II**) -*D*-galacturonic acid strongly resemble α- (**III**)- and β- (**IV**) -galactopyranose respectively. For the hydrated form of (**I**) $[\alpha]_D^{20} = +44{\cdot}83° \times 10^{-0{\cdot}0148t} + 10{\cdot}26 \times 10^{-0{\cdot}16t} + 51{\cdot}90°$, corresponding to an initial [α] of +107·0° and an equilibrium val. of +51·9°. For (**II**) $[\alpha]_D^{20} = -31{\cdot}84 \times 10^{-0{\cdot}0148t} + 6{\cdot}21 \times 10^{-0{\cdot}13t} + 56{\cdot}72°$, corresponding to an initial [α] of +31·1° and an equilibrium val. of +56·7°. In addition to the parallelism in the course of the mutarotation reactions, the mol. rotations and other properties indicate that (**I**) and (**II**) are an α–β-pyranose pair analogous to (**III**) and (**IV**). Oxidation of (**I**) or (**II**) by Br in acid solution gives optically active δ- and γ-mucolactones. The formation of optically active lactones is evidence that the ring forms of (**I**) and (**II**) are oxidised without the intermediate formation of either the open-chain modification of (**I**) or (**II**) or of free mucic acid and the production of both lactones established a relatively rapid pyranose furanose interconversion of (**I**) and (**II**). (**II**) is oxidised by Br more rapidly than (**I**). Oxidation measurements show that Na galacturonate is a salt of (**II**). (**II**) is conveniently obtained by repeated digestions of (**I**) with hot, glacial AcOH.

H. W.

Resolution of α-xanthogeno-*n*-butyric acid into optically active antipodes. A. Fredga and M. Tenow (*Arkiv Kemi, Min., Geol.*, 1943, **16**, **B**, No. 9, 5 pp.).—By successive uses of the alkaloids in aq. EtOH *r*-, m.p. 60—60·5°, is resolved into (−)-, m.p. 31—32°, $[\alpha]_D^{25}$ −102° in $CHCl_3$, −92·9° in EtOAc (*cinchonidine* salt), and (+)-, m.p. 31·32°, $[\alpha]_D^{25}$ +92·8° in EtOAc [*strychnine* (+$2H_2O$) salt], -α-*xanthogeno*-n-*butyric acid*.

A. T. P.

Derivatives of β-thiol*iso*butyric acid. A. Fredga and O. Mårtensson (*Arkiv Kemi, Min., Geol.*, 1943, **16**, **B**, No. 8, 6 pp.).—$CH_2{:}CMe{\cdot}CO_2H$ and $SH{\cdot}CH_2{\cdot}CO_2H$ (water-bath) give *β-acetylthiol*iso*butyric acid*, m.p. 40—40·5°, converted by aq. NaOH, followed by aq. $CH_2Br{\cdot}CO_2H$, into *β-carboxymethylthiol*iso*butyric acid*, m.p. 71—72°, also obtained from $SH{\cdot}CH_2{\cdot}CO_2H$–aq. NaOH–$CH_2Br{\cdot}CHMe{\cdot}CO_2H$ at room temp., or from $CBrMe_2{\cdot}CO_2Et$–Na–EtOH, followed by $SH{\cdot}CH_2{\cdot}CO_2Et$, and hydrolysis with HCl. $SH{\cdot}CMe_2{\cdot}CO_2H$, aq. NaOH, and $CH_2Br{\cdot}CO_2H$–$KHCO_3$ (neutralised) afford *α-carboxymethylthiol*iso*butyric acid*, m.p. 106—107·5°.

A. T. P.

Production of acraldehyde.—See B., 1943, II, 308.

Polymerisation of acetaldol. L. N. Owen (*J.C.S.*, 1943, 445—446).—Cryoscopic determinations in H_2O and dioxan show that dimeris-

ation of freshly distilled aldol is complete in ~4 hr.; there is no alteration in mol. wt. of each sample over a period of several hr. In one case, when an aq. solution of viscous aldol was kept for several weeks, there was a gradual fall in mol. wt. In AcOH (favours polymerisation), the mol. wt. is independent of the age of the aldol and corresponds to 20% of monomeride + 80% of dimeride. Freshly distilled aldol and a small amount of AcOH or BzOH show a rise in temp. and a marked increase in η in ~10 min.; with quinol, pyrogallol, α- or β-$C_{10}H_7$·OH, or p-NH_2·C_6H_4·OH, the sample becomes viscous in ~1 hr., thus behaving like pure aldol. A. T. P.

Dimeric glyceraldehyde $\alpha\gamma$-diphosphate. E. Baer and H. O. L. Fischer (*J. Biol. Chem.*, 1943, **150**, 213—221).—Successive addition of PPh_2OCl and *r*-glyceraldehyde to dry C_5H_5N at 10—15° and subsequently at room temp. gives *glyceraldehyde $\alpha\gamma$-di(diphenyl phosphate)*, m.p. 110—111°, transformed by catalytic hydrogenolysis in MeOH with H_2 and PtO_2 at room temp. into dimeric glyceraldehyde $\alpha\gamma$-diphosphate (**I**), $CH_2R{\cdot}CH\langle^{O{\cdot}CHR}_{CHR{\cdot}O}\rangle CH{\cdot}CH_2R$ [R = O·PO(OH)$_2$], identified as the Ba_2 H_4 (+$2H_2O$) and Ca_2 H_4 (+$2H_2O$) salts. The normal Ca and Ba salts are amorphous. Short acid hydrolysis of (**I**) gives glyceraldehyde γ-phosphate whereas prolonged hydrolysis leads to AcCHO. Towards alkali (**I**) is remarkably stable. A hydrolysis by phosphatases from dog fæces at pH 9·6 is described.

[By O. Meyerhof.] (**I**) has been tested for biological activity directly, after partial acid hydrolysis and after incubation with alkali. The negative results show that a substance of constitution and configuration such as (**II**) cannot be the expected intermediary between glyceraldehyde γ-phosphate and glyceric acid $\alpha\gamma$-diphosphate in carbohydrate metabolism. H. W.

Synthesis of *dl*-glyceraldehyde γ-phosphate. E. Baer and H. O. L. Fischer (*J. Biol. Chem.*, 1943, **150**, 223—229).—Dimeric glyceraldehyde $\alpha\gamma$-di(diphenyl phosphate) is converted by 30—32% HBr in AcOH at room temp. into *glyceraldehyde α-bromide γ-Ph_2 phosphate* (dimeric) (**I**), $CH_2R{\cdot}CH\langle^{CHBr{\cdot}O}_{O{\cdot}CHBr}\rangle CH{\cdot}CH_2R$ [R = O·PO(OPh)$_2$], m.p. 161—162°, and by HCl in pure dioxan into the corresponding dimeric *α-chloride* (**II**), m.p. 146—147°. (**II**) with 2 : 4-$(NO_2)_2C_6H_3{\cdot}NH{\cdot}NH_2$ in boiling 2·5N-HCl affords methylglyoxal-2 : 4-dinitrophenylosazone (**III**) in 97% yield. (**I**) is converted by reductive cleavage with PtO_2 and H_2 in dry AcOH or, preferably, by treatment with boiling 4% AcOH–$COMe_2$ into *glyceraldehyde α-bromide γ-H_2 phosphate* (*dimeric*) (**IV**), best purified as its additive *product* (**V**) with 2 mols. of dioxan. N-HCl at 100° for 1 hr. or N-NaOH for 20 min. at room temp. liberates 99·4 and 96·0% respectively of the H_3PO_4 from (**V**), which also gives (**III**) when treated with 2 : 4-$(NO_2)_2C_6H_3{\cdot}NH{\cdot}NH_2$. (**IV**) and (**V**) are readily hydrolysed to glyceraldehyde γ-H_2 phosphate, best isolated as the Ca salt. H. W.

General methods for the formation of ketens. C. F. Hurd, F. W. Cashion, and P. Perletz (*J. Org. Chem.*, 1943, **8**, 367—372).—No general method of preparing CHR:C:CO exists. Zn and $CH_2Br{\cdot}COBr$ (**I**) give HBr, EtOAc, $CH_2Br{\cdot}CO_2Et$, and $CH_2Br{\cdot}CO{\cdot}CHBr{\cdot}COBr$ (characterised by conversion by aq. NH_3 and then aq. Br into *$\alpha\alpha\gamma$-tribromoacetoacetamide*, m.p. 118°). Keten is also not obtained from (**I**) by Cu-bronze (gives HBr), Na (gives HBr), Mg (no reaction), or Mg + MgI_2–Et_2O–N_2 (gives I). $CH_2Cl{\cdot}CO_2Et$ with Zn gives HCl and with Mg + MgI_2 or NaI gives I, but no keten. OAc·CHMe·COBr, b.p. 160°, and Zn in Et_2O give HBr but no CHMe:C:CO. R. S. C.

Oxidation of ketones.—See B., 1943, II, 339.

Bromination of ketones.—See B., 1943, II, 308.

Autoxidation of Δ^α-unsaturated ketones. I. Peroxide formation and association processes. H. Albers and W. Schmidt (*J. pr. Chem.*, 1943, [ii], **162**, 91—112).—Thin films of CHMe:CH·COMe (**I**) evaporate, leaving a very small, soft residue. Those of CHMe:CH·CH:CH·COMe (**II**) rapidly change to a resin. Passing O_2 through (**I**) at 20±0·05° leads to absorption of ~0·5 atom of O and formation of <1% of peroxide but of much MeCHO. Similar passage of O_2 through (**II**) gives a peroxide very rapidly, with only traces of CO_2 and MeCHO; up to 1·75—1·8 atoms of O are absorbed before the liquid becomes too viscous to allow passage of gas. The peroxidic product (**III**) explodes when heated. Quant. measurements during the reaction indicate dimerisation of the peroxide, which is confirmed by determination of mol. wts. $\eta_{sp.}$ increases enormously during the reaction (from 1·46 to 14,614), this being ascribed to association rather than to polymerisation by primary valencies; the *trans*-form of the dimeric peroxide, $CHAc{:}CH{\cdot}CH\langle^{O{\cdot}O{\cdot}CHMe}_{CHMe{\cdot}O{\cdot}O}\rangle CH{\cdot}CH{:}CHAc$, is particularly suited to give linear aggregates leading to high η. The resins of the films are formed by decomp. of the peroxide, probably with concomitant polymerisation by primary valencies. (**III**) is readily sol.; it is thixotropic in C_6H_6; thermal dissociation occurs at higher temp. (*e.g.*, 50°). Inability to polymerise accounts for inability of (**III**) to catalyse polymerisation of styrene. R. S. C.

Alkylation of hydrazine. O. Westphal (*Ber.*, 1941, **74**, [*B*], 759—776).—Alkylation of N_2H_4 with AlkHal generally proceeds thus: $N_2H_4 \rightarrow NH_2{\cdot}NHAlk \rightarrow NH_2{\cdot}NAlk_2 \rightarrow NH_2{\cdot}NAlk_3Hal$ (**I**). If, however, Alk has a large vol. (*e.g.*, Pr$^\beta$, CH_2Ph) formation of (**I**) is hindered or prevented, and NHAlk·$NAlk_2$ (**II**) or, under favourable conditions, $(NAlk_2)_2$ results. Formation of (**II**) is also favoured by use of AlkCl, the reactivity of which decreases with increase in chain-length. If the reaction is carried out at >110° with AlkCl the yield of (**I**) falls and that of (**II**) rises (max. at 150—160° and diminishes at >170°). Formation of (**I**) is favoured when Alk is small but none results when AlkCl is >$C_8H_{17}Cl$, at which point the yield of (**II**) also begins to fall and is nil at >$C_{12}H_{25}$. MeCl could not be used since the reactions are usually carried out in glass tubes. Reaction proceeds differently when, *e.g.*, a steel autoclave is used; the lower AlkCl thus give unsaturated hydrocarbons, NH_3, NH_4Cl, and evil-smelling bases. The following (**II**) are obtained, usually with mono- and di-substituted hydrazines, from N_2H_4 (~1·25 mols.), AlkCl (~1 mol.), and sufficient EtOH to give a homogeneous solution at 150—155° unless stated otherwise: *triethyl-* (9·5%), b.p. 43—44°/30 mm., *triallyl-* (12% at 100°), b.p. 61—63°/11 mm., *tripropyl-* (25%), b.p. 59—61°/11 mm. [with (CH·CO)$_2$O in boiling C_6H_6 gives *maleic monotripropylhydrazide*, m.p. 65—66°], *tributyl-* (36%), b.p. 102—104°/11 mm. (15% of $NH_2{\cdot}NBu_3Cl$ also formed; *maleic monotributylhydrazide*, m.p. 60—61°), *trihexyl-* (42%), b.p. 172—174°/14 mm. (*maleic monotrihexylhydrazide*, m.p. 57—58°), and *trioctyl-hydrazine* (34%), b.p. 186—187°/4 mm. These are colourless, stable liquids which are somewhat sensitive to O_2 at high temp., reduce aq. NH_3–$AgNO_3$ in the cold, are not affected by yellow HgO, are weak to very weak bases, and show 1 active H (Zerevitinov at 90°; ~0·33 at 25°); the viscosity rises with increased C content. Pr$^\beta$Cl at 150° gives NN- or NN′-*diisopropylhydrazine* (49%), b.p. 32—34°/12 mm.; *sec.*-BuCl at 145° affords a *disec.-butylhydrazine* (28%), b.p. 86—87°/11 mm.; Bu$^\gamma$Cl in boiling MeOH gives *tert.-butylhydrazine hydrochloride*, m.p. 202° (after sublimation; transformation point at 122°). The following are also described: *mono-*, b.p. 80—81°/14 mm., and *di-hexyl-*, b.p. 138—140°/14 mm., *mono-*, b.p. 112—114°/12 mm., and *di-octyl-*, b.p. 185—187°/12 mm., m.p. ~26° (*Ac* derivative, m.p. 81—82°), *mono-*, b.p. 176—177°/15 mm., m.p. 31° (*hydrochloride*, m.p. 68°), and *di-dodecyl-*, m.p. 55·5° [oxidised (HgO in C_6H_6) to *tetradodecyltetrazen*, m.p. 52·5°], mono-, m.p. 57—58° (*hydrochloride*, m.p. 84°), and *di-hexadecyl-hydrazine*, m.p. 74—75° (corresponding tetrazen, m.p. 70°). NHMe·NH_2 and $C_{12}H_{25}Cl$ in EtOH at 110° give *N-methyl-N-dodecylhydrazine* (82%), b.p. 150—153°/11 mm., m.p. ~18° (corresponding tetrazen, m.p. 39°; methiodide, m.p. 126°; ethobromide, m.p. 82°). Cyclic *maleic monododecylhydrazide* is described. Prep. of $(NAlk_2)_2$ from (**II**) is best carried out with AlkBr (1·5—2 mols.) and an equiv. amount of freshly pptd., finely divided $Mg(OH)_2$ in EtOH at 140—150°. In the absence of alkali decomp. occurs; KOH is unsatisfactory since it causes olefine formation. $(NAlk_2)_2$ are unstable to acids at high temp.; when not quite pure they alter slowly in light. *Tetra-propyl-*, b.p. 88·6—89·9°/11 mm., and *-butyl-hydrazine*, b.p. 133—134°/12 mm., are described. H. B.

Synthesis of δ-diethylamino*iso*amylamine required for the manufacture of atebrin. P. C. Guha, P. L. N. Rao and T. G. Verghese (*Current Sci.*, 1943, **12**, 82—83).—$NEt_2{\cdot}CH_2{\cdot}CHO$,HCl and $COMe_2$ yield *α-diethylamino-Δ^β-penten-δ-one*, b.p. 103—105°/30 mm., reduced (Raney Ni) to $NEt_2{\cdot}[CH_2]_3{\cdot}COMe$. $CH_2Cl{\cdot}CH(OEt)_2$ with $COMe_2$ gives *α-chloropentan-β-ol-δ-one*, b.p. 128°/15 mm., which could not be dehydrated. F. R. G.

Reaction between chlorohydrins and ammonia or amines. I. Reaction mechanism. L. Smith [with T. Nilsson] (*J. pr. Chem.*, 1943, [ii], **162**, 63—70).—For interaction of α-chlorohydrin with an excess of dil. aq. NH_3, NaOH, and CHPhMe·NH_2 (**I**) at 20°, k = 5·63±0·08 to 5·84±0·12 (58·0 at 40°), 6·07 (62·0 at 40°), and 5·3—5·9, respectively, proving that the rate-controlling step in the reaction with the amines is formation of glycide (**II**). For interaction of (**II**) with an excess of *d*-(**I**) or 0′0554N-NH_3 at 20°, k = 0·0133 and (up to 40% reaction) 0·0038—0·00365, respectively. For analysis of the reaction mixture containing NH_3, 99% of the remaining NH_3 is removed in 10 min. by distillation at ~14 mm. For interaction of epichlorohydrin with NH_3 or (**I**) at 20°, k = 0·0175 and 0·050—0·051, respectively. R. S. C.

Monoalkylation of ethylenediamine with alkylene oxides. L. J. Kitchen and C. B. Pollard (*J. Org. Chem.*, 1943, **8**, 342—343).—By use of an excess of diamine, $(CH_2)_2O$, $\alpha\beta$-epoxy-*n*-propane or *-iso*-butane, or styrene oxide gives good yields of mono(hydroxyalkyl) compounds. Thus are obtained (in MeOH at 40—50°) *N-β-hydroxy-n-propyl-* (41%), b.p. 112°/10 mm. (*dihydrochloride*, m.p. 184·7—185°; picrate, m.p. 191—192·5°; phenylthiocarbamide derivative, m.p. 149·8—150°), *N-β-hydroxy-β-methylpropyl-* (87%), b.p. 103·7°/10 mm. [*dihydrochloride*, m.p. 195·7—196·4°; picrate, m.p. 198·5—200·5° (decomp.)], *N-β-hydroxy-β-phenylethyl-*, m.p. 76—80°, b.p. 184·8°/10 mm. (dihydrochloride, m.p. 196·7—200·8°), and *N-β-hydroxyethyl-ethylenediamine*, b.p. 123°/10 mm. [picrate, m.p. 224° (decomp.); dihydrochloride, m.p. 114·3—115·2°]. M.p. are corr. R. S. C.

Preparation of amino-ethers and their acyl derivatives.—See B., 1943, II, 339.

Determination of amino-acids.—See A., 1943, II, 404.

Amino-acid esters.—See B., 1943, II, 339.

Preparation of β-alanine. F. Weygand (*Ber.*, 1941, **74**, [*B*], 256—257).—$CN{\cdot}CH_2{\cdot}CO_2Et$ is hydrogenated at 40 atm. in AcOH containing PtO_2 and conc. H_2SO_4 to 74% of β-alanine Et ester, b.p. 55—56°/9—10 mm., hydrolysed [$Ba(OH)_2$] to 72% of β-alanine, m.p. 195°. J. WA.

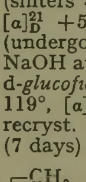
Amino-acid composition of tyrosidine. *NN'*-Diacetyl-*l*-ornithine, m.p. 156°, $[\alpha]_D^{15}$ +6·3° in EtOH.—See A., 1943, III, 846.

Preparation of cystine, methionine, and homocystine containing radioactive sulphur. A. M. Seligman, A. M. Rutenburg, and H. Banks (*J. clin. Invest.*, 1943, **22**, 275—279).—Radioactive $CH_2Ph{\cdot}SH$ (prep. using S or H_2S from active $BaSO_4$) was converted into radioactive *S*-benzylhomocysteine by way of $CH_2Ph{\cdot}S{\cdot}[CH_2]_2{\cdot}Cl$ and the phthalimidomalonate, and this was converted into methionine (21% yield) by Na–BuOH (giving radioactive *dl*-homocystine; yield 24%) followed by MeI. The synthesis of radioactive *dl*-cystine (21·5% yield) from $CH_2Ph{\cdot}SH$ via $CH_2Ph{\cdot}S{\cdot}CH_2Cl$ and *S*-benzylcysteine is also described. In each case 0·06 mol. of radioactive $BaSO_4$ was used.

Resolution of *dl*-pantothenic acid with cinchonidine. R. Kuhn and T. Wieland (*Ber.*, 1941, **74**, [*B*], 218).—The biologically inactive (−)-form of pantothenic acid (**I**) forms the less sol. salt with quinine, which is therefore not particularly suitable for isolating the biologically active (+)-(**I**). Cinchonidine, however, affords *cinchonidine* (+)-*pantothenate* (**II**), m.p. 178—179°, $[\alpha]_D^{18}$ −62·8° in H_2O, as the less sol. salt. The biological activity of (**II**), calc. in terms of (+)-(**I**), is twice that of the racemate. J. WA.

II.—SUGARS AND GLUCOSIDES.

Esters of methanesulphonic acid in the sugar group. IV. B. Helferich and H. Jochinke (*Ber.*, 1941, **74**, [*B*], 719—725).—Contrary to previous work (A., 1939, II, 468), 1 : 2-*iso*propylideneglucofuranose 5 : 6-diacetate 3-methanesulphonate is converted by HBr–AcOH–Ac_2O into 1 : 2-α-*bromoethylideneglucofuranose* 5 : 6-*diacetate* 3-*methanesulphonate* (**I**), which with C_6H_6–MeOH–C_5H_5N at room temp. gives the 1 : 2-α-*methoxyethylidene* derivative, m.p. 160—161° (sinters ~156°), $[\alpha]_D^{20}$ +13·1° (corresponding α-amyloxy-, m.p. 91·5°, $[\alpha]_D^{21}$ +5·1°, and α-benzyloxy-compound, m.p. 132°, $[\alpha]_D^{21}$ +0·49°) (undergoes quant. elimination of the 5- and 6-Ac with aq. MeOH–NaOH at 30°). Ag_2CO_3 and (**I**) in moist $COMe_2$ give, with difficulty, d-*glucofuranose* 2(?) : 5 : 6-*triacetate* 3-*methanesulphonate* (**II**), m.p. 119°, $[\alpha]_D^{19}$ (in EtOH) +22·4° (20 min.) → +17·4° (3 days) when recryst. from H_2O, $[\alpha]_D^{20}$ (in EtOH) +59·6° (15 min.) → +17·2° (7 days) when recryst. from H_2O and then from EtOH. (**II**) reduces Fehling's solution, is decomposed by alkali, does not give a pure compound with $MeSO_2Cl$–C_5H_5N, and is acetylated (C_5H_5N–Ac_2O at room temp.) to (?) d-*glucofuranose* 1 : 2 : 5 : 6-*tetra-acetate* 3-*methanesulphonate*, forms, m.p. 96—97·5° and 112°, $[\alpha]_D^{19}$ +80·2°, which [like (**II**)] affords (**I**) with AcOH–HBr. Di-*iso*propylidenefructose 3-methanesulphonate with HBr–AcOH–Ac_2O gives a *bromofructose triacetate* 3-*methanesulphonate* [probably (*A*), R = $MeSO_2$], m.p. 119°, $[\alpha]_D^{20}$ −178·4°, converted by Ag_2CO_3 in MeOH into the methylfructoside triacetate 3-methanesulphonate, m.p. 122° (decomp.), $[\alpha]_D^{20}$ −10·8°. [α] are in $CHCl_3$ unless stated otherwise. H. B.


(*A.*)

Thiocyanic esters of glucose and cellobiose. A. Müller and A. Wilhelms (*Ber.*, 1941, **74**, [*B*], 698—705).—6-*p*-Toluenesulphonates (but not the *sec.* esters) of sugar derivatives are converted by KCNS in abs. $COMe_2$ at 130° (sealed tube) into 6-thiocyanates. Thus β-glucose tetra-acetate 6-*p*-toluenesulphonate gives 47% of β-*glucose tetra-acetate* 6-*thiocyanate*, m.p. 117—118°, $[\alpha]_D^{21}$ +27·9°, converted by AcOH–HBr at room temp. into 1-*bromo*-α-*glucose triacetate* 6-*thiocyanate*, m.p. 160°, $[\alpha]_D^{20}$ +212·1°, which with Ag_2CO_3 in MeOH affords β-*methylglucoside triacetate* 6-*thiocyanate*, m.p. 135°, $[\alpha]_D^{21}$ +15·6°, also obtained from the corresponding 6-*p*-toluenesulphonate. α-*Methylglucoside triacetate* 6-*thiocyanate*, m.p. 101—103°, $[\alpha]_D^{21}$ +154·8° (from the 6-*p*-toluenesulphonate), with N-MeOH–NaOMe at room temp. and reacetylation gives *di*-α-*methylglucosidyl* 6 : 6'-*disulphide hexa-acetate*, m.p. 157°, $[\alpha]_D^{21}$ +254°. Contrary to Fischer (A., 1914, *i*, 662), acetobromoglucose and KCNS in $COMe_2$ give 1-*thiocyanoglucose tetra-acetate* (**I**), m.p. 132—133°, $[\alpha]_D^{19}$ −20·9° (+½ $COMe_2$), −21·8° ("anhyd."), converted by N-MeOH–NaOMe and reacetylation into *iso*thiotrehalose octa-acetate (poor yield), $[\alpha]_D^{19}$ −45·4°, and by MeOH–NH_3 into diglucosylamine octa-acetate. (**I**) reduces Fehling's solution with pptn. of CuS. At 141°/14 mm. or in boiling xylene, (**I**) rearranges to glucose tetra-acetate 1-thiocarbimide (*loc. cit.*), $[\alpha]_D^{20}$ +1·9°, which with MeOH–NH_3 and AlkOH gives 1-glucosylthiocarbamide, m.p. 210—212° (decomp.) (lit. 215—216°), and the corresponding *Me*, m.p. 182—184°, $[\alpha]_D^{20}$ +13·6°, and Et thiocarbamate, $[\alpha]_D^{21}$ +18·4°, respectively. Acetobromocellobiose and $COMe_2$–KCNS afford only *cellobiose hepta-acetate* 1-*thiocarbimide* (+2$COMe_2$), m.p. 205—206°, $[\alpha]_D^{20}$ −8·6°, m.p. ("anhyd.") 208—209°, whence the *Me*, m.p. 207—209°, $[\alpha]_D^{19}$ +12·8°, and *Et thiocarbamate*, m.p. 198°, $[\alpha]_D^{21}$ +30·7°. [α] are in $CHCl_3$. H. B.

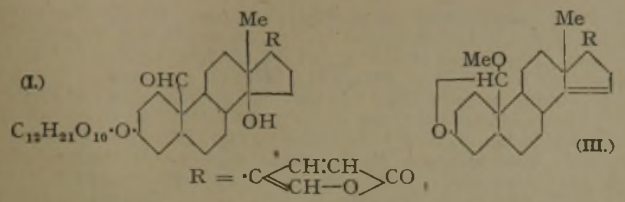
2 : 6-Dimethylglucose. K. Freudenberg and G. Hüll (*Ber.*, 1941, **74**, [*B*], 237—244; cf. A., 1943, II, 256).—2 : 6-Dimethylglucose (**I**) forms two highly cryst. tris(azobenzoyl) derivatives and hence the presence of (**I**) in the hydrolysis product from fully methylated potato starch cannot be overlooked, nor can (**I**) arise from hydrolysis of 2 : 3 : 6-trimethylglucose. Glucose, H_3BO_3, $COMe_2$, and conc. H_2SO_4 afford 1 : 2-*iso*propylidene-*d*-glucofuranose 3 : 5-monoborate (**II**), m.p. 90—100°, which is acetylated (Ac_2O, NaOAc) and hydrolysed to 1 : 2-*iso*propylidene-*d*-glucofuranose 6-acetate (**III**); Ac_2O and C_5H_5N afford (**III**) and much 1 : 2-*iso*propylideneglucose 3 : 5 : 6-triacetate. (**II**), C_5H_5N, and $(OMe{\cdot}CH_2{\cdot}CO)_2O$ afford 1 : 2-*isopropylidene*-d-*glucofuranose* 6-*methoxyacetate*, m.p. 95°. (**III**), PhCHO, and $ZnCl_2$ (better than P_2O_5) give 3 : 5-benzylidene-1 : 2-*iso*propylideneglucose 6-acetate, which, with KOH–Me_2SO_4, gives 3 : 5-benzylidene-6-methyl-1 : 2-*iso*propylideneglucofuranose (**IV**) and some 3 : 5-benzylidene-1 : 2-*iso*propylideneglucofuranose, m.p. 148·5—150°. (**IV**) gives on hydrolysis (0·5N-H_2SO_4, in aq. EtOH) 6-methylglucose, m.p. 144—145° [osazone, m.p. 186—187°; *tetra*(*azobenzoate*), m.p. 141—143°, $[\alpha]_{6252}^{20}$ +180° in $CHCl_3$], and is reduced (Pd–C, H_2) to 6-methyl-1 : 2-*iso*propylideneglucofuranose, m.p. 71°, which, with KOH and CH_2PhCl, gives 3 : 5-*dibenzyl*-6-*methyl*-1 : 2-*isopropylideneglucofuranose*, b.p. 208—211°/0·05 mm., m.p. 39—41°, $[\alpha]_D^{20}$ −40·56° in $CHCl_3$. Methanolysis affords 3 : 5-*dibenzyl*-6-*methyl*-(α + β)-*methylglucofuranoside*, b.p. 185—192°/0·05 mm., $[\alpha]_D^{20}$ −30·9°, further methylated (Me_2SO_4, KOH) to 3 : 5-*dibenzyl*-2 : 6-*dimethyl*-(α + β)-*methylglucofuranoside*, b.p. 203—207°/0·01 mm., $[\alpha]_D^{20}$ −21·05° in $CHCl_3$, which is hydrogenated (Pd–C) to 2 : 6-*dimethyl*-(α + β)-*methylglucofuranoside* (V), b.p. 118—120°/0·05 mm., $[\alpha]_D^{20}$ +5·17° in $CHCl_3$ converted into the equilibrium pyranoside mixture, b.p. 130°/0·01 mm., $[\alpha]_D^{20}$ +0·37° in $CHCl_3$, with MeOH–HCl. (**V**) is hydrolysed by aq. HCl to 2 : 6-dimethylglucose, $[\alpha]_D^{20}$ +59·8° → +63·3°, which affords 6-methylglucosazone with $NHPh{\cdot}NH_2$. 2 : 6-*Dimethylglucose* 1 : 3 : 4-*trisazobenzoate* exists in two forms, m.p. 205—207°, $[\alpha]_{6252}^{20}$ −275° in $CHCl_3$, and (more sol.) m.p. 128—131°, $[\alpha]_{6252}^{20}$ −172° in $CHCl_3$. 2 : 3 : 4-Trimethylglucose 1 : 6-bisazobenzoate has m.p. 133° (cf. A., 1943, II, 255). J. WA.

Chemistry of sulphite cooking. XLI. Effect of sulphite-cooking acids on different types of sugars. Fermentation of sulphite liquors of diverse origins. E. Hägglund, H. Heiwinkel, and T. Bergek (*J. pr. Chem.*, 1943, [ii], **162**, 2—18).—Heating fructose in H_2O containing CaO (1·2%) and SO_2 (4·43%) at 75°, removing polythio-acids by H_2SO_4 at 75°, SO_2 in air at pH 6, and sugars by fermenting, and finally treating with $BaCO_3$ gives a Ba salt and thence the *brucine* salt, $C_6H_{13}O_6{\cdot}H_2SO_3{\cdot}C_{23}H_{26}O_4N_2$, m.p. 258° (corr.), of a fructosesulphonic acid. This loses SO_2 when evaporated in H_2O or slowly when heated (not cold) in 2N-NaOH or 10—15% H_2SO_4, and does not reduce Fehling's solution. It is probably a rearrangement product of the primary unstable additive product. Small amounts of sugar-sulphonic acids (*A*) are present in sulphite liquor prepared at low pH, but in less acid solutions are converted by hydrolysis and oxidation into aldonic acids. The stability of the additive product of glucose and SO_2 is a max. at pH 6·6, decomp. becoming very rapid particularly at higher pH. (*A*) are not fermentable and hardly affect the fermentation of glucose. The unstable sugar–SO_2 products of sulphite liquor are also not fermentable but strongly decelerate the fermentation of glucose. Acidic liquors yield a sugar-sulphonic acid with a low Cu no. which is greatly increased after hydrolysis; a more alkaline liquor gives different acids for which the change in Cu no. is much less. Prior treatment of sulphite liquor with alkali increases the fermentation 7—10 times by destruction of the labile additive products. R. S. C.

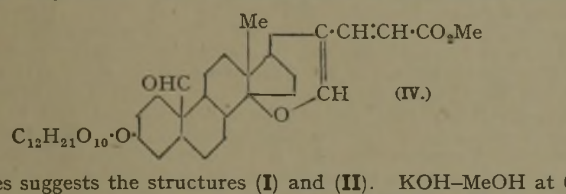
Effects of high pressure on the inversion of sucrose and the mutarotation of glucose.—See A., 1943, III, 683.

Hellebrin, a crystallised glycoside from *Helleboris niger* root. W. Karrer (*Helv. Chim. Acta*, 1943, **26**, 1353—1367).—The drug is defatted with Et_2O and extracted with H_2O. The aq. extract is treated successively by $Pb(OAc)_2$ and Na_2HPO_4 after which the glycoside is adsorbed on C. The adsorbate is extracted with MeOH–CH_2Cl_2 and the residue from this extract is treated with abs. EtOH, thereby giving crude *hellebrin* (**I**), $C_{36}H_{52}O_{15}$, best cryst. from MeOH. It has m.p. 283—284°, $[\alpha]_D^{20}$ −23·4°±0·2° in 50% MeOH. (**I**) gives a red colour in conc. H_2SO_4 and a blue to green Liebermann cholestol reaction. It does not give the Legal test or the Baljet reaction, thus indicating the presence of a 6- rather than a 5-membered lactone ring. This probability is confirmed by the close similarity of the absorption spectra of (**I**), scillaren *A*, and bufagin. The negative reaction of (**I**) with $CCl_3{\cdot}CO_2H$ indicates the absence of a double linking in the hydrophenanthrene ring system. Physiologically (**I**) is second only to convallatoxin (**II**) in cardiac activity. (**I**) is not

converted into a cryst. genin by boiling aq. or aq. alcoholic H_2SO_4; the sugar component is glucose. When kept in 2·5% HCl–MeOH



at 38° for several days (**I**) affords α-methyl-*d*-glucoside and a *compound* (**III**), m.p. ~206°, which contains 1 OMe but no active H. The ready methylation indicates the presence of CHO as in (**II**), *k*-strophanthin, and β-antiarin; the action of the acid leads to loss of sugar and 1 H_2O and production of a *cyclo*semiacetal with simultaneous etherification of the OH of the acetal. This behaviour considered in conjunction with the constitution of the known cardiac



glucosides suggests the structures (**I**) and (**II**). KOH–MeOH at 0° and subsequently at room temp. transforms (**I**) into *Me* iso*helle-brinate*, $C_{37}H_{54}O_{15}$, decomp. ~230°, softens at 195—200°, which has very little cardiac activity. (**I**) and boiling Ac_2O–NaOAc give *hellebrin hepta-acetate*, m.p. (indef.) 159—165°, in which all the Ac residues are in the sugar component. H. W.

Chemical nature of vitamin-*P*.—See A., 1943, III, 579.

Limit dextrins and starch. V. Fermentability of starch break-down-products.—See A., 1943, III, 684.

Enzymic degradation of starch. Structure of starch molecules. K. Myrbäck (*J. pr. Chem.*, 1943, [ii], **162**, 29—62).—A lecture. Starch is a much-branched chain mol. Enzymes degrade all the straight-chain parts until they meet a P substituent, a branch, or an *iso*maltose linking. Limit dextrins contain these "abnormal" portions. Enzymes first anchor themselves to the non-reducing end of the chain and attack the sixth unit (which is near in space) and so lead often to many six-unit dextrins or six-membered rings. R. S. C.

Micellar theory of cellulose. T. Lieser (*Ber.*, 1941, **74**, [*B*], 708—714).—In reply to Staudinger (A., 1938, II, 45) it is pointed out that the results of recent work (which is reviewed) make it clear that the majority of the reactions of cellulose and its derivatives are micellar, not macromol., in character. When by special methods the micelles are themselves dispersed as macromols., all the functional groups are reactive, whereas normally those in the interior of the micelles do not react since they are inaccessible. F. L. U.

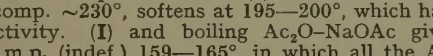
Fine structure of cellulose fibre.—See A., 1943, I, 300.

Electron-microscopic investigation of degradation of cellulose fibres.—See B., 1943, II, 345.

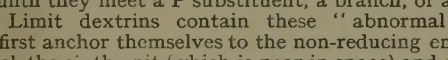
III.—HOMOCYCLIC.

Demjanoff's reaction for the enlargement of rings. Y. R. Naves and P. Bachmann (*Helv. Chim. Acta*, 1943, **26**, 1334—1337; cf. Demjanoff *et al.*, A., 1903, i, 403).—The hydrocarbon fraction which accompanies *cyclo*citronellol and the trimethyl*cyclo*heptanols when Demjanoff's reaction is applied to dihydro*cyclo*geranylamine contains 2-methylene-1 : 1 : 3-trimethyl*cyclo*hexane in addition to 1 : 1 : 4-trimethyl*cyclo*heptene. H. W.

Attempted synthesis of a *cyclo*octatetraene. *cis–trans*-Isomerism of substituted di- and tri-phenylbutadienes. G. B. Bachman and R. I. Hoaglin (*J. Org. Chem.*, 1943, **8**, 300—315).—Attempts to prepare *cyclo*octatetraene (**I**) by a Pschorr-type synthesis from CHPh:CH·CH:CH·C_6H_4·NH_2-*o* (*A*) failed. Reactivity of (**I**) is expected because inability to assume a planar form prevents its having a high resonance energy. *cyclo*Decapentadiene should be more "benzenoid" since it can assume the planar form annexed. Three steric forms of (*A*) or its derivatives are synthesised. Structures assigned below are based mainly on analogy. cis-trans-α-*Phenyl*-δ-o-*nitrophenylpentadienoic acid* (**II**), m.p. 208—209°, is obtained



(80—85%) from *o*-NO_2·C_6H_4·CH:CH·CHO (**III**), $CH_2Ph·CO_2Na$, [illegible] from CH$_2$Ph·CO$_2$H, (**III**), PbO, and Ac_2O at 140—145°. It is converted by Cu chromite in quinoline at 210—220° into cis-trans-*α-phenyl*-δ-o-*nitrophenylbutadiene* (**IV**) (75%), m.p. 79—80°, and is reduced by boiling $FeSO_4$–NH_3–H_2O to cis-trans-α-*phenyl*-δ-o-*aminophenylpentadienoic acid* (85—90%), m.p. 202—203°, which by decarboxylation affords *cis-trans*-α-phenyl-δ-o-aminophenylbutadiene (**V**), an oil (*hydrochloride*, softens 195°, decomp. 210—215°). *o*-NO_2·C_6H_4·CH_2·CO_2Na [best (55%) obtained from $CH_2Ar·CO·CO_2H$ by H_2O_2], (**III**), and Ac_2O at 110—120° give trans-trans-δ-*phenyl*-α-o-*nitrophenylpentadienoic acid* (**VI**) (23·5%), m.p. 203—204°, converted by Cu chromite in quinoline into trans-trans-α-*phenyl*-δ-o-*nitrophenylbutadiene* (**VII**), m.p. 98—99°, which is also obtained from (**IV**) by a trace of I in boiling $PhNO_2$ and in 10% yield by treating CHPh:CH·CH:CH·CO_2H in $COMe_2$ with *o*-NO_2·C_6H_4·N_2Cl in aq. HCl and treating the product with aq. $CuCl_2$–NaOAc. $FeSO_4$–NH_3 reduces (**VII**) to trans-trans-α-*phenyl*-δ-o-*aminophenylbutadiene*, m.p. 132—133° (hydrochloride, decomp. 224—226°), which is also obtained from (**V**) by boiling dil. H_2SO_4. trans-cis-γ-*Phenyl*-α-o-*nitrobenzylidene*-Δ$^{\beta}$-*butenoic acid* (**VIII**), m.p. 187—188°, is obtained (17%) from *o*-NO_2·C_6H_4·CHO (**IX**), CHPh:CH·CH_2·CO_2Na, and Ac_2O at 100° or (64%) from CHPh:CH·CH_2·CO_2H, (**IX**), PbO, and Ac_2O; with $FeSO_4$–NH_3 it gives the *lactam*, m.p. 257—258°, of *trans-trans*-γ-phenyl-α-o-aminobenzylidene-Δβ-butenoic acid. The *cis*-acid (**X**), m.p. (solvent-free)



237—238° (decomp.) (improved prep.; cf. Stobbe *et al.*, A., 1906, i, 91), with $FeSO_4$–NH_3 gives the amorphous *cis*-NH_2-acid (**XI**) (hydrochloride, decomp. 276—278°) (*loc. cit.*), but with a trace of I in boiling $PhNO_2$ gives an *anhydride* (**XII**), m.p. 256—257°, hydrolysed by alkali to an *isomeride*, $+H_2O$, of (**X**) which after softening at ~130° re-forms (**XII**). Attempts to cyclise (**XII**) failed. R. S. C.

Number of structural isomerides in simple ring compounds. II. T. L. Hill (*J. Physical Chem.*, 1943, **47**, 413—421).—Mathematical. Equations permitting the calculation of the no. of structural isomerides in a simple symmetrical ring of *n* members for any val. of *n* and for any kind of substitution have been derived (cf. A., 1943, II, 296). C. R. H.

New benzene substitution rule. G. N. Copley (*Ind. Chem.*, 1943, **19**, 505—510).—If X be the atom attached to the C_6H_6 nucleus in a compound C_6H_4XY then the group Y which contains X is an *o-p*-directing group when the valency of X is $\geqslant 4$ and a *m*-directing group when the valency of X is $\leqslant 4$. Although the rule holds good in nearly all cases where the valency is taken to be the ordinary classical valency of the atom in question it is more satisfactory to determine the valency by the four-bond max. rule, which is discussed in detail; it is then in complete accord with the electronic theory. H. W.

Alkylation of aromatic hydrocarbons.—See B., 1943, II, 309.

Physical data of *p*-alkyltoluenes.—See A., 1943, I, 300.

Scission of alkyl groups in the Friedel–Crafts reaction. J. von Braun and O. Schattner (*Ber.*, 1941, **74**, [*B*], 22—26).—When the chlorides of dialkylacetic acids (CHR_2·COCl) react (Friedel–Crafts) with C_6H_6 there are formed, in addition to COPh·CHR_2, higher-boiling homologues containing a group R in the *p*-position since oxidation yields *p*-$C_6H_4(CO_2H)_2$ (**I**). *n*-$C_{10}H_{21}Br$ condensed with *n*-$C_{10}H_{21}$·$CH(CO_2Et)_2$ gives *Et$_2$ didecylmalonate*, b.p. 196—198°/0·2 mm., which is hydrolysed (alkali) and decarboxylated to give *di-n-decylacetic acid*, m.p. 54° (*Me* ester, b.p. 218—222°/13 mm., m.p. 26°). The chloride, b.p. 240—242°, with $AlCl_3$ and C_6H_6 (standardised conditions) affords mainly *ω-di-n-decylacetophenone* (**II**), b.p. 218—220°/0·3 mm., and a small quantity of an *oil*, $C_{38}H_{68}O$, b.p. 290—300°/0·3 mm., oxidised by HNO_3 to (**I**). (**II**) gives no cryst. derivatives and is reduced (Ni, H_2) to *ββ-decyldodecylbenzene* [*ββ-didecylethylbenzene*], b.p. 218—222°/0·7 mm. Diheptylacetic acid, m.p. 28°, b.p. 200°/13 mm., is conveniently obtained from $(C_7H_{15})_2C(CO_2Et)_2$, b.p. 200°/13 mm.; the chloride, b.p. 178—180°/14 mm., C_6H_6, and $AlCl_3$ give *diheptylacetophenone*, b.p. 224—228°/12 mm., reduced (Clemmensen) to *β-heptylnonylbenzene* [*ββ-diheptylethylbenzene*], b.p. 203—205°/14 mm., and an *oil* $C_{29}H_{40}O$ [? *heptylphenyl α-heptyloctyl ketone*], b.p. 270—274°/0·5 mm., oxidised (HNO_3) to (**I**). Di*iso*amylacetyl chloride, b.p. 106°/12 mm., C_6H_6, and $AlCl_3$ give *ω-di*iso*amylacetophenone*, b.p. 172—176°/12 mm., reduced (Clemmensen) to ε-*methyl*-β-iso*amylhexylbenzene*, b.p. 145—150°/11 mm., and a *compound*, $C_{23}H_{38}O$, b.p. 216—218°/0·3 mm. Pr$^{\beta}$COCl gives iso*butyrophenone*, b.p. 210—230°, as sole product. *iso*-C_5H_{11}·CHMe·COCl affords *methyl*iso*amylacetophenone*, b.p. 152—154°/16 mm., and a *substance*, $C_{19}H_{30}O$, b.p. 180—220°/0·2 mm. *ββ*-Di*iso*amylethyl bromide and KCN give 100% of (*iso*-$C_5H_{11})_2CH·CH_2·CN$, b.p. 126°/11 mm., hydrolysed to the acid, b.p. 161—163°/11 mm., via the amide, m.p. 91°; the chloride, b.p. 120—125°/13 mm., C_6H_6, and $AlCl_3$ give exclusively *ββ*-di*iso*amylpropiophenone, b.p. 190—195°/13 mm. J. Wa.

Diene synthesis with β-nitrostyrene. C. F. H. Allen, A. Bell, and J. W. Gates, jun. (*J. Org. Chem.*, 1943, **8**, 373—379).—CHPh:CH·NO_2

(**I**) reacts readily with dienes (cf. A., 1937, II, 147). With $(CH_2{:}CH)_2$ in PhMe at 150°, isoprene at 70—80°, $(CH_2{:}CMe)_2$ at 100°, $(CHPh{:}CH)_2$ or $(CH_2{:}CPh)_2$ in *o*-$C_6H_4Cl_2$, (**I**) gives 1-*nitro*-2-*phenyl*- (**II**) (70%), m.p. 103°, 1-*nitro*-2-*phenyl*-4- or -5-*methyl*- (58%), m.p. 52°, 1-*nitro*-2-*phenyl*-4 : 5-*dimethyl*- (**III**) (82%), m.p. 96°, 1-*nitro*-2 : 3 : 6-*triphenyl*- (**IV**), m.p. 130° (with N oxides and a product, m.p. 76°), or 1-*nitro*-2 : 4 : 5-*triphenyl*-Δ^4-cyclo*hexene* (9%), m.p. 175°, respectively. With *cyclo*-hexa- or -penta-diene, (**I**) gives 1-*nitro*-2-*phenyl*-3 : 6-endo-*methylene*- (100%), b.p. 145°/1 mm., and -*ethylene*-Δ^4-cyclo*hexene* (25%), b.p. 138—142°/1 mm., respectively. With phellandrene, it gives a *product*, $C_{18}H_{23}O_2N$ (25%), m.p. 85°, b.p. 195°/1 mm. With tetraphenyl*cyclo*pentadienone in $C_6H_3Cl_3$ (no reaction in absence of a solvent), (**I**) gives C_6HPh_5, CO, and N oxides. With 10-methylene-9-anthrone in boiling AcOH, (**I**) gives N oxides, 3-phenylbenzanthron-7-one, and 2-*nitro*-3-*phenyl*-1 : 2 : 3 : 3a-*tetrahydrobenzanthr*-7-*one* (3%), m.p. 255° (oxidised by CrO_3–AcOH to 1-benzoylanthraquinone). With 1 : 2-diphenyl- or 1 : 2-diphenyl-4 : 5-dimethyl-*iso*benzfuran in boiling EtOH, (**I**) gives 3-*nitro*-1 : 4-*epoxy*-1 : 2 : 4-*triphenyl*-1 : 2 : 3 : 4- (**V**) (100%), m.p. 163°, and -1 : 2 : 4-*triphenyl*-6 : 7-*dimethyl*-1 : 2 : 3 : 4-*tetrahydronaphthalene* (**VI**) (100%), m.p. 182°, respectively. Furan, sylvan, and 2 : 5-dimethylfuran do not react with (**I**) at 100° or in a sealed tube. Br converts (**II**) or (**III**) in cold $CHCl_3$ into 4 : 5-*dibromo*-1-*nitro*-2-*phenyl*-cyclo*hexane*, m.p. 107°, and -4 : 5-*dimethyl*cyclo*hexane*, m.p. 69°, respectively, but (**IV**) gives only $(CHPhBr{\cdot}CHBr)_2$. The K (? Na) salt of (**III**) with Br–EtOH gives 1-*bromo*-1-*nitro*-2-*phenyl*-4 : 5-*dimethyl*-Δ^4-cyclo*hexene*, m.p. 68—69°, which decomposes explosively if heated alone or regularly in *p*-cymene at 100—165°, or violently if distilled at 3 mm. Hydrogenation (Raney Ni; EtOH) of (**II**) or (**III**) gives 2-phenyl- (*hydrochloride*, m.p. >220°) or 2-phenyl-4 : 5-dimethyl-Δ^4-*cyclo*hexenylamine, b.p. 129—132°/3 mm. [*hydrochloride*, m.p. 173° (decomp.)], respectively. 30—32% HBr–AcOH at room temp. and then the b.p. dehydrates (**V**) or (**VI**) to 3-*nitro*-1 : 2 : 4-*triphenyl*-, m.p. 218—219°, or -1 : 2 : 4-*triphenyl*-6 : 7-*dimethyl*-*naphthalene*, m.p. 237—238°, respectively, reduced by Zn dust in AcOH to 1 : 3 : 4-*triphenyl*-, m.p. 256—257°, and 1 : 3 : 4-*triphenyl*-6 : 7-*dimethyl*-2-*naphthylamine*, m.p. 226—227°, respectively, which by treatment with, successively, OBu·NO–AcOH–EtOH at 0°, HCl–AcOH at 0°, and boiling EtOH give 1 : 2 : 4-$C_{10}H_5Ph_3$ (**VII**) (A., 1929, 681) and 1 : 2 : 4-*triphenyl*-6 : 7-*dimethylnaphthalene* (**VIII**), m.p. 167—168°, respectively. Styrene with *iso*benzfuran or its 4 : 5-Me_2 derivative in boiling xylene give 1 : 4-*epoxy*-1 : 2 : 3-*triphenyl*-, m.p. 116—117°, and -1 : 2 : 3-*triphenyl*-6 : 7-*dimethyl*-1 : 2 : 3 : 4-*tetrahydronaphthalene*, m.p. 172—173°, and thence (HBr–AcOH) (**VII**) and (**VIII**), respectively. R. S. C.

Alkyl–oxygen fission in sulphinic ethers. M. P. Balfe, J. Kenyon, and A. L. Tárnoky (*J.C.S.*, 1943, 446; cf. A., 1943, II, 9).—Alkyl–O fission in sulphinic esters may occur analogously to the case of carboxylic esters. The racemising alkyl–O fission is promoted by the electron-release of an aromatic substituent in the alkyl group. Rearrangement of (−)-phenylmethylcarbinyl *dl*-*p*-toluenesulphinate to *dl*-*p*-tolyl α-phenylethyl sulphone involves alkyl–O fission. Other examples are discussed. A. T. P.

Magnetic investigations of organic substances. XX. True carbon diradical with *para* "free valencies." E. Müller and E. Tietz (*Ber.*, 1941, **74**, [*B*], 807—824).—4 : 3 : 5 : 1-$NH_2{\cdot}C_6H_2Cl_2{\cdot}CO_2H$, m.p. 291° (obtained in 15% yield from *p*-$NH_2{\cdot}C_6H_4{\cdot}CO_2H$ and $KClO_3$ in AcOH–NaOAc–conc. HCl), gives $(CH_2N_2{-}COMe_2)$ the *Me* ester (**I**), m.p. 82°, converted (Sandmeyer) into *Me* 3 : 5-*dichloro*-4-*iodobenzoate*, m.p. 98°. This with "Naturkupfer C" (previously heated in N_2) at 280° affords Me_2 2 : 6 : 2′ : 6′-*tetrachlorodiphenyl*-4 : 4′-*dicarboxylate* (**II**), m.p. 152°, which with *p*-LiC_6H_4Ph in C_6H_6 yields 2 : 6 : 2′ : 6′-*tetrachloro*-4 : 4′-*di*(*hydroxydi*-p-*diphenylylmethyl*)*diphenyl* (**III**), m.p. 248—249° (deep blue halochromism with conc. H_2SO_4), obtained with difficulty from admixed resinous products. $SOCl_2$ and (**III**) in C_6H_6 give the 4 : 4′-*di*(*chlorodi*-p-*diphenylylmethyl*) derivative, m.p. 295—296°, converted by Cu or "mol." Ag in C_6H_6 and N_2 into a dark brown solution (layers >3 mm. are non-transparent) of 2 : 6 : 2′ : 6′-tetrachloro-4 : 4′-di-*p*-diphenylylmethyldiphenyl (**IV**). The solution is decolorised rapidly by air giving a *diperoxide*, bright yellow, m.p. 155—156°, which does not liberate I from acidified KI. Solid (**IV**), m.p. 180—182°, is diamagnetic and is considered not to possess any diradical character. Solutions are paramagnetic; the diradical content of a 1·9% solution in C_6H_6 is computed to be 73 ± 7% at 20°, and 80 ± 8% at 80°. Comparison of the absorption spectra of (**II**) and *Me* 3 : 5-*dichlorobenzoate*, m.p. 58° [by deamination of (**I**)], and of $(C_6H_4{\cdot}CO_2Me$-$p)_2$ and MeOBz shows that for each pair the difference is largely in the height of the extinction. 2 : 6 : 2′ : 6′-Tetrachloro-4 : 4′-dibenzoyldiphenyl and *p*-LiC_6H_4Ph give a non-cryst. dicarbinol (blue-red halochromism with conc. H_2SO_4), which with $SOCl_2$–C_6H_6 affords 2 : 6 : 2′ : 6′-*tetrachloro*-4 : 4′-*di*(*phenyl*-p-*diphenylylchloromethyl*)*diphenyl*, m.p. 272—273°. This is converted by Hg, Cu, or Ag in C_6H_6 into 2 : 6 : 2′ : 6′-tetrachloro-4 : 4′-di-(phenyl-*p*-diphenylylmethyl)diphenyl (**V**) (A., 1940, II, 302). The red-brown solution contains the diradical, the amount of which decreases with increased concn.; the corresponding peroxide has m.p. 177—179°. Reply is made to Theilacker *et al.* (A., 1940, II, 270), who doubts the correctness of the conception of compounds of the type of (**IV**) and (**V**) as "doubled" CAr_3. H. B.

Rates of dissociation of penta-arylethanes. W. E. Bachmann, R. Hoffman, and F. Whitehead (*J. Org. Chem.*, 1943, **8**, 320—330).—Rates of dissociation of C_2HAr_5 in *o*-$C_6H_4Cl_2$–C_5H_5N–EtOH at 80°, determined by I–C_5H_5N–EtOH (A., 1940, II, 122), are given as half-lives in min. in parentheses below. CPh_2ArNa and $CHPh_2Br$ in C_6H_6 give *aaββ-tetraphenyl*-α-2-, m.p. 167—168° (decomp. in air), 190—202° (decomp. in N_2) (54·2), -α-3-, m.p. 183—188° (decomp. in air), 196—198° (decomp. in N_2) (50·3), and -α-9-*phenanthrylethane*, m.p. 149—152° (decomp. in air), 152—155° (decomp. in N_2) (5·7). CPh_2ArCl, $CHPh_2Br$, and Hg in Et_2O–C_6H_6–N_2 give *aaββ-tetraphenyl*-α-1-*phenanthryl*-, m.p. 123—134° (decomp. in air), 125—135° (decomp.; vac.) (0·45), and -2-*fluorenyl*-*ethane*, m.p. 168—176° (decomp. in air), 187—190° (decomp. in N_2) (24·4), reduced by red P–I–H_2O–AcOH–N_2 to *diphenyl*-2-*fluorenylmethane* (**I**), m.p. 147—148°, and converted by I–C_6H_6–EtOH–C_5H_5N at 100° into $C_5H_5N{,}CHPh_2I$ and *diphenyl*-2-*fluorenylcarbinol Et ether* (**II**), m.p. 115°. MgPhBr and 2-benzoylfluorene in Et_2O–C_6H_6 give *diphenyl*-2-*fluorenylcarbinol* (**III**), m.p. 143—144°, converted by AcCl–C_6H_6 or HCl–C_6H_6–$CaCl_2$ into the *chloride*, m.p. 114—115°, which with Hg–C_6H_6–N_2 and then air gives the *peroxide*, m.p. 172—173°. With H_2SO_4–EtOH, (**III**) gives its Et ether (**II**) and with H_2SO_4–MeOH gives its *Me ether* (**IV**), m.p. 108—109°, converted by 45% Na–Hg in Et_2O–N_2 and then EtOH and H_2O into (**I**). Na reacts with $C_{(9)}$ of the fluorene nucleus of (**I**), since the product obtained therefrom by MeI is 2-*benzhydryl*-9-*methylfluorene*, m.p. 119—120°, which is also obtained by treating the Na derivative of (**IV**) with MeI and by treating 9-methylfluorene with BzCl–$AlCl_3$–CS_2, boiling the product with MgPhBr–C_6H_6, and reducing the carbinol thus obtained by red P–I–H_2O–AcOH. $CHPhArBr$ (prep. from $CHPhAr{\cdot}OH$ by AcBr) with CPh_3Na gives *aaaβ-tetraphenyl*-β-1-, m.p. 174—180° (decomp. in air), 178—182° (decomp. in N_2) (12·4), -2-, m.p. 145—155° (decomp. in air), 153—157° (decomp. in N_2) (32·8), and -3-*phenanthryl*-, m.p. 162—174° (decomp. in air), 174—178° (decomp. in N_2) (36·1), -β-2-*naphthyl*-, m.p. 157—158° (decomp. in air), 177—181° (decomp. in N_2) (24·9), -β-o-, m.p. 138—144° (decomp. in air), 146—147° (decomp.; vac.) (63·2), -β-m-, m.p. 149—153° (decomp. in air), 168—170° (decomp.; vac.) (54·2), and -β-p-*fluorophenyl*-, m.p. 150—155° (decomp. in air), 156—157·5° (decomp.; vac.) (66·6), -β-o-, m.p. 139—147° (decomp. in air), 170·5—171·5° (decomp.; vac.) (22·2), and -β-m-*tolyl*-, m.p. 149—157° (decomp. in air), 157—159° (decomp.; vac.) (41·1), -β-o-, m.p. 141—152° (decomp. in air), 165—166° (decomp.; vac.) (20·2), and -β-m-*anisyl*-, m.p. 139—142·5° (decomp. in air), 144—144·5° (decomp.; vac.) (39·6), -β-m-, m.p. 146—153° (decomp. in air), 168—169° (decomp.; vac.) (62·8), and -β-o-*diphenylyl*-*ethane*, m.p. 167—173° (decomp. in air), 175—178° (decomp.; vac.) (10·8). 2-$C_{10}H_7{\cdot}CHPh{\cdot}OH$ (prep. from 2-$C_{10}H_7{\cdot}CHO$ and MgPhBr) with AcBr–C_6H_6 gives α-2-*naphthylbenzyl bromide*, m.p. 74—75°. *o*-$C_6H_4F{\cdot}COPh$ with $Al(OPr^{\beta})_3$–$Pr^{\beta}OH$ gives *o*-*fluorobenzhydrol*, m.p. 41—42°, and thence the *bromide*, b.p. 172—178°/17 mm. PhCHO and *m*-$C_6H_4F{\cdot}MgBr$ give m-*fluorobenzhydrol*, m.p. 26—27°, b.p. 178—179°/16 mm., and thence the *bromide*, b.p. 192—193°/28 mm. p-*Bromobenzhydryl bromide*, b.p. 176—178°/14 mm., and *m*-$C_6H_4Ph{\cdot}CHPh{\cdot}OH$, m.p. 78·5—79° (lit. 81°), are also prepared. R. S. C.

Preparation of 1 : 3-dinitronaphthalene. H. H. Hodgson and S. Birtwell (*J.C.S.*, 1943, 433).—2 : 4 : 1-$C_{10}H_5(NO_2)_2{\cdot}NH_2$ (**I**) (improved prep.) is diazotised in H_2SO_4 and added to AcOH (3 parts to 1 part of H_2SO_4) at <20°, followed by Cu_2O at 5° to 25—30°; 1 : 3-$C_{10}H_6(NO_2)_2$, m.p. 146—147°, is obtained in 82% yield, and is also formed (78%) when 2 : 4-dinitro-*p*-toluenesulphon-1-naphthalide and $NO{\cdot}SO_3H$–H_2SO_4 at <10° is added to AcOH at <20°, and the hydrolysed product (**I**) diazotised and treated with Cu_2O. A. T. P.

Reactions catalysed by aluminium chloride. XXII. Syntheses of hydrophenanthrene derivatives. C. D. Nenitzescu, E. Ciorănescu, and M. Maican (*Ber.*, 1941, **74**, [*B*], 687—693).—The mixture of unsaturated and Cl-ketones obtained from *cyclo*hexene, $CH_2Ph{\cdot}COCl$, and $AlCl_3$ in $PhNO_2$ at 0°—room temp. is reduced (Na–H_2O–Et_2O) to α-*cyclo*hexyl-β-phenylethyl alcohol (**I**), b.p. 170°/15 mm., m.p. 56°. *Ph hexahydrobenzyl ketone*, b.p. 170—171°/20 mm. (*semicarbazone*, m.p. 195°), from C_6H_6, *cyclo*hexylacetyl chloride (**II**), and $AlCl_3$ at 45°, is similarly reduced to β-*cyclo*hexyl-α-phenylethyl alcohol, b.p. 175°/20 mm., which [like (**I**)] is converted by distillation with P_2O_5 in a vac. into 1 : 2 : 3 : 4 : 9 : 10 : 11 : 12-octahydrophenanthrene (contains a little spiran; dehydrogenated to phenanthrene). Methyl*cyclo*hexene, $CH_2Ph{\cdot}COCl$, and $AlCl_3$ in $PhNO_2$ give mixed ketones (from which 2-*methyl*-Δ^1-cyclo*hexenyl* CH_2Ph *ketoxime*, m.p. 153°, is obtained) reduced to α-2-*methyl*cyclo*hexyl*-β-*phenylethyl alcohol*, b.p. 179—183°/14 mm., whence (P_2O_5) 12-methyl-1 : 2 : 3 : 4 : 9 : 10 : 11 : 12-octahydrophenanthrene, b.p. 155—157°/18 mm. 2-Methyl-Δ^1-*cyclo*hexenylacetyl chloride, C_6H_6, and $AlCl_3$ afford 4-*phenyl*-2-*methylcyclohexylacetic acid*, b.p. 190—192°/5 mm., m.p. 98°. p-*Anisyl hexahydrobenzyl ketone*, b.p. 169—170°/5 mm., m.p. 45° (*semicarbazone*, m.p. 186°) [from PhOMe, (**II**), and $AlCl_3$ in $PhNO_2$], is reduced to the *carbinol*, b.p. 169—172°/3 mm.

(P_2O_5 at 3 mm.) 7-*methoxy*-1 : 2 : 3 : 4 : 9 : 10 : 11 : 12-*octahydrophenanthrene*, b.p. 135—137°/3 mm., dehydrogenation (Se) of which gives phenanthrene. Δ^1-cyclo*Hexenyl* p-*methoxybenzyl ketone*, m.p. 112° (from *p*-OMe·C_6H_4·CH_2·COCl, *cyclo*hexene, and $AlCl_3$ in $PhNO_2$) (semicarbazone, m.p. 136°), could not be reduced satisfactorily. *cyclo*Pentylacetyl chloride, $C_{10}H_8$, and $AlCl_3$ in $PhNO_2$ give β-$C_{10}H_7$·cyclo*pentylmethyl ketone* (**III**), b.p. 186—187°/3 mm., m.p. 61—62°, reduced (Na, aq. MeOH, Et_2O) to β-cyclo*pentyl*-α-5 : 6 : 7 : 8-*tetrahydro*-2-*naphthylethyl alcohol*, b.p. 199—200°/5 mm., whence (P_2O_5) 3 : 4-*trimethylene*-1 : 2 : 3 : 4 : 5 : 6 : 7 : 8-*octahydrophenanthrene*, b.p. 172—173°/5 mm. Dehydrogenation (Se at 250°, then 360°) of this gives some 3 : 4-trimethylenephenanthrene. The *oxime*, m.p. 120°, of (**III**) with AcCl–PCl_5 at 0° affords cyclo*pentylacet*-β-*naphthylamide*, m.p. 125°, hydrolysed [HBr (*d* 1·49)] to β-$C_{10}H_7$·NH_2.

H. B.

Reactions of hydrazoic acid. II. Quantitative study of the action with substituted benzoic acids. L. H. Briggs and J. W. Lyttleton (*J.C.S.*, 1943, 421—425; cf. A., 1942, II, 140).—Yields % of NH_2Ar formed from HN_3 and the following acids in the Schmidt reaction, using conc. H_2SO_4 ($POCl_3$ is an unsatisfactory catalyst) in C_2HCl_3 at 40°, are: BzOH 69, *m*-C_6H_4X·CO_2H (X = Cl 75, Br 72, I 62, OH 80, OMe 77, OEt 73, NO_2 63, CN 59, CO_2H 57, Me 42), *o*- 80, and *p*-OMe·C_6H_4·CO_2H 78, *o*- 68, and *p*-NO_2·C_6H_4·CO_2H 41. The rate of reaction of the substituted acids, as determined by the time of half the evolution of N_2, is, in descending order of speed (*m*-series): Me > H > OEt > OMe > OH > Br > Cl > I > CO_2H > CN > NO_2. In general, this is in the reverse order of the strength of the acids (from dissociation const.). *o*-NO_2·C_6H_4·CO_2H is an exception, presumably because of an "*ortho*-effect." Speed of reaction depends on the character of the substituent according as this is electrophilic, *e.g.*, NO_2, or nucleophilic, *e.g.*, Me. The total vol. of N_2 evolved and yield of amine produced do not bear a close relation, and explanations are suggested. No trace of amine is obtained when PhOMe, $NPhMe_2$, or $PhNO_2$ is submitted to the Schmidt reaction at 40°. The mechanism of the reaction is discussed.

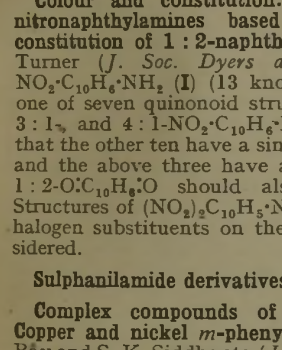
A. T. P.

Colour and constitution. VII. Structures of mono- and di-nitronaphthylamines based on their visual colours. Probable constitution of 1 : 2-naphthaquinone. H. H. Hodgson and H. S. Turner (*J. Soc. Dyers and Col.*, 1943, **59**, 218—220).—The NO_2·$C_{10}H_6$·NH_2 (**I**) (13 known isomerides) can each resonate into one of seven quinonoid structures; since all are red except 2 : 1-, 3 : 1-, and 4 : 1-NO_2·$C_{10}H_6$·NH_2, which are yellow, it is suggested that the other ten have a single linking between the central C atoms, and the above three have a double linking. By analogy, the red 1 : 2-O:$C_{10}H_6$:O should also possess a central single linking. Structures of $(NO_2)_2C_{10}H_5$·NH_2 are also discussed, and the effects of halogen substituents on the colours and structures of (**I**) are considered.

A. T. P.

Sulphanilamide derivatives.—See B., 1943, III, 279.

Complex compounds of diguanide with bivalent metals. V Copper and nickel *m*-phenylenebisdiguanidine and their salts. P. Ray and S. K. Siddhanta (*J. Indian Chem. Soc.*, 1943, **20**, 200—203).—*m*-$C_6H_4(NH_2)_2$,2HCl and dicyanodiamide (2 mols.) in hot H_2O give *m*-phenylenebisdiguanidine hydrochloride, which with aq. NH_3 and aq. NH_3–$CuSO_4$ affords the complex sulphate. This in aq. HCl with KOH (excess) gives the complex *base*, [Cu*B*·H_2]$(OH)_2$, which forms the anhydro-base [Cu*B*] at 110°, for which the formula (*A*) is suggested. The following *salts* are described: [Cu*B*·H_2]Cl_2,1·5H_2O; [Cu*B*·H_2]Br_2,2H_2O; [Cu*B*·H_2]I_2; [Cu*B*·H_2]$(NO_3)_2$,0·5H_2O; [Cu*B*·H_2]SO_4,0·5H_2O; [Cu*B*·H_2]S_2O_3,2·5H_2O; [Cu*B*·H_2]$(CNS)_2$,H_2O. The analogous *base*, [Ni*B*·H_2]$(OH)_2$,2H_2O {gives [Ni*B*·H_2]$(OH)_2$ at 85—90° and [Ni*B*] at 110°}, and *salt*, [Ni*B*·H_2]SO_4,5H_2O, are described; the chloride could not be prepared.



(*A*.)

S. A. M.

Polarographic study of *cis–trans* isomerism of azo-compounds. A. Winkel and H. Siebert (*Ber.*, 1941, **74**, [*B*], 670—675).—Two stages are observed in the reduction of solutions of (*m*-SO_3K·C_6H_4·N:)$_2$ at a dropping Hg cathode. Illumination of the solutions by a quartz Hg lamp causes the second stage to diminish and ultimately to disappear, whilst the consumption of H (2 atoms H per mol.) remains unaffected. The phenomenon is attributed to the presence in the original solution of *cis*- and *trans*-forms in approx. equimol. proportion, the latter being converted into the former under the influence of light. The *cis*-compound has a deeper colour than the *trans*-compound and can be conc. chromatographically to the extent of 10%, or of 25% if the Et_2 ester is used. The polarographic behaviour of (:NPh)$_2$ in EtOH solution is similar to that of its disulphonic acid. The energy of the *cis–trans* transition, calc. from the reduction potentials, is 10·8 kg.-cal. per mol., in agreement with the val., ~12 kg.-cal., obtained from the heats of fusion.

F. L. U.

Radioactive disazo-dyes. II. Synthesis and properties of radioactive dibromo-trypan-blue and radioactive dibromo-Evans-blue. L. H. Tobin and F. D. Moore (*J. clin. Invest.*, 1943, **22**, 155—159).—*o*-Tolidine was converted into the radioactive 5 : 5′-Br_2-derivative by means of ^{82}Br (obtained from EtBr bombarded in a cyclotron) and this was converted into the disazo-dyes as usual; the dry products have activity ~0·5 μc. per mg. when fresh. The brominated dyes are redder in shade than the non-brominated dyes; the absorption max. was shifted by bromination from 630 to 545 mμ. for Evans-blue and from 600 to 550 mμ. for trypan-blue. Other properties are compared.

Azo-compounds and their intermediates. XXV. Aminohydrazo-compounds. P. Ruggli and K. Hölzle (*Helv. Chim. Acta*, 1943, **26**, 1190—1197).—Partial hydrogenation (Raney Ni–EtOH at room temp.) of *p*-NH_2·C_6H_4·N_2Ph (**I**) gives NH_2Ph and *p*-$C_6H_4(NH_2)_2$. Gradual addition of Zn dust and 35% aq. NH_3 to (**I**) in EtOH at 50—55° until the solution becomes colourless leads to 4-*aminohydrazobenzene* (**II**), m.p. 81—84° to a brown melt, becomes yellow at ~50°. (**II**) is very unstable and decomposes completely within a few hr. even in a high vac. It is immediately disproportionated by Ac_2O but β-*acetyl*-α-*phenyl*-β-p-*acetamidophenylhydrazine*, m.p. 198—200° (decomp.) (also +MeOH), can be obtained by reduction of (**I**) in C_5H_5N with Zn dust and a little AcOH followed by acetylation with Ac_2O; hydrogenation (Raney Ni) transforms this into NH_2Ph and *p*-$C_6H_4(NHAc)_2$. Similarly *o*-NH_2·C_6H_4·N_2Ph (**III**) is reduced to 2-*aminohydrazobenzene*, m.p. 94—95° (decomp.), becomes yellow at 70°, which is somewhat more stable than (**II**), can be preserved for 1 day in a vac., but rapidly becomes discoloured in air; reduction of (**III**) by Zn dust in C_5H_5N containing a little AcOH followed by acetylation (Ac_2O) yields 2-*acetamidohydrazobenzene*, m.p. 167—168° (decomp.), oxidised by yellow HgO to *o*-NHAc·C_6H_4·N_2Ph. *m*-NH_2·C_6H_4·N_2Ph is reduced by NH_3–H_2S in EtOH to 3-*aminohydrazobenzene*, m.p. 107°, which is moderately stable in air when dry. 4-*Amino*-4′-*phenylhydrazinodiphenyl*, m.p. 139—141° (disproportionation), becomes pale yellow at ~100°, obtained by reduction (H_2S) of the azo-compound, is moderately stable in air and gives an *Ac*$_2$ derivative, NHPh·NAc·C_6H_4·C_6H_4·NHAc, m.p. 232—233°, catalytically hydrogenated to NH_2Ph and (C_6H_4·NHAc)$_2$.

H. W.

Union of aryl nuclei. VI. Reactions with 1-aryl-3 : 3-dimethyltriazens. J. Elks and D. H. Hey [with (in part) J. W. Haworth and C. W. Pritchett] (*J.C.S.*, 1943, 441—445; cf. A., 1940, II, 338).—NMe_2·N:NAr are prepared from ArN_2Cl–33% aq. $NHMe_2$–30% aq. Na_2CO_3. 1-Phenyl-3 : 3-dimethyltriazen, b.p. 125—127°/19 mm., with boiling C_6H_6–dry HCl gives $NHMe_2$, PhCl, and Ph_2 (25%; increased to 37% in C_6H_6–AcOH), with $PhNO_2$ at 100° (bath) gives a mixture (35%) of *p*- (**I**) and *o*-C_6H_4Ph·NO_2, and with C_5H_5N–HCl at 100° (bath) yields 2-, 3-, and 4-phenylpyridine (51%). 1-p-*Nitrophenyl*-3 : 3-*dimethyltriazen*, m.p. 144—145°, affords (**I**) (52%) with C_6H_6–HCl, and with C_5H_5N–HCl gives 50% of 2- + 3-*p*-nitrophenylpyridine; the m-NO_2-isomeride, m.p. 99—100°, with C_6H_6–HCl, but not with C_6H_6–AcOH, yields *m*-C_6H_4Ph·NO_2 (53%). 1-o-*Carboxyphenyl*-, m.p. 124—126° (decomp.) (C_6H_6–HCl gives *o*-C_6H_4Cl·CO_2H and no diaryl), and 1-β-*naphthyl*-3 : 3-*dimethyltriazen*, m.p. 57—58°, are prepared; the latter and C_6H_6–AcOH yield 2-$C_{10}H_7Ph$ (36%), and C_5H_5N–HCl give mixed 2-pyridylnaphthalenes (41%) and thence isomeric *picrates*, m.p. 199—200° (*base*, m.p. 99—100°), 177—178° [*base* (**II**), m.p. 69—70°], and 216—217°. β-$C_{10}H_7$·N_2Cl and C_5H_5N at 20—25°, and then $SnCl_2$–HCl–AcOH, afford (**II**), also obtained from β-$C_{10}H_7$·NAc·NO and C_5H_5N. 1-5′-Quinolyl-3 : 3-dimethyltriazen, m.p. 30—40° (impure), with C_6H_6–HCl gives 5-chloroquinoline (*picrate*, m.p. 220—223°) and 5-*phenylquinoline* (13%), m.p. 82—83° (*picrate*, m.p. 210—211°). 1-*Phenyl*-3 : 3-*dimethyltriazen*-3′ : 4′-*dicarboxylimide*, m.p. 251—253° (decomp.) [from 4 : 1 : 2-NH_2·$C_6H_3(CO)_2NH$ (**III**)], and C_6H_6–HCl give a little 4 : 1 : 2-$C_6H_3Ph(CO)_2NH$ (**IV**), and with C_5H_5N–HCl, a mixture (49%) of 4-*pyridylphthalimides*, m.p. 232—243°, also obtained (m.p. 238—245°) from diazotised (**III**) and C_5H_5N at 40—50°. Me_2 1-*phenyl*-3 : 3-*dimethyltriazen*-3′ : 4′-*dicarboxylate*, m.p. 74—75°, and C_6H_6–HCl yield 4 : 1 : 2-$C_6H_3Ph(CO_2Me)_2$ (**V**) (66%). 1-o-*Carbomethoxyphenyl*-3 : 3-*dimethyltriazen*, b.p. 180—182°/18 mm., and molten 2-$C_{10}H_7$·OMe–HCl or –AcOH at 100° (bath) afford 2 : 1-OMe·$C_{10}H_6$·C_6H_4·CO_2Me-*o* (25 or 29% respectively). Diazotised (**III**) and C_6H_6–aq. NaOAc at 5—10° give (**IV**), and 1 : 2 : 4-$(CO_2Me)_2C_6H_3$·N_2Cl and C_6H_6–aq. NaOH or –NaOAc yield (**V**) (34 or 52% respectively).

A. T. P.

Production of phenol from *cyclo*hexanol and *cyclo*hexanone.—See B., 1943, II, 341.

Manufacture of phenols.—See B., 1943, II, 341.

Absorption spectra of *m*-substituted phenols; influence of nucleophilic substituents on electronic mobility.—See A., 1943, I, 271.

Mesomeric anions containing nitro-groups.—See A., 1943, I, 295.

Amino-acid ester salts of phenols.—See B., 1943, II, 341.

Peroxidic degradation of substituted aromatic aldehydes and ketones to the corresponding phenols. II. Degradation with peracetic acid. A. von Wacek and A. von Bézard (*Ber.*, 1941, **74**, [*B*],

845—857).—*o*-OH·C_6H_4·CHO is oxidised by AcO_2H [containing 0·5% of *p*-$C_6H_4Me·SO_3H$ (**I**) unless stated otherwise] at 35—40° to muconic acid and some *o*-OH·C_6H_4·O·CHO (**II**), b.p. 125°/12 mm. (with NHPh·NH_2 gives ? N-*formyl*-N′-*phenylhydrazine*, m.p. 147°), readily hydrolysed to *o*-$C_6H_4(OH)_2$. Use of Ac_2O–AcO_2H at 25° affords 88% of (**II**), which with Et_2O–CH_2N_2 gives o-*anisyl formate*, b.p. 109°/12 mm., hydrolysed to guaiacol. These results support the rearrangement mechanism (*a*) (A., 1943, II, 260) but do not preclude (*b*) direct attack by O at the C carrying CHO. That both mechanisms can operate is proved for 6 : 3 : 1-OH·C_6H_3Me·CHO, which with AcOH–AcO_2H [(**I**)-free; otherwise acetylation occurs also], methylation of the product, and subsequent hydrolysis gives 3 : 1 : 4-OH·C_6H_3Me·OMe (**III**) (*b*) and its 4 : 1 : 3-isomeride (**IV**) (*a*); similarly 2 : 4 : 1-OH·C_6H_3Me·CHO yields (**III**) (*a*) and (**IV**) (*b*). *p*-OH·C_6H_4·CHO with Ac_2O–AcO_2H gives *p*-OH·C_6H_4·OAc and *p*-$C_6H_4(OAc)_2$; with AcOH–AcO_2H [(**I**)-free] p-*hydroxyphenyl formate*, b.p. 150°/12 mm., m.p. 57°, results. The following oxidations are also effected: *o*-OMe·C_6H_4·CHO to *o*-OMe·C_6H_4·O·CHO (99%); 3 : 4 : 1-$(OMe)_2C_6H_3$·CHO to 3 : 4-*dimethoxyphenyl formate*, m.p. 57°; *p*-OMe·C_6H_4·COMe to *p*-OMe·C_6H_4·OAc; *m*-OH·C_6H_4·CHO and *o*- and *m*-NO_2·C_6H_4·CHO to the corresponding acids. H. B.

Stability of 2 : 2′-dihydroxydiphenylmethane. C. A. Buehler, D. E. Cooper, and E. O. Scrudder (*J. Org. Chem.*, 1943, **8**, 316—319).—*p*-C_6H_4Br·OH and CH_2O in H_2SO_4–H_2O at 80—90° give 5 : 5′-*dibromo*-2 : 2′-*dihydroxydiphenylmethane* (**I**), m.p. 183—184° (*dibenzoate*, m.p. 192°), reduced by Na in *n*-C_5H_{11}·OH at 160—170° to the stable (cf. lit.) 2 : 2′-*dihydroxydiphenylmethane* (**II**), m.p. 119—120° (*dibenzoate*, m.p. 76—77°), which gives xanthene when heated at 150—160° and then distilled. *o*-OH·C_6H_4·CH_2·OH, *p*-C_6H_4Cl·OH, and a little conc. HCl at 30° give 5-*chloro*-2 : 2′-*dihydroxydiphenylmethane*, m.p. 128—129° (*dibenzoate*, m.p. 80—81°), reduced as above to (**II**). With KOH–Me_2SO_4–$COMe_2$–H_2O, (**I**) gives the Me_2 ether, m.p. 107·5°, and thence (CrO_3–AcOH) $(2 : 5 : 1\text{-}OMe·C_6H_3Br)_2CO$, m.p. 123—124°. R. S. C.

Synthetic œstrogens. II. Configuration of synthetic œstrogens. F. von Wessely and H. Welleba (*Ber.*, 1941, **74**, [*B*], 777—785).—A more detailed account of work previously abstracted (A., 1942, II, 89). Reduction (H_2, Pd-black, AcOH) of diethylstilbœstrol gives ~88% of *dl*- and 12% of *meso*-(*p*-OH·C_6H_4·CHEt)$_2$. *dl*-(CHPhMe)$_2$ has m.p. 12·5° and is obtained nearly pure by reduction of *trans*-(CPhMe:)$_2$. H. B.

Ethers of 4-chloro-2-nitro-3 : 5-dimethylphenol. B. Jones (*J.C.S.*, 1943, 445; cf. A., 1941, II, 221).—The *k* (0·0728) recorded for the CH_2Ph ether (*loc. cit.*) is for the hexyl ether. The following are prepared: *Me*, m.p. 166°, *Et*, m.p. 107°, *Pr*$^{\alpha}$, m.p. 68°, n-C_6H_{13}, m.p. 41°, and p-$C_6H_4Br·CH_2$ *ether*, m.p. 105°, of 1 : 3 : 5 : 4 : 2-OH·$C_6HMe_2Cl·NO_2$. The CH_2Ph *ether*, m.p. 105°, is obtained from 4-*chloro*-3 : 5-*dimethylphenyl* CH_2Ph *ether*, m.p. 57°, and HNO_3 (*d* 1·5)–AcOH. A. T. P.

Halogenation of phenolic ethers and anilides. XIV. *m*-Substituted phenyl ethers. B. Jones (*J.C.S.*, 1943, 430—432; cf. A., 1941, II, 287).—Velocity coeffs. for the chlorination of *m*-$C_6H_4X·OR$ (X = CO_2H, R = C_nH_{2n+1} where *n* = 1—9, $C_{12}H_{25}$, $[CH_2]_m$·Ph where *m* = 1, 2, or 3, and *p*-$C_6H_4Hal·CH_2$; X = NO_2, R = Me, Et; X = Cl, R = Me, CH_2Ph; X = F, R = *o*-$NO_2·C_6H_4·CH_2$), 2 : 5 : 1-$C_6H_3Cl_2$·OR (R = CH_2Ph, *p*-$C_6H_4Me·CH_2$, *p*-$C_6H_4Br·CH_2$, *m*- or *p*-$C_6H_4F·CH_2$), 3 : 5 : 1-$C_6H_3Cl_2$·OR (R = Me, *p*-$C_6H_4Br·CH_2$), and 5 : 2 : 1-$NO_2·C_6H_3Me·OR$ (R = Me, Et, CH_2Ph), in 99% AcOH at 20°, are given. The relative directive powers of OR groups obtained from a ratio of velocity coeffs. are very similar to those found in *p*-$C_6H_4X·OR$, where chlorination yields a single homogeneous product. The following are new: m-iso*propoxy*-, m.p. 96°, -n-*butoxy*-, m.p. 62°, -n-*amyloxy*-, m.p. 72°, -n-*hexyloxy*-, m.p. 71°, -n-*heptyloxy*-, m.p. 80°, -n-*octyloxy*-, m.p. 73°, -n-*nonyloxy*-, m.p. 84°, and -n-*dodecyloxy*-, m.p. 91°, -*benzyloxy*-, m.p. 134°, -p′-*fluoro*-, m.p. 148°, -*chloro*-, m.p. 170°, and -*bromo-benzyloxy*-, m.p. 179°, -β-*phenylethoxy*-, m.p. 110°, and -γ-*phenyl*-n-*propoxy-benzoic acid*, m.p. 118°; 3 : 5-*dichlorophenyl* p-*bromobenzyl ether*, m.p. 68°; 4-*nitro*-o-*tolyl* *Pr*$^{\alpha}$, m.p. 51°, CH_2Ph, m.p. 79°, and p-*methylbenzyl ether*, m.p. 110°; m-*fluorophenyl* o-*nitrobenzyl ether*, m.p. 53°; m-*chlorophenyl* CH_2Ph *ether*, m.p. 65°; 2 : 5-*dichlorophenyl* CH_2Ph, m.p. 58°, m-, m.p. 79°, and p-*fluoro*-, m.p. 86°, p-*bromo*-, m.p. 77°, and p-*methyl-benzyl*, m.p. 58°, *ether*. A. T. P.

Applications of camphor oil. II. *cis*- and *trans-iso*-Chavibetol alkyl ethers. E. Funakubo (*Ber.*, 1941, **74**, [*B*], 832—840).—trans-iso*Chavibetol Me*, b.p. 126°/5 mm. (prep. by aq. MeOH–NaOH–Me_2SO_4), *Et*, m.p. 49·3—50·3° (aq. EtOH–NaOH–EtI), and *Pr*$^{\alpha}$ *ether*, m.p. 44·2—45·7° (EtOH–NaOH–Pr$^{\alpha}$Br at 110—130°), with Et_2O–Br at room temp. give the *dibromides* (*A*), m.p. 94—95·7°, 118·5—119°, and 94—95·7° (? 97—98°), respectively, converted by KOH (<5 mols.) at >90° into 3 : 4-dimethoxy-, b.p. 139°/4 mm., 4-methoxy-3-ethoxy-, b.p. 163—164°/7 mm., and 4-methoxy-3-*n*-propoxy-Δ$^{\alpha}$-propinylbenzene, b.p. 185°/9 mm., respectively. These are reduced (1 H_2, Pd-black, EtOH) to *cis-iso*chavibetol Me (**I**), b.p. 137—137·5°/6 mm., Et, m.p. 38—39·8° (lit. 40—41°), and *Pr*$^{\alpha}$ *ether*, b.p. 140—141°/6·5 mm. (dibromide, m.p. 103—105·5°), respectively. With MeOH–KOH at room temp. (*A*) give 4 : 3 : 1-OMe·C_6H_3(OR)·CH:CMeBr [R = *Et*, b.p. 162—163°/3 mm., m.p. 67·3—68·8°, oxidised (aq. KOH–$KMnO_4$) to 4 : 3 : 1-OMe·C_6H_3(OEt)·CO_2H, m.p. 164·2—167·2° (*Ag* salt)]. Small amounts of KOH at higher temp. give mixtures. The *cis-iso*eugenol Me ether [= (**I**)] of Boedecker *et al.* (A., 1931, 348) is probably impure. Absorption spectra of the *cis*- and *trans*-ethers are given. H. B.

Constituents of red sandalwood. III. Synthesis of pterostilbene [4-hydroxy-3′ : 5′-dimethoxystilbene]. E. Späth and K. Kromp (*Ber.*, 1941, **74**, [*B*], 189—192; cf. *ibid.*, 1940, **73**, 881).—*p*-OH·C_6H_4·CH_2·CO_2H, m.p. 153—154° (lit. 150°) [obtained by demethylation (P + HI) of the OMe-acid] (as Na salt), and 3 : 5 : 1-$(OMe)_2C_6H_3$·CHO (**I**) (improved isolation) in Ac_2O at 160° afford (after hydrolysis) 3 : 5-*dimethoxy*-α-p-*hydroxyphenylcinnamic acid* (**II**), m.p. 228—229° (vac.). The oil obtained by decarboxylation (Cu + quinoline at 240—260°) of (**II**), when treated with conc. aq. HCl in MeOH at 20° for 36 hr., affords (*cis* → *trans* conversion) pterostilbene, m.p. 87—88°. Similarly, Na homoanisate and (**I**) give 3 : 5-*dimethoxy*-α-p-*anisylcinnamic acid*, m.p. 192°, decarboxylated to an oil, converted as above into pterostilbene Me ether, m.p. 56—57°, which is identical with resveratrole Me_3 ether (Takaoka, A., 1940, II, 328). J. Wa.

βδζ-Tri-*p*-anisyl-$^{\alpha\gamma\epsilon}$-heptatriene; problem of tautomerism or mesomerism? W. Schneider and H. Keller (*Ber.*, 1941, **74**, [*B*], 729—755).—The compound, $C_{28}H_{28}O_3$ (**I**), m.p. 113—114°, obtained in 5—6% yield from PhOMe and $SO_3H·CH_2·CO_2H$ (prep. described), is considered to be βδζ-*tri*-p-*anisyl*-Δ$^{\alpha\gamma\epsilon}$-*heptatriene*; (**I**) may arise from CMeR:CH·CR:CH·CR:CH·COR (R = anisyl) by an acetolysis. Many of its reactions are explicable by the scheme

$$CMeR{:}CH{\cdot}CR{:}CH{\cdot}CR{:}CH_2 \longleftrightarrow \overset{+}{C}MeR{\cdot}CH{:}CR{\cdot}CH{:}C\overset{-}{R}{\cdot}CH_2 \rightleftharpoons CMeR\begin{cases}CH{=}CR\\ CH_2{\cdot}CR\end{cases}CH \quad (A).$$

(**I**) shows intense halochromism and gives a *dihydrochloride* [1 HCl lost in a vac.; useful for purification of (**I**)], *perchlorate*, detonates when heated, and a *dihydrobromide stannibromide*, $2(I),H_2SnBr_6$. With 75 vol.-% H_2SO_4, (**I**) (in C_6H_6; subsequently removed) gives first a hydrolysable halochromic salt and then a stable *sulphonic acid sulphate*, $C_{28}H_{27}O_3·SO_3H,H_2SO_4,6H_2O$, green, m.p. 120—125°; with H_2SO_4,H_2O at 70° a trisulphonic acid [amorphous *Ba* salt, $(C_{28}H_{25}O_{12}S_3)_2Ba_3$] results. (**I**) absorbs 2 H_2 on reduction (Pd–$BaSO_4$, AcOH) but titration with *o*-$CO_2H·C_6H_4·CO_3H$ (**II**) shows 3 double linkings. Demethylation (aq. AcOH–HBr) of (**I**) gives 3 : 5-*di*-p-*hydroxyphenyltoluene* (+$2H_2O$), m.p. 100° (loss of H_2O; rapid heating), 108° (slow) resolidifying with m.p. 140° (*diacetate*, m.p. 139°), presumably formed by loss of PhOH from the intermediate (*A*, R = *p*-OH·C_6H_4). (:CH·CO)$_2$O and (**I**) in boiling C_6H_6 give (mainly) amorphous material and ~20% of an *adduct*, $C_{32}H_{30}O_6$, m.p. 201—202°, which could not be reduced but contains one C:C [titration with (**II**)]. (**I**) is dehydrogenated by AcOH–Br or ~30% H_2O_2 to a compound, $C_{28}H_{26}O_3$ (**III**), m.p. 133—134°. Whilst oxidative degradation of (**I**) is inconclusive, (**III**) with AcOH–CrO_3 gives anisic acid and ~50% of anisil, thus indicating that it is 2 : 3 : 5-*tri*-p-*anisyltoluene*, formation of which involves migration of anisyl. Reduction (H_2, PtO_2, AcOH) of (**I**) results in absorption of 12—13 H_2 and gives a mixture. *s*-Tri-*p*-anisylbenzene similarly affords a mixture containing ~5% of 1 : 3 : 5-*tri*cyclo*hexyl*-cyclo*hexane*, m.p. 157—159°, also obtained (<5%) from *s*-$C_6H_3Ph_3$; the behaviour of related compounds [*e.g.*, PhOMe, $CH(C_6H_4·OMe)_3$] is investigated. H. B.

***N*-Nitroalkyl-*p*-aminophenols.**—See B., 1943, II, 340.

Kerr effect in solutions of p-azoxyanisole.—See A., 1943, I, 298.

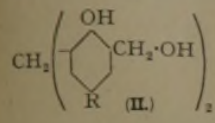
4-Nitro- and 4-amino-4′-acylamidodiphenyl sulphones.—See B., 1943, III, 279.

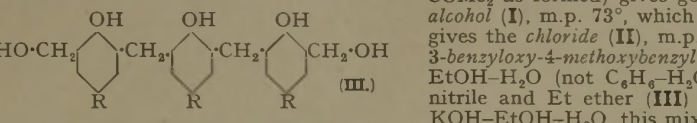
4 : 2′ : 5′-Triaminodiphenyl sulphone and derivatives.—See B., 1943, III, 279.

Ultra-violet absorption of formaldehyde–phenol resins.—See A., 1943, I, 295.

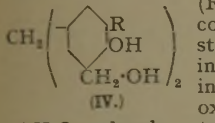
Hardening process of phenol–formaldehyde resins. IV. A. Zinke and F. Hanus [with H. Prennschütz-Schützenau, H. Troger, and (in part) R. Möldner and K. Lercher] (*Ber.*, 1941, **74**, [*B*], 205—214; cf. A., 1939, II, 476).—The course of the hardening of 1 : 4 : 2 : 6- (**I**) and 1 : 2 : 4 : 6-OH·$C_6H_2R(CH_2·OH)_2$ is bound up with the step-wise elimination of H_2O and CH_2O; when R is a large substituent the two processes can be separated. Firstly, loss of H_2O leads to ether linkings since HBr affords bromides corresponding to the starting materials. In hardening, small amounts of cryst. sublimates are formed consisting of OH·$C_6H_2R(CHO)_2$; their formation is attributed to "cracking" and disproportionation of the $-CH_2·O·CH_2-$ linkings and analogous cases are already known. The elimination of CH_2O is less easy to interpret. Assuming that a macromol. with CH_2 linkings between nuclei is formed, 1 mol. of CH_2O should arise from 1 mol. of dicarbinol but the max. found is 0·6 mol. The deficit must participate in further reactions such as formation of CH_2: ethers with phenolic OH groups, or CH_2 bridges

with reactive nuclear positions forming cross linkings in the macromols. These processes should result in H_2O-formation in excess of 1 mol. which is, in fact, observed. Some CH_2O is used in methylating OH groups since the resins from (**I**) (R = Me and Cl) contain respectively 0·5 and 1·6% OMe. The *p*-toluenesulphonates of the phenoldicarbinols with esterified phenolic OH give no CH_2O and the products contain ether linkings. It is suggested that CH_2O may condense with the CH_2 groups linking benzene nuclei and confirmation is


(II.)


(III.)

sought, and found, in the behaviour of (**II**) (R = Me or Cl), (**III**) (R = Me or Cl), and (**IV**) (R = Me or Cl) which contain preformed CH_2 groups; these substances give less CH_2O and much more H_2O in proportion than do the mononuclear dicarbinols. 4 : 4′-Dihydroxy-3 : 5 : 3′ : 5′-tetra(hydroxymethyl)diphenylmethane (**V**) affords 2 mols. of H_2O and only a trace of CH_2O. (**III**) (R = Cl) affords a *pentaacetate*, m.p. 142°, and the *tetrabromide*, from (**V**) has m.p. (crude) 169°. J. WA.


(IV.)

Hardening processes of phenol–formaldehyde resins. VI. "Salireton" [di-*o*-hydroxybenzyl ether]. E. Ziegler (*Ber.*, 1941, **74**, [*B*], 841—844).—*o*-OH·C_6H_4·CH_2·OH at 140° alone or in glycerol gives ~10 or ~16% respectively of $(o\text{-OH·C}_6H_3\text{·CH}_2)_2O$, m.p. 122—123° (*dibenzoate*, m.p. 115°) (cf. Giacosa, A., 1880, 716), which when heated above its m.p. affords *o*-OH·C_6H_4·CHO (**I**). 2 : 3 : 5 : 1-OH·$C_6H_2Me_2$·CH_2·OH and -OH·$C_6H_2Cl_2$·CH_2·OH with PhCHO in aq. EtOH–HCl give the 1 : 2-*CHPh ethers*, m.p. 46° and 87—88°, respectively. 4 : 4′-Dihydroxy-3 : 3′-dimethyl-5 : 5′-di(hydroxymethyl)diphenylmethane similarly affords the 4 : 5 : 4′ : 5′-*(CHPh)*$_2$ *ether*, m.p. 140°; (**I**) gives no cryst. product. H. B.

Hardening processes of phenol–formaldehyde resins. V. A. Zinke and E. Ziegler (*Ber.*, 1941, **74**, [*B*], 541—545).—2 : 3 : 5 : 1-OH·$C_6H_2Me_2$·CH_2·OH (**I**) at 135—140° (bath)/1 hr. gives 2 : 2′-*dihydroxy*-3 : 5 : 3′ : 5′-*tetramethyldibenzyl ether*, m.p. 100—101°, converted [as is (**I**)] by HCl–C_6H_6 into 2 : 3 : 5 : 1-OH·$C_6H_2Me_2$·CH_2Cl, m.p. 59°, and by boiling 3% NaOH into 2 : 2′-dihydroxy-3 : 5 : 3′ : 5′-tetramethyldiphenylmethane, m.p. 148° [also obtained when 2 : 3 : 5 : 1-ONa·$C_6H_2Me_2$·CH_2·OH is fused or heated at 130—140°/vac., whereby CH_2O is evolved]. 4-Hydroxy-3-methoxy-5-hydroxymethylallylbenzene [eugenotin alcohol] (**II**) resinifies when heated, but the 4-ONa derivative at 200° or, better, 125°/vac. gives 2 : 2′-*dihydroxy*-3 : 3′-*dimethoxy*-5 : 5′-*diallyldiphenylmethane*, m.p. 84°, also obtained from (**II**) and an excess of boiling 5% NaOH or from eugenol, CH_2O, and KOH. Reactions of OH-alcohols of type (**I**) are thus influenced by alkali. H. B.

Symmetrical diaryldialkylethanediols. I. βγ-Diphenylbutane-βγ-diol. E. J. H. Chu and J. C. Chu (*J. Chinese Chem. Soc.*, 1942, **9**, 190—195).—Both modifications of $(CPhMe\text{·}OH)_2$ with AcOH–I yield $CPhMe_2$·COPh. F. R. G.

Catalytic hydrogenation of dimedone (dimethyldihydroresorcinol), and a preparation of 1 : 1-dimethyl*cyclo*pentane. T. Henshall (*J.S.C.I.*, 1943, **62**, 127—128).—Dimedone has been hydrogenated under pressure in the presence of the Raney Ni catalyst, to furnish 3 : 3-dimethyl*cyclo*hexanol (**I**) (75% yield) and 3 : 3-dimethyl*cyclo*hexane-1 : 5-diol. (**I**) has been converted into 1 : 1-dimethyl*cyclo*pentane.

Mechanism of formation of leuco-triphenylmethane dyes, and an analogy in the Perkin reaction. R. R. Davies and H. H. Hodgson (*J. Soc. Dyers and Col.*, 1943, **59**, 196—198).—The mechanism of the formation of leuco-triphenylmethane dyes appears to be a two-stage process, viz., (*a*) an initial aldol condensation between ArCHO and 1 mol. of arylamine, and (*b*) elimination of H_2O between the aldol and a second mol. of amine. Condensation of *o*-SO_3H·C_6H_4·CHO (**I**) (1 mol.) (prep. from *o*-C_6H_4Cl·CHO and aq. Na_2SO_3 at 170—175°/130—140 lb. per sq. in.) and $NPhEt_2$ (2 mols.) at 105—110° is examined in detail. Whereas only 2% of (**I**) is uncondensed after 18 hr., optimum production of the leuco-compound is obtained only after 36 hr.; the aldol stage seems to be attained quickly. The leuco-compound is oxidised by PbO_2–aq. AcOH and the dye estimated by $TiCl_3$. The mechanism of reaction is discussed. In standard Perkin reactions of PhCHO, *o*-OH·C_6H_4·CHO, or *o*-C_6H_4Cl·CHO with NaOAc–Ac_2O at ~180°, yields of CHPh:CH·CO_2H, coumarin, and *o*-C_6H_4Cl·CH:CH·CO_2H are 68, 43, and 47%, respectively, thus showing the electron-repelling effect of the OH and of the mesomeric Cl in decreasing the amount of aldol formation. A. T. P.

Absorption of light by organic molecules and ions according to quantum mechanics.—See A., 1943, I, 295.

Acidity constants, resonance energies, and light absorption of simple dyes.—See A., 1943, I, 296.

Effect of acidifying substituents on chromophoric systems.—See A., 1943, I, 296.

Preparation of substituted phenylacetic acids. C. Schöpf and L. Winterhalder [with W. Salzer] (*Annalen*, 1940, **544**, 62—77).—Methods of preparing these acids are discussed and some are investigated. 3 : 4 : 1-CH_2Ph·O·C_6H_3(OMe)·CHO (modified prep.), m.p. 62°, with H_2–PtO_2–MeOH or $Al(OPr^{\beta})_3$–$Pr^{\beta}OH$ at 95° (removal of $COMe_2$ as formed) gives good yields of 3-*benzyloxy*-4-*methoxybenzyl alcohol* (**I**), m.p. 73°, which with $SOCl_2$–C_5H_5N–$CHCl_3$ at −5° to 0° gives the *chloride* (**II**), m.p. 79°. With NaCN in MeOH, (**II**) gives 3-*benzyloxy*-4-*methoxybenzyl Me ether*, m.p. 58°, but in boiling EtOH–H_2O (not C_6H_6–H_2O) gives about equal parts of the oily nitrile and Et ether (**III**) with probably some (**I**). With boiling KOH–EtOH–H_2O, this mixture gives 3 : 4 : 1-CH_2Ph·O·C_6H_3(OMe)·CH_2·CO_2H (**IV**); the unchanged (**III**) with Et_2O–HCl affords (**II**). HNO_3 (*d* 1·4) in AcOH converts (**IV**) into the 6-NO_2-acid, sinters 158°, m.p. 178—179°, hydrolysed to 3 : 4 : 6 : 1-OH·C_6H_2(OMe)(NO_2)·CH_2·CO_2H, m.p. 192° (Me ether, m.p. 203°) (A., 1927, 365). Me gallate (prep. by HCl–MeOH), m.p. 198°, Me_2SO_4, and NaOH in aq. MeOH at 35—40° and then the b.p. gives much 4-Me ether, m.p. 136° (lit. 143—147°), which with CH_2PhCl and K_2CO_3 in boiling MeOH (later also C_6H_6) gives *Me gallate* 4-*Me* 3 : 5-$(CH_2Ph)_2$ *ether* (**V**) (52%), m.p. 121—122°, and a residue converted by boiling KOH–EtOH–H_2O into 2 : 6-*dibenzyloxyanisole*, m.p. 106°, and *gallic acid* $(CH_2Ph)_3$ *ether*, m.p. 187°. The acid, m.p. 173°, obtained from (**V**) by KOH–EtOH–H_2O, with $SOCl_2$ at 50—60° gives the *chloride*, m.p. 125°, and thence *ω-diazo*-3 : 5-*dibenzyloxy*-4-*methoxyacetophenone*, m.p. 92°, which with a little conc. HCl in EtOH gives 3 : 5-*dibenzyloxy*-4-*methoxyphenacyl chloride*, m.p. 93°, and with Ag_2O in MeOH at 50°, followed by boiling KOH–EtOH–H_2O, yields 3 : 5-*dibenzyloxy*-4-*methoxyphenylacetic acid* (70%), m.p. 138—139°. R. S. C.

Transamination reaction. Mechanism of the reaction between α-keto-acids and α-NH_2-acids. R. M. Herbst and D. Rittenberg (*J. Org. Chem.*, 1943, **8**, 380—389).—The α-H of the NH_2-acid is not involved in uncatalysed *in vitro* transamination. Firstly, when NH_2·CHPh·CO_2H (**I**) and $AcCO_2H$ are boiled in H_2O containing 3·5% of D_2O, the PhCHO produced has > a trace of D. The NH_2·CHMe·CO_2H (**II**) produced has ~2 D, of which only a small part is on $C_{(\alpha)}$; most of the D enters the Me by a secondary reaction, for oxidation of (**II**) by Ag_2O–D_2O gives AcOH containing D in the Me and shaking AgOAc with D_2O introduces D; during transamination a labile intermediate, >CH·NH·C(:CH_2)·CO_2H ⟷ >CH·N:CMe·CO_2H, may be involved. Secondly, NH_2·CDPh·CO_2H (**III**) with $AcCO_2H$ in H_2O gives (**II**) free from D and PhCDO (→ CHDPh·OH + BzOH free from D). (**III**) is prepared by shaking (**I**) in D_2O, the exchange being slightly catalysed by H^+ and much by OH^-. Only a small part of the α-D is removed from (**II**) when it is converted into the 3-phenyl-5-methylhydantoin and treated with alkali. Transamination proceeds by the reactions:

NH_2·CHR·CO_2H + COR′·CO_2H → CO_2H·CHR·N:CR′·CO_2H →
H^+ + CO_2 + CHR:N·C⁻R′·CO_2H → (+H^+) CHR:N·CHR′·CO_2H →
(+H_2O) RCHO + NH_2·CHR′·CO_2H. R. S. C.

Syntheses in the phenanthrene series. G. Blumenfeld (*Ber.*, 1941, **74**, [*B*], 524—531).—CHPh:CH·CH:CH_2 (**I**) (prep. in 39% yield from MgPhBr and CHMe:CH·CHO) with CH_2:CH·CHO in boiling C_6H_6–quinol give 2-phenyl-Δ^3-tetrahydrobenzaldehyde (69%) (**II**), b.p. 150°/12 mm., which with $CH_2(CO_2H)_2$ in C_5H_5N–piperidine affords 2-*phenyl*-Δ^3-*tetrahydrocinnamic acid*, m.p. 107° [Et ester, b.p. 192°/13 mm. (**III**), obtained with an isomeride, b.p. 182°/13 mm., from (**II**), EtOAc, and Na; both forms are hydrolysed (EtOH–KOH) to the acid; *hydrazide*, m.p. 180°, from (**III**) only]. Reduction (H_2, Raney Ni, EtOH) of (**II**) gives 2-phenylhexahydrobenzyl alcohol (**IV**), ? b.p. 162—166°/13 mm. (*dinitrobenzoate*, m.p. 101°); $Al(OPr^{\beta})_3$–C_6H_6 affords 2-*phenyl*-Δ^3-*tetrahydrobenzyl alcohol*, b.p. 163°/12 mm. The chloride, b.p. 148°/12 mm., from (**IV**) and PCl_5–$CHCl_3$ is converted (Grignard) into 2-*phenylhexahydrophenylacetic acid*, m.p. 112°, cyclised by warm conc. H_2SO_4 to *trans*-9-keto-1 : 2 : 3 : 4 : 9 : 10 : 11 : 12-octahydrophenanthrene, m.p. 96°. CH_2:CH·CO_2H and (**I**) in boiling PhMe–quinol give 2-phenyl-Δ^3-tetrahydrobenzoic acid (**V**), m.p. 122°. The Me ester, b.p. 162°/14 mm., of (**V**) is hydrogenated (Raney Ni, MeOH) and then hydrolysed to the -hexahydrobenzoic acid, which is converted (warm conc. H_2SO_4 or chloride with $AlCl_3$–CS_2) into hexahydrofluorenone (*semicarbazone*, m.p. 204°). CH_2:CH·CO_2Et and (**I**) at 100° give the Et ester (**VI**), b.p. 155—160°/15 mm., of a stereoisomeride (m.p. 103°) [also obtained by oxidation of (**II**)] of (**V**) (cf. Lehmann *et al.*, A., 1935, 978). Hydrogenation of (**VI**) and subsequent hydrolysis (aq. EtOH–KOH) affords 2-phenylhexahydrobenzoic acid, m.p. 110°. H. B.

Benzoylation of erythritol and preparation of derivatives of *O*-benzoylglycollaldehyde.—See A., 1943, II, 350.

3 : 4-Dinitro-benzonitrile and -benzaldehyde. H. Goldstein and R. Voegeli (*Helv. Chim. Acta*, 1943, **26**, 1125—1128; cf. A., 1943, II, 192).—NO_2 at $C_{(4)}$ is mobile in the compounds 1 : 3 : 4-$C_6H_3R(NO_2)_2$ in which R = CO_2H, CN, or CHO. 3 : 4-*Dinitrobenzonitrile* (**I**), m.p. 92° (corr.), is not satisfactorily obtained by Sand-

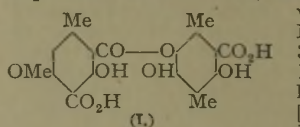
meyer's reaction from 3 : 4 : 1-$(NO_2)_2C_6H_3$·NH_2 but is prepared in 91% yield from 3 : 4 : 1-$(NO_2)_2C_6H_3$·CO·NH_2 and boiling $SOCl_2$. It is hydrolysed by H_2SO_4–AcOH–H_2O to 3 : 4 : 1-$(NO_2)_2C_6H_3$·CO_2H and converted by hot dil. NaOH into 4 : 3 : 1-OH·$C_6H_3(NO_2)$·CO_2H. (**I**) is converted by NH_3–EtOH, NH_2Ph–K_2CO_3, and piperidine into 3 : 4 : 1-NO_2·$C_6H_3(NH_2)$·CN, 3 : 4 : 1-NO_2·C_6H_3(NHPh)·CN and 3-nitro-4-piperidinobenzonitrile, respectively. 1 : 3 : 4-$C_6H_3Me(NO_2)_2$ is transformed by CrO_3 in Ac$_2$O–conc. H_2SO_4 into 3 : 4-*dinitrobenzylidene diacetate*, m.p. 94—95° (corr.), hydrolysed by boiling HCl to 3 : 4 : 1-$(NO_2)_2C_6H_3$·CHO, m.p. 64° (corr.). This yields $NaNO_2$ when treated with boiling dil. NaOH. The action of NH_2Ph or $NHPh·NH_2$ in presence of K_2CO_3 establishes the mobility of NO_2 (probably but not definitely) at $C_{(4)}$. H. W.

Chlorine substitution products of veratraldehyde, veratric acid, and related compounds. L. C. Raiford and D. E. Floyd (*J. Org. Chem.*, 1943, **8**, 358—366).—Vanillin and Cl_2 in $CHCl_3$ at 40—50° give 4 : 5 : 3 : 1-OH·C_6H_2Cl(OMe)·CHO, converted in aq. $NaHCO_3$ by Me_2SO_4 at ~70° into 3 : 4 : 5 : 1-$(OMe)_2C_6H_2Cl$·CHO; with fuming HNO_3 at 0—10° this gives 5-*chloro*-6-*nitroveratraldehyde*, m.p. 122—123°, oxidised by $KMnO_4$ in aq. C_5H_5N at 50—60° to 5-*chloro*-6-*nitro*-, m.p. 190—191°, which yields 5-*chloro*-6-*amino*-, m.p. 188—189°, and thence 5 : 6-*dichloro-veratric acid*, m.p. 186—187° (Me ester, m.p. 95—96°) (cf. Mazzara, A., 1901, i, 720). 3 : 4 : 1-$(OMe)_2C_6H_3$·CHO gives similarly 3 : 4 : 6 : 1-$(OMe)_2C_6H_2Cl$·CHO, and thence 6-*chloro*-2-*nitro-veratraldehyde* (**I**), m.p. 101—102°, and *-veratric acid*, m.p. 192—193°, and 6-*chloro*-2-*aminoveratric acid* (**II**), m.p. 163—165°. 3 : 4 : 1-OMe·C_6H_3(OAc)·$CH(OAc)_2$ gives the 6-Cl-derivative and thence, by way of its acetate, 2 : 6 : 3 : 4 : 1-NO_2·C_6HCl(OMe)(OH)·CHO, which yields (**I**) and, successively, 2 : 6 : 3 : 4 : 1-NH_2·C_6HCl(OMe)(OH)·CHO, 3 : 2 : 6 : 4 : 1-OMe·C_6HCl_2(OH)·CHO, 2 : 6-*dichloro-veratraldehyde*, m.p. 119—120°, and *-veratric acid*, m.p. 115° [also obtained from (**II**)]. Similar reactions lead to 6-*bromo*-2-*amino*-, m.p. 101°, 2 : 6-*dibromo*-, m.p. 137°, 5-*chloro*-2-, m.p. 62—63°, 6-*chloro*-5-, m.p. 127—128°, 2-*chloro*-5-, m.p. 51—52°, and 5-*chloro*-6-*bromo*-, m.p. 119—120°, 2 : 5 : 6-*tribromo*-, m.p. 129—130°, 5-*chloro*-2-*nitro*-, m.p. 51—52°, 2 : 5-*dichloro*-, m.p. 55°, 2 : 5 : 6-*trichloro*-, m.p. 94—95°, and 5-*iodo*-, m.p. 72—73°, *-veratraldehyde* and 2-, m.p. 200—202°, 5-, m.p. 189—190°, and 6-*chloro*-, m.p. 175—176°, 2 : 5-*dichloro*-, m.p. 164—165° (Me ester, b.p. 185—187°/5 mm.), 2 : 5 : 6-*trichloro*-, m.p. 123—124°, and *-tribromo*-, m.p. 169—170°, 5-*chloro*-2-, m.p. 175—176°, 2-*chloro*-5-, m.p. 183—184°, 6-*chloro*-5-, m.p. 189—190°, and 5-*chloro*-6-*bromo*-, m.p. 178—179°, 5-*chloro*-2-*nitro*-, m.p. 179—180°, 6-*bromo*-2-*nitro*-, m.p. 198—199°, 6-*bromo*-2-*amino*-, m.p. 182°, and 5-*iodo-veratric acid*, m.p. 184—185°. R. S. C.

Volatile plant substances. XXIV. Composition of the essential oil and resin of lovage (*Levisticum officinale*, Koch). Y. R. Naves (*Helv. Chim. Acta*, 1943, **26**, 1281—1295).—*o*-CHO·C_6H_4·CO_2H with $MgBu^aBr$ affords α-n-*butylphthalide* (**I**), b.p. 141°/2·4 mm. *o*-$C_6H_4(CO)_2O$, *n*-valeric anhydride, and Na *n*-valerate give n-*butylidenephthalide*, b.p. 141°/2·4 mm., hydrogenated (Raney Ni in 95% EtOH) to (**I**) and (PtO_2 in AcOH) to α-n-*butylhexahydrophthalide*, b.p. 129°/1·3 mm., which is hydrolysed (50% KOH) to o-α-*hydroxyamylhexahydrobenzoic acid*, m.p. 97—97·5° (*benzylthiuronium* salt, m.p. 131·5—132°). H. W.

Identification of aromatic carboxylic acids as ureides. II. F. Zetzsche and G. Voigt (*Ber.*, 1941, **74**, [*B*], 183—188; cf. A., 1940, II, 129).—*N*-Aroyl-*NN'*-di-*p*-dimethylaminophenylcarbamides are prepared from $ArCO_2H$ and (*p*-NMe_2·C_6H_4·NH_2)$_2$C in a solvent (Et_2O, EtOH, C_6H_6, or $COMe_2$) and the colours of the products recorded in terms of W. Ostwald's colour nomenclature. *o*-Substituents, except NO_2, exert a hypsochromic effect. The *o*-, m.p. 152—153°, m-, m.p. 240°, and p-*amino*-, sinters from ~250°, o-, m.p. 166°, m-, m.p. 137°, and p-*salicylideneamino*-, m.p. 207°, o-, m.p. 169—170°, m-, m.p. 115°, and p-*benzoyl*-, m.p. 154°, o-, m.p. 161°, m-, m.p., 138·5°, and p-*nitro*-, m.p. 210°, 2-*methoxy*-3-, m.p. 151°, -4-, m.p. 122°, and -5-*methyl*-, m.p. 153°, p-*dimethylamino*-, m.p. 205—212° (sinters and darkens from 157°), o-*anilino*-, m.p. 145°, o-*phenyl*-, m.p. 140°, and 4-*nitro*-2-*amino*-, m.p. 176° (darkens 170—172°), *-benzoyl*-, o-, m.p. 162°, m-, m.p. 170°, and p-*nitrocinnamoyl*-, m.p. 178° (sinters 175°), and 2 : 6-*dimethylpyridoyl*-, m.p. 151°, -derivatives are described. J. WA.

Lichen substances. XCVI. New depside "hypothamnolic acid." Y. Asahina, M. Aoki, and F. Fuzikawa (*Ber.*, 1941, **74**, [*B*], 824—831).—Et_2O extraction of (so-called) *Cladonia uncialis* (f. *obtusata*) (Japanese) yields usnic and *hypothalamic acid* (**I**), $C_{19}H_{18}O_{10}$, m.p. 217—218° (decomp.), but no squamatic acid (cf. A., 1933, 159). CH_2N_2 then gives the *Me*$_2$ ester (**II**), m.p. 197—198°, or *Me*$_2$ ester *Me*$_3$ *ether*, m.p. 127°, which are cleaved by cold conc. H_2SO_4 to 3-Me 1-H 2-hydroxy-4-methoxy-6-methyl*iso*phthalate (**III**) and *Me* 2 : 4 : 5-*trihydroxy*-3 : 6-*dimethylbenzoate* (**IV**), m.p. 151—152°, or 3-Me 1-H 2 : 4-dimethoxy-6-methyl*iso*phthalate and *Me* 5-*hydroxy*-2 : 4-*dimethoxy*-3 : 6-*dimethylbenzoate*, m.p. 45°, respectively. Reduction (2 H_2, Pd–C, AcOH) of the *Me*$_2$ ester, m.p. 158°, of thamnolic acid, m.p. 222°, gives (**II**). 1 : 4 : 2 : 3 : 5-$C_6HMe_2(OH)_3$, $Zn(CN)_2$, and Et_2O–HCl afford 2 : 4 : 5-*trihydroxy*-3 : 6-*dimethylbenzaldehyde*, m.p. 193°, the *triacetate*, m.p. 148° (prep. by Ac$_2$O–C_5H_5N), of which is oxidised (aq. $KMnO_4$–$COMe_2$–$MgSO_4$ at 45°) to 2 : 4 : 5-*triacetoxy*-3 : 6-*dimethylbenzoic acid*, m.p. 142—143° (*Me* ester, m.p. 197—198°), hydrolysed to the (*OH*)$_3$-*acid*, m.p. 190° [*Me* ester = (**IV**)]. (**III**) and $ClCO_2Et$ in $COMe_2$–C_5H_5N give a mixed *anhydride*, $C_{17}H_{20}O_{10}$, m.p. 81°, hydrolysed (aq. $COMe_2$–$NaHCO_3$) to 3-Me 1-H 4-methoxy-2-carbethoxyoxy-6-methyl*iso*phthalate, m.p. 127·5° (cf. A., 1937, II, 102), the chloride ($SOCl_2$) from which with (**IV**) affords *Me*$_2$ *carbethoxyhypothamnolate*, m.p. 178°, and thence (**II**). (**I**) has the structure shown. H. B.



(I.)

5-Amino-2-sulphanilylbenzoic acid and derivatives.—See B., 1943, II, 341.

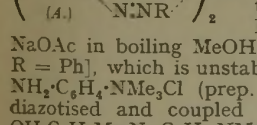
Derivatives of 3 : 4-dihydroxy-2-carboxyphenylacetic acid. C. Schöpf, I. Jäckh-Tettweiler, G. Mayer, H. Perrey-Fehrenbach, and L. Winterhalder (*Annalen*, 1940, **544**, 77—100).—Meconinecarboxylic acid (prep. from opianic acid by aq. NaCN at ~5—8° and then conc. HCl at 100°; 80% yield) with boiling HBr and then red P–HI (*d* 1·7) at 135° gives 3 : 4-*dihydroxy*-2-*carboxyphenylacetic acid* (**I**) (~50—60%), m.p. 220° (yellow at 212°) (blue $FeCl_3$ colour), and with aq. $KMnO_4$ yields 2-*carboxy*-3 : 4-*dimethoxyphenylglyoxylic acid*, m.p. 98°, which undergoes ring-closure when reduced. Evaporating meconinylacetic acid (**II**) with 50% aq. KOH gives 2-*carboxy*-3 : 4-*dimethoxycinnamic acid* (80%), m.p. 178—180° [with warm acid regenerates (**II**)], hydrogenated (Pd–$CaCO_3$) as Na_2 salt in H_2O to β-2-*carboxy*-3 : 4-*dimethoxyphenylpropionic acid*, +2H_2O, m.p. 125—127°, which with Ac$_2$O at the b.p. and then 200° yields CO_2 and 6 : 7-dimethoxy-α-hydrindone (64%), m.p. 40—43°[*semicarbazone*, +H_2O and anhyd., sinters 214°, m.p. 217—219° (decomp.)]. The derived (amyl nitrite–conc. HCl–MeOH at 0° and then 50°) 2-*OH*·*N*: derivative, m.p. 209—211°, with PCl_5–Et_2O gives 2-*carboxy*-3 : 4-*dimethoxybenzyl cyanide*, m.p. 104—108°, with, sometimes, 2-*carboxy*-3 : 4-*dimethoxyphenylacetamide*, m.p. 176—178°, hydrolysed by aq. KOH to 2-carboxy-3 : 4-dimethoxyphenylacetic acid (**III**), m.p. 115—117° (lit. an oil), which is also obtained from (**I**) by Me_2SO_4–NaOH (40° and then, for hydrolysis, the b.p.) and with 57% HI–AcOH gives 3-*hydroxy*-2-*carboxy*-4-*methoxyphenylacetic acid* (**IV**), sinters 190°, m.p. 209—210° (decomp.) (bluish-violet $FeCl_3$ colour; 3-*Et ether*, m.p. 135—140°). Boiling MeOH–H_2SO_4 converts (**I**) into the *Me*$_2$ ester (**V**), m.p. 135—136° (and some *Me* 3 : 4-*dihydroxy*-2-*carboxyphenylacetate*, m.p. 196—198°, which can be further esterified), which with CH_2PhCl–K_2CO_3–MeOH gives 2 : 3 : 4 : 1-CO_2Me·C_6H_2(O·CH_2Ph)$_2$·CH_2·CO_2Me (**VI**), an oil, hydrolysed successively to 2-*carbomethoxy*-, m.p. 100—102°, and 2-*carboxy*-3 : 4-*dibenzyloxyphenylacetic acid*, m.p. 160—166°. Similar treatment of (**IV**) gives *Me* 3-*hydroxy*-2-*carbomethoxy*-4-*methoxyphenylacetate*, m.p. 96—101° [bluish-violet $FeCl_3$ reaction; the impure derived 2-CO_2H-ester has m.p. 103—112°; 3-CH_2Ph *ether* (**VII**), m.p. 60—65°], 2-*carboxy*- (**VIII**), m.p. 128—131°, and 2-*carbomethoxy*-3-*benzyloxy*-4-*methoxyphenylacetic acid*, m.p. 85—87°. With CH_2N_2–Et_2O, (**III**) gives the Me_2 ester, b.p. 203—205°/15 mm., and thence by half hydrolysis 2-*carbomethoxy*-3 : 4-*dimethoxyphenylacetic acid*, sinters 75°, m.p. 83—85°; short treatment of (**III**) with HCl–MeOH gives *Me* 2-*carboxy*-3 : 4-*dimethoxyphenylacetate*, m.p. 110—112°. With 1 mol. of CH_2PhCl and K_2CO_3 in MeOH, (**V**) gives (**VI**), unchanged (**V**), and a mixture, rapidly hydrolysed by aq. NaOH at room temp. to 3-*hydroxy*-2-*carbomethoxy*-4-, m.p. 179—184° (blue $FeCl_3$ colour), and 4-*hydroxy*-2-*carbomethoxy*-3-*benzyloxyphenylacetic acid*, m.p. 112—116° (no $FeCl_3$ colour), converted by prolonged hydrolysis at 100° into 3-*hydroxy*-2-*carboxy*-4- (**IX**), m.p. 186—188°, and 4-*hydroxy*-2-*carboxy*-3-*benzyloxyphenylacetic acid*, m.p. 160—163°, respectively, and by CH_2N_2 into Me 2-carbomethoxy-4-benzyloxy-3-methoxyphenylacetate, an oil (and a substance, m.p. 138—143°), and (**VII**), respectively, which by prolonged hydrolysis give 2-*carboxy*-4-*benzyloxy*-3-*methoxyphenylacetic acid*, m.p. 177—179°, and (**VIII**), respectively. With CH_2PhCl (1 mol.) and NaOMe–MeOH, (**V**) gives *Me* 3-*hydroxy*-2-*carbomethoxy*-4-*benzyloxyphenylacetate*, m.p. 90—95°, and thence (**IX**). Opianic acid Me ψ-ester (α-Me ether) with H_2–Pd–C in MeOH at 50—55° gives 3 : 4-*dimethoxy*-o-*toluic acid*, m.p. 95—96° (Me ester, m.p. ~30°, b.p. 156—157°/17 mm.), and meconine. In boiling HBr, (**II**) gives (45 min.) 3 : 4-*dihydroxy*-α-*phthalidylacetic acid*, +H_2O, m.p. 228—229° (decomp.), and anhyd. R. S. C.

Synthesis of anthracene-9 : 10-dicarboxylic acid. H. Beyer and H. Fritsch (*Ber.*, 1941, **74**, [*B*], 494—499).—9 : 10-Dibromoanthracene (**I**) and CuCN in boiling quinoline give 9 : 10-*dicyanoanthracene*, m.p. 328—330°, hydrolysed (conc. H_2SO_4 at 100°) to *anthracene*-9 : 10-*dicarboxylamide*, m.p. 342—345° (decomp.) (does not give the acid with HNO_2). (**I**) and Mg (activated by EtBr) in Bu_2O–C_6H_6 followed by CO_2 afford 9-*bromoanthracene*-10-*carboxylic acid*, m.p. 273° [*Me* (by CH_2N_2 only), m.p. 114—115°, and *Et* (by $CHMeN_2$), m.p. 83°, ester; 1 : 1-*adduct*, m.p. 265° (decomp.), with (:CH·CO)$_2$O], reduced (2 H_2, PtO_2, AcOH, room temp.) to the 1 : 2 : 3 : 4-H_4-derivative. Schlenk's method (A., 1914, i, 398) gives 9 : 10-dihydroanthracene-9-carboxylic, m.p. 206—207° [Me, m.p. 98—99° (lit.

94—95°), and *Et*, m.p. 54—55°, ester; *hydrazide*, m.p. 206—207°], and -9 : 10-dicarboxylic acid (**I**), m.p. 305—307° (decomp.) [Me_2 (**II**), m.p. 163—164° (clear at 165°), and Et_2, m.p. 68—69° (clear at 70°), ester; *dihydrazide*, m.p. 310—312° (decomp.) (block)]. Se and (**I**) at 300° give anthracene but (**II**) at 220—230° affords *Me*$_2$ *anthracene*-9 : 10-*dicarboxylate*, m.p. 180—181°, hydrolysed (boiling 20% MeOH–KOH) to the *acid*, m.p. ~341—342° (decomp.).

H. B.

Stereochemistry of inner complex copper salts. P. Pfeiffer and H. Krebs (*J. pr. Chem.*, 1940, [ii], **155**, 77—114).—Attempts to decide the configuration by preparing *cis–trans* isomeric or optically active 4-covalent Cu compounds failed. A planar configuration is favoured. Cu salicylaldehydemethylimine, dimorphic (green needles; black rhombic pyramids), m.p. 158°, is obtained from (*a*) *o*-OH·C_6H_4·CHO (**I**), $Cu(OAc)_2$, and NH_2Me in EtOH at room temp. (96% yield) and (*b*) from Cu salicylaldehyde (**II**) and NH_2Me in boiling EtOH; the brown (A., 1939, II, 479) or other form could not be isolated. Cu salicylaldehydeanil, m.p. 234—236° (Schiff, *Annalen*, 1869, **150**, 197), is similarly obtained by both methods in only one form. *Cu salicylaldehyde-p'-nitroanil*, $+C_5H_5N$ and "anhyd.," m.p. 309° (decomp.), and *-α-naphthylimine*, m.p. 241·5°, are obtained by method (*b*). 2 : 1-OH·$C_{10}H_6$·CHO, $Cu(OAc)_2$, and NH_2R in EtOH give Cu 2-hydroxy-1-naphthaldehyde-methyl- (**III**), m.p. 235°, and *-1'-naphthyl-imine*, m.p. 269—270°, and -anil, m.p. 238—239° [also obtained from (1 : 2-CHO·$C_{10}H_6$·O)$_2$Cu and NH_2Ph in xylene at 150°] (cf. *loc. cit.*), which are also obtained in only one form [except for (**III**)]. *βγ-Di-o-hydroxyanilo*-n-*butane*, m.p. 232°, and *benzilmono-o-hydroxyanil*, $+C_5H_5N$, m.p. 90—120°, are obtained from *o*-NH_2·C_6H_4·OH by Ac_2 in boiling EtOH and Bz_2 in boiling C_5H_5N, respectively, but give no Cu derivatives. *p*-NH_2·C_6H_4·CO_2H and (**II**) in boiling C_5H_5N give the *Cu*, $+C_5H_5N$, salt of Cu salicylaldehyde-*p'*-carboxyanil; the derived *Na*$_2$, $+9H_2O$ and anhyd., and *Ba* salts are too unstable for attempts at resolution. *p*-NH_2·C_6H_4·SO_3Na and (**II**) in boiling EtOH give the *Na*$_2$, brownish-red and dark brown *forms*, both $+5H_2O$ and anhyd., and thence the *Ba* salts, brownish-red, $+5H_2O$ and anhyd., and dark brown, $+9H_2O$ and anhyd., all decomp. 350—370°, of Cu salicylaldehyde-*p'*-sulphoanil; derived alkaloidal salts are intractable; adding 0·66 equiv. of *d*-$\{Co(NH_2·[CH_2]_2·NH_2)_3\}_2(SO_4)_3$ (**IV**) to the Ba salt gives a *salt*, $+17H_2O$ and anhyd., the [*M*] of which coincide with those of (**IV**) (as bromide). Hal·$[CH_2]_2$·NH_2,HHal, (**II**), and NaOAc in boiling EtOH give *Cu salicylaldehyde-β-chloro-*, m.p. 168°, and *-β-iodo-ethylimine*, m.p. 143—144°, the halogen of which could not be exchanged for NMe_2. *Ni salicylaldehyde-β-chloroethylimine*, m.p. 175—177°, is similarly prepared. NH_2·$[CH_2]_2$·NEt_2 (**V**) and (**II**) give exothermally *Cu salicylaldehyde-β-diethylaminoethylimine*, green, m.p. 142°, but the di-imine could not be prepared. Warming (**I**) and (**V**) gives *salicylaldehyde-β-diethylaminoethylimine*, b.p. 168—172°/12 mm.; the derived *methiodide*, m.p. 148—149°, with $Cu(OAc)_2$ and anhyd. NaOAc in MeOH at 0° gives the *Cu* derivative *dimethiodide*, $C_{28}H_{44}O_2N_4I_2Cu$, $+1·5H_2O$ and anhyd., m.p. 210—220° (decomp.; varies with rate of heating), which yields the *dimetho*-d-*α-bromo-π-camphorsulphonate*, green, $+1·5H_2O$ and anhyd., m.p. 240—245° (variable); pptn. of only 50% of the salt gives a substance, the [*M*] of which is due solely to the anion. *Ni*, m.p. 246—247° (in boiling 96% EtOH or moist $COMe_2$ gives *o*-OH·C_6H_4·CH:N·C_6H_4·NMe_2-*p*, m.p. 134°), and *Cu salicylaldehyde-p'-dimethylaminoanil*, sinters 206—207°, m.p. 208·5° (*dimethiodide*; dimetho-α-bromo-π-camphorsulphonate), are also prepared. 4 : 1-SO_3H·$C_{10}H_6$·N_2Cl and *p*-cresol in NaOH give *Na p-cresol-3'-azo-1'-naphthalene-4'-sulphonate*, decomp. ~300°, and thence, by way of the Ba salt, the *acid*, $+H_2O$, which with $Cu(OAc)_2$ in boiling EtOH gives the *Cu* derivative (*A*; R = 4 : 1-SO_3H·$C_{10}H_6$·), $+6H_2O$ (Na_2 salt, $+6H_2O$, too dark for optical measurement). 4 : 2 : 1-NMe_2·C_6H_3(OH)·N_2Ph, $Cu(OAc)_2$, and NaOAc in boiling MeOH give the *Cu* derivative [analogous to *A*, R = Ph], which is unstable and does not give quaternary salts. *p*-NH_2·C_6H_4·NMe_3Cl (prep. from *p*-NHAc·C_6H_4·NMe_3I described) is diazotised and coupled with *p*-cresol to give the *salt*, 2 : 5 : 1-OH·C_6H_3Me·N_2·C_6H_4·NMe_3Cl-*p*, $+1·5H_2O$, m.p. 200—210° (decomp.; varies with rate of heating); with $Cu(OH)_2$ in boiling EtOH this gives the *Cu* derivative (*A*; R = *p*-NMe_3Cl·C_6H_4), sinters 185—190°, and thence the *dimetho-α-bromo-π-camphorsulphonate*, m.p. 223—224° (decomp.), which, when formed by half-pptn., has only very slight optical activity.



R. S. C.

Androtermone of *Chlamydomonas eugametos*; *l*-4-hydroxy-2 : 6 : 6-trimethyl-Δ^1-tetrahydrobenzaldehyde. R. Kuhn and I. Löw (*Ber.*, 1941, **74**, [*B*], 219—231).—Hydrolysis (dil. acid or alkali) of picrocrocin (**I**) to *d*-glucose (**II**) and 2 : 6 : 6-trimethyl-$\Delta^{1:3}$-dihydrobenzaldehyde (safranal) (**III**) (A., 1934, 395) may occur in two stages with production of a hydroxyaldehyde and its subsequent dehydration. The reaction is now followed polarimetrically in 50 vol.-% EtOH since (**III**) is insol. in H_2O. Reliable observations are not obtained for alkaline hydrolysis as (**II**) is largely destroyed at the necessary [OH] but alkaline hydrolysis is best for prep. of (**III**). Hydrolysis with HCl is unimol. with energy of activation 7590 g.-cal. per mol. between 29·9° and 19·5° and 11,380 g.-cal. per mol. between 19·5° and 9°. No indication of the accumulation of an intermediate product was observed. (**I**) is a β-glucoside since emulsin at pH 6·0 and 27° affords 4-*hydroxy*-2 : 6 : 6-*trimethyl*-Δ^1-*tetrahydrobenzaldehyde* (**IV**), b.p. 80—90° (bath)/0·001 mm., $[\alpha]_D^{20}$ −84·2° and −87·2° in 96% EtOH. The *thiosemicarbazone*, m.p. 191—192°, $[\alpha]_D^{20}$ −64° in 96% EtOH (absorption band in EtOH at 305 mμ), of (**IV**) is hydrolysed by 2N-H_2SO_4 to (**III**), b.p. ~60°/0·001 mm. [*thiosemicarbazone*, m.p. 191° (decomp.), shows an absorption band in EtOH at 340 mμ.]. Comparison of the optical inactivation of (**IV**) by acid with hydrolysis of (**I**) shows that these proceed at the same rate, indicating that the latter process does not involve (**IV**). The termone activity of (**IV**) is ten times that of (**III**), the abs. activity being 1·3 mols. per cell, and it is concluded that 1 mol. suffices to convert a hermaphrodite cell into a male cell.

J. Wa.

Synthesis of 3-hydroxy-4-methoxy- (homo*iso*vanillin) and 3 : 4-dihydroxy-phenylacetaldehyde (homoprotocatechnaldehyde). C. Schöpf, (Miss) E. Brass, E. Jacobi, W. Jorde, W. Mocnik, L. Neuroth, and W. Salzer (*Annalen*, 1940, **544**, 30—62).—Methods of synthesising CH_2Ar·CHO are discussed; some are investigated. The mixture obtained from commercial eugenol Me ether (**I**) by MgMeI (Hirao, A., 1936, 839), with KOH–EtOH at 0° gives the insol. K salt and thence the benzoate, m.p. 67° (lit. 69°), of eugenol; the crude chavibetol (**II**) in the filtrate is purified by means of the benzoate, m.p. 49·5°, which yields pure (**II**), b.p. 124°/12 mm. *Chavibetol CH*$_2$*Ph ether* (**III**), m.p. 48°, is obtained from pure or, in better over-all yield, crude (**II**) by CH_2PhCl and K_2CO_3 in boiling MeOH. 3 : 4 : 1-CH_2Ph·O·C_6H_3(OMe)·CH_2·CO_2H with PCl_5– or, less well, pure $SOCl_2$–C_6H_6 gives the chloride, which with CH_2N_2–Et_2O at 0° and then room temp. gives 3-*benzyloxy*-4-*methoxybenzyl CHN*$_2$ *ketone*, m.p. 86°, converted in AcOH at 60—70° (finally 100°) into the *CH*$_2$·*OAc ketone* (77%), m.p. 106°. When boiled with $Al(OPr^\beta)_3$–$Pr^\beta OH$ with removal of $COMe_2$, this gives γ-3-*benzyloxy*-4-*methoxyphenylpropane-αβ-diol* (**IV**) (94%), m.p. 110°, which is also obtained by treating AgOBz with I and then (**III**) in boiling C_6H_6 (absence of H_2O) and hydrolysing the product by NaOH–MeOH. With H_2–Pd–$BaSO_4$, (**IV**) gives α-3-*hydroxy*-4-*methoxyphenylpropane-αβ-diol* (*chavibetol glycol*), m.p. 88°, which could not be converted into CH_2Ar·CHO. The azlactone from 3 : 4 : 1-CH_2Ph·O·C_6H_3(OMe)·CHO with 10% NaOH–N_2 gives 3 : 4 : 1-CH_2Ph·O·C_6H_3(OMe)·CH_2·CO·CO_2H (**V**), m.p. 159°, reduced by H_2–PtO_2 and then –Pd–$BaSO_4$ in MeOH to 3 : 4 : 1-OH·C_6H_3(OMe)·CH_2·CH(OH)·CO_2H (**VI**), sinters 167°, m.p. 170°, whence no aldehyde could be obtained. The *Me* ester (prep. by CH_2N_2), m.p. 148—150°, of (**V**) gives similarly the *Me* ester, m.p. 62°, of (**VI**). Zn dust reduces (**V**) in 50% AcOH to α-*hydroxy*-β-3-*benzyloxy*-4-*methoxyphenylpropionic acid*, m.p. 129—130°; the Me ester, m.p. 87°, of which with MgMeI–Et_2O and then conc. aq. NH_4Cl gives α-3-*benzyloxy*-4-*methoxyphenyliso*pentane-βγ-*diol* (**VII**), m.p. 86°. $Pb(OAc)_4$ oxidises (**IV**) or (**VII**) to 3-*benzyloxy*-, b.p. 155° (bath)/0·01 mm. (*semicarbazone*, m.p. 143—144°; 2 : 4-*dinitrophenylhydrazone*, m.p. 151—152°), hydrogenated (Pd; MeOH) to PhMe, and 3-*hydroxy*-4-*methoxyphenylacetaldehyde*, b.p. 110—115° (bath)/0·05 mm. (*semicarbazone*, m.p. 182—183°), which is stable at pH 3—4, fairly stable at pH 5—6, but unstable at pH 8. When (**I**) or, less well, eugenol or safrole is heated with an excess of MgMeI–xylene–N_2 at 160—180°, the mixture contains 33% of 3 : 4 : 1-$(OH)_2C_6H_3$·CH_2·CH:CH_2, m.p. 47—58° (diacetate, b.p. 150—160° (bath)/12 mm., with O_3 gives no CH_2Ar·CHO). CH_2PhCl–K_2CO_3–$COMe_2$–N_2 then gives 3 : 4-*dibenzyloxyallylbenzene* (75%), m.p. 37—38°, purified by chromatography (AlO_3; C_6H_6) and fractional freezing in MeOH and converted by AgOBz–I–C_6H_6 and then NaOH–MeOH–H_2O into γ-3 : 4-*dibenzyloxyphenylpropane-αβ-diol* (75%), m.p. 82—83°, and thence [$Pb(OAc)_4$] into 3 : 4-dibenzyloxy- (75%), decomposes at 0·01 mm. (*semicarbazone*, m.p. 158°), and (activated PdO → Pd–H_2–MeOH) 3 : 4-dihydroxy-phenylacetaldehyde (**VIII**) (*semicarbazone*, m.p. 200—201°). Under certain conditions (**VIII**) polymerises, as formed, in presence of the catalyst. In H_2O, (**VIII**) gives a violet colour with Schiff's reagent, a green colour with $FeCl_3$, and an orange-red colour with HIO_4 (stable *o*-quinone formed), reduces $AuCl_3$, cold NH_3–$AgNO_3$, and hot neutral $AgNO_3$. Its 2 : 4-*dinitrophenylhydrazone*, m.p. 169—170°, is unstable in acid; the *p*-nitro- and *p*-bromo-phenylhydrazone are too unstable to be isolated. Its stability decreases from pH 3—4 to pH 7—8. 3 : 4 : 1-CH_2O_2:C_6H_3·CH_2·CO·CO_2H (**IX**) with H_2–PtO_2 in aq. Na_2CO_3 gives α-*hydroxy*-β-3 : 4-*methylenedioxyphenylpropionic acid* (**X**), m.p. 101°, which with $Pb(OAc)_4$ gives CO_2 and only 31—34% of homopiperonal (**XI**). The *Me* ester, m.p. 130—131°, of (**IX**) in MeOH yields similarly the *Me* ester, m.p. 39°, of (**X**), converted by an excess of MgMeI into α-3 : 4-*methylenedioxyphenyliso*pentane-βγ-*diol*, m.p. 106°, which with $Pb(OAc)_4$ in C_6H_6 gives good yields of (**XI**) and $COMe_2$. 3 : 4 : 1-$(OAc)_2C_6H_3$·CH_2·CH:CH_2, b.p. 99°/0·06 mm., with BzO_2H in $CHCl_3$ gives an oil, but the 2 : 3-$(OAc)_2$-compound, m.p. 65°, at 0° and then room temp. gives after 5 days ~50% of 2 : 3-*diacetoxy*-βγ-*epoxy*-n-*propylbenzene*, m.p. 86°. 4-*Acetoxy*-3-*methoxy*-βγ-*epoxy*-n-*propylbenzene* (similarly prepared), m.p. 50—52°, b.p. 133°/0·05 mm., in boiling 10% AcOH gives 3 : 4 : 1-OMe·C_6H_3(OAc)·CH_2·CH(OH)·CH_2·OH, b.p. 168°/0·03 mm. 3 : 4 : 1-$(CH_2Ph·O)_2C_6H_3$·CHO (improved prep.; 73% yield), m.p.

92—93°, gives the *azlactone*, m.p. 156—157°, which with alkali yielded no pyruvic acid. Br converts *iso*ferulic acid in AcOH or its acetate in $CHCl_3$ into *ω-bromo-3-hydroxy-*, m.p. 95—96°, or *-3-acetoxy-4-methoxystyrene*, m.p. 101—102°, respectively. 3 : 4 : 1-$(OMe)_2C_6H_3$·CH:CHBr and NaOEt at 180—185° give 3 : 4 : 1-$(OMe)_2C_6H_3$·C:CH, m.p. 73—74°, b.p. 130°/15 mm. 3 : 4 : 1-$(OAc)_2C_6H_3$·CO·CH_2·OAc and Zn dust in AcOH at 70° give 3 : 4 : 1-$(OAc)_2C_6H_3$·COMe, m.p. 86° (2 : 4-dinitrophenylhydrazone, m.p. 192—193°) (cf. Voswinckel, A., 1910, i, 42; Birnbaum *et al.*, A., 1939, II, 373). R. S. C.

Influence of alkylation on reactions of acid derivatives in the Friedel–Crafts synthesis. E. Rothstein and M. A. Saboor (*J.C.S.*, 1943, 425—429).—Mechanisms are suggested for the two classes of reactions of acids or their chlorides or anhydrides and $AlCl_3$ or P_2O_5, where the product is either a ketone or an unsaturated substance. The absence of an ionisable α-H leads to the formation of an unsaturated substance, usually polymerised, with loss of CO; in other cases, little CO is eliminated and a ketone results. Dry distillation of $(CPhMe_2·CMe_2·CO_2)_2Ca$ gives, with loss of CO and H_2O, an unsaturated *hydrocarbon*, $C_{12}H_{16}$, b.p. 110°; a second *hydrocarbon*, $C_{12}H_{16}$, b.p. 154°, is obtained by distillation of the acid with soda–lime. Normal reaction of acid derivatives with $AlCl_3$ and C_6H_6 is possible only where an α-H is present, and the aromatic nucleus will attach itself to the CO group nearest to the one which is most ionised. The sole product from trimethylsuccinic anhydride, $AlCl_3$, and C_6H_6 is *β-benzoyl-αα-dimethyl*-n-*butyric acid* (**I**), m.p. 135·6° (or *γ-hydroxy-γ-phenyl-ααβ-trimethylbutyrolactone*) [*Me* ester (or *ether*), b.p. 151°/8 mm.; excess of AcCl gives *γ-phenyl-ααβ-trimethyl-*Δ^{β}*-butenolactone*, b.p. 145°/10 mm.; HI affords *γ-phenyl-ααβ-trimethylbutyrolactone*, m.p. 71°], also obtained by methylation (MeI–$KOBu^{\gamma}$) of the *Me* ester, b.p. 153°/7 mm., m.p. 46—47° (2 : 4-*dinitrophenylhydrazone*, m.p. 126°), of COPh·CH_2·CMe_2·CO_2H (**II**), m.p. 173° (2 : 4-*dinitrophenylhydrazone*, m.p. 198—199°). (**II**) is reduced (AcOH–HI–red P) to Ph·$[CH_2]_2$·CMe_2·CO_2H. Excess of AcCl converts (**II**) into *γ-phenyl-αα-dimethyl-*Δ^{β}*-butenolactone*, m.p. 45°. Attempted synthesis of COPh·CMe_2·CHMe·CO_2H by methylating COPh·CMe_2·CH_2·CO_2H, m.p. 101—102° (*Me* ester, b.p. 131—143°/8 mm.), failed. Methylation of the *Me* ester, b.p. 164°/14 mm., of *β-benzoyl-α-methyl*-n-*butyric acid*, m.p. 78—79° [obtained from *trans*-$(CHMe·CO)_2O$, C_6H_6, and $AlCl_3$ at b.p., then at 100°], also gives (**I**). A ketone or CO-acid is not obtained by Friedel–Crafts reaction on the anhydrides or chlorides of *tert.*-acids. $(CMe_2·CO)_2O$ and C_6H_6–$AlCl_3$ at 0°, then gradually to 100°, give CO (60% yield in the cold), a neutral *substance*, $C_{20}H_{22}O_2$, m.p. 147—148°, and (mainly) *β-phenyl-ααβ-trimethyl*-n-*butyric acid* (**III**), m.p. 179° [*Me* ester, m.p. 24—25° (Ag salt and MeI), or from CH_2:$CMe·CMe_2·CO_2Me$–C_6H_6–$AlCl_3$; *anhydride*, m.p. 87°; NO_2-derivative, m.p. 232°], also obtained through its *Et* ester, b.p. 138°/11 mm., from *Et β-chloro-ααββ-tetramethylpropionate*, b.p. 70—74°/8 mm. (from the OH-ester and $SOCl_2$–C_5H_5N), and from the β-OH-ester. (**III**) and conc. H_2SO_4 yield 2 : 2 : 3 : 3-*tetramethyl-α-hydrindone*, b.p. 142°/25 mm. (NO_2-derivative, m.p. 130—131°). *β-p-Tolyl-ααβ-trimethyl*-n-*butyric acid* has m.p. 178°. CH_2:$CH·CMe_2·CO_2Me$–$AlCl_3$–C_6H_6 afford, through the *Me* ester, b.p. 124—126°, *β-phenyl-αα-dimethyl*-n-*butyric acid*, m.p. 54—57°. $(Bu^{\gamma}CO)_2O$ (from the chloride and dry K or Ag salt at 100°) and C_6H_6–$AlCl_3$ afford PhBu$^{\gamma}$ (55% yield), $Bu^{\gamma}CO_2H$, and CO. COCl·CMe_2·CH_2·CO_2Me (Friedel–Crafts) gives (**II**), and (**III**) is similarly obtained from COCl·$[CMe_2]_2$·CO_2Me. Impure (?) COPh·CMe_2·CHMe·CO_2H (*Me* ester, b.p. 95°/0·3 mm.) is probably obtained from COPhPr$^{\beta}$ (K derivative) and CHMeI·CO_2Et. Condensation of COPh·CMe_2Br with $CMeNa(CO_2Et)_2$ or CN·CHNa·CO_2Et, or of COPhPr$^{\beta}$ (Na or K derivative) with $CHBr(CO_2Et)_2$ was not successful. A. T. P.

Action of sodium on ethyl β-methylbutane-αβδ-tricarboxylate. I. [Structure of the methylated condensation product.] II. Structure of the ethylated condensation product. R. N. Chakravarti (*J. Indian Chem. Soc.*, 1943, **20**, 173—177, 189—194).—I. The CO_2Et concerned in the Dieckmann cyclisation of $CO_2Et·CH_2·CH_2·CMe(CO_2Et)·CH_2·CO_2Et$ (**I**) is that on $C_{(\alpha)}$, and not that on $C_{(\delta)}$, as stated by Baker (A., 1931, 957). (**I**) with Na in C_6H_6 and then MeI (*in situ*) gives Et_2 3 : 5-*dimethyl*cyclo*pentanone*-3 : 5-*dicarboxylate* (**II**), b.p. 135°/6 mm. (no colour with $FeCl_3$), hydrolysed (KOH–25% EtOH) to *β-methylpentane-ααβδ-tricarboxylic acid* (**III**), m.p. 178—179° (p-*phenylphenacyl* ester, m.p. 158°). (**II**) with boiling NaOEt–EtOH gives the Et_3 ester, b.p. 140—142°/5 mm., of (**III**), which with Na in C_6H_6 gives Et_2 2 : 4-*dimethyl*cyclo*pentanone*-4 : 5-*dicarboxylate*, b.p. 130—133°/6 mm. (violet colour with $FeCl_3$). Hydrolysis with 6% HCl then gives 2 : 4-dimethyl*cyclo*pentanone-4-carboxylic acid, an oil [*semicarbazone*, m.p. 173° (decomp.)]. $CH_2Ac·CHMe·CO_2Et$, CN·CH_2·CO_2Et, and NH_2Ac in AcOH (cf. Cope, A., 1938, II, 5) give Et_2 *α-cyano-β-methyl-*Δ^{α}*-pentene-αδ-dicarboxylate*, b.p. 148°/5 mm., which with HCN affords Et_2 *αβ-dicyano-β-methylpentane-αδ-dicarboxylate*, b.p. 176°/5 mm., hydrolysed (conc. HCl) to (**III**).

II. (**I**) with Na in C_6H_6 and then EtI (*in situ*) gives Et_2 3-*methyl*-5-*ethyl*cyclo*pentanone*-3 : 5-*dicarboxylate* (**IV**), b.p. 142°/6 mm. (no colour with $FeCl_3$), hydrolysed (KOH–25% EtOH) to *β-methyl*-n-*hexane-αβδ-tricarboxylic acid* (**V**), m.p. 172—173°. Ketonic hydrolysis of (**IV**) gives 3-methyl-5-ethyl*cyclo*pentanone-3-carboxylic acid (**VI**) [*semicarbazone*, m.p. 191° (decomp.); Et ester, b.p. 110°/8 mm. (*semicarbazone*, m.p. 142—143°)]. Baker (*loc. cit.*) represented (**V**) as *γ-methyl*-n-*hexane-αγδ-tricarboxylic acid* (**VII**). (**VII**) was synthesised from $CO_2Et·[CH_2]_2·CMe(CN)·CH(CN)·CO_2Et$ (Banerjee, A., 1941, II, 16) by ethylation with NaOEt and EtI to *Et₂ γδ-dicyano-γ-methylhexane-αδ-dicarboxylate*, b.p. 175°/5 mm., followed by hydrolysis with conc. HCl; it has m.p. 169°, depressed when mixed with (**V**). The Et_3 ester, b.p. 150°/5 mm., of (**VII**) with Na in C_6H_6 gives Et_2 3-*methyl*-2-*ethyl*cyclo*pentanone*-3 : 5-*dicarboxylate*, b.p. 150°/8 mm. (violet colour with $FeCl_3$), hydrolysed by 6% HCl to 3-*methyl*-2-*ethyl*cyclo*pentanone*-3-*carboxylic acid*, m.p. 91° [*semicarbazone*, m.p. 213—214° (decomp.)]. $CH_2Ac·CHEt·CO_2Et$, CN·CH_2·CO_2Et, NH_2Ac, and AcOH give Et_2 *α-cyano-β-methyl-*Δ^{α}*-hexene-αδ-dicarboxylate*, b.p. 150°/5 mm.; addition of HCN and hydrolysis (conc. HCl) of the resulting Et_2 *αβ-dicyano-β-methylhexane-αδ-dicarboxylate*, b.p. 170°/4 mm., affords (**V**). The Et_3 ester b.p. 140°/5 mm., of (**V**) with Na in C_6H_6 gives Et_2 3-*methyl*-5-*ethyl*cyclo*pentanone*-2 : 3-*dicarboxylate*, b.p. 130°/5 mm. (violet colour with $FeCl_3$), hydrolysed by 6% HCl to (**VI**). S. A. M.

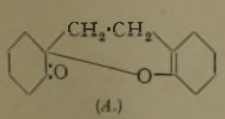
Syntheses in the sterol and sex hormone group. IV. Synthesis of 3-β-naphthyl*cyclo*pentanone derivatives. C. K. Chuang, J. H. Chu, and Y. S. Kao (*Ber.*, 1941, **74** [*B*], 798—806).—2-$C_{10}H_7$·CO·$[CH_2]_2$·CO_2Et, $CH_2Br·CO_2Et$, and Zn in C_6H_6 give Et_2 *β-hydroxy-β-2-naphthyladipate* (**I**), m.p. 84—88° [and acidic products from which is obtained by hydrolysis (aq. KOH) a small amount of a *β-2-naphthyldihydromuconic acid* (**II**), m.p. 186—187°], which could not be dehydrated by $SOCl_2$–Et_2O, Ac_2O, or P_2O_5–C_6H_6. Hydrolysis (20% KOH at room temp.) of (**I**) gives *β-hydroxy-β-2-naphthyladipic acid* (**III**), m.p. 156—158° (decomp.) (p-*nitrobenzyl* ester, m.p. 132—133°), converted at 160—170° or by 6N-H_2SO_4 in boiling $COMe_2$ into the *γ-lactonic acid*, m.p. 167—168°. Hydrolysis of (**I**) with boiling EtOH–KOH affords a little (**III**) and a mixture (*A*) of unsaturated acids from which (**II**) is isolable. (**II**) [also obtained in poor yield from (**III**) and boiling Ac_2O] and (*A*) are reduced (H_2, Pt-black, AcOH) to *β-2-naphthyladipic acid* (**IV**), m.p. 168—169° (*p*-nitrobenzyl ester, m.p. 98°). The Me_2 ester of (**IV**) gives (Dieckmann) 3-*β*-naphthyl*cyclo*pentanone [semicarbazone, m.p. 199—201° (lit. 196—197°)]. H. B.

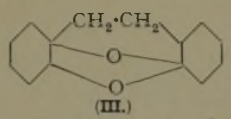
Reactions catalysed by aluminium chloride. XXI. Route to 8-methylhydrindan-1-one. C. D. Nenitzescu and V. Przemetzky (*Ber.*, 1941, **74**, [*B*], 676—686).—*cyclo*Hexene (**I**) and $CH_2Cl·OAc$ (**II**) in CS_2 at room temp. give 2-*chlorohexahydrobenzyl acetate* (**III**), b.p. 110—112°/14 mm. (the Cl is unaffected by boiling quinoline, $NPhEt_2$, or EtOH–KOH, by KOAc at 200°, or by reducing agents), which with C_6H_6–$AlCl_3$ at 45° affords 4-*phenylhexahydrobenzyl acetate*, b.p. 156—158°/12 mm. (**I**), 37% CH_2O–HCl (1 mol.), and $ZnCl_2$ at 0—45° give 2-*chlorohexahydrobenzyl alcohol* (**IV**), b.p. 105—107°/15 mm.; 2-*bromohexahydrobenzyl alcohol*, b.p. 120°/15 mm., and 2-*chloro*cyclo*pentylcarbinol*, b.p. 92—93°/15 mm., are similarly prepared. (**IV**) with Na–H_2O–Et_2O affords hexahydrobenzyl alcohol, b.p. 182—185°/760 mm., and with Na–EtOH gives the 2-*OEt-alcohol*, b.p. 75°/10 mm., oxidised (aq. KOH–$KMnO_4$) to 2-*ethoxyhexahydrobenzoic acid*, m.p. 96°. (**III**) and (**IV**) with solid KOH at 160° give Δ^1-*tetrahydrobenzyl alcohol* (**V**), b.p. 90—93°/23 mm., attempted dehydrogenation (Cu at 300°) of which affords hexahydrobenzaldehyde. (**I**), 35% CH_2O, and conc. H_2SO_4 give the *CH_2: ether*, b.p. 63—67°/10 mm., of 2-hydroxymethyl*cyclo*hexanol; this is unchanged by dil. acids at 150° or by Al_2O_3 at 400°. 1-Methyl-Δ^1-*cyclo*hexenylpropionic acid, b.p. 162°/18 mm., and thence (chloride, b.p. 112—115°/9 mm., with $AlCl_3$ in *cyclo*hexane) into 8-methylhydrindan-1-one, b.p. 98—99°/15 mm., m.p. 39·5° (lit. 34° and an oil) [semicarbazone, *forms*, m.p. 214·5° and 224° (cf. lit.)], together with a little 8-methyltetrahydroindan-1-one (*semicarbazone*, m.p. 238°). *β*-Δ^1-cyclo*Hexenylpropionic acid*, b.p. 156—159°/18 mm. (p-*bromophenacyl* ester, m.p. 112°) [similarly obtained starting with (**V**)], is similarly converted into 4 : 5 : 6 : 7-*tetrahydroindan*-1-*one*, b.p. 124—125°/17 mm. (*semicarbazone*, m.p. 243°). *cyclo*Hexanone, Cl·$[CH_2]_2$·CO_2Et (or Br-ester), and Li in C_6H_6 give (after hydrolysis) mono- and di-*cyclo*hexylidene*cyclo*hexanone and *β*-2-keto*cyclo*hexylpropionic acid, b.p. 180—182°/15 mm., reduced (Na–Hg, H_2O) to the 2-*OH-acid lactone*, b.p. 145—150°/? vac. $CO_2Me·[CH_2]_2·COCl$, (**I**), and $AlCl_3$ in $PhNO_2$ at room temp. afford Me *γ*-keto-*γ*-Δ^1-*cyclo*hexenylbutyrate, b.p. 170—175°/20 mm., the *semicarbazone*, m.p. 141·5°, of which with EtOH–NaOEt at 160° gives *γ*-Δ^1-cyclo*hexenylbutyric acid*, b.p. 165—167°/22 mm. This is cyclised (as above) to 1-keto-Δ^9-octahydronaphthalene (*semicarbazone*, m.p. 241°). CMe_2:CH_2 and (**II**) give *γ-chloro-γ-methyl*-n-*butyl acetate*, b.p. 112°/25 mm., whilst CH_2:$CH·CH_2Cl$,

CH_2Cl·OMe, and $ZnCl_2$ afford *αβ-dichloro-δ-methoxy*-n-*butane*, b.p. 170°/760 mm., converted by boiling 10% KOH into *β-chloro-δ-methoxy-*Δ^{α}*-butene*, b.p. 42°/18 mm. H. B.

Carbon rings. XXXII. Productive preparation of *cyclo*nononanone. L. Ruzicka, P. A. Plattner, and H. Wild (*Helv. Chim. Acta*, 1943, **26**, 1631—1637).—At room temp. the equilibrium *cyclo*octanonecyanohydrin (**I**) ⇌ *cyclo*octanone (**II**) + HCN lies almost entirely on the right side but at 0° (**I**) is obtained by the gradual addition of 37% HCl to an emulsion of (**II**) and KCN in Et_2O and is stabilised by conversion (well-cooled Ac_2O + AcCl) into the *acetate*, b.p. 94—100°/0·25 mm. This is hydrogenated (PtO_2 in AcOH containing a little 37% HCl at 60°) to *cyclo*octylmethylamine (**III**) and 1-*acetoxycyclooctanecarboxylamide*, m.p. 109°. Similar hydrogenation of (**I**) at 18° gives (**III**) (Bz derivative, m.p. 69—70°), 1-aminomethyl*cyclo*octanol (**IV**), m.p. 35° (*hydrochloride*, m.p. 232°; N-*Bz* derivative, m.p. 132·5—133°), and 1-*hydroxy*cyclo*octylmethyl*-1′-*hydroxy*cyclo*octylmethyleneamine*, $[CH_2]_7>C(OH)\cdot CH_2\cdot N{:}CH\cdot C(OH)<[CH_2]_7$, b.p. 140—142°/0·1 mm., m.p. 105°, converted by Ac_2O and C_5H_5N in C_6H_6 into the *monoacetate*, m.p. 95°. (**IV**) is transformed by HNO_2 into *cyclo*nonanone (**V**), b.p. 94·5—95·5°/13 mm., m.p. 34°, purified through the semicarbazone, m.p. 183°. (**V**) is oxidised (CrO_3 in AcOH at 100°) to azelaic acid. M.p. are corr. H. W.

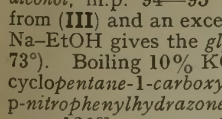
"Dimeric 2-methylene*cyclo*hexanone." C. Mannich (*Ber.*, 1941, **74**, [*B*], 557—564).—"*Dimeric 2-methylene*cyclo*hexanone*" (**I**), b.p. 160—161°/14 mm., is (*A*); it gives a mono-semicarbazone, m.p. 206°, and -oxime, m.p. 123° (cf. A., 1928, 300). With 20% HCl (**I**) gives 1-*hydroxy*-2 : 2′-*diketo-αβ-di*cyclo*hexylethane*, m.p. 154—155° [*dioxime*, m.p. 195°, also obtained when (**I**) is treated with NH_2OH in weakly acid solution for a long time], which contains 1 active H and is reduced (H_2, PtO_2, EtOH) to 1 : 2 : 2′-*trihydroxy-αβ-di*cyclo*hexylethane*, m.p. 154° (*triacetate*, m.p. 71—72°). Similar reduction of (**I**) gives the *alcohol* (**II**) [(*A*) with CH·OH for CO], m.p. 69—70° (*acetate*, b.p. 177—180°/12 mm.), converted by 20% HCl into the


(*A.*)


(III.)

diether (**III**), b.p. 146—149°/12 mm. (**II**) and (**III**) are dehydrogenated (Pt–asbestos at 320—330° in H_2) to (*o*-OH·C_6H_4·CH_2)$_2$. (**I**), (**II**), or (**III**) with aq. AcOH–CrO_3 at 60° gives *α-keto-α-2-keto*cyclo*pentyl-γ-1-hydroxy-2-keto*cyclo*hexylpropane*, m.p. 134°, cleaved by hot dil. KOH to *cyclo*pentanone, *γ-2-keto*-2 : 3 : 4 : 6 : 7 : 8-*hexahydro-1-naphthylbutyric acid* (**IV**), m.p. 111° [*semicarbazone*, m.p. 224° (decomp.)], and *β-1-hydroxy-2-keto*cyclo*hexylpropionic acid lactone* (**V**), m.p. 60° [*semicarbazone*, m.p. ~196° (decomp.); *oxime*, m.p. 124—125°]. Reduction (H_2, PtO_2, EtOH) of (**IV**) affords H_4-[*semicarbazone*, m.p. ~209° (decomp.)] or H_6-derivatives, m.p. 147°; (**IV**) probably arises from the intermediate ε-keto-η-1-hydroxy-2-keto*cyclo*hexyloctoic acid. Oxidation (Ag_2O) of (**V**) gives γ-keto-azelaic acid reduced (Clemmensen) to azelaic acid. H. B.

Rearrangement of "dimeric 2-methylene*cyclo*hexanone" by acids. C. Mannich (*Ber.*, 1941, **74**, [*B*], 565—570).—"Dimeric 2-methylene*cyclo*hexanone" or 1-hydroxy-2 : 2′-diketo-αβ-di*cyclo*hexylethane with boiling 20% H_2SO_4 gives the *diketone* (**I**), b.p. 155—156°/10 mm. (*mono-semicarbazone*, m.p. 157—158°, and *-oxime*, m.p. 156—157°), reduced (H_2, PtO_2, EtOH) to a *CO-alcohol*, $C_{14}H_{22}O_2$, b.p. 162—163°/12 mm. (**II**) [*oxime*, m.p. 198—199°; *acetate* (**III**), b.p. 171—172°/?vac.], or (exceptionally) an isomeric *CO-alcohol*, m.p. 94—95° (**IV**) (*oxime*, m.p. 149—150°), also obtained from (**III**) and an excess of boiling n-EtOH–KOH. (**II**) or (**IV**) with Na–EtOH gives the *glycol*, $C_{14}H_{24}O_2$, m.p. 169—170° (*diacetate*, m.p. 73°). Boiling 10% KOH converts (**I**) into 1-*β*-2′-*keto*cyclo*hexylethyl*-cyclo*pentane*-1-*carboxylic acid*, m.p. 84° [*semicarbazone*, m.p. 198°; *p-nitrophenylhydrazone*, m.p. 156° (decomp.); *CHPh*: derivative, m.p. 126°], reconverted into (**I**) by P_2O_5 at 105°, and oxidised ($KMnO_4$; small amount) to ε-*keto-η-1-carboxy*cyclo*pentyloctoic acid*, m.p. 83° [*semicarbazone*, m.p. 171° (decomp.)], or (large amount) to a mixture of $H_2C_2O_4$, $(CH_2\cdot CO_2H)_2$, glutaric, adipic, 1-carboxy*cyclo*pentylacetic, and *cyclo*pentane-1 : 1-dicarboxylic acid. H. B.


(I.)

Methylenequinones. Oxido-reductive dimerisation. H. von Euler, E. Adler, and A. O. Caspersson (*Arkiv Kemi, Min., Geol.*, 1943, **16**, **A**, No. 11, 14 pp.; cf. A., 1943, II, 189).—1 : 2 : 5-$C_6H_3Me(OH)_2$, 8% aq. NaOH, and 40% CH_2O (in N_2) at 2—5° (70 hr.) give 2 : 5-*dihydroxy-3-methylbenzyl alcohol* (**I**), m.p. 156·5—157·5°; its 2 : 5-*Me*$_2$ *ether*, m.p. 74·5—75°, is oxidised by aq. $KMnO_4$–NaOH to 2 : 5-*dimethoxy-m-toluic acid*, m.p. 124—125°, converted by HBr–AcOH into the 2 : 5-$(OH)_2$-compound, m.p. ~190° (decomp.) (lit. 215°). Short treatment of (**I**) with HCl in EtOAc (solid CO_2 cooling), followed by aq. $NaHCO_3$, gives, through the corresponding benzyl chloride (**II**), the unstable 1 : 6 : 4 : 2-O:$C_6H_2Me(OH)$:CH_2 (*A*), and thence a *quinhydrone* (**III**), $C_{32}H_{32}O_8$, m.p. 210° (pre-heated bath). (**III**) is reduced by Zn–AcOH (not by SO_2 or $SnCl_2$) to *αβ-di-*(2 : 5-*dihydroxy-3-methylphenyl*)*ethane* (**IV**), m.p. 286—287° (pre-heated bath) (*tetra-acetate*, m.p. 167°), oxidised by $FeCl_3$ in MeOH to the corresponding *diquinone* (**V**), m.p. 193°. (**III**) is synthesised from equal amounts of (**IV**) and (**V**) in MeOH. (**II**) is reduced by Zn dust in moist Et_2O or C_6H_6 to (**IV**). (*A*) is considered to undergo oxido-reduction to 2 : 5 : 3 : 1-$(OH)_2C_6H_2Me{:}CH_2$··· and the corresponding quinone; the radicals then dimerise. A. T. P.

IV.—STEROLS AND STEROID SAPOGENINS.

Oxidation of cholesterol and other unsaturated sterols in colloidal aqueous solution by molecular oxygen. S. Bergström (*Arkiv Kemi, Min., Geol.*, 1943, **16**, **A**, No. 10, 72 pp.).—An account of work previously abstracted (A., 1941, II, 139; 1942, II, 102, 230; 1943, II, 13). A. T. P.

Cholesteryl thiocyanate. A. Müller and E. Bátyka (*Ber.*, 1941, **74**, [*B*], 705—707).—Cholesteryl *p*-toluenesulphonate (**I**) or benzenesulphonate and KCNS in abs. $COMe_2$ at 100° (sealed tube) give cholesteryl thiocyanate (**II**), m.p. 128—129°, $[\alpha]_D^{19}$ −14·6° in $CHCl_3$ (cf. lit.) (5 : 6-*dibromide*, m.p. 79—80°, $[\alpha]_D^{19}$ −34·6 in $CHCl_3$), converted by boiling C_6H_6–n-MeOH–NaOMe into dicholesteryl disulphide, $[\alpha]_D^{19}$ −44·9° in $CHCl_3$. Thermal rearrangement of (**II**) could not be effected. (**II**) or (better) (**I**) and boiling NH_2Ph give *N*-phenylcholesterylamine, m.p. 189—190°, $[\alpha]_D^{19}$ −35·6° in $CHCl_3$, and [from (**II**)] a substance, m.p. >220°. Cholesteryl chloride and NaI in $COMe_2$ at 180—190° give $\Delta^{3:5}$-cholestadiene, m.p. 77—78°, $[\alpha]_D^{20}$ −80·2° in C_6H_6. H. B.

Acyl migration in the sterol series. M. F. C. Paige (*J.C.S.*, 1943, 437—441).—Attempted partial hydrolysis of 3(*β*) : 6(*β*)-diacetoxy-Δ^4-cholestene to 6(*β*)-acetoxy-Δ^4-cholesten-3(*β*)-ol failed. 3-*O*-Carbomethoxycholesterol (**I**) and aq. SeO_2–Ac_2O at 105—110° give 3-O-*carbomethoxy*-4-*acetoxycholesterol* (**II**), m.p. 160·5—161°, hydrolysed by boiling 5% KOH–MeOH to *cis*-Δ^5-cholestene-3 : 4-diol (**III**). Oxidation of (**I**) with aq. SeO_2 in AcOH at 100° gives (**II**) and the *carbonate* (**IV**), m.p. 173—173·5°, of (**III**); (**IV**) is also obtained from (**III**) and PhMe–$COCl_2$–C_5H_5N–C_6H_6 at 70° (sealed tube). The 3 : 6-ester was not isolated in either oxidation of (**I**), but was probably present as hydrolysis of the non-cryst. residues gives a little Δ^4-cholestene-3 : 6-diol. 4-Hydroxycholesterol and $ClCO_2Me$–C_5H_5N–Et_2O–C_6H_6 at room temp. afford 4-*hydroxy*-3-O-*carbomethoxycholesterol*, m.p. 157·5—159·5° (*benzoate*, m.p. 173—174°), acetylated (Ac_2O) to (**II**), which is also obtained similarly from the 4-monoacetate of (**III**) and $ClCO_2Me$–C_5H_5N. 3-*O*-Carbethoxycholesterol and aq. SeO_2–Ac_2O yield 3-O-*carbethoxy*-4-*acetoxycholesterol* (**V**), m.p. 163—163·5°, and 3-O-*carbethoxy*-6-*acetoxy*-Δ^4-*cholesten*-3-*ol*, m.p. 121—122·5° (hydrolysed to Δ^4-cholestene-3 : 6-diol); the same products and (**IV**) are formed by oxidation in AcOH. (**V**) is hydrolysed to (**III**) and can be obtained from the 4-monoacetate of (**III**) and $ClCO_2Et$. (**III**) and $ClCO_2Et$–C_5H_5N afford 4-*hydroxy*-3-O-*carbethoxycholesterol*, m.p. 130·5—131° (*benzoate*, m.p. 131—131·5°), acetylated to (**V**). Acyl migration in the 3-monoesters of (**III**) probably occurs through the orthocarbonate. The 3-monoacetate and $EtCO_2H$ at 100° afford some 4-acetate; even in AcOH, conversion is incomplete in 6 hr., indicating an equilibrium reaction. (**IV**) and MeMgI (in Et_2O–dry H_2) give only Δ^4-cholestene (**VI**). (**I**) is probably first oxidised in AcOH to its 4-OH derivative, which rearranges to an orthocarbonate; loss of MeOH then gives (**IV**). The 3-*O*-CO_2Me- or -CO_2Et-derivatives of (**III**) are converted by boiling AcOH or $EtCO_2H$ into (**IV**). Hydrogenation (Pd, then Pt) of 6(*β*)-acetoxy-Δ^4-cholesten-3-one gives a non-cryst. product, but Na–C_5H_{11}·OH followed by BzCl–C_5H_5N at room temp. yields cholestane-3(*β*) : 6(*α*)-diol dibenzoate, also obtained similarly from cholesterol *α*- or *β*-oxide (modified prep.). Δ^4-Cholestene-3 : 6-diol and boiling Na–C_5H_{11}·OH afford a hydrocarbon, m.p. 79—80°, possibly (**VI**). A. T. P.

Constituents of the adrenal cortex and related substances. LXIV. Configurative connexion of 17(*β*)-hydroxypregnane derivatives with glycerol grouping in the side-chain. B. Koechlin and T. Reichstein (*Helv. Chim. Acta*, 1943, **26**, 1328—1334).—$\Delta^{5:17}$-Pregnadiene-3 : 21-diol diacetate is converted by OsO_4 in Et_2O at room temp. followed by Na_2SO_3 in boiling aq. EtOH and acetylation (Ac_2O–C_5H_5N at room temp.) into Δ^5-*pregnene*-3(*β*) : 17(*β*) : 20(*β*) : 21-*tetraol* 3 : 20 : 21-*triacetate*, rhombs which pass into needles at 184—185° and melt at 189—190°, $[\alpha]_D^{13}$ +5·9°±1·5° in $COMe_2$. It is hydrolysed by boiling KOH–MeOH to the tetraol (Prins records m.p. 215—220°, or 220—223° after prolonged keeping, $[\alpha]_D^{14}$ −56·2°±5° in $COMe_2$), converted by $COMe_2$ and anhyd. $CuSO_4$ at room temp. into Δ^5-20 : 21-iso*propylidenepregnene*-3(*β*) : 17(*β*) : 20(*β*) : 21-*tetraol*, m.p. 201—203°, becomes opaque at 100°, $[\alpha]_D^{22}$ −62·7°±2° in $COMe_2$. This is oxidised by $Al(OBu^{\gamma})_3$ and $COMe_2$ in boiling C_6H_6 to Δ^4-20 : 21-iso*propylidenepregnene*-17(*β*) : 20(*β*) : 21-*triol*-3-*one*, two *forms*, m.p. 146—147° and 200—204° without change at 147°, $[\alpha]_D^{22}$ +74·7°±2° in $COMe_2$, which is hydrolysed to Δ^4-pregnene-17(*β*) : 20(*β*) : 21-triol-3-one (**I**), identified as the diacetate, m.p. 196—197°, $[\alpha]_D^{18}$ +135·9°±2° in $COMe_2$, identical with that obtained from the Δ^4-pregnene-17(*β*) : 20 : 21-triol-3-one of Ruzicka *et al.*

(A., 1939, II. 328). (**I**) is therefore configuratively similar to *allo*-pregnane-3(β) : 17(β) : 20(β) : 21-tetraol and Δ⁵-pregnene-3(β) : 17(β) : 20(β) : 21-tetraol. M.p. are corr. (block); limit of error ±2°. H. W.

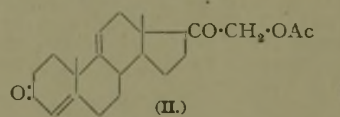
Steroids and sex hormones. LXXXVI. Products of the hydrogenation of $\Delta^{5:6-20:22}$-3(β)-hydroxynorcholadienoic acid. P. A. Plattner and J. Pataki (*Helv. Chim. Acta*, 1943, **26**, 1241—1252).—Further examples are given of the formation of isomerides due to differing configuration at $C_{(20)}$. Those compounds which have a configuration at $C_{(20)}$ differing from that of cholesterol are termed 20-*iso*-derivatives. Me $\Delta^{5:6-20:22}$-3(β)-acetoxynorcholadienoate is hydrogenated (Pt in AcOH) to *Me* 3(β)-*acetoxynor*allo*cholanate* (**I**), m.p. 162·5—163°, $[\alpha]_D^{16}$ +11·7° in $CHCl_3$, hydrolysed to the 3(β)-OH-acid, m.p. 225—226°, $[\alpha]_D^{14\cdot5}$ +22·9° in EtOH (Me ester, m.p. 157—158°, $[\alpha]_D^{15}$ +19·1° in $CHCl_3$), and a mixture which, after hydrolysis, gives 3(β)-*hydroxy*-20-iso*nor*allo*cholanic acid*, m.p. 249—251°, $[\alpha]_D^{17}$ +18·2° in EtOH (*Me* ester, m.p. 169—171°, $[\alpha]_D^{15\cdot6}$ +16·4° in $CHCl_3$, and its *acetate*, m.p. 135—137°, $[\alpha]_D^{15\cdot5}$ +8·2° in $CHCl_3$). $\Delta^{5:6-20:22}$-3(β)-Hydroxynorcholadienoic acid is hydrogenated (Raney Ni in aq. EtOH–NaOH) to $\Delta^{5:6}$-3(β)-*hydroxy*-20-iso*norcholenic acid*, m.p. 263—264°, $[\alpha]_D^{16\cdot8}$ −44·7° in EtOH, and $\Delta^{5:6}$-3(β)-hydroxynorcholenic acid (**II**), m.p. 244·5—245°, $[\alpha]_D^{16}$ −41·2° in EtOH (*Me* ester, m.p. 143—145°, $[\alpha]_D^{16}$ −42·5° in $CHCl_3$, and its acetate, m.p. 132—134°). Hydrogenation of Me $\Delta^{20:22}$-3(β)-acetoxynor*allo*cholenate (Pt in EtOH or AcOH) leads to (**I**); in presence of Raney Ni a mixture results containing predominatingly the 20-*iso*-form. Rapid addition of Me $\Delta^{5:6}$-3(β)-acetoxycholenate (**III**) in C_6H_6 to MgMeBr in Et_2O followed by alkaline hydrolysis gives $\Delta^{5:6}$-3(β)-hydroxynorcholenyldimethylcarbinol, m.p. 181·5—182·5° (lit. 192°), $[\alpha]_D$ −34·4° in EtOH, converted by Ac_2O in C_5H_5N at room temp. into the 3(β)-*acetate*, m.p. 165·5—166·5°, $[\alpha]_D^{15\cdot7}$ −41·6° in $CHCl_3$, which is hydrogenated (PtO_2 in AcOH at 50°) to 3(β)-*acetoxynor*allo*cholanyldimethylcarbinol*, m.p. 161—162°, $[\alpha]_D^{14}$ +5·6° in $CHCl_3$; this is oxidised (CrO_3 in AcOH) and then esterified (CH_2N_2) to (**I**). (**III**) is converted by an excess of MgPhBr into $\Delta^{5:6-23:24}$-3(β)-*acetoxy*-24 : 24-*diphenylcholadiene*, m.p. 172—173°, converted by successive treatments with Br in CCl_4, CrO_3 in AcOH, Zn dust, and AcOH, CH_2N_2, and Ac_2O–C_5H_5N into *Me* $\Delta^{5:6}$-3(β)-*acetoxynorcholenate*, m.p. 133·5—135·5°, $[\alpha]_D^{22}$ −45·7° in $CHCl_3$, which is hydrolysed to (**II**). M.p. are corr. (vac.). H. W.

Structure of choleic acids. N. P. Buu-Hoï (*Z. physiol. Chem.*, 1943, **278**, 230—235).—Deoxycholic acid (**I**) forms 8 : 1 *compounds* with chaulmoogric, m.p. 185—186°, hydnocarpic, m.p. 183°, dihydrochaulmoogric, m.p. 186°, and dihydrohydnocarpic acid, m.p. 182—183°, Et chaulmoograte, m.p. 187°, hydnocarpate, m.p. 186—187°, dihydrochaulmoograte, m.p. 188°, and dihydrohydnocarpate, m.p. 185—186°, chaulmoogryl, m.p. 185—186°, and dihydrochaulmoogryl alcohol, m.p. 186—187°, and Et κ-phenylundecoate, m.p. 174°. (**I**) forms 4 : 1 *compounds* with $CH_2Ph{\cdot}CO_2Me$, m.p. 168—169° (after sintering), and BuOBz, m.p. 169—170° (after sintering), and 6 : 1 *compounds* with $Ph{\cdot}[CH_2]_3{\cdot}CO_2Et$, m.p. 170—172° (after sintering), and 1-$C_{10}H_7{\cdot}CH_2{\cdot}CN$, m.p. 175—177° (after sintering). Hence the theory of Kratky *et al.* (cf. A., 1937, I, 118) requires modification. W. McC.

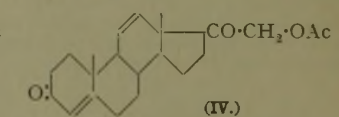
Androstanolones substituted in the 17-position.—See B., 1943, III, 279.

Steroids and sex hormones. LXXXV. *D*-Homoandrostane derivatives, a group of highly active androgens. M. W. Goldberg and E. Wydler (*Helv. Chim. Acta*, 1943, **26**, 1142—1155; cf. A., 1943, II, 199).—*trans*-Dehydroandrosterone 3-monoacetate is converted by KCN and AcOH in EtOH at >0° into its cyanohydrin, hydrogenated (PtO_2 in AcOH) to 17-*hydroxy*-3(β)-*acetoxy*-17-*aminomethylandrostane*, m.p. 234—236°, which is converted by HNO_2 into (mainly) 17α-keto-(**I**), m.p. 120—122°, and 17-*keto*-3(β)-*acetoxy*-D-*homoandrostane* (**II**), m.p. 102—104°, $[\alpha]_D$ −3·7° in dioxan [*semicarbazone*, m.p. 251—253° (decomp.)]. (**II**) is hydrolysed to 3(β)-*hydroxy*-17-*keto*-D-*homoandrostane*, m.p. 170—172°, $[\alpha]_D$ +23° in dioxan, oxidation (CrO_3, AcOH) of which affords 3 : 17-*diketo*-D-*homoandrostane*, m.p. 168—170°, $[\alpha]_D$ −32° in dioxan. The isomeric 3 : 17α-*diketone*, m.p. 183—185°, $[\alpha]_D$ −27° in dioxan, is obtained by hydrolysing and oxidising (**I**). Both diketones are converted by successive treatments with N_2H_4,H_2O and NaOEt into D-*homoandrostane*, m.p. 85·87°, $[\alpha]_D$ −3·7° in dioxan. Hydrogenation (PtO_2 in AcOH) followed by benzoylation of (**I**) and chromatography of the product leads to *D*-homoandrostane-3(β) : 17α(α)-diol 3-acetate 17-benzoate, m.p. 201—202°, $[\alpha]_D$ +17·6° in dioxan (cf. A., 1940, II, 350), and -3(β) : 17α(β)-*diol* 3-*acetate* 17-*benzoate*, m.p. 139—142°, $[\alpha]_D$ −10·7° in dioxan. These are partly hydrolysed ($KHCO_3$ in boiling aq. MeOH) to the respective *benzoates*, m.p. 230—233°, $[\alpha]_D$ −59° in dioxan, and m.p. 154—155°, $[\alpha]_D$ −50·7° in dioxan. Complete hydrolysis gives 3(β) : 17α(α)-, m.p. 217—218° $[\alpha]_D$ +26° in dioxan, and 3(β) : 17α(β)-*dihydroxy*-D-*homoandrostane*, m.p. 219—220°, $[\alpha]_D$ −16° in dioxan. Oxidation of the respective alcohols yields 3-*keto*-17α(β)-, m.p. 132—133°, $[\alpha]_D$ −35·5° in dioxan, and 3-keto-17α(α)-benzoyloxyandrostane, m.p. 194—195°, $[\alpha]_D$ +28° in dioxan (*D*-homodihydrotestosterone 17α(β)- and 17α(α)-benzoates). 3-*Keto*-17α(α)-*acetoxy*-D-*homoandrostane* (D-*homodihydrotestosterone* 17α(α)-*acetate*), m.p. 194—195°, $[\alpha]_D$ +9·8° in dioxan, obtained by acetylation of the OH-compound (*loc. cit.*), is converted by Br in AcOH containing conc. aq. HBr into the 2-*Br*-derivative, m.p. 214—215°, $[\alpha]_D$ +21° in dioxan; this affords a pyridinium compound, m.p. 280° (decomp.), which passes when heated into (?) Δ⁴-3-*keto*-17α(α)-*acetoxy*-D-*homoandrostene*, m.p. 158·5—160°, $[\alpha]_D$ +80·3° in dioxan. The derivatives of the *D*-homoandrostane series appear as active physiologically as the corresponding compounds of the natural steroid series. M.p. are corr. H. W.

Constituents of the adrenal cortex and related substances. LXIII. 11-*epi*Corticosterone acetate and two isomeric anhydrocorticosterone acetates. C. W. Shoppee and T. Reichstein (*Helv. Chim. Acta*, 1943, **26**, 1316—1328; cf. A., 1940, II, 350; 1941, II, 259).—Corticosterone acetate (**I**), m.p. 147·5—148·5°, $[\alpha]_D^{20}$ +195°±3°, $[\alpha]_{5461}^{20}$ +236°±3° in $COMe_2$, is converted by boiling conc. HCl–AcOH (1 : 9) (30 min.) into (after reacetylation) *anhydrocorticosterone acetate* (**II**), m.p. 159—160°, $[\alpha]_D^{18}$ +129°±2°, $[\alpha]_{5461}^{18}$ +150°±2° in $COMe_2$ (yield 35—40%), and 11-epi*corticosterone acetate* (**III**), m.p. 122—125°, $[\alpha]_D^{20}$ +187°±4°, $[\alpha]_{5461}^{20}$ +222°±4° in $COMe_2$. (**III**) does not give a colour with $C(NO_2)_4$, rapidly reduces Ag_2O–NH_3, and gives a green fluorescence in conc. H_2SO_4. Dehydration of (**I**) under more energetic conditions (conc. HCl–AcOH, 1 : 4) gives unchanged material, no (**III**), (**II**) (26%), an *anhydrocorticosterone acetate* (**IV**) (17%), m.p. 142—143°, $[\alpha]_D^{15}$ +98°±6°, $[\alpha]_{5461}^{15}$ +130°±6° in $COMe_2$, and a very small amount of a substance, m.p. 169°. (**II**) is largely unchanged when boiled for 30 min. with conc. HCl–AcOH (1 : 9), but is partly converted into (**IV**) by the boiling 1 : 4 mixture, which partly transforms (**III**) into (**II**) and (**IV**). (**III**) is oxidised (CrO_3 in AcOH) to dehydrocorticosterone acetate, m.p. 178—181·5°, $[\alpha]_D^{18}$



(II.)



(IV.)

+215°±8°, $[\alpha]_{5461}^{18}$ +266°±8° in $COMe_2$. In the Everse–de Fremery test (**II**) is 2—3 times more powerful than deoxycorticosterone acetate (**V**) and is about equally or somewhat less active towards adrenalectomised rats. In the former test (**IV**) is 2—3 times less active than (**V**). M.p. are corr. H. W.

V.—TERPENES AND TRITERPENOID SAPOGENINS.

***cis*-Δ²-Menthene.** W. Hückel and H. Wagner (*Ber.*, 1941, **74**, [*B*], 657—662).—Catalytic reduction of *l*-piperitone (**I**), $[\alpha]_D$ −50·6°, is reinvestigated (cf. A., 1939, II, 434). It is established that (**I**) contains some racemate and that *d*-menthone is produced as well as *d-iso*menthone. Vals. of [α] (for different λλ and various solvents) are given for *d*-neo*iso*menthol (phenylcarbamate, m.p. 91—92°, $[\alpha]_D^{20}$ −12·4° in EtOH; H phthalate, m.p. ~85—86°, $[\alpha]_D^{20}$ −18·0° in $CHCl_3$). *dl-iso*Menthyl H phthalate has m.p. 116—117° (lit. 107—108°). *d-iso*Menthyl *p*-toluenesulphonate (*loc. cit.*) with boiling EtOH–NaOEt gives 60% of *cis*-Δ²-menthene (**II**), b.p. 46—48°/10 mm., $[\alpha]_D^{20}$ +45·2°; differences in physical data for (**II**) and *trans*-Δ²-menthene are in accordance with the Auwers–Skita rule. Treatment of (**II**) with p-$C_6H_4Me{\cdot}SO_3H$ in EtOH causes a slight reduction in α_D; if this is not due to racemisation then (**II**) contains some Δ³-menthene (**III**). *d-iso*Menthylamine and HNO_2 give *d-iso*menthol and a mixture of (**II**) (50%), *r*-(**III**) (38%), and active (**III**) (12%). H. B.

1 : 5-*meso*-Methylene*cyclo*heptane, the dicyclic ring homologue of norcamphane. J. von Braun and J. Reitz (*Ber.*, 1941, **74**, [*B*], 273—275; cf. A., 1937, II, 404).—Homonorcamphanecarboxylic acid in conc. H_2SO_4 with HN_3 in $CHCl_3$ affords 60% of 2-*amino*-1 : 5-meso(= endo)*methylene*cyclo*heptane* (**I**), b.p. 69—70°/14 mm. (platinichloride, m.p. 275—280°; picrate, m.p. 180°; Bz derivative, m.p. ~95°). (**I**) is treated with Me_2SO_4 etc.; the methohydroxide with KOH yields 38% of 2-*dimethylamino*-1 : 5-meso-*methylene*cyclo*heptane*, b.p. 83°/13 mm. (platinichloride, m.p. 173°; *picrate*, m.p. 197°), and 45% of 1 : 5-meso-*methylene*-Δ²-cyclo*heptene*, b.p. 132°, which when hydrogenated over Pd gives 1 : 5-meso-*methylene*cyclo*heptane*, b.p. 131°. J. Wa.

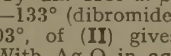
Nitrobornylphenols.—See B., 1943, III, 239.

Position of substituents in Reychler's sulphocamphoric acid and the so-called β-bromocamphor. G. Komppa (*J. pr. Chem.*, 1943, [ii], **162**, 19—28).—The ω-position of the Br in "β"-bromocamphor (**I**) and "β"-bromocamphoric acid (**II**) is substantiated. For steric reasons *dl*-(**I**), m.p. 78°, does not react with Mg or moist Ag_2O. The camphor skeleton of *dl*-(**II**), m.p. 207—208° (decomp.) (anhydride, m.p. 148—149°), is confirmed by reduction by Zn dust in AcOH to *dl*-camphoric acid (anhydride, m.p. 229°). In boiling 20% aq. KOH (Cu vessel), (**II**) gives dl-ω-*hydroxycamphoric acid* (**III**) (80%), m.p. 158—159°, converted by AcCl into the ω-*acetate anhydride*, m.p. 123—124°, and thence the ω-*acetate toluididic acid*, m.p. 124°. With dil. HNO_3, (**III**) gives indefinite products, but

with 1% $KMnO_4$ at 60—70° gives a good yield of *carboxyapocamphoric acid*, m.p. 195—196°, which at > the m.p. yields (mainly *cis*-) *apo*camphoric acid, identified also as anhydride and anilide. The Me_2 ester (prep. by MeOH–H_2SO_4 or by way of the chloride), m.p. 137°, in boiling $NPhEt_2$ gives MeBr, CO_2, and Me *dl*-α-campholytate (**IV**) (~54%), b.p. 67—70°/8 mm., and thence by dil. HCl *dl*-β-campholytic (*dl-iso*lauronolic) acid (**V**), m.p. 132—133° (dibromide, m.p. 138—139°). The Et_2 ester, m.p. 102—103°, of (**II**) gives similarly the Et ester corresponding to (**IV**). With Ag_2O in aq. EtOH at 30°, (**II**) gives the stable lactone, dl-*ω-camphanic acid* (65%), m.p. 151—152°, which, when heated, gives (**V**) and CO_2. The true β-bromo- and β-hydroxy-camphoric acid of Toivonen (*Ann. Acad. Sci. Fennicae*, 1927, **A**, **29**, No. 10) differ from (**I**) and (**II**) in m.p. R. S. C.

Effect of phenyl group on rotatory power : phenylcamphoranilic acids and *p*-diphenylylimino-*d*-camphor. M. Singh and A. Singh (*J. Indian Chem. Soc.*, 1942, **19**, 145—148).—In comparison with that of other substituted camphoranilic acids, $[\alpha]_D^{20}$ in MeOH of 4′-, m.p. 196—197° (shrinks at 194°), is abnormally high (+64°), that of 3′-, m.p. 204—205°, abnormally low (+40·8°), and that of 2′-*phenylcamphoranilic acid*, m.p. 181° [from camphoric anhydride, $C_6H_4Ph{\cdot}NH_2$, and NaOAc at 130—135° (120° for the *o*- and *m*-compounds)], normal (+26·5°). In each case $[\alpha]_D$ of the Na salt is > of the free acid in org. solvents. p-*Diphenylylimino*-d-*camphor* (from camphorquinone, *p*-$C_6H_4Ph{\cdot}NH_2$, and anhyd. Na_2SO_4 at 100°), m.p. 148—149°, $[\alpha]_D^{20}$ +696·8° in MeOH, +720·7° in EtOH (anilinocamphor has $[\alpha]_D^{20}$ +606·8° in MeOH), is reduced (Zn +10% KOH) to *p*-diphenylylaminocamphor, $[\alpha]_D^{20}$ +82·3° in EtOH. A. Lr.

Sesquiterpenes. LX. Oxidative degradation of norcedrenedicarboxylic acid by nitric acid. P. A. Plattner and H. Kläui (*Helv. Chim. Acta*, 1943, **26**, 1553—1559; cf. A., 1943, II, 97).—Cedrene (**I**) is brominated by $(CH_2{\cdot}CO)_2NBr$ in boiling CCl_4 and the crude bromocedrene (which cannot be distilled in a vac. without decomp.) is oxidised by $KMnO_4$ in boiling aq. $COMe_2$ followed by boiling aq. HNO_3 to norcedrenedicarboxylic acid (**II**). The mother-liquors from (**II**) contain $CO_2H{\cdot}CMe_2{\cdot}CH_2{\cdot}CO_2H$ and $CO_2H{\cdot}CMe_2{\cdot}CH(CO_2H){\cdot}CH_2{\cdot}CO_2H$ (**III**). This has been obtained previously by the oxidation of cedrene and temporarily regarded as camphoronic acid (cf. Plattner, *et al.*, A., 1943, II, 97; Treibs, *Ber.*, 1943, **76**, 160). Contrary to Treibs, (**III**), m.p. 145—145·5°, $[\alpha]_D$ −8° in H_2O, is best obtained by the protracted oxidation of (**I**) with HNO_3 (*d* 1·4) at 100—115°. Elimination of HBr from bromonorcedrenedicarboxylic ester carried out in an autoclave instead of a sealed tube gave relatively little dehydronorcedrenedicarboxylic acid and much oily mother-liquor which, when oxidised with $KMnO_4$ in alkaline solution, yields trans-*norcedrenedicarboxylic acid*, m.p. 222·5—223°, $[\alpha]_D^{22·5}$ −53·3° in $CHCl_3$, converted by boiling Ac_2O into the norcedrenedicarboxylic anhydride, m.p. 126—127°. M.p. are corr. H. W.

Constitution of cafestol. V. A. Wettstein, F. Hunziker, and K. Miescher (*Helv. Chim. Acta*, 1943, **26**, 1197—1218; cf. A., 1943, II, 199, 203).—Ozonisation of epoxynorcafestadienone (**I**) in *n*-C_6H_{14} or CCl_4 and treatment of the ozonide with boiling H_2O gives as main product a difficultly volatile, non-cryst. acid (**II**) transformed by esterification (CH_2N_2), chromatographic purification, and alkaline hydrolysis into the *Me H* ester (**III**), $C_{18}H_{26}O_5$, m.p. 156—157°, $[\alpha]_D^{18}$ +25·7°±2° in dioxan. (**III**) is transformed by CH_2N_2 into the Me_2 ester, m.p. 53—55°, which gives a *monosemicarbazone*, m.p. 211—213° (decomp.). Although (**III**) cannot be hydrolysed, its OMe is not present in (**II**), which does not contain OAlk (Zeisel) and is transformed by EtOH and mineral acid into the Et_2 ester, $C_{21}H_{32}O_5$, m.p. 104—105°, hydrolysed to the *Et H* ester (**IV**), m.p. 162—163°. (**III**) is converted by EtOH–mineral acid into the *Me Et* ester, m.p. 86—88°, and (**IV**) affords analogously an isomeric *Me Et* ester, m.p. 126—128°. In all probability (**II**) is therefore $C_{17}H_{24}O_5$ and contains only 3 intact C rings. The formation of (**II**) is accompanied by the elimination of 2 C but not of H and involves the loss of ethereal O and formation of CO_2. The furan ring and a C ring are opened. It appears therefore the $C_{(2)}$ and $C_{(3)}$ of the furan ring in cafestol (**V**) are attached to H whereas $C_{(4)}$ and $C_{(5)}$ participate in the formation of an *ortho*-condensed C ring. A strict proof that the furan ring of (**V**) is substituted at $C_{(4)}$ and $C_{(5)}$ and only in these positions is afforded by the observation that the adduct from cafestyl acetate (**VI**) and $(CH{\cdot}CO)_2O$ is converted by successive treatments with HCl–AcOH at 90°, 33% HNO_3 at 190—200°, and CH_2N_2 into 1 : 2 : 3 : 4-$C_6H_2(CO_2Me)_4$. Since a H has been shown previously to be attached to $C_{(2)}$, this must be true also of $C_{(3)}$ and the furan ring of (**V**) must be attached to the remainder of the mol. by $C_{(4)}$ and $C_{(5)}$. (**I**) is converted by *o*-$CO_2H{\cdot}C_6H_4{\cdot}CO_3H$ in Et_2O at 0° into a non-cryst. product, transformed (Ac_2O–C_5H_5N at room temp.) directly or after treatment by $HClO_4$ into a *ketoacetoxynorcafestenolide*, $C_{21}H_{26}O_5$, m.p. 239—240°. The requirement of 2 equivs. of alkali for hydrolysis, the presence of 1 Ac and absence of active H, together with the formation of a *monosemicarbazone*, m.p. 278° (decomp.), show the 5 O to be present in keto, Ac, and lactone groups. According to the absorption spectrum, a double linking is in the αβ position to the lactone group. The substance does not decolorise Br–AcOH or $KMnO_4$–EtOH, does not give the Legal or Baljet reactions, and does not reduce Ag_2O–NH_3. It is stable towards O_3 and CrO_3–AcOH at low temp. Its alkaline hydrolysis leads to a *compound*, $C_{19}H_{24}O_4$, m.p. 257—261° (decomp.), which does not give a quinoxaline derivative. It probably has the partial structure  . Analogously (**VI**) is oxidised by *o*-$CO_3H{\cdot}C_6H_4{\cdot}CO_2H$ and then acetylated to a *hydroxydiacetoxycafestenolide*, $C_{24}H_{32}O_7$, m.p. 197—198°. Crude (**II**) is transformed by Ac_2O followed by distillation in vac. into a *diketone* (**VII**), $C_{16}H_{22}O_2$, m.p. 204—205°, characterised by a *disemicarbazone*, m.p. >400°, darkens >300°, showing according to Blanc's rule that the original ring A is 6- or 7-membered. Analogously the Me_2 or Me Et ester of (**II**) is cyclised by Na in boiling PhMe to a β-ketocarboxylic ester ketone, converted by boiling conc. HCl–EtOH into (**VII**). The ready formation of a m-*nitrobenzylidene* derivative, m.p. 227—229°, of (**VII**) is ascribed to the at. grouping in the contracted ring A since cafestol derivatives which contain CO or CH_2 exclusively in ring D do not react with ArCHO. $C_{(5)}$ or $C_{(6)}$ must be present in CH_2 and also the neighbouring $C_{(6)}$ or $C_{(7)}$ must be united to at least 1 H atom. 17 of the 20 C atoms of cafestol are thus accounted for and the nature and mode of union of all substituents and double linkings is explained. *Piperonylidenenorcafestanedione* has m.p. 164—165°. M.p. are corr. H. W.

Triterpenes. LXXVII. Siaresinolic acid. L. Ruzicka, A. Grob, R. Egli, and O. Jeger (*Helv. Chim. Acta*, 1943, **26**, 1218—1235).—Evidence is adduced in favour of the view that siaresinolic acid (**I**) is $\Delta^{12:13}$-2 : 19-dihydroxy-28-oleanenic acid. (**I**), m.p. 279—280°, $[\alpha]_D$ +39·2° in abs. EtOH (prep. from Siamese gum benzoin described), is converted into its *Me* ester (**II**), m.p. 182°, $[\alpha]_D$ +44·9°, by CH_2N_2 in Et_2O (also obtained from the K salt and Me_2SO_4 in somewhat alkaline MeOH); the Et ester, m.p. 175—176°, $[\alpha]_D$ +44·6° in EtOH, is prepared from EtI and the Ag·salt in boiling abs. Et_2O. (**I**) and Ac_2O in C_5H_5N at room temp. afford 2-*acetylsiaresinolic acid* [$\Delta^{12:13}$-19-*hydroxy*-2-*acetoxy*-28-*oleanenic acid*], m.p. 282—284°, $[\alpha]_D$ +48·7°, converted by CH_2N_2 into the Me ester (**III**), m.p. 125—127° (lit. 110—120°), $[\alpha]_D$ +47·5°, also obtained by acetylation of (**II**) and hydrolysed to (**II**) by boiling KOH–MeOH. Passage of dry HCl through (**III**) in Ac_2O at 100° leads to *Me* iso*diacetylsiaresinolate*, (**IV**), m.p. 234—236°, $[\alpha]_D$ +41·3°, also obtained from the corresponding *acid*, m.p. 262°, $[\alpha]_D$ +40°, and CH_2N_2. It is hydrolysed by boiling N-KOH to *Me* iso-19-*acetylsiaresinolate* (**V**), m.p. 235—237°, $[\alpha]_D$ +40·7°, converted by Ac_2O–C_5H_5N at room temp. into (**IV**) and by Claisen's reagent at 150° into (**I**). Analogously the *acid* is converted by mild hydrolysis into iso-19-*acetylsiaresinolic acid*, m.p. 235—237°, $[\alpha]_D$ +39°, and by vigorous hydrolysis into (**I**). (**III**) and dry HCl in Ac_2O at room temp. afford *Me* iso-2-*acetylsiaresinolate* (**VI**), m.p. 237—238°, $[\alpha]_D$ +48·5°, also obtained similarly from (**II**) and acetylated (Ac_2O–HCl at 100°) to (**IV**). It is gently hydrolysed to *Me* iso*siaresinolate*, m.p. 205—206°, re-acetylated (Ac_2O–C_5H_5N at room temp.) to (**V**) and energetically hydrolysed to (**II**). iso-2-*Acetylsiaresinolic acid*, m.p. 273—274° (much decomp.), $[\alpha]_D$ +40°, is hydrolysed by boiling N-KOH–MeOH to (**I**). (**V**) is oxidised by CrO_3 (≡1·5 O) in AcOH at room temp. to *Me* iso-2-*keto*-19-*acetoxy*-28-*oleanenoate*, m.p. 225—227°, $[\alpha]_D$ +50·4° (*c* = 1·43) and +48° (*c* = 2·29), which is not hydrolysed by boiling 2N-KOH in 2 days. Similarly (**III**) affords *Me* 19-*keto*-2-*acetoxy*-28-*oleanenoate*, m.p. 244—247°, $[\alpha]_D$ +107·6° (*c* = 1·56) and +110° (*c* = 3·36), which gives a marked yellow colour with $C(NO_2)_4$ and does not appear to yield a semicarbazone; it is hydrolysed by boiling N-KOH–MeOH or boiling conc. HCl–MeOH to Me $\Delta^{13:18}$-19-keto-2-hydroxy-28-oleanenoate (**VII**), m.p. 209—210° (lit. 189—190°), $[\alpha]_D$ −209·0°. It is also obtained from Me $\Delta^{12:13}$-19-keto-2-acetoxyoleanenoate and HCl in AcOH at room temp. (**VI**) is oxidised to *Me* iso-19-*keto*-2-*acetoxy*-28-*oleanenoate*, m.p. 221—223°, $[\alpha]_D$ +62·2°, hydrolysed to the 2-*OH-ester*, m.p. 195—197° $[\alpha]_D$ +46·0°, from which it is re-formed by Ac_2O–C_5H_5N at room temp. Addition of CrO_3 to a solution of (**I**) in AcOH containing conc. H_2SO_4 at room temp. gives a non-homogeneous product from which Me $\Delta^{12:13}$-2 : 19-diketo-28-oleanenoate, m.p. 211—212° (lit. 207—208°), $[\alpha]_D$ +139·8° (*c* = 0·361), +140·5° (*c* = 0·642) (*oxime*, m.p. 232—233°; semicarbazone, m.p. 233—234°), is isolated. It is also obtained from (**II**). It is not affected by Ac_2O–C_5H_5N at room temp. or catalytically hydrogenated in AcOH containing PtO_2. Oxidation (CrO_3 in AcOH at room temp.) of (**VII**) affords Me $\Delta^{13:18}$-2 : 19-diketo-28-oleanenoate, m.p. 193—194°, $[\alpha]_D$ −189·0° [*semicarbazone*, m.p. 250—251° (decomp.)], which does not give a yellow colour with $C(NO_2)_4$. The semicarbazone of Me $\Delta^{12:13}$-2-keto-19-hydroxy-28-oleanenoate is transformed by NaOEt in EtOH at 180° into *Me* $\Delta^{12:13}$-19-*hydroxy*-28-*oleanenoate*, m.p. 213—214°, which is un-

changed by Ac_2O–C_5H_5N; it is oxidised to *Me* $\Delta^{12:13}$-19-*keto*-28-*oleanenoate*, m.p. 204—205°. M.p. are corr. $[\alpha]_D$ are in $CHCl_3$ unless otherwise stated. H. W.

Triterpenes. LXXVIII. Introduction of additional double linkings into the α- and β-amyrin types with *N*-bromosuccinimide. L. Ruzicka, O. Jeger, and J. Redel [with, in part, W. Hofer] (*Helv. Chim. Acta*, 1943, **26**, 1235—1240).—β-Amyrin acetate and $(CH_2{\cdot}CO)_2NBr$ in CCl_4 at 100° afford *β-amyratrienyl acetate* (**I**), m.p. 185°, $[\alpha]_D$ +527 in $CHCl_3$, which gives a marked brown colour with $C(NO_2)_4$. It is hydrolysed by alkali to *β-amyratrienol*, m.p. 179—180°, re-acetylated (Ac_2O–C_5H_5N at room temp.) to (**I**). α-Amyrin acetate and $(CH_2{\cdot}CO)_2NBr$ in boiling CCl_4 afford α-amyradienyl acetate (**II**), m.p. 166—167°, $[\alpha]_D$ +334° in $CHCl_3$. Similarly Me acetylursolate yields *Me acetyldehydroursolate*, m.p. 229—230°, $[\alpha]_D$ +254° in $CHCl_3$, hydrolysed (KOH–EtOH at 170°) to *dehydroursolic acid*, m.p. 277—279° (decomp.), $[\alpha]_D$ +291° in C_5H_5N [*acetate*, m.p. 287—288° (decomp.), $[\alpha]_D$ +272° in C_5H_5N]. An amended method for the prep. of (**II**) from α-amyrin benzoate and S in $CH_2Ph{\cdot}OAc$ under N_2 at 220° is described. M.p. are corr. H. W.

Triterpenes. LXXIX. Relationships between α-elemolic acid and the so-called "β-elemonic acid." L. Ruzicka, E. Rey, M. Spillmann, and H. Baumgartner (*Helv. Chim. Acta*, 1943, **26**, 1638—1658).—Chemical and physical evidence shows that "β-elemonic acid" (**I**) is directly related to α-elemolic acid (**II**) in position of the double linking and hence should be termed α-elemonic acid (**III**). To avoid confusion it is proposed to discontinue the use of α- and β- in this series and to adopt a rational nomenclature for the elemic acid group based on the name "elemane" for the unknown, saturated parent hydrocarbon. The old and new (in parentheses) nomenclature is as follows: (**II**) (elemandienolic); dihydro-α-elemolic (**IV**) (elemenolic); β-elemolic (**V**) (*epi*elemodienolic); dihydro-β-elemolic (**VI**) (*epi*elemenolic); *epi*-α-elemolic (*epi-iso*elemadienolic); *epi*dihydro-α-elemolic (*epi-iso*elemenolic); isomeric (**II**), from (**IV**) + SeO_2 (dehydroelemenolic or isomeric elemadienolic acid); (**III**) (*iso*elemadienonic); dihydro-α-elemonic (**VII**) (*iso*elemenonic); (**I**) (elemadienonic); dihydro-β-elemonic (**VIII**) (elemenonic); deoxo-α-elemonic (*iso*elemadienic); dihydrodeoxo-α-elemonic (*iso*elemenic); deoxo-β-elemonic (elemadienic); dihydrodeoxoelemonic (elemenic); diketodihydro-2-elemolic (**IX**) (*iso*elemendionolic); diketodihydro-β-elemolic (*epi-iso*elemendionolic); dihydro-β-elemolaldehyde (*epi*elemenolal); dihydro-β-tritelemol (*epi*elemenol); β-tritelemediol (*epi*elemadienediol); trisnor-α-tritelemenoldicarboxylic (trisnorelemenoldicarboxylic); trisnor-α-tritelemenonedicarboxylic (*iso*trisnorelemenonedicarboxylic); trisnor-β-tritelemenonedicarboxylic (trisnorelemenonedicarboxylic) acid. The following general survey of experimental results in the series is given. Hydrogenation of the >CO group with Na and EtOH leads invariably to the isolation of *epi*-compounds since in this reaction the isomerides with normal position of OH are formed in very small amount. Catalytic and Meerwein and Ponndorf's methods yield compounds with normal and *epi* OH groups together in isolable amount although members of each series have not actually been isolated previously in all operations, since the separations have not been carried sufficiently far. Oxidation with CrO_3 or according to Oppenauer gives >CO compounds with unchanged position of the double linkings and those with conjugated double linkings (*iso*-series). Dehydrogenation with Cu at 300° gives exclusively >CO compounds with unchanged position of the double linkings. The following transitions are recorded: (**IV**) is oxidised by CrO_3 in aq. AcOH at 50° to (**VII**), m.p. 309—310°, $[\alpha]_D$ −97·0° [*Me* ester, m.p. 152—153°, $[\alpha]_D$ −95·3°; oxime, m.p. 233—234° (decomp.), $[\alpha]_D$ −117·2°], and (**VIII**), m.p. 251—252 [oxime, m.p. 235—237° (decomp.)]. (**IV**) is dehydrogenated by Cu powder at 270—300° to (**VIII**), m.p. 224—225° [*oxime*, m.p. 219—220° (decomp.)], reduced (PtO_2 in AcOH at room temp.) to (**VI**), m.p. 251—252°, $[\alpha]_D$ +14·9°, and by Na and EtOH to (**V**), m.p. 232—233°, $[\alpha]_D$ +9·6°. (**V**) is dehydrogenated by Cu powder to (**VIII**). (**IV**) is converted by NaOEt–EtOH at 180—190° followed by CH_2N_2 into Me elemadienolate (**X**), m.p. 149—150°, $[\alpha]_D$ −11·7°; treatment of the non-cryst. residue with H_2 (PtO_2 in AcOH) followed by acetylation gives Me *epi*acetylelemenolate, m.p. 136·5—137°, $[\alpha]_D$ +15·35°. Me elemadienonate (**XI**) is reduced [$Al(OPr^\beta)_3$ in $Pr^\beta OH$] to Me elemadienolate, m.p. 149·5—150°, $[\alpha]_D$ −13·8° (acetate, m.p. 114—115°, $[\alpha]_D$ −40·8°); the non-cryst. residue is hydrogenated and acetylated to Me *epi*acetylelemenolate, m.p. 137—137·5°, $[\alpha]_D$ +12·5°. Oxidation (Oppenauer) of (**X**) gives a mixture of approx. equal amounts of (**XI**) and Me *iso*elemadienonate. The alkaline hydrolysis of acetyl- and *epi*acetyl-elemadienolic acid has been followed quantitatively. Reduction of (**VII**) by Na and EtOH and acetylation of the product leads to *epi-iso*acetylelemenolic acid, m.p. 253—254°, oxidised (CrO_3 in AcOH at 100°) to *epi-iso*acetylelemendionolic acid (**XII**), m.p. 271—272°, $[\alpha]_D$ +22·6°. CrO_3 in AcOH at 100° oxidises (**VII**) to *iso*elementrionic acid (**XIII**), m.p. 291—292°, $[\alpha]_D$ +6·8° also obtained similarly from (**IX**) and (**V**). (**XII**) is hydrolysed (boiling KOH–MeOH) to *epi*-iso*elemendionolic acid*, m.p. 275—276°, $[\alpha]_D$ +3·8°, oxidised (CrO_3 in AcOH at room temp.) to (**XIII**). *iso*Acetylelemendionolic acid similarly affords (**IX**), m.p. 269—270°, $[\alpha]_D$ −11·4°, oxidised to (**XIII**). M.p. are corr. (vac.). $[\alpha]_D$ are in $CHCl_3$. H. W.

Triterpenes. LXXX. Further transformation of elemic acid. L. Ruzicka, E. Rey, M. Spillmann, and H. Baumgartner (*Helv. Chim. Acta*, 1943, **26**, 1659—1671).—Various formulæ are tentatively advanced to explain the relationships of the elemic acids which cannot be brought into line with the proposals of Bilham *et al.* (A., 1942, II, 418). Elemenic acid is converted by $SOCl_2$ in boiling abs. hexane into the corresponding *chloride*, m.p. 115—116°, reduced (H_2–Pd–$BaSO_4$ in PhMe at 90—100°) to *elemenal* (**I**), m.p. 139—139·5°, $[\alpha]_D$ +3·6°. This is converted (Na in $C_5H_{11}{\cdot}OH$ and N_2H_4,H_2O at 180°) into non-cryst. *elemene*, $[\alpha]_D$ −9·83°, which gives a yellow colour with $C(NO_2)_4$; the *azine*, m.p. 214—214·5°, of (**I**) is occasionally obtained. *iso*Elemenic acid is similarly converted through its *chloride*, m.p. 126—127°, $[\alpha]_D$ −45·2°, into iso*elemenal*, m.p. 181·5—182°, $[\alpha]_D$ −55·8° (oxime, m.p. 110—111°; *azine*, m.p. 205—206°), and thence into iso*elemene*, m.p. 92—93°, $[\alpha]_D$ −77·8°. Ozonisation of Me acetylelemenolate in AcOH and decomp. of the ozonide with hot H_2O yields 95% of neutral, difficultly volatile material separated chromatographically into an αβ-unsaturated *ketone* (**II**), $C_{33}H_{52}O_5$, m.p. 177—178°, $[\alpha]_D$ −36·3°, Me acetyl*iso*elemendionolate (**III**), m.p. 146—147°, $[\alpha]_D$ −26·3°, and a *compound* (**IV**), $C_{33}H_{54}O_6$, m.p. 211—213°, probably a mol. oxide or a diketone. (**II**) and (**III**) but not apparently (**IV**) are obtained after ozonisation in $CHCl_3$. Oxidation of acetylelemenolic acid by CrO_3 in AcOH at 70° leads to *iso*acetylelemendionolic acid, m.p. 261·5—262°, $[\alpha]_D$ −28·3°; the Me ester, m.p. 146—147°, $[\alpha]_D$ −25·8°, is hydrogenated (PtO_2 in AcOH at room temp.) to the αβ-unsaturated ketodihydroxy-*ester*, $C_{33}H_{52}O_6$, m.p. 266—266·5°, $[\alpha]_D$ −56·4°, and a *substance*, m.p. 122—124°; both compounds give an intense yellow colour with $C(NO_2)_4$. Acetylelemadienolic acid is converted by $SOCl_2$ in boiling hexane into the *chloride*, m.p. 209—210°, $[\alpha]_D$ −120·6°. A OH·CH compound from Me *iso*elemenonate could not be obtained by the action of NaOEt and $HCO_2C_5H_{11}$-*iso* at 20° or 0° or by addition of finely-divided Na in Et_2O to the reactants in abs. EtOH. M.p. are corr. (vac.). $[\alpha]_D$ are in $CHCl_3$. H. W.

Sapogenins.—See B., 1943, III, 280.

VI.—HETEROCYCLIC.

Preparation of 3-alkylchromones. Effect of substitution on the reactivity of the 2-methyl group in chromones. A. Zaki and R. C. Azzam (*J.C.S.*, 1943, 434—435).—2-*Methoxy*-4-*methylbenzoylacetone* (**I**), m.p. 52°, prepared from the corresponding acetophenone and Na–EtOAc, with boiling HI gives 2 : 7-dimethylchromone, which with anisaldehyde in EtOH–NaOEt gives 4′-*methoxy*-2-*styryl*-7-*methylchromone*, m.p. 150°. The following are similarly obtained from the appropriate reagents: α-2-*methoxy*-4-*methylbenzoyl*-α-*methylacetone*, b.p. 190—192°/20 mm. (-α-*ethylacetone*, b.p. 197—200°/20 mm., -α-n-*propylacetone*, b.p. 206—210°/20 mm., -α-n-*butylacetone*, b.p. 207—210°/10 mm., and α-n-*amylacetone*, b.p. 215—220°/10 mm.); 2 : 3$_5$: 7-trimethylchromone, 2 : 7-dimethyl-3-ethyl-, m.p. 51° (lit., liquid), -3-n-*propyl*-, m.p. 56—57°, -3-*n*-butyl-, and -3-*n*-amyl-chromone; 4′-*methoxy*-2-*styryl*-3 : 7-*dimethyl*-, m.p. 123°, and -7-*methyl*-3-*ethyl*-*chromone*, m.p. 114°; 4′-*nitro*-2-*styryl*-7-*methyl*-3-n-*propyl*-, m.p. 176—177°, -3-n-*butyl*-, m.p. 168—170°, and -3-n-*amyl*-*chromone*, m.p. 173—174°; α-2-*methoxy*-4-*methylbenzoyl*-α-*benzylacetone*, m.p. 67—68°; 3-*benzyl*-2 : 7-*dimethyl*-, m.p. 95°, and 4′-*methoxy*-2-*styryl*-3-*benzyl*-7-*methyl*-*chromone*, m.p. 176°. NaOEt and (**I**) in EtOH give a mixture of forms of α-*benzoyl*-α-2-*methoxy*-4-*methylbenzoylacetone*, m.p. 134—151°. F. R. S.

Improved syntheses of 7-hydroxy- and 5 : 7-dihydroxy-flavanone. S. Fujise and H. Tatsuta (*Ber.*, 1941, **74**, [*B*], 275—278; cf. A., 1934, 416).—5 : 7-Dihydroxyflavanone (**I**), m.p. 170—175°, is obtained from phloroglucinol, $CHPh{:}CH{\cdot}COCl$, and $AlCl_3$ in $PhNO_2$; resorcinol, similarly treated, affords 7-hydroxyflavanone (**II**), m.p. 182·5—184·5° (pure 186—188°), and 2′ : 4′-dihydroxychalkone, m.p. 146°. (**I**), but not (**II**), may be purified by vac. sublimation (at 0·007 mm.), giving (**I**), m.p. 199—200°. Chromatographic methods of purification have also given useful results. J. Wa.

Constituents of *Ampelopsis meliæfolia*, Kudo (Haku-Tya). M. Kotake and T. Kubota (*Annalen*, 1940, **544**, 253—271).—The leaves of this plant yield to hot H_2O a mixture, whence basic Pb acetate removes myricetin and *ampelopsin* (**I**) (7·4%), +2·5H_2O, m.p. 245—246° (*hexa-acetate*, m.p. 174—175°, and *-benzoate*, m.p. 174°). (**I**) is shown, as follows, to be 3 : 5 : 7 : 3′ : 4′ : 5′-*hexahydroxyflavanone*. With CH_2N_2–Et_2O it gives a *Me*$_4$ (**II**), m.p. 168°, and 5 : 7 : 3′ : 4′ : 5′-*Me*$_5$ *ether* (**III**), m.p. 194—195° [*acetate*, m.p. 156°; also obtained from (**II**) by CH_2N_2]. MeI–K_2CO_3–$COMe_2$ also gives (**III**), but Me_2SO_4–KOH–MeOH gives the *Me*$_6$ *ether* (**IV**), m.p. 190—191°. KOH at 140—210° converts (**I**) into *s*-$C_6H_3(OH)_3$ and gallic acid (**V**). With $KMnO_4$–H_2O–C_6H_6, (**III**) gives the Me_3 ether of (**V**). In hot KOH–MeOH–H_2O, (**IV**) gives 2′-*hydroxy*-α : 3 : 4 : 5 : 4′ : 6′-*hexamethoxychalkone* (**VI**), m.p. 147° (orange-yellow $FeCl_3$ colour; adds Br), converted by Me_2SO_4–25% KOH–MeOH into the *Me*$_7$

derivative, m.p. 129—130°, and synthesised from 2 : 4 : 6 : 1-OH·C_6H_2(OMe)$_2$·CO·CH_2·OMe and 3 : 4 : 5 : 1-(OMe)$_3C_6H_2$·CHO in KOH–aq. EtOH at room temp. (later 30—40° and then 50—60°). Heating (**III**) in 10% KOH–EtOH–H_2 for 1 hr. gives a substance, m.p. 129—130°, pentamethylmyricetin, and 3 : 5-*dimethoxy*-2-3′ : 4′ : 5′-*trimethoxybenzylidene*-1 : 2-*dihydrobenzfuran*, m.p. 162—163°. Heating (**III**) in 10% KOH–MeOH for 3 min. gives *epi-ampelopsin Me*$_5$ (**VII**), m.p. 170—171°, and thence (Me_2SO_4) the *Me*$_6$ *ether*, m.p. 120°, both obtained also from (**VI**) by HCl–EtOH–H_2O under appropriate conditions. 10% KOH at 100° (1 hr.) converts (**VII**) into pentamethylampelopsic acid, 2 : 4 : 6 : 1-OH·C_6H_2(OMe)$_2$·C(OH)(CO$_2$H)·CH_2·C_6H_2(OMe)$_3$-1 : 3 : 4 : 5, very readily converted into the *lactone*, m.p. 158—159°, and with CH_2N_2–Et_2O giving *Me hexamethylampelopsate*, m.p. 150—151° (derived *acid*, m.p. 140°). Alcoholic acid or alkali dehydrates these products to *pentamethylanhydroampelopsolactone* (**VIII**), m.p. 159—160°, and *Me hexamethylanhydroampelopsate*, 2 : 4 : 6 : 1-(OMe)$_3C_6H_2$·C(CO$_2$Me):CH·C_6H_2(OMe)$_3$-1 : 3 : 4 : 5, m.p. 112—113°, hydrolysed to the *acid* (**IX**), m.p. 159—160° (*Et* ester, m.p. 150—151°), and thence by decarboxylation 2 : 4 : 6 : 3′ : 4′ : 5′-*hexamethylchalkone*, m.p. 143—144°. O_3 converts (**VIII**) or (**IX**) into 3 : 4 : 5 : 1-(OMe)$_3C_6H_2$·CHO. (**III**) is dehydrogenated by Pd-CHPh:CH·CO$_2$H at 170—175° or H_2O_2–NaOH–MeOH–H_2O to 3-hydroxymyricetin 5 : 7 : 3′ : 4′ : 5′-Me$_5$ ether; by the former method (**IV**) gives a *compound*, $C_{21}H_{22}O_8$, m.p. 145—146°. (**I**) has $a = 0$; it and the *epi*-derivatives are *dl*-forms of C_{2-3} stereoisomerides. R. S. C.

Constitution of calycopterin, yellow colouring matter of the leaves of *Calycopteris floribunda*. R. C. Shah, V. V. Virkar, and K. Venkataraman (*J. Indian Chem. Soc.*, 1942, **19**, 135—138).—Calycopterin (*dibenzyl ether*, m.p. 185°) with Me_2SO_4 yields 3 : 5 : 6 : 7 : 8 : 4′-hexamethoxyflavone (**I**), but with CH_2N_2 in Et_2O gives 5-*hydroxy*-3 : 6 : 7 : 8 · 4′-*pentamethoxyflavone*, m.p. 124° (*acetate*, m.p. 107°; sparingly sol. K and Na salts; green colour with $FeCl_3$) [also obtained by partial demethylation (50% HBr–AcOH at room temp.) of (**I**)], and is therefore 5 : 4′-dihydroxy-3 : 6 : 7 : 8-tetramethoxyflavone. 3-Methoxyflavone is demethylated by anhyd. $AlCl_3$ at 100°, or by HBr–AcOH at 100°, but not at room temp. A. Li.

Kostanecki–Robinson reaction. V. Benzoylation of some *o*-hydroxy-ketones. P. L. Trivedi, S. M. Sethna, and R. C. Shah (*J. Indian Chem. Soc.*, 1943, **20**, 171—172; cf. A., 1942, II, 60).—Resacetophenone, 2-acetylresorcinol, and phloracetophenone are benzoylated to 7- (cf. lit.), 5-, m.p. 234—235°, and 5 : 7-*di-benzoyloxy*-3-*benzoylflavone*, m.p. 167—168°, respectively. The OBz groups are then removed smoothly by conc. H_2SO_4 (5 : 7-*dihydroxy*-3-*benzoylflavone* has m.p. 145—146°) leaving the *C*-Bz groups intact. Subsequent heating with KOH–EtOH gives 7-, 5-, and 5 : 7-di-hydroxyflavone, respectively. S. A. M.

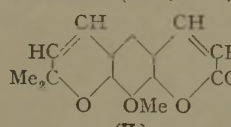
Parachors and constitution of pyrones.—See A., 1943, I, 299.

Tetrahydrodibenzopyrans.—See B., 1943, II, 342.

Natural coumarins. LVI. Constitution of sphondin. E. Späth and H. Schmid (*Ber.*, 1941, **74**, [*B*], 595—598).—Sphondin (**I**) (A., 1936, 860) is not identical (mixed m.p.) with bergapten or *allo*bergapten. With O_3 in $CHCl_3$ at 0° (**I**) gives 7-*hydroxy*-6-*methoxycoumarin*-8-*aldehyde* (**II**), m.p. 191·5—192·5°, also prepared from scopoletin and $(CH_2)_6N_4$ in AcOH. Crude (**II**) [from (**I**)] and 1% H_2O_2 in 0·05N-NaOH at 18° give fraxetin [7 : 8-dihydroxy-6-methoxycoumarin]. (**I**) is, therefore, 6-*methoxy*-7 : 8-2′ : 3′-*furanocoumarin*. H. B.

Formation of 2 : 4-dimethyl-1 : 3-benzdioxins and their fission to *o*-vinylphenols. E. Adler, H. von Euler, and G. Gie (*Arkiv Kemi, Min., Geol.*, 1943, **16**, **A**, No. 12, 20 pp.).—*aa-Di*-6-*hydroxy*-m-*tolylethane*, m.p. 141° (*diacetate*, m.p. 136—137°), obtained by the action of conc. HCl on a cold solution of *p*-cresol (4 mols.) and MeCHO (1 mol.) in EtOH, CHMe($C_6H_2Me_2$·OH-3 : 5 : 6)$_2$, CHMe(C_6H_4·OH-*p*)$_2$, and CHMe(C_6H_3Me·OH-3 : 4)$_2$ are converted by dry distillation under diminished pressure over frankonite into the corresponding vinylphenol, which invariably undergoes disproportionation when its separation from the large proportion of phenols produced simultaneously is attempted by distillation under atm. pressure; the final products are resins and the corresponding ethylphenol. 2 : 4 : 6 : 8-*Tetramethyl*-1 : 3-*benzdioxin* (**I**), m.p. 43·5°, is obtained in 30% yield when a solution of *m*-4-xylenol (0·5 mol.) and MeCHO (or paracetaldehyde) (1 mol.) in C_6H_6 is kept over 8N-HCl for 3 days at room temp. Under similar conditions *p*-cresol affords 2 : 4 : 6-*trimethyl*-1 : 3-*benzdioxin* (**II**), b.p. 115—120°/15 mm., m.p. 37°, in 40% yield and PhOH in Et_2O gives 2 : 4-*dimethyl*-1 : 3-*benzdioxin* (**III**), b.p. 90—95°/15 mm. (**I**) is converted by HCl in boiling EtOH, or by heating at 220—230° or at 120—150° in presence of frankonite, into 2-2′-*hydroxy*-3′ : 5′-*dimethylphenyl*-4 : 6 : 8-*trimethylchroman* (**IV**), m.p. 131·5°, converted by Me_2SO_4–NaOH in aq. MeOH into the *Me ether*, m.p. 147°, and by Ac_2O containing a little conc. H_2SO_4 at room temp. into *ay-di*-(2-*acetoxy*-3 : 5-*dimethylphenyl*)-n-*butyl acetate*, m.p. 112°. Passage of (**I**), (**II**), or (**III**) in N_2 or steam through a glass, porcelain, or metal tube at (best) 550°, 600—650°, or 400—450° respectively gives 2 : 4-*dimethyl*-6- (**V**), b.p. 108°/12 mm., m.p. 43°, and 4-*methyl*-2-*vinylphenol* (**VI**), b.p. 116—117°/15 mm., 74°/1 mm., and *o*-vinylphenol. (**V**) sublimes readily at room temp. (**V**) is transformed by CH_2Cl·CO$_2$H and 27% NaOH into 3 : 5 : 7-*trimethylcoumaran*-2-*carboxylic acid* (or 6 : 8-*dimethylchroman*-2-*carboxylic acid*), m.p. 99°. (**V**) is converted by Br in Et_2O followed by aq. $NaHCO_3$ into the (?) trimeric *quinonemethide*, $(C_9H_9OBr)_3$, m.p. 133°. (**V**) passes into (**IV**) when heated at 100° for 10 hr. (**VI**) is partly transformed by distillation under 1 mm. pressure into a viscous dimeride which passes into an alkali-insol. resin when distilled. With CH_2Cl·CO$_2$H and NaOH (**VI**) affords 4-*methyl*-2-*vinylphenoxyacetic acid*, m.p. 135°. H. W.

Natural coumarins. LV. Synthesis of luvangetin. E. Späth and H. Schmid (*Ber.*, 1941, **74**, [*B*], 193—196; cf. *ibid.*, 1940, **73**, 1361).—1 : 3 : 2-C_6H_2(OH)$_2$·OMe, Zn(CN)$_2$, and dry HCl in abs. Et_2O afford 2 : 4-*dihydroxy*-3-*methoxybenzaldehyde*, m.p. 85·5—86·5°, which gives daphnetin (**I**), m.p. 161°, by a Perkin reaction. (**I**) and CH:C·CMe_2·OH at 200° (sealed tube) give a small yield of luvangetin (**II**), m.p. 106—107°, after removal of unchanged (**I**). J. Wa.


(**II.**)

Vat dyes (thianthrens, phenoxthionins, etc.).—See B., 1943, II, 344.

Substituted 4-aminopiperidines. III. V. Hahn, E. Cerkovnikov, and V. Prelog (*Helv. Chim. Acta*, 1943, **26**, 1132—1142).—Tetrahydropyran-4-carboxylamide is converted by Br–NaOH into 4-aminotetrahydropyran (hydrochloride, m.p. 218—219°; *picrate*, m.p. 175—175·5°; *Ac* derivative, m.p. 149—150°), from which *aε-dichloro-γ-aminopentane hydrochloride* is obtained by the action of conc. HCl at 120—130°. It is converted by NH_2Ph–EtOH at 150—160° into 4-amino-1-phenylpiperidine, b.p. 125—126°/0·7 mm. (dipicrate, m.p. 201—202°; dihydrochloride, m.p. 264—265°), in 67% yield. 4-Dimethyltetrahydropyran hydrochloride (corresponding *picrate*, m.p. 174·5—175·5°) is similarly transformed into *aε-dichloro-γ-dimethylaminopentane hydrochloride*, m.p. 127—128° (corresponding *picrate*, m.p. 124—125°), which yields 4-*dimethylamino*-1-*phenylpiperidine* (**I**), b.p. 128—132°/1 mm., m.p. 47·5—48·5° (dihydrochloride, m.p. 252—253°; dipicrate, m.p. 203—204°). 4-*Hydroxy*-1-*phenylpiperidine hydrochloride*, m.p. 193·5—194·5° (corresponding *hydriodide*, m.p. 73—74°), is transformed by $SOCl_2$ in $CHCl_3$ into the glassy 4-*chloro*-1-*phenylpiperidine hydrochloride* (corresponding *picrate*, m.p. 163·5—164·5°), which is converted by anhyd. $NHMe_2$ in abs. EtOH at 150° into (**I**) in 20% yield. 4-*Iodo*-1-*phenylpiperidine hydrioidide*, m.p. 189—190°, and piperidine in boiling abs. EtOH give 4-piperidino-1-phenylpiperidine, b.p. 165—168°/1 mm., and 1-phenyl-1 : 2 : 3 : 4-tetrahydropyridine, b.p. 125—130°/1 mm., in 27% and 47% yield respectively. 1-*p*-Tolyl-4-pyridone is reduced by Na and EtOH to 4-*hydroxy*-1-p-*tolylpiperidine*, b.p. 160—162°/0·25 mm., m.p. 88·5—89° (*hydrobromide*, m.p. 172—173°), transformed by 68% HBr at 175—185° into 4-*bromo*-1-p-*tolylpiperidine*, m.p. 78—79° [*hydrobromide* (**II**), m.p. 206·5—207°; *picrate*, m.p. 158°]. 4-*Iodo*-1-p-*tolylpiperidine*, m.p. 92—93° (*hydriodide*, m.p. 92—93°), is described. Both compounds are converted by $NHMe_2$ in abs. EtOH at 140—150° into 4-dimethylamino-1-*p*-tolylpiperidine in 36% yield. (**II**) and piperidine in abs. EtOH at 140—150° give 1-*p*-tolyl-1 : 2 : 5 : 6-tetrahydropyridine, b.p. 116—117°/0·1 mm. (*picrate*, m.p. 130—131°), in 56% yield and 4-*piperidino*-1-p-*tolylpiperidine*, b.p. 170—175°/0·1 mm., m.p. 83·5—84·5° (*dihydrochloride*, m.p. 264—266°; *dipicrate*, m.p. 205—206°), in 24% yield. (**II**) and NH_2Ph in abs. EtOH at 140—145° afford 4-*anilino*-1-p-*tolylpiperidine* (amorphous *dihydrochloride*; *dipicrate*, decomp. 205—210°; *direineckate*, decomp. 200—205°). 4-*Hydroxy*-1-2′ : 4′-*dimethylphenylpiperidine*, b.p. 160—161°/0·3 mm. (*hydrobromide*, m.p. 189°; *phenylurethane*, m.p. 128°), is obtained by reduction (Na–EtOH) of 1-2′ : 4′-dimethylphenyl-4-pyridone and is converted into 4-bromo-1-2′ : 4′-dimethylphenylpiperidine which does not crystallise or give cryst. salts; its hydrobromide affords 4-*piperidino*-1-2′ : 4′-*dimethylphenylpiperidine*, a viscous liquid, b.p. 220—222°/1 mm. (*dipicrate*, m.p. 186·5—188°; *dipicrolonate*, m.p. 178—179°). Chelidonic acid and *p*-OMe·C_6H_4·NH_2 at 180° afford 1-p-*anisyl*-4-*pyridone*, m.p. 185—186° (*picrate*, m.p. 188—189°); the *hydrochloride*, m.p. 159—161°, is reduced to 4-*hydroxy*-1-p-*anisylpiperidine*, b.p. 180—182°/0·2 mm., m.p. 76·5—77°, the *hydrobromide*, m.p. 225—226°, of which is transformed by 68% HBr at 175—185° into 4-*bromo*-1-p-*hydroxyphenylpiperidine*, m.p. 129—130° (*hydrobromide*, m.p. 222·5—223·5°), converted by piperidine in EtOH at 140—145° into the non-cryst. 4-piperidino-1-*p*-hydroxyphenylpiperidine [*dipicrate*, m.p. 189—191° (decomp.); *direineckate*, m.p. 191—193° (decomp.)] and by NH_2Ph in EtOH at 140—145° into 4-anilino-1-*p*-hydroxyphenylpiperidine (*dipicrate*, decomp. 205—210°; *direineckate*, decomp. 205—210°). H. W.

Novel preparation of α-hydroxypyrroles; example of an intramolecular correlated reaction. W. Siedel [with, in part, K. Theis] (*Annalen*, 1943, **554**, 144—161).—A general method of preparing α-OH-pyrroles depends on simultaneous exchange of Br for OH and decarboxylation; if the latter is prevented, *e.g.*, by esterification,

replacement of Br does not occur. 3-Methyl-4-ethylpyrrole-2-carboxylic acid is converted by Br in cold AcOH into the 5-Br-derivative (**I**), which is converted by MeOH–conc. HCl into 5-*methoxy*-3-*methyl*-4-*ethylpyrrole* (**II**), b.p. 79—80°/10 mm., 85°/13 mm. [*picrate*, m.p. 152° (corr.); 5-*methoxy*-3-*methyl*-4-*ethylpyrroleazobenzenesulphonic acid hydrochloride*, m.p. 180—182°], and a non-cryst. *compound*, b.p. 127°/2·5 mm. Under similar conditions 5-*ethoxy*-, b.p. 95°/11 mm., 5-*propoxy*-, b.p. 104—105°/11 mm. (these do not give picrates or azo-dyes), and 5-*benzyloxy*-, m.p. 136°, -3-*methyl*-4-*ethylpyrrole* are obtained. 5-*Hydroxy*-3-*methyl*-4-*ethylpyrrole* (iso*hydroxyopsopyrrole*) (**III**), b.p. 156°/11 mm., 130—133°/3 mm., forms very volatile and hygroscopic crystals, m.p. 58—60°; it is obtained from (**II**) and saturated HCl–MeOH at 100° or from (**I**) and conc. aq. HCl. It does not give a picrate or azo-dye but affords a very hygroscopic *hydrochloride*, m.p. 78°, softens at 60°. Attempts to introduce the CHO into (**III**) by successive treatments with MgEtBr and HCO_2Et give iso*opsopyrryl formate* (**IV**), b.p. 116—117°/3 mm., which does not give a picrate or an azo-dye and is hydrolysed by alkali to (**III**); iso*opsopyrryl acetate* has b.p. 118°/2 mm., 121—122°/3 mm. With HCN–HCl in Et_2O (**III**) gives an unidentified *compound*, b.p. 126—127°/3 mm. The proof that OH in (**III**) has replaced Br and not CO_2H of (**I**) is afforded by the prep. of Me *iso*xanthobilirubate, m.p. 205°, from (**IV**) and β-5-aldehydo-2 : 4-dimethylpyrrole-3-propionic acid in boiling Ac_2O followed by hydrolysis and esterification (CH_2N_2) and of Me *iso*neoxanthobilirubate, m.p. 206°, from (**III**) and aldehydo-opsopyrrolecarboxylic acid (**V**) followed by HCl–MeOH. Et 2 : 3 : 4-trimethylpyrrole-5-carboxylate in abs. Et_2O is transformed by SO_2Cl_2 at room temp. into Et 2-carboxy-3 : 4-dimethylpyrrole-5-carboxylate, which passes at 220° followed by distillation at 340°/10 mm. into *Et* 3 : 4-*dimethylpyrrole*-5-*carboxylate*, m.p. 95—96°; the corresponding *acid*, sublimes without melting at 180°, is converted by Br in AcOH at 0° into 2-*bromo*-3 : 4-*dimethylpyrrole*-5-*carboxylic acid*, no m.p., transformed by conc. HCl into 2-*hydroxy*-3 : 4-*dimethylpyrrole*, m.p. 135° (decomp.). This with (**V**) and NaOH in aq. MeOH at 100° affords 5-*hydroxy*-3 : 3′ : 4-*trimethylpyrromethene*-4′-*propionic acid*, m.p. 289° (corr.) [*Me* ester, m.p. 223° (corr.), 234° (microscope)]. (**I**) and (**V**) in MeOH and 48% HBr yield *Me* 5-*carbomethoxy*-4 : 3′-*dimethyl*-3-*ethylpyrromethene*-4′-*propionate hydrobromide*, m.p. 173° (microscope), softens at 168°; the free base affords a *picrate*, m.p. 138°, and *salts*, $C_{38}H_{46}O_8N_4Cu$, m.p. 138°, and $C_{38}H_{46}O_8N_4Zn$, m.p. 151°. H. W.

Adermine.—See B., 1943, III, 256.

Preparation of alkoxy-*o*-aminophenylacetic acids, alkoxy-oxindoles and -isatins. G. Hahn and M. R. Tulus (*Ber.*, 1941, **74**, [*B*], 500—519; cf. A., 1939, II, 387).—*iso*Vanillin cyanohydrin and boiling Ac_2O–NaOAc give the *diacetate*, m.p. 84°, converted by the prolonged action of HCl in C_6H_6 into α-*chloro*-α-3-*acetoxy*-4-*methoxyphenylacetamide*, m.p. 135—136°; the -α-3 : 4-*dimethoxy*-, m.p. 145°, and -*methylenedioxy-phenyl*, m.p. 107°, analogues are similarly obtained. These amides with HNO_3 (*d* 1·4) at <0° give α-*chloro*-α-6-*nitro*-3-*acetoxy*-4-*methoxy*- (**I**), m.p. 137°, -α-6-*nitro*-3 : 4-*dimethoxy*- (**II**), m.p. 186° (decomp.), and -α-6-*nitro*-3 : 4-*methylenedioxy-phenylacetamide* (**III**), m.p. 168°, respectively. Reduction of (**II**) with H_2–Pd–AcOH affords 5 : 6-dimethoxyoxindole (**IV**) (98%), m.p. 204—205°, with H_2–Pd–AcOH–HCl (2 mols.) gives (**IV**) (25%) and 6-*amino*-3 : 4-*dimethoxyphenylacetamide*, m.p. 147° [as *hydrochloride* (**V**) (72%), m.p. 214°, converted by short treatment with warm AcOH into (**IV**); the amide is hydrolysed by 2N-Na_2CO_3 at 70° to (**IV**)], with H_2–PtO_2–AcOH affords (**IV**) (22%) and (**V**) (76%), with H_2–PtO_2–AcOH–HCl (2 mols.) gives (**IV**) (15%) and (**V**) (80%), and with H_2–Pd–MeOH affords (**IV**) (11%) and (**V**) (77%). Under the same reduction conditions (**III**) gives 94 and 0, 78 and 15, 88 and 7, 73 and 22, and 30 and 51%, respectively, of 5 : 6-methylenedioxyoxindole, m.p. 218° (decomp.), and 6-*amino*-3 : 4-*methylenedioxyphenylacetamide hydrochloride*, decomp. 190° (free base, m.p. 146—147°). Oxindole formation does not occur on reduction of (**I**) but the intermediate NH_2-amide undergoes hydrolysis; H_2–Pd–AcOH gives 6-*hydroxy*-3-*acetoxy*-4-*methoxy*-, m.p. 143°, and H_2–PtO_2–AcOH affords 3 : 6-*dihydroxy*-4-*methoxy-phenylacetamide*, m.p. 152—153°. Reduction of *o*-NO_2·C_6H_4·CH_2·CO_2H, 3 : 4 : 6 : 1-$(OMe)_2C_6H_2(NO_2)$·CH_2·CO_2H, and 3 : 4 : 6 : 1-CH_2O_2:$C_6H_2(NO_2)$·CH_2·CO_2H (**VI**) with H_2–Pd–AcOH–HCl gives, as expected, mainly the NH_2-acid hydrochlorides, which are thermolabile. The free NH_2-acids are best obtained by reduction with H_2–Pd–MeOH and adding C_6H_6 to the resulting solution; they can be diazotised and coupled with β-$C_{10}H_7$·OH. 6-2′-*Hydroxy*-1′-*naphthaleneazo*-3 : 4-*dimethoxy*-, m.p. 214—215°, and -3 : 4-*methylenedioxy-phenylacetic acid*, decomp. 228—229°, are described. 3 : 4 : 1-CH_2O_2:C_6H_3·CH_2·CO·NH_2 and HNO_3 at 0° give 6-*nitro*-3 : 4-*methylenedioxyphenylacetamide*, m.p. 218—219°, hydrolysed (6N-HCl) to (**VI**), new m.p. 184—185°, also obtained by nitration of homopiperonylic acid. Isatin (1 mol.) and (**IV**) (1 mol.) in AcOH–12N-HCl give 5 : 6-*dimethoxyindigotin*, decomp. 334°. Excess of Br and (**IV**) in boiling $CHCl_3$ afford a tribromo-oxindole, m.p. 187°, converted by boiling 2N-NaOH into 7-*bromo*-6-*hydroxy*-5-*methoxyisatin*, decomp. 280° (darkens 250°). $NaNO_2$ and (**IV**) in AcOH give 5 : 6-*dimethoxyisatin*-3-*oxime*, m.p. 213—214° (unaffected by dil. acid, alkali, AcOH–H_2O_2, or short treatment with AcOH–H_2SO_4; boiling acid ultimately causes demethylation), reduced (H_2, Pd, 80% HCO_2H, H_2SO_4) to 3-amino-5 : 6-dimethoxyoxindole; the *hydrochloride* of this with hot 2N-NaOH in air affords 5 : 6-*dimethoxyisatin*, decomp. 250—252° (darkens 220°). 5 : 6-*Methylenedioxyisatin*-3-*oxime*, m.p. 242°, similarly gives 3-*amino*-5 : 6-*methylenedioxyoxindole hydrochloride*, decomp. 200°, and thence 5 : 6-methylenedioxyisatin, decomp. 284°. H. B.

Synthesis of 2-pyridyl- and 2-quinolyl-dialkylcarbinols. B. Emmert and E. Pirot (*Ber.*, 1941, **74**, [*B*], 714—719; cf. A., 1939, II, 387).—Addition of $HgCl_2$ in *cyclo*pentanone to Mg in anhyd. C_5H_5N gives (cf. *loc. cit.*) 1-2′-*pyridyl*cyclo*pentanol*, b.p. 137—138°/13 mm., m.p. 84°, and 1 : 1′-dihydroxy-1 : 1′-di*cyclo*pentyl. Similarly, *cyclo*hexanone gives 1-2′-*pyridyl*cyclo*hexanol* (**I**), b.p. 143—144°/13 mm., m.p. 43°, and 1 : 1′-dihydroxy-1 : 1′-di*cyclo*hexyl. With camphor (synthetic) Al must be used for Mg; 5% of 2′-*pyridylborneol*, b.p. 155—157°/12 mm., is thus obtained. Dehydration ($KHSO_4$ at 150°; conc. H_2SO_4 at 100°) of (**I**) gives (?) 1-2′-*pyridyl*-Δ¹-cyclo*hexene*, b.p. 259°. With quinoline, use of much Al and $HgCl_2$ is necessary: $COMe_2$ thus affords 2-*quinolyldimethylcarbinol*, m.p. 67° (picrate, m.p. 110°), also obtained from Me quinoline-2-carboxylate and MgMeI; COMeEt gives 2-*quinolylmethylethylcarbinol*, b.p. 126—128°/0·1 mm. (picrate, m.p. 92—93°); *cyclo*hexanone gives 1-2′-*quinolyl*cyclo*hexanol*, m.p. 66° (picrate, m.p. 145°). The Mg or Al is activated with I. No reaction occurs with 2 : 6-dimethylpyridine, $COMe_2$, Al, and $HgCl_2$. The reaction cannot be applied to CO-esters, diketones, and RCHO; unsaturated ketones and CHPh:NPh (for C_5H_5N) are resinified. $C_{10}H_8$ (for C_5H_5N) does not react. It is unlikely that radicals play any part in the reaction; CRR′(MgCl)·OMgCl may be an intermediate. H. B.

Solution colours of phenol betaines of the quinoline series. W. Schneider and A. Pothmann (*Ber.*, 1941, **74**, [*B*], 471—493).—7-Hydroxy-2-phenylquinoline-4-carboxylic acid is decarboxylated by distillation with Hg to 7-hydroxy-2-phenylquinoline (**I**), m.p. 229—230°, which with Me_2SO_4 at 120—130° followed by aq. KI gives the *methiodide* (**II**), m.p. 223°. 7-Methoxy-2-phenylquinoline [from (**I**) and CH_2N_2 or by decarboxylation of 7-*methoxy*-2-*phenylquinoline*-4-*carboxylic acid*, m.p. 238° (from PhCHO, AcO_2H, and *m*-anisidine in EtOH at 70—80°)] similarly gives a *methiodide*, m.p. 206°, converted by HBr (*d* 1·78) at 140° (sealed tube) followed by aq. KI into (**II**). A basic *methiodide*, $(C_{16}H_{13}ON)_2$,HI, m.p. 216°, is obtained from (**II**) and Ag_2O in cold H_2O; in warm H_2O, 7-*hydroxy*-2-*phenylquinoline methyl betaine* (+2H_2O) (**III**), m.p. 85° (rapid), 253° (slow heating), results. 6-Methoxy-2-phenylquinoline-4-carboxylic acid, m.p. 237° (from PhCHO, AcO_2H, and *p*-anisidine), is demethylated (HBr) and then decarboxylated (Hg) to 6-hydroxy-2-phenylquinoline, m.p. 218°, the *methiodide* (+H_2O), m.p. 110—111° (rapid), 188° (slow cautious heating), of which with Ag_2O–H_2O gives the impure *betaine* (+>1H_2O), m.p. 165—166°. The colours of this and (**III**) in various solvents (detailed) are similar. It is immaterial for colour production whether quinonoid formation can occur or not. In accordance with this view the *betaine* (+4H_2O), m.p. 85° (rapid), 217° (slow heating), from 2-p-*hydroxyphenylquinoline methiodide* (+H_2O), m.p. 209—210°, and Ag_2O–H_2O shows the characteristic colour changes of phenol betaines. 2-*p*-Hydroxyphenylquinoline-4-carboxylic acid, m.p. 330°, is prepared from *p*-OH·C_6H_4·CHO, AcO_2H, and NH_2Ph. Introduction of ·CH:CH· or ·CH:CH·CH:CH· between the quinoline and Ph rings causes a considerable deepening in colour. 2-*p*-Hydroxystyrylquinoline (**IV**) gives (cf. Vonderwahl, *Diss., Genève*, 1913) a *methiodide* (+H_2O) (**V**), m.p. 256°, and an *ethiodide* (+EtOH) (**VI**), m.p. 231° [described by Vonderwahl as (**V**)] [readily obtained from 2-methylquinoline ethiodide (**VII**) and *p*-OH·C_6H_4·CHO in EtOH–piperidine]. With Ag_2O or, better, short treatment with boiling aq. EtOH–NH_3, (**V**) gives a basic *methiodide*, $(C_{18}H_{15}ON)_4$,HI,6H_2O, m.p. 149°, converted by aq. EtOH–NH_3 into the *betaine* (+3H_2O; 0·5H_2O lost rapidly in air; 1·5H_2O lost in a desiccator), m.p. 212° (sinters 190°); (**VI**) (in AcOH) with excess of NaOH affords the *ethyl betaine* (+3H_2O), m.p. 152°. The colours of both betaines are similar. The betaines (not isolated except in $CHCl_3$) from 2-m-*hydroxystyrylquinoline methiodide* (+H_2O), m.p. 244° (decomp.), and *ethiodide* (+H_2O), m.p. 231°, show relatively lighter colorations (yellow changing to red; ? change of dissolved hydrate to anhydride) which are independent of temp., indicating the possibility of a quinonoid limiting state in hydroxyphenylquinoline derivatives. CH_2PhCl and (**IV**) at 200—210° give the hydrochloride (+2H_2O), m.p. 292° (lit. 264—266°), of (**IV**) and the impure benzylochloride. The latter with aq. NaOH in $CHCl_3$ affords the *benzyl betaine* (+H_2O), m.p. 143—144° (softens from 130°), which shows a little deeper solution colours than the Me and Et analogues. 4-p-*Hydroxystyrylquinoline methiodide* (+1·5H_2O), m.p. 131° or 260° (stable) (from the 4-Me derivative and *p*-OH·C_6H_4·CHO in EtOH–piperidine), gives (NaOH) the *betaine* (+3H_2O), m.p. 234° (sinters from 207°), which are distinctly deeper in colour than the 2-derivatives. *p*-OMe·C_6H_4·CH:CH·CHO (**VIII**) could not be condensed with various quaternary iodides but with (**VII**) in EtOH–piperidine gives 2-δ-p-*anisyl*-$\Delta^{\alpha\gamma}$-*butadienylquinoline ethiodide*, m.p. 259°, demethylated (aq. AcOH–HBr) to the

p-OH-ethiodide, m.p. 193—194°, which affords the impure *betaine* (+1·5H_2O) (shows the expected deepening in colour). Attempted condensation of 4-methylquinoline ethiodide and (**VIII**) in HCO_2H at 100° gave, unexpectedly, *4-methyl-1-ethylquinolinium tri-iodide*, m.p. 91°. With some of the betaines studied, *e.g.*, those from (**V**) and (**VI**), it is found that for solvents of decreasing solvating power there is an increasing depth in the colour; in PhMe, C_5H_5N, and dioxan the colours are displaced slightly towards the red and heating above room temp. produces no deepening. H. B.

8-Hydroxyquinoline-5-sulphonamide.—See B., 1943, III, 256.

Syntheses and transformations of natural substances under conditions possible in the cell. VIII. Biogenesis of 1-benzyl-1 : 2 : 3 : 4-tetrahydro*iso*quinoline alkaloids. Synthesis of 6 : 7-dihydroxy-1-3′ : 4′-methylenedioxybenzyl-1 : 2 : 3 : 4-tetrahydro*iso*quinoline under conditions possible in the cell. C. Schöpf and W. Salzer (*Annalen*, 1940, **544**, 1—30; cf. A., 1936, 1002; 1937, II, 526).—Contrary to Hahn *et al.* (A., 1937, II, 76), 1-benzyl-1 : 2 : 3 : 4-tetrahydro*iso*quinolines can be synthesised under "natural" conditions from Ar·$[CH_2]_2$·NH_2 and CH_2Ar′·CHO provided that Ar has a group activating the *o*-position. Natural alkaloids containing OAlk in the *Bz* nucleus are formed by way of the OH-derivatives, which are alkylated after cyclisation. The condensation occurs at pH 3—7; at pH 7 it is extremely rapid (30% in 13 min.). Self-condensation of CH_2Ar′·CHO occurs in acid solution, but at pH ~7 is not rapid enough to interfere appreciably with the formation of the *iso*quinoline derivative. 3 : 4 : 1-CH_2O_2:C_6H_3·CH_2·OH [prep. from piperonal by $Al(OPr^{\beta})_3$–$Pr^{\beta}OH$ at 95°], m.p. 51°, b.p. 151°/13 mm., with $SOCl_2$–$CHCl_3$–C_5H_5N gives the chloride, b.p. 130°/13 mm., and thence (NaCN–EtOH–H_2O) the nitrile, b.p. 164°/14 mm., and (alkali) homopiperonylic acid, m.p. 128°. This with 3 : 4 : 1-$(CH_2Ph·O)_2C_6H_3$·$[CH_2]_2$·NCO (prep. *in situ* from the hydrazide by way of the azide) in boiling C_6H_6 gives CO_2 and *piperonyl-β-3′ : 4′-dibenzyloxyphenylethylamide* (74%), m.p. 119—121°, converted by PCl_5 in $CHCl_3$ at <0° and then room temp. into 6 : 7-*dibenzyloxy*-1-*piperonyl*-3 : 4-*dihydroisoquinoline hydrochloride* (70%), m.p. 205—207° [gives the *methiodide* (**I**), m.p. 204—205°, of the base], which with Zn dust in boiling 50% AcOH gives 6 : 7-*dibenzyloxy*-, sinters 105°, m.p. 108°, and with H_2–PtO_2 and then Pd–$BaSO_4$ in MeOH gives 6 : 7-dihydroxy-1-piperonyl-1 : 2 : 3 : 4-tetrahydro*iso*quinoline (**II**), sinters 123°, m.p. 128° (decomp.) [*hydrochloride* (**III**), +2EtOH, m.p. 256° (decomp.); picrate, sinters 153°, m.p. 159° (decomp.)]. (**III**) is determined (95·5—99%) in presence of 3 : 4 : 1-$(OH)_2C_6H_3$·$[CH_2]_2$·NH_2,HBr (**IV**) in much H_2O by pptn. of the picrolonate, m.p. (anhyd.) 243° (decomp.) or (+xH_2O) swells at 159°, m.p. 165—170° (turbid), decomp. 238—240°. With AgOAc and then Zn dust in aq. AcOH at the b.p. etc., (**I**) gives 6 : 7-*dibenzyloxy*-1-*piperonyl*-2-*methyl*-1 : 2 : 3 : 4-*tetrahydroisoquinoline hydrochloride*, +0·5H_2O (retained at 60°/high vac.), m.p. 105—115°. Safrole oxide (prep. by BzO_2H in $CHCl_3$; 50% yield), b.p. 149—150°/11 mm., in boiling 10% AcOH gives the glycol (90%), m.p. 82°, which with $Pb(OAc)_4$ gives homopiperonal (**V**). (**V**) is readily determined in H_2O by pptn. of its semicarbazone, m.p. 180°. (**V**) is stable for 3 days at pH 3—5, but undergoes self-condensation in ~24 hr. at pH 7 or 1 hr. at pH 9. The rates of disappearance of (**V**) and formation of (**II**) from mixtures of (**IV**) (1 mol.) and (**V**) (1·1 mol.) in H_2O (~0·01M.) are determined at pH 3—7 and 25°. (**V**) disappears faster than (**II**) is formed, particularly at pH 7; in such cases the semicarbazone is formed after heating but not in the cold; it is assumed that condensation gives initially and reversibly $(OH)_2C_6H_3$·$[CH_2]_2$·N:CH·CH_2·C_6H_3:CH_2O_2 or irreversibly (**II**). 3 : 4 : 1-CH_2O_2:C_6H_3·CH_2·CO·CO_2H is determined in H_2O as the *p*-nitrophenylhydrazone, m.p. 201°. The rate of its condensation with (**IV**) is faster at pH 7 than at pH 5, but in all cases much slower than that of (**V**). Thus, synthesis of *iso*quinoline alkaloids is by way of the aldehydes rather than of the pyruvic acids. R. S. C.

Photographic sensitisers derived from quinaldine. M. Q. Doja and D. Prasad (*J. Indian Chem. Soc.*, 1943, **20**, 153—158; cf. A., 1943, II, 172).—*p*-NEt_2·C_6H_4·CHO and quinaldine methiodide, with piperidine in hot EtOH, give 2-p-*diethylaminostyrylquinoline methiodide*, m.p. 190°, yield 40%, range of photographic sensitisation 4200—6350 A. and of uniformly intense sensitisation 4400—5250 A. Corresponding figures for other alkiodides, obtained similarly, are: *Et*, 230°, 76%, 4200—6400, 4350—5000 A.; *Pr*$^{\alpha}$, 198°, 67%, 4250—6150, 4400—5000 A.; *Bu*$^{\alpha}$, 111°, 31%, 4200—6350, 4350—5000 A., respectively. Optical and dyeing properties are described. The syntheses have not been quite successful in producing a single sensitiser for panchromatic plates, owing to the failure to sensitise for a short region in the blue-green portion of the spectrum. *Quinaldine* n-*propiodide*, m.p. 145—146°, and n-*butiodide*, m.p. 193°, are new. S. A. M.

Chemical constitution and antiplasmodic action. VI. Heterocyclic derivatives of 8-aminoquinoline and of 8-amino-6-methoxyquinoline. E. Cerkovnikov, V. Prelog, and P. Stern (*Helv. Chim. Acta*, 1943, **26**, 1180—1185).—8-Amino-6-methoxyquinoline, Br·$[CH_2]_2$·Br, and $CaCO_3$ in EtOH at 150° afford *8-piperidino-6-methoxyquinoline*, b.p. 240°/0·8 mm., m.p. 57—58° (*dihydrochloride*, m.p. 141—142°); in absence of $CaCO_3$ hydrolysis of OMe occurs. Under similar conditions Br·$[CH_2]_6$·Br yields *8-hexamethyleneimino-6-methoxyquinoline*, b.p. 240—245°/0·7 mm. (*dipicrate*, m.p. 168—169°; dihydrochloride; *dipicrolonate*, m.p. 222—223°). Analogously $O([CH_2]_2$·$Cl)_2$ gives *8-morpholino-6-methoxyquinoline*, b.p. 238°/0·5 mm. m.p. 122—123° (*sulphosalicylate*, m.p. 235—236°), and $S([CH_2]_2$·$Cl)_2$ yields *8-thiomorpholino-6-methoxyquinoline*, b.p. 240—241°/0·3 mm. (*picrate*, m.p. 190—191°; *hydrochloride*, m.p. 218—219°). *8-4′-Aminopiperidino-6-methoxyquinoline*, b.p. 205—209°/0·1 mm. [*trihydrochloride* (**I**), m.p. 219—220°; *dipicrate*, m.p. 209—210°], is derived from NH_2·CH($[CH_2]$·Br)$_2$,HBr. (**I**), KOH, and Cl·$[CH_2]_3$·NEt_2,HCl in abs. EtOH at 140° yield *8-4′-γ-diethylaminopropylaminopiperidino-6-methoxyquinoline*, b.p. 235°/0·2 mm. [*tetrahydrochloride*, m.p. 217—218° (decomp.)]. *8-4′-Dimethylaminopiperidino-6-methoxyquinoline*, b.p. 225—230°/0·3 mm., gives a *dipicrate*, m.p. 208—209° (decomp.). Compounds which do not contain OH or OMe at $C_{(6)}$ are physiologically inactive. Of the remaining compounds only those are active which have at least one free H united to N; this is not necessarily united to the N atom directly attached to the quinoline nucleus. H. W.

Synthesis of nitrogen-containing heterocyclic rings. XXI. Synthesis of dibenzquinolizine derivatives. IV. Synthesis of 2′ : 3′ : 2″ : 3″-tetramethoxy-1 : 2 : 6 : 9-tetrahydro-3 : 4-7 : 8-dibenzquinolizine. S. Sugasawa, K. Kodama, and H. Inagaki. **XXII. Oxidation of β-phenylethylpyridinium salts. II.** S. Sugasawa and H. Shigehara (*Ber.*, 1941, **74**, [*B*], 455—459, 459—469).—XXI. Et *β*-keto-*γ*-3 : 4-dimethoxyphenylbutyrate [from 3 : 4 : 1-$(OMe)_2C_6H_3$·CH_2·COCl and CHNaAc·CO_2Et in Et_2O followed by aq. NH_3–NH_4Cl] with 3 : 4 : 6 : 1-$(OMe)_2C_6H_2(NH_2)$·CHO in EtOH–piperidine at 29—30° gives *Et* 6 : 7-*dimethoxy*-2-3′ : 4′-*dimethoxybenzylquinoline*-3-*carboxylate*, m.p. 140° (*picrate*, decomp. 179°; 1 : 2 : 3 : 4-H_4-derivative, m.p. 94—95°, readily obtained by H_2–PtO_2–dil. HCl). The free *acid*, decomp. 230°, with Cu chromite in quinoline at 230—235° gives 6 : 7-*dimethoxy*-2-3′ : 4′-*dimethoxybenzylquinoline* (**I**), m.p. 205° (decomp.) (sinters ~100°) (*hydrochloride*, decomp. 234°; *picrate*, decomp. 199—200°), which is only slowly reduced to the 1 : 2 : 3 : 4-H_4-derivative, m.p. 99—100° [*hydrochloride* (**II**), decomp. 212—213°; 1-*Bz* derivative, m.p. 176°; 1-*Me* derivative *picrate*, m.p. 148—149°, obtained by reduction (H_2, PtO_2, EtOH) etc. of the methosulphate of (**I**)]. (**II**) with 40% CH_2O and 2N-HCl at 100° affords 2′ : 3′ : 2″ : 3″-*tetramethoxy*-1 : 2 : 6 : 9-*tetrahydro*-3 : 4-7 : 8-*dibenzquinolizine* (**III**), decomp. 80° (becomes red) (*methiodide*, decomp. 197—198°). The unstable hydrochloride, decomp. ~180° (sinters and becomes red ~90°), of (**III**) is dehydrogenated by passing air through a solution in EtOH containing Pt-black; the product with KI in aq. HCl gives a (?) *tetramethoxydibenzquinolizinium iodide*, $C_{21}H_{20}O_4NI$, m.p. 235°.

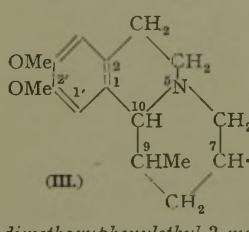
XXII. The generalisation previously made (A., 1939, II, 281) regarding the oxidation of 1-*β*-arylethylpyridinium salts to 1-*β*-arylethyl-2-pyridones is now found to be invalid. 2-*Phenyl*-4-3′ : 4′-*dimethoxy*-6′-*methylbenzylidene*-5-*oxazolone*, m.p. 167—168·5° [from 3 : 4 : 6 : 1-$(OMe)_2C_6H_2Me$·CHO, NHBz·CH_2·CO_2H, and Ac_2O–NaOAc at 100°], is hydrolysed (10% NaOH in H_2) to 3 : 4-*dimethoxy*-6-*methylphenylpyruvic acid*, m.p. 195—196·5°, which is oxidised (H_2O_2) to 6-*methylhomoveratric acid*, m.p. 102—104°, purified through its Et ester (**IV**), b.p. 162—164·5°/4 mm. Bouveault–Blanc reduction of (**IV**) gives 3 : 4 : 6 : 1-$(OMe)_2C_6H_2Me$·$[CH_2]_2$·OH, b.p. 166—168°/4 mm. (p-*nitrobenzoate*, m.p. 114·5—116°), the *bromide*, b.p. 158—159°/4 mm. (prep. by PBr_3), of which with C_5H_5N at 110° affords 1-*β*-3′ : 4′-*dimethoxy*-6′-*methylphenylpyridinium bromide*, m.p. 154—156°. This is oxidised by aq. NaOH–$K_3Fe(CN)_6$ to the non-cryst. 2-pyridone, which is converted by $POCl_3$ followed by aq. HCl–KI into 1′ : 2′-*dimethoxy*-4′-*methyl*-3 : 4-*dihydro*-5 : 10-*dehydro*-1 : 2-*benzquinolizinium iodide*, decomp. 186·5—187° (becoming red) [the corresponding chloride readily absorbs 3 H_2 (PtO_2–EtOH) to give a *tert.*-base (hydriodide, m.p. 225—226°)]. o-*Methoxybenzylidenerhodanine*, decomp. 250° (from *o*-OMe·C_6H_4·CHO, rhodanine, and AcOH–NaOAc at 100°), with 15% NaOH gives *o*-OMe·C_6H_4·CH_2·CS·CO_2H, m.p. 133—135°, converted by EtOH–NaOEt–NH_2OH,HCl into o-*anisylpyruvic acid oxime* (**V**), decomp. 162·5°. Crude (**V**) with Ac_2O affords *o*-OMe·C_6H_4·CH_2·CN, new m.p. 71°, whence *o*-OMe·C_6H_4·CH_2·CO_2Et, b.p. 135°/10 mm., and *o*-OMe·C_6H_4·$[CH_2]_2$·OH, b.p. 123—124°/8 mm. (p-*nitrobenzoate*, m.p. 59°). 1-*β*-*o*-Anisylethylpyridinium bromide (corresponding *picrate*, m.p. 114—115·5°) is oxidised to 1-*β*-o-*anisylethyl*-2-*pyridone*, m.p. 130—131°, 2 : 3 : 1-$(OMe)_2C_6H_3$·$[CH_2]_2$·OH, b.p. 125—128°/2 mm. (p-*nitrobenzoate*, m.p. 111—112°), gives the pyridinium bromide (corresponding *picrate*, m.p. 111—112°), converted (as above) into the 2-pyridone and thence into 3′ : 4′-*dimethoxy*-3 : 4-*dihydro*-5 : 10-*dehydro*-1 : 2-*benzquinolizinium iodide*, decomp. 182° (corresponding picrate, m.p. 135—136°). Reduction (H_2, PtO_2, EtOH) of the chloride affords 3′ : 4′-dimethoxy-3 : 4 : 6 : 7 : 8 : 9-hexahydro-1 : 2-benzquinolizine (*picrate*, m.p. 147·5°; hydriodide, m.p. 170°). 2 : 5-*Dimethoxybenzylidenerhodanine*, m.p. 243°, similarly yields 2 : 5-*dimethoxyphenylpyruvic acid oxime*, m.p. 153° (decomp.) (intermediate thio-acid, decomp. 186°), 2 : 5-*dimethoxybenzyl cyanide*, m.p. 54—55°, 2 : 5 : 1-$(OMe)_2C_6H_3$·CO_2Et, b.p. 162—165°/8 mm., 2 : 5 : 1-$(OMe)_2C_6H_3$·$[CH_2]_2$·OH, b.p. 161°/8 mm. (p-*nitrobenzoate*, m.p. 76—77·5°; *bromide*, b.p. 149—150°/8 mm.), the *pyridinium*

bromide, m.p. 53—54·5°, and *picrate*, m.p. 122°, the crude 2-pyridone, 1′ : 4′-*dimethoxy*-3 : 4-*dihydro*-5 : 10-*dehydro*-1 : 2-*benzquinolizinium iodide*, m.p. 156—157·5°, and *chloride*, m.p. 63°, and 1′ : 4′-dimethoxy-3 : 4 : 6 : 7 : 8 : 9-hexahydro-1 : 2-benzquinolizine (*picrate*, m.p. 127—128·5°; *methiodide*, m.p. 158—159°).

β-Nitro-2 : 5-*dimethoxystyrene*, m.p. 119—120·5° [from 2 : 5 : 1-$(OMe)_2C_6H_3$·CHO and $MeNO_2$ in EtOH–NH_2Me], is reduced electrolytically in EtOH–AcOH–conc. HCl at a Pb cathode to 2 : 5 : 1-$(OMe)_2C_6H_3$·$[CH_2]_2$·NH_2. The *Ac* derivative, m.p. 98—99°, of this gives 5 : 8-dimethoxy-1-methyl-3 : 4-dihydro*iso*quinoline, b.p. 144—147°/2 mm., m.p. 67—68° (*methiodide*, m.p. 198—199°); catalytic reduction of the methochloride, m.p. 123—125°, affords 5 : 8-dimethoxy-1 : 2-dimethyl-1 : 2 : 3 : 4-tetrahydro*iso*quinoline, b.p. 149—150°/5 mm. (*picrate*, m.p. 209—210°). The methosulphate of this with ~30% KOH at 100° gives β-2 : 5-dimethoxy-6-vinylphenylethyldimethylamine, b.p. 147—150°/10 mm. (*picrate*, m.p. 170—172°), reduced to the 6-Et derivative, b.p. 166—169°/25 mm. (*picrate*, m.p. 182—183°), which on further exhaustive methylation gives a product oxidised ($KMnO_4$) to 3 : 6 : 1 : 2-$(OMe)_2C_6H_2(CO)_2O$.

H. B.

Synthesis of nitrogen-containing heterocyclic rings. XXIII. Synthesis of ethyl 2′ : 3′-dimethoxy-9-methyl-3 : 4 : 6 : 7 : 8 : 9-hexahydro-1 : 2-benzquinolizine-7-carboxylate. S. Sugasawa, K. Sakurai, and T. Okayama (*Ber.*, 1941, **74**, [*B*], 537—541).—3-*Carbomethoxy*-, decomp. 197°, 3-*carbethoxy*-, decomp. 195°, and 3-*carbamyl*-, m.p. 209°, -1-β-*phenylethylpyridinium bromide* (from Ph·$[CH_2]_2$·Br and the nicotinic acid derivative in xylene) are all oxidised by alkaline $K_3Fe(CN)_6$ to 1-β-*phenylethyl*-2-*pyridone*-5-*carboxylic acid* (**I**), m.p. 190°. Reduction (Na–Hg, H_2O) of (**I**) gives 1-β-*phenylethyl*-2-*piperidone*-5-*carboxylic acid* (**II**), m.p. 140—141°. Ph·$[CH_2]_2$·NH_2 and Et_2 α-formylglutarate give a product which is reduced slowly by H_2–PtO_2–EtOH–AcOH to the Et ester of (**II**); Et_2 α-formylsuccinate similarly gives the Et ester, b.p. 170—180°/4 mm., of 1-β-*phenylethyl*-2-*pyrrolidone*-4-*carboxylic acid*, m.p. 192—193°. Et_2 α-formyl-α′-methylglutarate, b.p. 108—113°/4 mm. (from CO_2Et·$[CH_2]_2$·CHMe·CO_2Et, HCO_2Et, and Na in Et_2O), with 3 : 4 : 1-$(OMe)_2C_6H_3$·$[CH_2]_2$·NH_2 similarly affords *Et* 1-β-3′ : 4′-*dimethoxyphenylethyl*-3-*methyl*-2-*piperidone*-5-*carboxylate*, b.p. 208—215°/4 mm., converted by $POCl_3$ in boiling PhMe into 2′ : 3′-*dimethoxy*-7-*carbethoxy*-9-*methyl*-3 : 4 : 6 : 7 : 8 : 9-*hexahydro*-5 : 10-*dehydro*-1 : 2-*benzquinolizinium chloride*, m.p. 177—178°, which is reduced (H_2, PtO_2, EtOH) to *Et* 2′ : 3′-*dimethoxy*-9-*methyl*-3 : 4 : 6 : 7 : 8 : 9-*hexahydro*-1 : 2-*benzquinolizine*-7-*carboxylate* (**III**), m.p. 115—116° (possibly one of the *r*-forms).


(III.)

H. B.

Chemical constitution and antiplasmodic action. V. Derivatives of 2-chloro-5-amino-7-methoxyacridine. V. Prelog, E. Rajner, and P. Stern (*Helv. Chim. Acta*, 1943, **26**, 1172—1180).—The following are obtained from the α-Br-ester and *sec.* amine (2 mols.) in C_6H_6 at 100°: *Et* α-*diethylaminovalerate*, b.p. 85°/15 mm. (*reineckate*, m.p. 123°); *Et* α-*dipropylaminobutyrate*, b.p. 90°/16 mm. (*picrate*, m.p. 94°); *Et* α-*dibutylaminobutyrate*, b.p. 133°/17 mm. (*reineckate*, m.p. 119°). Reduction (Bouveault–Blanc) of the appropriate NH_2-ester gives the following: β-*dipropylaminopropan*-α-*ol*, b.p. 92°/12 mm. (*reineckate*, m.p. 128°); β-*dipropylaminobutan*-α-*ol*, b.p. 100°/16 mm. (*hydrochloride*, m.p. 121°); β-*dibutylaminobutan*-β-*ol*, b.p. 125°/16 mm. (*reineckate*, m.p. 125°); β-*diethylaminopentan*-α-*ol*, b.p. 91°/16 mm. (*reineckate*, m.p. 127°). Treatment of the hydrochloride of the NH_2-alcohol with $SOCl_2$ in $CHCl_3$ and of the resulting chloride with 18% NH_3–MeOH at 100—120° leads to the following: β-*diethylaminopropylamine*, b.p. 67°/18 mm. (*picrate*, m.p. 127°), and *di*-(β-*diethylaminopropyl*)*amine*, b.p. 150°/18 mm. (*picrate*, m.p. 132°); β-*diethylamino*-n-*butylamine*, b.p. 80°/20 mm. (*picrate*, m.p. 153—154°), and di-(β-diethylaminobutyl)amine, b.p. 145°/20 mm. (*dipicrate*, m.p. 143°); β-*diethylaminoamylamine*, b.p. 84°/16 mm. (*picrate*, m.p. 163°); β-*dipropylaminopropylamine*, b.p. 89°/12 mm. (*dipicrate*, m.p. 187°), and *di*-(β-*dipropylaminopropyl*)*amine*, b.p. 165°/12 mm. (*dipicrate*, m.p. 151°); β-*dipropylaminobutylamine*, b.p. 115°/18 mm. (*picrate*, m.p. 170°); β-*dibutylaminobutylamine*, b.p. 119°/16 mm. (*picrate*, m.p. 164°); β-*piperidinopropylamine*, b.p. 85°/25 mm. (*picrate*, m.p. 220°), and *di*-(β-*piperidinopropyl*)*amine*, b.p. 175°/25 mm. (*picrate*, m.p. 169°); β-*piperidinobutylamine*, b.p. 94°/25 mm. (*dipicrate*, m.p. 198°); α-*aminomethylquinuclidine*, b.p. 118°/14 mm. (*dipicrate*, m.p. 213°). Passage of NH_3 through 2 : 5-dichloro-7-methoxyacridine in PhOH at 170—180° gives 2-*chloro*-5-*amino*-7-*methoxyacridine* (**I**), m.p. 267° (*lactate*, m.p. 221—222°). Analogous methods lead to the following 2-*chloro*-7-*methoxy*-*acridines*: 5-α-*quinuclidylmethylamino*- (**II**), m.p. 157° (*trihydrochloride*, m.p. 282°); 5-β-*piperidinopropylamino*-, m.p. 165°; 5-β-*piperidino*-*butylamino*-, m.p. 139°; 5-β-*diethylaminopropylamino*-, m.p. 115° (*trihydrochloride*, m.p. 254°); 5-β-*diethylaminobutylamino*- [*trihydrochloride* (+1H_2O), m.p. 245·5°]; 5-β-*diethylaminoamylamino*-, m.p. 112° [*trihydrochloride*, (+1H_2O), m.p. 219—220°]; 5-β-*dipropylaminopropylamino*-, m.p. 146° (*dihydrochloride*, m.p. 242°); 5-β-dipropylaminobutylamino- [*dihydrochloride* (**III**), m.p. 240°]; 5-β-dibutylaminobutylamino- [*dihydrochloride* (+1H_2O), m.p. 218°]. (**I**) is devoid of antiplasmodic action. (**II**) and compounds with dialkylamino-groups in the side-chain are highly active; (**III**) is exceptional in being slightly toxic. Substances with a piperidine residue are inactive.

H. W.

Polynuclear condensed systems with heterocyclic rings. VII. Ring-closure of 3-phenyl- and 3-benzyl-7 : 8-benzocinchonic acids. W. Borsche and M. Wagner-Roemmich (*Annalen*, 1940, **544**, 272—279; cf. A., 1937, II, 519; 1939, II, 348).—3-*Phenyl*-7 : 8-*benzcinchonic acid*, m.p. 282° (decomp.), is obtained from α-$C_{10}H_7$·NH_2 (**I**), CH_2Ph·CO·CO_2H (**II**), and CH_2O in hot aq. EtOH (22% yield) or from α-$C_{10}H_7$·NH·CHO (**III**) and (**II**) in EtOH at room temp. (42% yield) and, when melted with Cu-bronze, gives 3-*phenyl*-7 : 8-*benzquinoline*, m.p. 106—108°. (**I**) and (**II**) with MeCHO in hot EtOH or PhCHO in hot AcOH gives 3-*phenyl*-2-*methyl*-, m.p. 292°, and 2 : 3-*diphenyl*-7 : 8-*benzcinchonic acid*, m.p. 271°, respectively, and thence 2 : 3-*diphenyl*-7 : 8-*benzquinoline*, m.p. 144°. Ph·$[CH_2]_2$·CO·CO_2H (**IV**), (**I**), and PhCHO in EtOH give 2-*phenyl*-3-*benzyl*-7 : 8-*benzcinchonic acid* (**V**), m.p. 278° (decomp.), and thence 2-*phenyl*-3-*benzyl*-7 : 8-*benzquinoline*, m.p. 132—134°. α-Naphthisatin with $COMe_2$ and KOH in hot H_2O–EtOH gives 2-methyl-, m.p. 238°, and with COPhMe gives 2-phenyl-7 : 8-benzcinchonic acid, m.p. 288° (decomp.). β-$C_{10}H_7$·NH·CHO with (**II**) or (**IV**) in hot EtOH gives 3-phenyl-, decomp. 293° (and thence 3-phenyl-5 : 6-benzquinoline), and 3-*benzyl*-5 : 6-*benzcinchonic acid*, m.p. 256°, respectively. Ring-closure of the cinchonic acids by conc. H_2SO_4 at ~80° or by $SOCl_2$–$AlCl_3$–$PhNO_2$ gives *naphtho*-1′ : 2′-2 : 1-3-*azafluoren*-9-*one*, m.p. 287° (*oxime*, m.p. 281°), and its 4-*Me*, m.p. 231° (*oxime*, m.p. 278°), and 4-*Ph* derivative, m.p. 267° (*oxime*, m.p. 269°), reduced by $N_2H_4.H_2O$ at 180—190° to *naphtho*-1′ : 2′-2 : 1-3-*azafluorene*, m.p. 223°, and its 4-*Me*, m.p. 163°, and 4-*Ph* derivative, m.p. 189—190°, respectively. 3-Phenyl-2-benzyl-7 : 8-benzcinchonic acid could not be obtained, nor could (**V**) be cyclised.

R. S. C.

Hydantoins.—See B., 1943, II, 342.

Barbituric acids.—See B., 1943, III, 280.

Many-membered cyclic compounds. XI. *cyclo***Dioctamethylenedi-imine (1 : 10-diaza***cyclo***octadecane).** A. Müller and L. Kindlmann (*Ber.*, 1941, **74**, [*B*], 416—422).—Sebacamide is converted (Hofmann) into $[CH_2]_8(NH_2)_2$ (**I**), the Bz_2 derivative, m.p. 173° (lit. 140°, 168·5°, 169·5°), of which with PBr_5 gives $[CH_2]_8Br_2$ (**II**), b.p. 140—142°/13 mm. (not obtained from Ag sebacate and Br). Very dil. solutions of (**I**) (as dihydrochloride), (**II**), and NaOH or Na_2CO_3 in 50% EtOH containing ~0·5% of light petroleum and N_2 give 9—17% of *cyclodioctamethylenedi-imine*, m.p. 55° (sealed tube) [*dihydrochloride*, darkens ~365° without melting; (*NO*)$_2$-derivative, m.p. 72°; *aurichloride*; *platinichloride*; *picrate*], when regenerated from its *di*-p-*toluenesulphonyl* derivative (**III**), m.p. 182°. αθ-*Di*-p-*toluenesulphonamido*-*octane*, m.p. 149°, and (**II**) added in successive portions to boiling C_5H_{11}·OH + K_2CO_3 give 30% of (**III**). The base slowly absorbs CO_2 from the air. M.p. are corr.

H. B.

Dipyrromethines.—See B., 1943, II, 313.

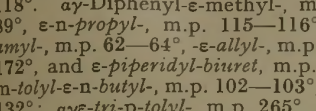
Diopsopyrroquinone. W. Siedel and F. Winkler (*Annalen*, 1943, **554**, 201—212).—5-Hydroxy-2 : 4-dimethyl-3-ethylpyrrole is oxidised by $Pb(OAc)_4$ (2 mols.) in AcOH at 100° to an oil (**I**) from which 4-*methyl*-2-*triacetoxymethyl*-3-*ethylpyrrolen*-5-*one* (**II**), m.p. 124°, separates; it is not obtained when 3 mols. of the oxidant are used. (**II**) requires 4 mols. of NaOH for neutralisation but the pyrrolenonecarboxylic acid cannot be isolated; in its place, *diopsopyrroquinone*, CMe:CEt>NH–CO / CO—NH>C:C<CEt:CMe (**III**), m.p. >300°, is formed in small amount. This is also obtained as by-product in the prep. of 5-methoxy-3-methyl-4-ethylpyrrole from 5-bromo-3-methyl-4-ethylpyrrole-2-carboxylic acid, its origin being due to the oxidation of an accompanying impurity, possibly 2 : 5-dihydroxyopsopyrrole. (**III**) is stable towards H_2O, acids, and alkalis, relatively stable towards heat. A quinhydrone could not be produced. The yellow colour of (**III**) is discharged by addition of 1 mol. of H_2 probably owing to destruction of conjugation by saturation of the linking joining the two nuclei. (**III**) is oxidised by HNO_3 to methylethylmaleimide (**IV**). The portion of (**I**) which remains liquid consists mainly of (**IV**). Alkaline hydrolysis of (**II**) in presence of H_2O_2 gives (**IV**). *Cryptopyrryl formate*, b.p. 135—150°/11 mm., gives only ill-defined oils when oxidised. Boiling MeOH–H_2O (1 : 1) appears to convert (**II**) into 4-*methyl*-2-*diacetoxymethoxymethyl*-3-*ethylpyrrolen*-5-*one*, m.p. 150—156°, whilst KOH–MeOH gives 1-*methoxy*-4-*methyl*-2-*dimethoxymethylene*-3-*ethylpyrrolen*-5-*one*, sublimes at 220°.

R. S. C.

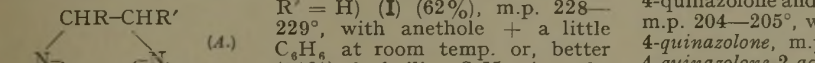
Formation and properties of uretediones. L. C. Raiford and H. B. Freyermuth (*J. Org. Chem.*, 1943, **8**, 230—238).—Uretediones are obtained by adding PEt_3 to the liquid carbimide under N_2 at room temp., or by adding the catalyst to the molten carbimide or to a solution of it in dioxan. 1-p-*Chlorophenyl*-3-p′-*tolyl*-, m.p. 195°, 1 : 3-*di*-1′-*naphthyl*-, sublimes at 296°, and 1 : 3-*di*-2′-*naphthyl*-

uretedione, incipient decomp. ~220°, are described. 1 : 3-*Diphenyluretediones* with substituents in Ph are obtained as follows, the yields being placed in parentheses: *di*-3′-*methyl*- (67), m.p. 159—160°; *di*-4′-*methyl*- (70), m.p. 185°; *di*-4′-*ethoxy*- (**I**) (95°), m.p. 181—182°; *di*-2-*chloro*- (37), m.p. 234—235°; *di*-3′-*chloro*- (72), m.p. 153—154°; *di*-4′-*chloro*-, (85), m.p. 155—156°; *di*-4′-*bromo*- (87), m.p. 203—204°; *di*-4′-*nitro*- (67), sublimes at 300°; *di*-4-*phenyl*- (38), m.p. 270° (decomp.); *di*-4′-*benzeneazo*- (nearly quant.), m.p. 281—282° (decomp.). (**I**) is hydrolysed by boiling KOH–EtOH to $CO(NH{\cdot}C_6H_4{\cdot}OEt)_2$-*p*. The biurets are usually obtained from the uretedione and two mol. proportions of the requisite amine in boiling EtOH. *αγ*-*Di*-2′-*naphthyl*-ε-n-*butylbiuret* has m.p. 117—118°. *αγ*-Diphenyl-ε-methyl-, m.p. 144—145°, -ε-*ethyl*-, m.p. 88—89°, ε-n-*propyl*-, m.p. 115—116°, -ε-n-*butyl*-, m.p. 79—80°, -ε-iso-*amyl*-, m.p. 62—64°, -ε-*allyl*-, m.p. 94—95°, -εε′-ethylene-, m.p. 171—172°, and ε-*piperidyl*-*biuret*, m.p. 135—136°, are described. *αγ*-*Di*-m-*tolyl*-ε-n-*butyl*-, m.p. 102—103°, *αγ*-*di*-p-*tolyl*-ε-n-*butyl*-, m.p. 131—132°; *αγε*-*tri*-p-*tolyl*-, m.p. 265°, *αγ*-*di*-p-*ethoxyphenyl*-ε-*methyl*-, m.p. 110—111°, *αγ*-*di*-m-*chlorophenyl*-ε-n-*butyl*-, m.p. 119—120°, *αγ*-*di*-p-*chlorophenyl*-ε-n-*butyl*-, m.p. 104—105°, and *αγ*-*di*-p-*bromophenyl*-ε-n-*butyl*-*biuret*, m.p. 118—120°, have been prepared. Successive treatments of p-$NH_2{\cdot}C_6H_4{\cdot}N_2Ph$ in PhMe with dry HCl and $COCl_2$ lead to $CO(NH{\cdot}C_6H_4{\cdot}N_2Ph)_2$, m.p. 270° (decomp.), and p-*benzeneazophenylcarbimide*, m.p. 94—95°. N-*Phenyl*-N′-n-*butylcarbamide* has m.p. 129—130°. H. W.

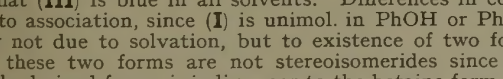
Indigo dyes of the *cis*-series. R. Pummerer and H. Fiesselmann [with O. Müller] (*Annalen*, 1940, **544**, 206—239).—Dehydroindigo does not react with $(CH{\cdot}CO)_2O$ alone at the m.p. or in boiling C_6H_6, $CH_2{:}CH{\cdot}CN$, $CH_2{:}CH{\cdot}CHO$, $CHCl{:}CH{\cdot}OAc$, $CH_2{:}CH{\cdot}CH_2{\cdot}CNS$, indene, dimethylfulvene, *cyclo*pentadiene, or *cyclo*hexene at 100°. It decomposes in boiling PhMe. It adds to styrene at 100° (exothermal; rising to 130—140°) to give a *compound* (*A*; R = Ph, R′ = H) (**I**) (62%), m.p. 228—229°, with anethole + a little C_6H_6 at room temp. or, better (84%), in boiling C_6H_6 gives the *compound* (*A*; R = *p*-$C_6H_4{\cdot}OMe$, R′ = Me) (**II**), m.p. 164—165°,



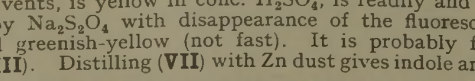
with safrole + some C_6H_6 at room temp. gives the *compound* (*A*; R = 3 : 4 : 1-CH_2O_2:$C_6H_3{\cdot}CH_2$, R′ = H) (**III**), with *iso*safrole + some C_6H_6 at the b.p. gives the *compound* (*A*; R = 3 : 4 : 1-CH_2O_2:C_6H_3, R′ = Me), and with *iso*eugenol Me ether at 100° gives the *compound* (*A*; R = 4 : 3 : 1-$OH{\cdot}C_6H_3{\cdot}OMe$, R′ = Me) (**IV**). The solid products are lighter than indigo; they are blue in alcohols, phenols, or AcOH, but dark red in C_6H_6, PhCl, CCl_4, or other non-polar solvents, except that (**III**) is blue in all solvents. Differences in colour are not due to association, since (**I**) is unimol. in PhOH or PhCl; it is probably not due to solvation, but to existence of two forms (cf. below); these two forms are not stereoisomerides since (*A*) are necessarily derived from *cis*-indigo, nor to the betaine form of Kuhn (*Naturwiss.*, 1932, **20**, 618). (**III**) differs because the Ph is separated from the ring by CH_2 and resembles rather *NN*′-diethylindigo. Structures are proved as follows. Conc. HNO_3–AcOH or CrO_3–AcOH oxidises (**I**) to "*styrenedi-isatin*" (**V**) (73%), m.p. 175° (*di*-



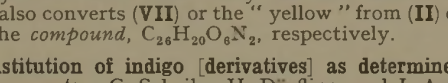
phenylhydrazone, m.p. 224°), which couples with hydroxythionaphthen to give the *substance*, $C_{40}H_{24}O_4N_2S_2$, m.p. 159—160° after sintering. (**II**) with HNO_3–AcOH gives similarly "*anetholedi-isatin*," m.p. 272—275°. With alkaline H_2O_2 at 100° (**V**) gives "*styrenedianthranilic acid*," *o*-$CO_2H{\cdot}C_6H_4{\cdot}NH{\cdot}CH_2{\cdot}CHPh{\cdot}NH{\cdot}C_6H_4{\cdot}CO_2H$-*o* (**VI**) (89%), m.p. 214—215° (blue fluorescence in EtOH or Et_2O, not in H_2SO_4), which in boiling Ac_2O gives 1-*acetyl*-2′-*phenylindigotin* (yellowish-green fluorescence in conc. H_2SO_4, not in Et_2O or EtOH; sol. in hot KOH–MeOH by enolisation). In boiling NaOH–, KOH–, or $Ba(OH)_2$–EtOH, or slower, aq. NaOH, KOH, $Ba(OH)_2$, Na_2CO_3, or Na_2HPO_4, (**I**) gives "*styreneindigo yellow*" (**VII**) (85%), sinters at 205°, m.p. 210° [*Ac* derivative, m.p. 189°



(decomp.)]. Similar *dyes* are obtained from (**II**), (**III**), and (**IV**) (product has m.p. 220—230°). (**VII**) is sol. in $NaHCO_3$ etc., fluoresces in org. solvents, is yellow in conc. H_2SO_4, is readily and reversibly reduced by $Na_2S_2O_4$ with disappearance of the fluorescence, and dyes wool greenish-yellow (not fast). It is probably formed by way of (**VIII**). Distilling (**VII**) with Zn dust gives indole and NH_2Ph.

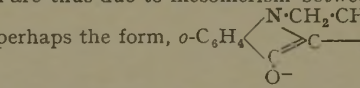


Conc. HNO_3, CrO_3, or PbO_2 in AcOH, aq. alkaline $KMnO_4$ or $K_3Fe(CN)_6$ converts (**VII**) into the *compound* (**IX**) (72—86%), m.p. 185—187° (2 : 4-*dinitrophenylhydrazone*), which neutralises 2 NaOH



rapidly and a third mol. slowly and with alkaline H_2O_2 gives (**VI**). H_2O_2 also converts (**VII**) or the "yellow" from (**II**) directly into (**VI**) and the *compound*, $C_{26}H_{20}O_6N_2$, respectively. R. S. C.

Constitution of indigo [derivatives] as determined by absorption measurements. G. Scheibe, H. Dörfling, and J. Assmann (*Annalen*, 1940, **544**, 240—253).—The absorption spectra of the adducts of dehydroindigo with styrene or anethole (cf. preceding abstract) in CCl_4, C_6H_6, *iso*-$C_5H_{11}{\cdot}OH$, EtOH, MeOH, and NH_2Ph differ only in the position of the max. and differ only in this way from that of indigotin in CCl_4, C_6H_6, *iso*-$C_5H_{11}{\cdot}OH$, or NH_2Ph. The blue and red colours are not due to *cis–trans* isomerism since the adducts are *cis*-compounds. Distribution of the anethole adduct between aq. MeOH and C_6H_6 or CCl_4 precludes association in either solvent. Addition of *iso*-$C_5H_{11}{\cdot}OH$ to the CCl_4 solution causes changes in the absorption of the styrene adduct which are incompatible with the existence of different compounds in the two solvents. Variations in colour and absorption are thus due to mesomerism between (*A*; preceding abstract) and perhaps the form,



The safrole adduct and *NN*′-diethylindigo differ somewhat from the above compounds, but the causes are somewhat obscure. R. S. C.

Condensation of chloral with 2-methyl-4-quinazolone, 2-methyl-3-amino-4-quinazolone, and some of their derivatives. P. Y. Kulkarni (*J. Indian Chem. Soc.*, 1942, **19**, 180—182).—2-Methyl-4-quinazolone and chloral (hot) yield 2-*γγγ*-*trichloro*-*β*-*hydroxypropyl*-, m.p. 204—205°, which with Ac_2O yields 2-*γγγ*-*trichloro*-Δ^{α}-*propenyl*-4-*quinazolone*, m.p. 212°, and with 10% aq. NaOH at 60° gives 4-*quinazolone*-2-*acrylic acid*, m.p. 262—263°. Similarly 3-amino- yields 3-*βββ*-trichloro-α-hydroxyethylamino-, m.p. 151—152°, dehydrated (AcCl in C_5H_5N) to 3-*βββ*-*trichloroethylideneamino*-2-*methyl*-4-*quinazolone*, m.p. 104—105°. A. Li.

Polynuclear condensed systems with heterocyclic rings. VIII. Diazaphenanthrenecarboxylic acids and diazaphenanthrenes. W. Borsche and M. Wagner-Roemmich (*Annalen*, 1940, **544**, 280—286). —Aminoquinolines, RCHO, and $CH_2R{\cdot}CO{\cdot}CO_2H$ give sometimes diketopyrrolidines and sometimes diazaphenanthrenes. 3-Aminoquinoline, PhCHO, and $CH_2Ph{\cdot}CO{\cdot}CO_2H$ (**I**) in EtOH at 100° give 4 : 5-*diketo*-2 : 3-*diphenyl*-1-3′-*quinolylpyrrolidine*, m.p. 269—270°. 5-Aminoquinoline (**II**) (prep. from the NO_2-compound by H_2–Pd–C in AcOH), b.p. 183—187°/16 mm., with PhCHO and (**I**) or $Ph{\cdot}[CH_2]_2{\cdot}CO{\cdot}CO_2H$ (**III**) gives 4 : 5-*diketo*-2 : 3-*diphenyl*-, m.p. 186°, and -2-phenyl-3-benzyl- (*picrate*, m.p. 252°), -1-5′-quinolylpyrrolidine, respectively. 6-Aminoquinoline (**IV**) (prep. from p-$NO_2{\cdot}C_6H_4{\cdot}NH_2$ by a Skraup reaction and subsequent hydrogenation; >90% yield), m.p. 116°, b.p. 192—195°/14 mm., with MeCHO and (**I**) at the b.p. (2 days) gives mainly 4 : 5-*diketo*-3-*phenyl*-1-6′-*quinolyl*-2-*methylpyrrolidine*, m.p. 203°, and ~10% of 3-*phenyl*-2-*methyl*-1 : 8-*diazaphenanthrene*-4-*carboxylic acid*, m.p. 288° (with loss of CO_2 to yield 3-*phenyl*-2-*methyl*-1 : 8-*diazaphenanthrene*, m.p. 144°), but with PhCHO and (**I**) in AcOH at 100° or (**III**) in hot EtOH, (**IV**) gives 2 : 3-*diphenyl*- (**V**) (55%), m.p. 278°, and 2-*phenyl*-3-*benzyl*-1 : 8-*diazaphenanthrene*-4-*carboxylic acid* (good yield), m.p. 272°, respectively, decarboxylated by Cu-bronze at the m.p. to 2 : 3-*diphenyl*-, m.p. 242—243°, and 2-*phenyl*-3-*benzyl*-1 : 8-*diazaphenanthrene*, m.p. 98°, respectively. 8-Aminoquinoline, b.p. 150—154°/16 mm., is obtained from the 5-NO_2-compound by H_2–Pd–C in AcOH or from 8-hydroxyquinoline and $CaCl_2,8NH_3$ at 220—230° and later 280—290°, and with PhCHO and (**I**) gives 2 : 3-*diphenyl*-4 : 5-*diazaphenanthrene*-1-*carboxylic acid*, m.p. 260—262°. 5-Amino-*iso*quinoline with hot PhCHO and (**I**) gives, in 1—2 days, 2 : 3-*diphenyl*-4 : 7-*diazaphenanthrene*-1-*carboxylic acid*, m.p. 237°, and thence 2 : 3-*diphenyl*-4 : 7-*diazaphenanthrene*, m.p. 263—264°. When heated for 1 day with $SOCl_2$ and then $AlCl_3$ in $PhNO_2$ at 50° or conc. H_2SO_4 at 100°, (**V**) gives 4-*phenylquinolino*-5′ : 6′-1 : 2-3-*azafluoren*-9-*one*, m.p. 242° (*oxime*, m.p. 213°), but ring-closure of the other acids could not be achieved. R. S. C.

Polynuclear condensed systems with heterocyclic rings. IX. 7-Aminoquinolines and 1 : 5-diazaphenanthrene-4-carboxylic acids. W. Borsche and M. Wagner-Roemmich (*Annalen*, 1940, **544**, 287—300).—*m*-$NH_2{\cdot}C_6H_4{\cdot}OH$ (**I**) with $CH_2Ph{\cdot}CO{\cdot}CO_2H$ (**II**) and PrCHO in hot EtOH gives 7-*hydroxy*-2-n-*propylcinchonic acid*, which at the m.p. (302°) gives CO_2 and 7-*hydroxy*-2-n-*propylquinoline* (**III**), m.p. 132°. Use of other appropriate aldehydes gives 7-*hydroxy*-3-*phenyl*-2-*methyl*-, m.p. 323° (decomp.), 7-*hydroxy*-2 : 3-*diphenyl*- (20%), m.p. 313°, and 7-*hydroxy*-2-2′-*furyl*-*cinchonic acid* (~50%), m.p. 311—312°, and thence 7-*hydroxy*-3-*phenyl*-2-*methyl*-, m.p. 258°, 7-*hydroxy*-2 : 3-*diphenyl*-, m.p. 277°, and 7-*hydroxy*-2-2′-*furyl*-*quinoline*, m.p. 265—266°. $Ph{\cdot}[CH_2]_2{\cdot}CO{\cdot}CO_2H$ (**IV**), (**I**), and MeCHO or PhCHO in hot EtOH give 7-*hydroxy*-3-*benzyl*-2-*methyl*- (50%), m.p. 307—

309° (decomp.), and 7-*hydroxy*-2-*phenyl*-3-*benzyl*-*cinchonic acid*, decomp. 327°, and thence 7-*hydroxy*-2-*phenyl*-3-*benzylquinoline*, m.p. 274°. With $CaCl_2,8NH_3$, (**II**) at 250° and then ~270° gives 7-*amino*-2-n-*propylquinoline*, m.p. 98° (picrate, m.p. 204°). 7-*Hydroxy*-2-*phenylquinoline* (acetate, m.p. 115°; *benzoate*, m.p. 123°; 8-PhN_2-derivative, m.p. 197°; with $NaNO_2$–AcOH gives 2-*phenylquinoline*-7 : 8-*quinone*-8-*oxime*, m.p. 191°) with $CaCl_2,8NH_3$ at 250° and then 280—290° gives 7-*amino*-2-*phenylquinoline* (**V**) (~80%), m.p. 134° (*picrate*, m.p. 216°; *Bz* derivative, m.p. 222°; *azo*-dye, m.p. 233—234°, from 2 : 1-OH·$C_{10}H_6$·N_2Cl); 7-hydroxy- gives similarly 7-*amino*-2-*phenylcinchonic acid* (*hydrochloride*, $+2H_2O$, m.p. ~166°), converted at the m.p. (274°) into CO_2 and (**IV**). 2 : 4 : 1-$(NO_2)_2C_6H_3$·CH:CH·CO_2H (*anilide*, m.p. 222°) with $SOCl_2$–C_6H_6 and then $AlCl_3$ at 40—50° gives 2 : 4-*dinitrobenzylideneacetophenone*, m.p. 151°, which with $SnCl_2$–HCl–AcOH gives exothermally the salt, (**V**),$SnCl_2$,HCl. With PhCHO and $AcCO_2H$ at 100° (1 day), (**V**) gives 2 : 6-*diphenyl*-1 : 5-*diazaphenanthrene*-4-*carboxylic acid*, m.p. 268°, decarboxylated by Cu-bronze to give 2 : 6-*diphenyl*-1 : 5-*diazaphenanthrene*, m.p. 164° (*picrate*, m.p. 233—234°); use of (**II**) or (**IV**) gives 2 : 3 : 6-*triphenyl*-, m.p. 275° (decomp.), and 2 : 6-*diphenyl*-3-*benzyl*-1 : 5-*diazaphenanthrene*-4-*carboxylic acid*, m.p. 273° (decomp.), respectively, and thence 2 : 6-*diphenyl*-3-*benzyl*-1 : 5-*diazaphenanthrene*, m.p. 177°. *m*-NH_2·C_6H_4·OMe (modified prep.), b.p. 125—127°/13 mm., with $AcCO_2H$–paraldehyde or –PhCHO gives 7-*methoxy*-2-*methyl*-, m.p. 303°, and -2-*phenyl*-, m.p. 237—238°, respectively, with (**II**)–MeCHO or –PhCHO gives 7-*methoxy*-3-*phenyl*-2-*methyl*- (**VI**), m.p. 323°, and -2 : 3-*diphenyl*- (**VII**), m.p. 276—278°, and with (**IV**)–PhCHO–EtOH gives 7-*methoxy*-2-*phenyl*-3-*benzyl*-*cinchonic acid* (**VIII**), m.p. 295°. Decarboxylation by Cu powder gives 7-*methoxy*--2-*phenyl*-, m.p. 127—128° (*picrate*, m.p. 186—187°), -2 : 3-*diphenyl*-, m.p. 149°, and -2-*phenyl*-3-*benzyl*-*quinoline*, m.p. 129°. Cyclisation of (**VI**) and (**VII**) by $COCl_2$ and then $AlCl_3$ in $PhNO_2$ gives 9-*keto*-4-*methyl*-, m.p. 213° (*oxime*, m.p. 298°), and -4-*phenyl*-1 : 2-4′-*methoxybenzo*-3-*azafluorene* (~85%), m.p. 213°, but that of (**VIII**) failed.

R. S. C.

New therapeutic agents of the quinoline series. I. Monopyridylquinolines. H. Coates, A. H. Cook, I. M. Heilbron, D. H. Hey, A. Lambert, and (in part) F. B. Lewis. **II. Dipyridylquinolines.** A. H. Cook, I. M. Heilbron, D. H. Hey, A. Lambert, and (in part) A. Spinks. **III. Methoxy-, hydroxy-, and alkyl-pyridylquinolines.** H. Coates, A. H. Cook, I. M. Heilbron, D. H. Hey, A. Lambert, and (in part) F. B. Lewis. **IV. Lutidylquinolines.** A. H. Cook, I. M. Heilbron, and L. Steger. **V. Pyridylacridines.** A. H. Cook, I. M. Heilbron, and A. Spinks. **VI. Quinolyl-thiazoles, -amidines, and -pyrroles.** H. Coates, A. H. Cook, I. M. Heilbron, and F. B. Lewis (*J.C.S.*, 1943, 401—404, 404—406, 406—413, 413—417, 417—419, 419—420).—I. Existing spasmolytics are briefly reviewed, and their relation to the present series is indicated. The variation of antispasmodic action with changing orientation and substitution among pyridylquinolines and related compounds is described. Diazotised 3-aminoquinoline and C_5H_5N give a mixture from which can be separated, through the picrates, 3-2′-*pyridylquinoline*, m.p. 101·5° (*picrate*, m.p. 227—229°), and an *isomeride*, m.p. 123° [*picrate*, m.p. 196° (decomp.)]. 2-*p*-Aminophenylpyridine undergoes the Skraup reaction to a mixture of 5-, m.p. 88—89°, and 7-2′-*pyridylquinolines*, m.p. 87—88°. 2-p-Aminophenylpyridine is similarly converted into 6-2′-*pyridylquinoline*, m.p. 82—83°, whilst 6-3′-, m.p. 32—34° (*dipicrate*, m.p. 249—250°), and 6-4′-*derivatives*, m.p. 104—105°, are obtained from the corresponding NH_2-compounds. Addition of C_5H_5N to the diazotised base from the reduction of 8-nitroquinoline leads to a mixture of 8-2′-, m.p. 74—76° [*picrate*, m.p. 209—210°, *styphnate*, m.p. 181·5—182·5° (decomp.)], 8-3′-, m.p. 111—112° (*picrate*, m.p. 226°), and 8-4′-*pyridylquinoline*, m.p. 127° [*picrate*, m.p. 238—240° (decomp.)]. The constitution follows from the prep. of the 2′- and 3′-compounds from the 2- and 3-*o*-aminophenylpyridines by the Skraup reaction.

II. Nitration of 2-*p*-acetamidophenylpyridine gives the -3-NO_2-compound, m.p. 142—143°, hydrolysed (NaOH) to 2-3′-*nitro*-4′-*aminophenylpyridine*, m.p. 148—149°. This undergoes the Skraup reaction to 8-*nitro*-6-2′-*pyridylquinoline*, m.p. 123—124°; reduced (Fe–HCl) to the 8-NH_2-derivative, m.p. 125—126°, which after diazotisation and treatment with C_5H_5N gives 6-2′-*pyridyl*-8-2′-(3′ and 4′)-*pyridylquinoline*, m.p. 118—121°. 2-3′ : 4′-*Diaminophenylpyridine*, m.p. 126—126·5°, by reduction of the NO_2-compound, with benzil gives 2 : 3-*diphenyl*-6-2′-*pyridylquinoxaline*, m.p. 198—199°. The diazotised mixture of 3-aminophenylpyridines with C_5H_5N affords 1 : 3-dipyridylbenzenes the *dinitrate*, m.p. 110—120°, of which with hot H_2SO_4 gives 4-*nitro*-1 : 3-*dipyridylbenzenes*, m.p. 137—140°. This mixture after reduction undergoes the Skraup reaction (*m*-NO_2·C_6H_4·SO_3Na) to 6 : 8-*dipyridylquinolines*, m.p. 152—156°. *p*-Aminophenylpyridine is converted similarly into dipyridylbenzene, which is nitrated to 2 : 5-dipyridylnitrobenzene. On reduction ($SnCl_2$–HCl), this affords 2 : 5-dipyridylaniline, converted (Skraup) into mixed 5 : 8-dipyridylquinolines, containing a fraction, m.p. 167°.

III. 2-3′-*Amino*-4′-*methoxyphenylpyridine*, m.p. 98° (*Ac* derivative, m.p. 171—172°), prepared from the corresponding NO_2-derivative, is converted (Skraup reaction) into 8-*methoxy*-5-2′-*pyridylquinoline*, m.p. 115—116° [*picrate*, m.p. 196—198° (decomp.)]. 2-3′-Amino-6′-methoxyphenylpyridine (*Ac* derivative, m.p. 168—169°). similarly gives 6-*methoxy*-5(or 7)-, m.p. 100—101° (*picrate*, decomp. 222°), and -7(or 5)-2′-*pyridylquinoline*, m.p. 95° [*picrate*, m.p. 215—216° (decomp.)]. Diazotised 5-amino-6-methoxyquinoline with $NPhMe_2$ affords a *triazen*, $C_{12}H_{14}ON_4$, m.p. 82—83°. Diazotised 8-amino-6-methoxyquinoline with C_5H_5N yields a mixture of 6-*methoxy*-8-2′- (**I**), m.p. 106—107° (*picrate*, m.p. 247—248°), -3′- (**II**), m.p. 100° (*picrate*, m.p. 243—244°), and -4′-*pyridylquinoline*, m.p. 146° [*picrate*, m.p. 260° (decomp.)]. Nitration (HNO_3–AcOH) and treatment with picric acid of 2-*m*-methoxyphenylpyridine gives in poor yield 2-2′-*nitro*-5′-*methoxyphenylpyridine picrate*, m.p. 190—191°, and two unidentified *isomerides*, m.p. 155—156°, and 273°. Diazotised 4-nitro-*m*-anisidine with C_5H_5N affords a mixture of 3-, m.p. 91—92° (*picrate*, m.p. 202—204°), and 2-2′-*nitro*-5′-*methoxypyridine*, m.p. 76°, which are reduced respectively to 3- (**III**), m.p. 131—132° (deaminated to 3-m-*methoxyphenylpyridine picrate*, m.p. 160—162°), and 2-2′-amino-5′-methoxyphenylpyridine (**IV**) (*picrate*, m.p. 193—194°). 4-m-*Hydroxyphenylpyridine*, m.p. 227—228°, is prepared by boiling the diazo-solution from the 4-*m*-NH_2-compound. The Skraup reaction on (**III**) and (**IV**) gives (**II**) and (**I**) respectively, thus confirming the identities. *o*-$C_6H_4(CO)_2O$ and 3-nitro-*p*-anisidine yield *phthalo*-3-*nitro*-p-*anisidide*, m.p. 150°; reduced (Fe–HCl) to the -3-NH_2-compound, m.p. 188°, the diazo-solution from which with C_5H_5N forms (**IV**), identified through the picrate. Nitration of (**I**) affords the 5-NO_2-derivative, m.p. 192—193°, which is reduced (Fe–HCl) to the 5-NH_2-compound, m.p. 124—125°. 2-, 3-, and 4-*p*-Aminophenylpyridine when heated with paraldehyde give respectively 6-2′-, m.p. 106—107°, -3′-, m.p. 65—66°, and -4′-*pyridylquinaldine*, m.p. 186°, whilst the 2′- and 3′-compounds with $AcCO_2H$ afford 2-*phenyl*-6-2′-, m.p. 287—288° (decomp.), and -3′-*pyridylquinoline*-4-*carboxylic acid*, m.p. 301° (decomp.). Diazotised 2 : 1 : 4-NO_2·$C_6H_3Bu^{\gamma}$·NH_2 with C_5H_5N forms a mixture of 3-nitro-4-*tert*.-butylpyridylbenzenes, isolated as *picrates* A (3- ?), m.p. 217—218°, B (4- ?), m.p. 231° (decomp.), and C (2- ?), m.p. 160°, from which the 3-(?)*isomeride* of the base has been liberated of b.p. 130°/high vac. Diazotised 3 : 1 : 4-NO_2·$C_6H_3Bu^{\gamma}$·NH_2 with C_5H_5N gives 2-*nitro*-4-tert.-*butylpyridylbenzene*, b.p. 170—190°/0·05 mm., reduced ($SnCl_2$–HCl) to the 2-NH_2-compound, b.p. 136—141°/0·02 mm., which undergoes the Skraup reaction to 8-*pyridyl*-5-tert.-*butylquinoline*, b.p. 120°/high vac. 2-3′-Nitro-4′-aminophenylpyridine boiled with KOH gives the -4-*OH*-compound, m.p. 125°, reduced to the 2-3′-*amino*-4′-*hydroxy*-derivative, m.p. 166—167°. This compound undergoes the Skraup reaction to form 8-*hydroxy*-5-2′-*pyridylquinoline*, m.p. 133·5—134°, which with CH_2N_2 affords a *substance*, m.p. >250°. Nitration of 3-*p*-acetamidophenylpyridine leads to the -3-NO_2-derivative, m.p. 169° (decomp.), hydrolysed (KOH) to 3-3′-*nitro*-4′-*aminophenylpyridine*, m.p. 176—177°. Reduction (PtO_2–H_2) of this compound gives 3-3′ : 4′-*diaminophenylpyridine*, m.p. 122—123°, which with glyoxal forms 6-3′-*pyridylquinoxaline*, m.p. 144—145°, with benzil yields 6-3′-*pyridyl*-2 : 3-*diphenylquinoxaline*, m.p. 194·5—196·5°, and with isatin forms two *products*, $C_{19}H_{12}N_4$, m.p. 275—276°, and 307—308° (decomp.). The appropriate pyridylaniline with CH_2Ac·CO_2Et affords 3-, m.p. 154·5°, and 4-4′-*pyridylacetoacetanilide*, m.p. 136°, which, after heating and successive treatments with HCl and aq. NH_3 gives s-*bis*-2-4′-*pyridylphenylcarbamide*, m.p. 278° (decomp.).

IV. Quinoline-2-aldehyde with NH_2·CMe:CH·CO_2Et gives *Et* 4-2′-*quinolyl*-2 : 6-*dimethyldihydropyridine*-3 : 5-*dicarboxylate*, m.p. 190°, converted by HNO_3 into the -*dimethylpyridine*-3 : 5-*dicarboxylate*, m.p. 91°, of which the Ag salt affords on heating 2-*lutidylquinoline*, m.p. 135° [*picrate*, m.p. 230° (decomp.)]. Quinoline-3-carboxylic ester and N_2H_4,H_2O yield *quinoline*-3-*carboxyhydrazide*, m.p. 190°, converted through the p-*toluenesulphonyl* derivative, m.p. 232° (decomp.), into *quinoline*-3-*aldehyde*, m.p. 70°. With CH_2Ac·CO_2Et, this aldehyde gives Et 4-3′-*quinolyl*-2 : 6-*dimethyldihydro*-, m.p. 193°, converted similarly into the -*dimethyl*-*pyridine*-3 : 5-*dicarboxylate*, m.p. 77°, and 3-*lutidylquinoline*, m.p. 100°. Quinoline-4-aldehyde similarly yields *Et* 4-4′-*quinolyl*-2 : 6-*dimethyldihydro*-, m.p. 200°, -*dimethyl*-*pyridine*-3 : 5-*dicarboxylate*, m.p. 122°, and 4-*lutidylquinoline*, m.p. 122°. *Et quinoline*-5-*carboxylate*, b.p. 190—192°/15 mm., m.p. 10°, from the corresponding acid, is converted through the p-*toluenesulphonyl* derivative of the hydrazide, m.p. 200°, into *quinoline*-5-*aldehyde*, m.p. 96°. This undergoes the same reactions to give *Et* 4-5′-*quinolyl*-2 : 6-*dimethyldihydro*-, m.p. 201°, -*dimethyl*-*pyridine*-3 : 5-*dicarboxylate*, m.p. 79°, and 5-2′ : 6′-*lutidylquinoline*, m.p. 151° (*picrate*, m.p. 231—234°). *Et*$_2$ 4-p-*nitrophenyl*-2 : 6-*dimethylpyridine*-3 : 5-*dicarboxylate*, m.p. 115°, from the corresponding H_2-ester, is reduced (Sn–HCl) to the -NH_2-*ester*, m.p. 145°, from which the free acid is decarboxylated to 4-p-*aminophenyl*-2 : 6-*dimethylpyridine*, m.p. 131°, converted (Skraup) into 6-*lutidylquinoline* (**V**), m.p. 84° (*picrate*, m.p. 224—225°). Et quinoline-6-carboxylate is converted through the p-*toluenesulphonyl* derivative of the hydrazide, m.p. 218° (decomp.), into quinoline-6-aldehyde, which forms successively *Et*$_2$ 4-6′-*quinolyl*-2 : 6-*dimethyldihydro*-, m.p. 209°, -*dimethyl*-*pyridine*-3 : 5-*dicarboxylate*, m.p. 97°, and (**V**). 5-Acetamidoquinoline, through its NO-derivative, with 2 : 6-lutidine affords a mixture from which can be separated 6-3′-2′ : 6′-*dimethylpyridylquinoline*, m.p. 68° [*picrate*, m.p. ~243°

(decomp.)]. *m*-Aminophenyl-lutidine, m.p. 117° (lit. 110°), by the Skraup reaction forms a mixture of 7-, m.p. 125° (*picrate*, m.p. 223°), and 5-*lutidylquinoline*, m.p. 151° (*picrate*, m.p. 231—234°). *Et quinoline-8-carboxylate*, b.p. 194—197°/13 mm., from the acid, affords successively *quinoline-8-carboxyhydrazide*, m.p. 99°, and its p-*toluenesulphonyl* derivative, m.p. 187°, quinoline-8-aldehyde, Et_2 4-8′-*quinolyl*-2 : 6-*dimethyldihydro*-, m.p. 161°, and -*dimethylpyridine*-3 : 5-*dicarboxylate*, m.p. 80°, and 8-*lutidylquinoline*, m.p. 132°.

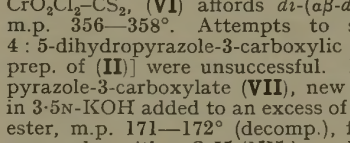
V. 2-*p*-Aminophenylpyridine with *o*-$C_6H_4Cl{\cdot}CO_2H$, K_2CO_3, and Cu in $C_5H_{11}{\cdot}OH$ gives 4-2″-*pyridyldiphenylamine*-2′-*carboxylic acid* (**V**), m.p. 198°, cyclised (H_2SO_4) to 3-2′-*pyridylacridone*, m.p. 315—317°, which is reduced (EtOH–Al–Hg) to the -*acridine*, m.p. 140°. A similar series of reactions affords 4-3″-, m.p. 248—250°, and 4-4″-*pyridyldiphenylamine*-2′-*carboxylic acid*, m.p. 244°, 3-3″-, m.p. 314—316°, and 3-4′-*pyridylacridone*, m.p. 343°, and 3-3′-, m.p. 132°, and 3-4′-*pyridylacridine*, m.p. 179°. 2-2″-*Pyridyldiphenylamine*-2′-*carboxylic acid*, m.p. 165—166°, yields successively 1-2′-*pyridyl*-*acridone*, m.p. 186—187°, and -*acridine*, m.p. 111·5°. Nicotinic acid and $NHPh_2$ with $ZnCl_2$ afford 5-3′-*pyridylacridine*, m.p. 118°. Diazotised $NHPh{\cdot}C_6H_4{\cdot}NH_2$-*p* with C_5H_5N gives only one, 4-2″-*pyridyldiphenylamine*, m.p. 133° (*picrate*, m.p. 196·5°), also obtained by decarboxylation of (**V**).

VI. 2-Cyanoquinoline with aq. NH_3 and H_2S gives *quinoline*-2-*thioamide*, m.p. 168—169°, which with $CH_2Br{\cdot}COMe$ affords 2-5′-*methyl*-2′-*thiazylquinoline*, m.p. 121·5—122·5°. Similarly, *quinoline*-3-, m.p. 197—198° (decomp.), -4-, m.p. 223° (decomp.), -5-, m.p. 187—188° (decomp.), -6-, m.p. 184—185° (decomp.), and -8-*thioamide*, m.p. 112—112·5° (decomp.), and 3-5′-, m.p. 118—118·5°, 4-5′-, m.p. 82·5—83·5°, 5-5′-, m.p. 97—98°, and 6-5′-*methyl*-2′-*thiazyl*-, m.p. 90·5—91·5°, and 8-2′-*thiazylquinoline*, m.p. 69—70°. Quinoline-2- [*picrate*, m.p. 258—259° (decomp.)], -3- [*hydrochloride*, m.p. 168—169° (decomp.)], and -6-amidine [*hydrochloride*, m.p. 242° (decomp.)] are prepared from the corresponding cyanoquinolines. The appropriate aminoquinolines with Et diacetylsuccinate in AcOH–EtOH afford *Et* 1-5′-*quinolyl*-, m.p. 99°, -6′-*quinolyl*-, m.p. 115°, -6′-*methoxy*-8′-*quinolyl*-, m.p. 141°, and -8′-*methoxy*-6′-*quinolyl*-2 : 5-*dimethylpyrrole*-3 : 4-*dicarboxylate*, m.p. 117°, and with $(CH_2Ac)_2$ yield 1-3′-*quinolyl*-, m.p. 167°, and 1-6′-*methoxy*-8′-*quinolyl*-2 : 5-*dimethylpyrrole*, m.p. 147°. F. R. S.

3 : 6-Diazacarbazole. E. Koenigs and P. L. Nantka (*Ber.*, 1941, **74**, [*B*], 215—217).—As 4-chloro-3-nitropyridine fails to undergo the Wurtz–Fittig reaction, 2 : 7-diazacarbazole was not accessible from the anticipated 3 : 3′-dinitro-4 : 4′-dipyridyl. When 4′-pyridyl-3 : 4-pyridotriazole (**I**) (A., 1933, 720) is added to paraffin oil at 280—290° (or syrupy H_3PO_4) and the mixture heated at 320°, the diacid base, 3 : 6-*diazacarbazole* (**II**), m.p. 328° (*dinitrate*, m.p. 275—276°; picrate, m.p. 310°; *methochloride*, m.p. 259—260°), is obtained in 60% yield. (**II**) does not give carbazole colour reactions and is inert towards Br, HNO_3, and $NaNH_2$ but adds Me_2SO_4 readily. Similarly, the 3′-NH_2-derivative of (**I**) affords 1-*amino*-3 : 6-*diazacarbazole*, m.p. >350° (nitrate, m.p. >350°; picrate, m.p. 283°), which can be diazotised and coupled with α-$C_{10}H_7{\cdot}OH$ to give a bluish-red colour J. Wa.

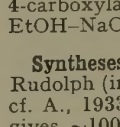
Flavazole, a new heterocyclic system from sugars. I. 1-Phenyl-3-(*d-erythro*trihydroxypropyl)flavazole. Constitution of the side-chain. H. Ohle and G. A. Melkonian (*Ber.*, 1941, **74**, [*B*], 279—291; cf. A., 1943, II, 309).—Pyrazolo-3′ : 4′-2 : 3-quinoxaline (**I**) is called "flavazole" and is numbered as shown. The substance $C_{18}H_{16}O_3N_4$ (**II**), obtained by the action of $NHPh{\cdot}NH_2$ and boiling dil. AcO*H* on 3-*d-arabo*tetrahydroxybutylquinoxaline, is shown to be 1-phenyl-3-(*d-erythro*trihydroxypropyl)flavazole and the mechanism of its formation is discussed. (**II**) (improved prep.), CPh_3Cl, and C_5H_5N give 1-phenyl-3-(3′-triphenylmethyl-*d-erythro*trihydroxypropyl)flavazole, m.p. 108—110° after regeneration from the *diacetate*, m.p. 163·5°, $[\alpha]_D^{19}$ +65·7° in $CHCl_3$. (**II**), $COMe_2$, and H_2SO_4 afford 1-*phenyl*-3-(2′ : 3′-iso*propylidene*-d-erythro*trihydroxypropyl*)*flavazole* (**III**), m.p. 147°, $[\alpha]_D^{18}$ +1·3° in $CHCl_3$. Benzoylation of (**III**) in C_5H_5N affords the 1′-*Bz* derivative (**IV**) of (**III**), m.p. 132—133°, $[\alpha]_D^{20}$ −35·4° in $CHCl_3$, and the isomeric 1-*phenyl*-3-(3′-*benzoyl*-1′ : 2′-iso*propylidene*-d-erythro*trihydroxypropyl*)*flavazole* (**V**), m.p. 161°, $[\alpha]_D^{25}$ +22·3° in $CHCl_3$. (**IV**), hydrolysed with AcOH, gives 1-*phenyl*-3-(1′-*benzoyl*-d-erythro*trihydroxypropyl*)-*flavazole* (**VI**), two forms, m.p. 183—184° and 175—177°, $[\alpha]_D^{21}$ +11·48° and ~+3° respectively; acyl migration is suspected to be the cause, but both forms regenerate (**V**) with $COMe_2$. The 1′ : 2′ : 3′-*Bz*$_3$ derivative of (**II**) has m.p. 155—155·5°, $[\alpha]_D^{18}$ −74·2° in $CHCl_3$. (**II**), BzCl, and C_5H_5N afford the 3′-*Bz* derivative (**VII**), m.p. 185—186°, $[\alpha]_D^{20}$ ~ −50° in C_5H_5N, and one other homogeneous *substance*, $C_{32}H_{24}O_5N_4$, presumably a *dibenzoate*, m.p. 159°. (**VII**) condenses with $COMe_2$ to give (**V**), which is hydrolysed (Zemplén) to 1-*phenyl*-3-(1′ : 2′-iso*propylidene*-d-erythro*trihydroxypropyl*)*flavazole*, m.p. 200—201°. (**VI**) with $Pb(OAc)_4$ in C_6H_6 gives 60% of the theoretical CH_2O and 65% of (1-*phenyl*-3-*flavazolyl*)-O-*benzoylglycollaldehyde*, m.p. 147°, $[\alpha]_D^{20}$ +101·1° in $CHCl_3$ [unstable *phenylhydrazone*, m.p. 124—125° $[\alpha]_D^{25}$ −20·8°; stable *phenylmethylhydrazone*, m.p. 110·5—111°, $[\alpha]_D^{26}$ −152·1° in $CHCl_3$; unstable 2 : 4-*dinitrophenylhydrazone*, m.p. 230° (decomp); *dihydrophenylmethylosazone*, m.p. 162—163°]. (**VII**) and $Pb(OAc)_4$ afford 1-*phenylflavazole*-3-*aldehyde* (**VIII**), m.p. 144° (red "*phenylhydrazone*," m.p. 196—197°, converted by acid into a violet-red *form*, m.p. 223°; 2 : 4-*dinitrophenylhydrazone*, m.p. 271—272°), and $OBz{\cdot}CH_2{\cdot}CHO$, isolated as the 2 : 4-dinitrophenylhydrazone, m.p. 185° (cf. A., 1943, II, 350). (**VIII**) may be obtained by direct $Pb(OAc)_4$ oxidation of (**II**). J. Wa.

Flavazole. II. Structure of the ring system. H. Ohle and G. A. Melkonian (*Ber.*, 1941, **74**, [*B*], 398—408).—Oxidation (CrO_3 in boiling AcOH) of 1-phenyl-3-αβγ-trihydroxypropylflavazole (**I**) or the 3-CHO derivative (preceding abstract) gives 65—70% of 1-*phenylflavazole*-3-*carboxylic acid* (**II**), m.p. 244° (decomp.) (*Et* ester, m.p. 168°), decarboxylated at 260° (bath)/vac. to 1-phenylflavazole (**III**), m.p. 152·5—153·5°. 4 : 5-Diketo-1-phenyl-4 : 5-dihydropyrazole, an oil [from 1-phenyl-5-pyrazolone and *p*-$NO{\cdot}C_6H_4{\cdot}NMe_2$ (**IV**) in aq. EtOH–Na_2CO_3 and subsequent hydrolysis (dil. H_2SO_4 + Et_2O)], and *o*-$C_6H_4(NH_2)_2$ in aq. EtOH–AcOH afford the 4-o-*aminoanilo*-derivative, m.p. 274° (decomp.), converted by boiling N-NaOH into (**III**) (poor yield). The flavazole structure of (**I**) is thus confirmed. Contrary to Sachs *et al.* (A., 1902, i, 503), 4 : 5-diketo-1-phenyl-3-methyl-4 : 5-dihydropyrazole similarly gives the 4-o-*aminoanilo*-derivative (**V**) (+EtOH), and EtOH-free, both forms, m.p. 223° (decomp.), and not 1-*phenyl*-3-*methylflavazole* (**VI**), m.p. 133·5—134°. (**VI**) is obtained from (**V**) by boiling AcOH (36 hr.) or N-NaOH (~1 min.). (**VI**) does not react with PhCHO, is not attacked appreciably by SeO_2, and with Br–AcOH at 100° gives an additive compound [regenerates (**VI**) with cold EtOH]; the Me could not be oxidised ($KMnO_4$, CrO_3) to CO_2H. With CrO_2Cl_2–CS_2, (**VI**) affords *di*-(α*β*-*di*-1-*phenyl*-3-*flavazolylethyl*) *ether*, m.p. 356—358°. Attempts to synthesise 4 : 5-diketo-1-phenyl-4 : 5-dihydropyrazole-3-carboxylic acid [as an intermediate for the prep. of (**II**)] were unsuccessful. Et 5-keto-1-phenyl-4 : 5-dihydropyrazole-3-carboxylate (**VII**), new m.p. 181·5—182·5°, and $NaNO_2$ in 3·5N-KOH added to an excess of cold dil. HCl give the 4-*oximino*-ester, m.p. 171—172° (decomp.), from which :N·OH could not be removed; with *o*-$C_6H_4(NH_2)_2$ and H_3BO_3 in dil. AcOH and CO_2 at 100° an *adduct*, $C_{18}H_{19}O_3N_5$, m.p. 260°, results. With (**IV**) in EtOH, (**VII**) affords (mainly) Et_2 5 : 5′-dihydroxy-1 : 1′-diphenyl-4 : 4′-dipyrazolyl-3 : 3′-dicarboxylate (**VIII**), m.p. 273° (decomp.) (discoloured at 263°) (*diacetate*, m.p. 169°) [the leucopyrazole-blue of Ruhemann (*J.C.S.*, 1896, **69**, 1396)], and a little of the dye (*A*)


(*A*.)

(R = CO_2Et). With SeO_2–EtOH, (**VII**) gives (**VIII**). 4-Oximino-5-keto-1-phenyl-4 : 5-dihydropyrazole-3-carboxylic acid, m.p. (solvent-free) 209° (also +0·5 EtOH or *x*MeOH) (Chattaway *et al.*, A., 1927, 1087), with EtOH–*o*-$C_6H_4(NH_2)_2$ affords a *salt*, $C_{16}H_{15}O_4N_5$, m.p. 161° (decomp.), but in aq. AcOH–H_3BO_3 gives an *adduct*, $C_{16}H_{15}O_4N_5$, m.p. 260—265° (decomp.). Oxidation of 1-phenyl-3-methyl-5-pyrazolone with SeO_2 in EtOH or AcOH affords 5 : 5′-dihydroxy-1 : 1′-diphenyl-3 : 3′-dimethyl-4 : 4′-dipyrazolyl, m.p. ~320°, or the dye (*A*) (R = Me), m.p. 242—244° (decomp.), respectively. Et 5-keto-1-phenyl-4 : 5-dihydropyrazole-4-carboxylate has m.p. 104° (from petroleum) or 118—119° [from EtOH–NaOH (trace)]. H. B.

Syntheses in the tetrazole series. II. J. von Braun and W Rudolph (in part with R. Michaelis) (*Ber.*, 1941, **74**, [*B*], 264—272; cf. A., 1933, 76).—$CPhCl{:}NPh$ in $CHCl_3$ with 10% HN_3 in $CHCl_3$ gives ~100% of 1 : 5-diphenyltetrazole (**I**). Analogously prepared are: 1-*phenyl*-5-p-*tolyl*-, m.p. 136°; 5-*phenyl*-1-p-*tolyl*-, m.p. 132°; 1 : 5-*di*-p-*tolyl*-, m.p. 148°; 1-phenyl-5-*o*-tolyl-, impure; 1 : 5-di-*o*-tolyl-, impure; 1-*phenyl*-5-o-, m.p. 168°, -5-m-, m.p. 156°, and -5-p-*nitrophenyl*-, m.p. 178°; 5-*phenyl*-1-o-, m.p. 168°, and 1-m-*nitro*-, m.p. 133°; 1 : 5-*di*-p- (**II**), m.p. 262°, 1 : 5-*di*-m-, m.p. 244°, 1 : 5-*di*-o-*nitrophenyl*-, m.p. 209°; 1-*m*-nitrophenyl-5-*p*-nitrophenyl; 1-*phenyl*-5-(2′ : 4′-, m.p. 164°, and -(3′ : 5′-*dinitro*)*phenyl*-, m.p. 208°; 5-*phenyl*-1-*methyl-tetrazole* (**III**), b.p. 144—146°/0·3 mm., m.p. 102—103°. $NHBu^{\alpha}Bz$, b.p. 186—190°/12 mm., is converted via $CPhCl{:}NBu^{\alpha}$, b.p. 105°/high vac., into 5-*phenyl*-1-*butyltetrazole* (**IV**), b.p. 190—193°/12 mm. *Benz*-n-*octylamide*, m.p. 49°, is converted via *n*-$C_8H_{17}{\cdot}N{:}CPhCl$, b.p. 170°/12 mm., into 5-*phenyl*-1-n-*octyltetrazole*, b.p. 205°/0·5 mm. *n*-$C_{17}H_{35}{\cdot}COPh$ (from $C_{17}H_{35}{\cdot}COCl$, C_6H_6, and $AlCl_3$) is reduced (Clemmensen) to *n*-$C_{18}H_{37}Ph$, m.p. 29°, nitrated to *p*-*n*-$C_{18}H_{37}{\cdot}C_6H_4{\cdot}NO_2$, b.p. 250—252°/0·5 mm., which is reduced to p-*octadecylaniline*, b.p. 240—245°/0·4 mm., and the *Bz* derivative, m.p. 118°, is converted into 5-*phenyl*-1-p-*octadecylphenyltetrazole* (**V**), m.p. 80°. 2-Chloropyridine and 2-chloroquinoline and HN_3 (not NaN_3) give respectively "1 : 5-*iso*benztetrazole" (*A*), m.p. 159°, and "1 : 5-*iso*-α-naphthotetrazole," m.p. 157°. (**III**) does not react with AcCl, $AlCl_3$, CH_2O–HCl, or Br; (**I**) does not react with Br even at 130—140°. 5-p-*Tolyl*-1-*methyltetrazole*, m.p. 113° (obtained from *p*-$C_6H_4Me{\cdot}CO{\cdot}NHMe$, m.p. 138°, b.p. 160°/0·5 mm., via *p*-$C_6H_4Me{\cdot}CCl{:}NMe$, b.p. 114°/14 mm.), reacts with Br; the Br-derivative is not obtained pure but reacts with $NHEt_2$ to give the NEt_2-derivative, $C_{12}H_{19}N_5$, m.p. 109° (oily picrate; hydrochloride, m.p. 135°), which reverts to the Br-derivative with BrCN.


(*A*.)

Me groups in tolyltetrazoles are oxidised (CrO_3 in AcOH) with difficulty; 1-*phenyl*-5-p-*carboxyphenyl*- (?), m.p. 267° (chloride, m.p. 104°), and 1 : 5-*di*-p-*carboxyphenyl-tetrazole*, m.p. 310° (chloride, m.p. 174°), have been isolated. Aromatic substituted tetrazoles are very stable towards HNO_3 but (**IV**) gives a p(?)-NO_2-derivative, b.p. 205°/0·5 mm., and, under vigorous conditions, (**I**) gives (**II**), m.p. 260°. Sulphonation introduces one SO_3H group into (**I**), the *Na* salt giving the *anilide* (**VI**), m.p. 213°. Reference compounds were synthesised as follows: *p*-$SO_2Cl{\cdot}C_6H_4{\cdot}COCl$, b.p. 150°/12 mm., m.p. 57°, gives the *dianilide*, m.p. 251°, and then 1-*phenyl*-5-p-*sulphonanilidophenyl-tetrazole* (**VII**), m.p. 180°, mixed m.p. with (**VI**) 162—170°; m-*sulphobenzdianilide*, m.p. 166°, affords the m-*isomeride*, m.p. ~136°, of (**VII**); *p*-$NHBz{\cdot}C_6H_4{\cdot}SO_2Cl$, m.p. 176°, is converted through the *anilide*, m.p. 223°, into (**VI**), m.p. and mixed m.p. 213°. (**IV**) and (**V**) also undergo sulphonation and aq. solutions of the *Na* salts have foaming properties. J. Wa.

Tetrazole.—See B., 1943, III, 280.

Wing-pigments of butterflies. VI. Leucopterin and xanthopterin. H. Wieland and R. Purrmann. **VII. Synthesis of leucopterin. Nature of guanopterin.** R. Purrmann (*Annalen*, 1940, **544**, 163—182, 182—190; cf. A., 1940, II, 236).—VI. Numerous analyses show leucopterin (**I**) to be $(C_6H_5O_3N_5)_x$ and xanthopterin (**II**) $(C_6H_5O_2N_5)_x$ ($x = 1$ or 2); many derivatives are similarly revised. "Iminoleucopterin" (A., 1939, II, 392) is really (**I**) (*X*-ray spectra). It is best (63%) obtained by shaking Ba xanthopterin with O_2 and Pt in aq. NaOH–Na_2CO_3 (not 2N-HCl). Evaporating leucopterin glycol with 0·1N-LiCl (4 mols.) at room temp. (desiccator) gives 2-*imino*-5-*hydantoinyl-oxamic acid* (**III**) (58%) and *-oxamide* (**IV**) (20%) (*loc. cit.*); titrating with 0·1N-LiOH and evaporating at 100° gives (**IV**) (69%) and (**III**) (15%); titrating (**IV**) with 0·1N-LiOH and evaporating at room temp. gives (**III**) (50%). In 25% HCl at 75° (**IV**) gives 5-amino-2-iminohydantoin (64%) (*dihydrochloride*), which with KCNO in faintly acid solution gives 2-*iminoallantoin* (88%). Alkaline H_2O_2 converts (**II**) or di-iminouric acid into imino-oxonic acid, $\begin{matrix}NH\text{——}CO\\ |\quad\quad |\\ C(:NH){\cdot}NH\end{matrix}\!>\!C(OH){\cdot}NH{\cdot}CO_2H$ (*Na* salt; 12% and 16%, respectively). (**II**) contains a red *dye*, decomp. >300°, which is difficult to remove but is obtained pure after catalytic dehydrogenation (yield up to 8%). Hot $Ba(OH)_2$ only very slowly decomposes (**II**).

VII. 2 : 4 : 5-Triamino-6-hydroxypyrimidine and $H_2C_2O_4$ at 140—260° give (**I**) (90%) and thence deiminoleucopterin (**V**). "Guanopterin" is really *iso*guanine; in boiling HCl it gives xanthine. *X*-Ray spectra of (**V**) and (**I**) from different sources support the identity. Structures are discussed in both papers. R. S. C.

Oxidation of pyrrole derivatives with lead tetra-acetate. New porphyrin syntheses. W. Siedel and F. Winkler (*Annalen*, 1943, **554**, 162—201).—Gradual addition of $Pb(OAc)_4$ to Et 2 : 4-dimethyl-3-ethylpyrrole-5-carboxylate in AcOH at >20—25° gives *Et* 2-*hydroxymethyl*-3-*ethylpyrrole*-5-*carboxylate* (**I**), m.p. 126—128°, converted by Ac_2O at 100° into the *acetate*, m.p. 135—136°, and by 2N-HCl in boiling EtOH into *Et*$_2$ 4 : 4′-*dimethyl*-3 : 3′-*diethylpyrromethane*-5 : 5′-*dicarboxylate*, m.p. 128°. (**I**) and Me opsopyrrole-carboxylate condense in Ac_2O at 100° to *Me* 1′ : 6′-*dicarbethoxy*-1 : 3 : 6-*trimethyl*-2 : 5-*diethyltripyrran*-4-*propionate*, m.p. 152—163°, becomes yellow at 52°. Alkaline hydrolysis of (**I**) leads to the relatively stable *acid* (**II**), m.p. 155°, which could not be recrystallised. It is decarboxylated when heated at 160—170°, when boiled with MeOH containing HBr through which air is passed, when kept for several days in MeOH exposed to air, or when suddenly (but not slowly) heated at 180° in a high vac. with formation of a mixture of ætioporphyrin I (**III**) and II (**IV**). When heated with Cu-bronze or ZnO at 160—170° (**II**) gives the Cu and Zn complex salts of (**III**) and (**IV**). Cryptopyrrole (**V**) (picrate, m.p. 135°) is identified among the products of the dry decarboxylation of (**II**). The intermediate ætioporphyrinogen, blackens at 200° after becoming discoloured at 140°, can be isolated if condensation by HBr in MeOH is effected rapidly; this passes slowly into (**III**) and (**IV**) when exposed to air but is relatively stable when dry. Condensation of (**V**) with 3-methyl-4-ethylpyrrole-5-aldehyde by 48% HBr gives 3′ : 4 : 5′-*trimethyl*-3 : 4′-*diethylpyrromethene hydrobromide*, m.p. 178—179°, and with 2-bromo-3-methyl-4-ethylpyrrole-5-aldehyde affords 5-*bromo*-3′ : 4 : 5′-*trimethyl*-3 : 4′-*diethylpyrromethene hydrobromide* (**VI**), m.p. 216—217° (decomp.). Bromination of either pyrromethene in AcOH affords a mixture of ~90% of the perbromide (**VII**), m.p. 147—148°, of (**VI**) and ~10% of 5-bromo-3′ : 4-dimethyl-5′-bromomethyl-3 : 4′-diethylpyrromethene hydrobromide, m.p. >300° [also obtained when (**VII**) is boiled with AcOH]. The mixture is converted by boiling HCO_2H into homogeneous (**III**). Analogous condensations using 2 : 3-dimethyl-4-ethylpyrrole give respectively 4 : 4′ : 5′-*trimethyl*-3 : 3′-*diethylpyrromethene hydrobromide*, m.p. 181°, softening, and its 5-*Br*-derivative, swells at 247°, softens at 216°; either pyrromethene gives the *perbromide*, m.p. >300°, converted by boiling AcOH into 5-*bromo*-4 : 4′-*dimethyl*-5′-*bromomethyl*-3 : 3′-*diethylpyrromethene hydrobromide*, softens indistinctly at 285°, darkens at 180°, and by HCO_2H into homogeneous (**IV**). (**III**) appears to be dimorphous. Oxidation of Et 2 : 3-dimethyl-4-ethylpyrrole-5-carboxylate by $Pb(OAc)_4$ in AcOH and treatment of the product with Ac_2O gives *Et* 3-*methyl*-2-*acetoxymethyl*-4-*ethylpyrrole*-5-*carboxylate*, m.p. 106°, hydrolysed (KOH–MeOH) to 3-*methyl*-2-*hydroxymethyl*-4-*ethylpyrrole*-5-*carboxylic acid*, m.p. 135° (decomp.), which gives a mixture of (**III**) and (**IV**) when heated rapidly to 160—170° or treated with 48% HBr in boiling MeOH. A similar mixture also results from 4 : 4′-dimethyl-3 : 3′-diethylpyrromethane-5 : 5′-dicarboxylic acid and MeOH–HBr. 5-Carbethoxy-2 : 4-dimethylpyrrole-3-propionic acid is oxidised [$Pb(OAc)_4$ in AcOH] to the 2-*hydroxymethyl* compound, m.p. 277—278°. 5-*Carboxy*-4-*methyl*-2-*hydroxymethylpyrrole*-3-*propionic acid* does not melt when slowly heated but immediately melts with decomp. when placed on a plate heated at 200°; when heated at 240—250° or treated with 48% HBr–MeOH it gives coproporphyrin I Me_4 ester (**VIII**) (with some coproporphyrin) in somewhat impure form and in small yield. 2-Aldehydo-3-methylpyrrole-4-propionic acid and 2 : 4-dimethylpyrrole-3-propionic acid are condensed by 48% HBr to 3 : 3′ : 5′-*trimethylpyrromethene*-4 : 4′-*dipropionic acid hydrobromide*, m.p. 200° (decomp.), darkens at 150—160°, which is converted by Br in AcOH into the 5-*Br*-compound, softens at 219—220° after darkening, and thence by treatment with $AcCO_2H$ at 180° into coproporphyrin II Me_4 ester, m.p. 292°, softens at 280°, which differs appreciably from (**VIII**) in Debye–Scherrer diagram. Et 2 : 3 : 4-trimethylpyrrole-5-carboxylate is oxidised [$Pb(OAc)_4$] and then acetylated to *Et* 3 : 4-*dimethyl*-2-*acetoxymethylpyrrole*-5-*carboxylate*, m.p. 132°; the corresponding *acid*, m.p. ~135° (decomp.), passes at 160—170° into octamethylporphin. Gradual addition of 2-methyl-3 : 4-dipropylpyrrole followed by $ClCO_2Et$ to MgEtBr in Et_2O gives *Et* 2-*methyl*-3 : 4-*dipropylpyrrole*-5-*carboxylate*, m.p. 99—101°, oxidised by $Pb(OAc)_4$ in AcOH at room temp. to *Et* 2-*acetoxymethyl*-3 : 4-*dipropylpyrrole*-5-*carboxylate*, m.p. 97°. This appears to be hydrolysed and decarboxylated simultaneously by KOH–MeOH and the alkali-insol. product is transformed by 48% HBr in MeOH into octapropylporphin, m.p. 290°, softens at 280°. Et 2 : 4-dimethylpyrrole-5-carboxylate is oxidised to *Et* 4-*methyl*-2-*acetoxymethylpyrrole*-5-*carboxylate*, m.p. 110—112° (sublimation); the free acid does not give a porphyrin according to the previous methods or when heated with AcOH in a sealed tube. *Et* 2-*acetoxymethylpyrrole*-5-*carboxylate*, m.p. 98—99°, obtained by oxidation of the 2-Me compound, is hydrolysed by 5% Na_2CO_3 in presence of $COMe_2$ to *Et* 2-*hydroxymethylpyrrole*-5-*carboxylate*, m.p. 83—84°, and by NaOH in aq. MeOH to 2-*hydroxymethylpyrrole*-5-*carboxylic acid*, m.p. >300°, which could not be condensed to a porphin. By use of a larger proportion of $Pb(OAc)_4$ it is possible to convert α-Me into α-CHO; the prep. of Et 2-aldehydo-4-methyl-3-ethylpyrrole-5-carboxylate, m.p. 90°, and 5-carbethoxy-2-aldehydo-4-methylpyrrole-3-propionic acid, m.p. 173°, is recorded. The yield of Et 2-aldehydopyrrole-5-carboxylate, m.p. 74—75°, is less satisfactory. $Pb(OAc)_4$ does not appear suitable for the conversion of α-Me into α-CO_2H. H. W.

Chlorophyll. XCVIII. Conversion of porphyrins into dihydroxychlorins by the action of osmium tetraoxide. H. Fischer and H. Eckoldt (*Annalen*, 1940, **544**, 138—162).—OsO_4 adds to porphyrins in Et_2O–C_5H_5N to give compounds, hydrolysis of which by Na_2SO_3 in boiling aq. MeOH and then esterification (CH_2N_2) gives *dihydroxychlorins* (*A*) (5—20%), the structure of which is proved by reactions given below and by absorption spectra (figures in parentheses are absorption max. in order of intensity). (*A*) differ from the parent porphyrins by 2 additional OH in ring IV. (*A*) are prepared from the compounds named as follows: ætioporphyrin (hydrolysis by aq. Na_2SO_3; no esterification), m.p. >300° (6463, 4928, 5935, 5230, 6151, and 5443 A. in C_5H_5N–Et_2O); from deuteroporphyrin Me_2 ester, m.p. 229° (6413, 4914, 5868, 5198, 6112, and 5415 A. in C_5H_5N–Et_2O; *Cu* salt, m.p. 208—212°) (a compound having absorption max. at 6720, 4892, 5215, 6107, and 6377 A. in Et_2O–C_5H_5N is also formed); from coproporphyrin, (**I**), m.p. 251° [6438, 4953, 5901, 5248, 6138, and 5449 A. in Et_2O–C_5H_5N; Bz derivative (6507, 4991, 5310, 5931, 6236, and 5675 A. in Et_2O); from phylloporphyrin, compounds, m.p. 286° (6433, 5042, 5895, and 5383 A. in Et_2O–C_5H_5N; *Cu* salt, m.p. 233°), and m.p. 201—205° (6491, 5466, 5940, 5248, 4968, and 6175 A. in Et_2O–C_5H_5N); from rhodoporphyrin Me_2 ester, (**II**), m.p. 262° (5121, 5457, 6354, 5830, and 6051 A. in Et_2O–C_5H_5N); *Cu* salt, m.p. 233°; Bz derivative (6453, 5509, 5120, and 5871 A. in Et_2O). All these products are reduced by a little HI in AcOH at 100° to the original porphyrins. (**I**) and (**II**) do not react with NH_2OH. In HBr–AcOH, (**I**) gives a red compound (5021, 5348, 5673, and 6222 A. in Et_2O), and (**II**) gives a red compound (5489, 5095, 5751, and 6355 A. in Et_2O). Oleum converts (**II**) into an *anhydro*-compound, $C_{34}H_{38}O_5N_4$ (5573, 6375, 5210, 5800, and 6106 A. in Et_2O; also obtained by conc. HCl), and (**I**) into a substance (6411, 5412, 5065, 5828, and 6116 A. in Et_2O). The absorption spectra of the $(OH)_2$-compounds from pyrroporphyrin and mesoporphyrin are almost identical; the ε at ~640 mμ. is 3·5—4·0 × 10^{-4}, but nowhere else >1·0 × 10^{-4}; the similarity to mesopyrrochlorin is very great. "Propylrhodin" gives (as above) a *compound*, $C_{37}H_{44}O_5N_4$, m.p. 223° after sintering (6710, 5073, 5405, and 6084 A. in Et_2O–C_5H_5N); mesorhodin gives a *compound*, $C_{35}H_{40}O_5N_4$, m.p. 184°. Protoporphyrin Me_2 ester, m.p. 223°, is obtained (~50%) directly from hæmin by successive[illegible]

MeOH, HCl–MeOH, and CH_2N_2–Et_2O; with MgBr·OPr it gives the phyllin, m.p. 245° (cf. A., 1939, III, 343); deuteroporphyrin Me_2 ester gives similarly the *phyllin*, m.p. 248°. With $Mn(OAc)_2$ in warm AcOH ætio- and meso-porphyrin Me_2 ester give *Mn* salts, m.p. >330° and 266°, respectively. R. S. C.

Nucleic acids. XVIII. Existence of guanineuridylic acid. H. Bredereck, E. Berger, and F. Richter (*Ber.*, 1941, **74**, [*B*], 338—342).—The existence of guanineuridylic acid is maintained (cf. Levene *et al.*, A., 1940, II, 27; Gulland, *ibid.*, 235). The yield of product (**I**) obtained by deaminating yeast nucleic acid (**II**) is improved (cf. A., 1939, III, 326) from 30 to 47·3%; the remainder is lost in the isolation of (**I**). The same method of isolation applied to (**II**) gave a yield of 49·5%. (**I**) contains N and P in the ratio 1·35 (calc. 1·35) and has an equiv. of ~4·3. Thymonucleic acid (**III**) gives similar yields of deaminated product [N : P = 1·26 (calc. 1·35); equiv. ~4·4]. (**II**) and (**III**) are thus completely deaminated but the tetranucleotide structure is preserved; hence (**II**) and (**III**) do not contain N–P linkings. Cleavage of some specimens of (**II**) with aq. C_5H_5N at 100° gives (no details) guanylic acid (*G*) and a trinucleotide (**IV**). Further cleavage of (**IV**) does not afford a dinucleotide but adenylic acid (*A*) appears to be liberated first. Thus, (**II**) and (**IV**) contain (*G*) and (*A*), respectively, as end- groups. (**II**) probably contains the combination (*G*)-uridylic acid-cytidylic acid-(*A*). H. B.

Nucleic acids. XIX. Enzymic and chemical preparation of nucleosides from yeast nucleic acid. H. Bredereck, A. Martini, and F. Richter (*Ber.*, 1941, **74**, [*B*], 694—697).—Details are given for the isolation of guanosine, adenosine, cytidine, and uridine from the hydrolysate obtained from yeast nucleic acid (**I**) and an enzyme prep. (from sweet almonds). The same nucleosides are also obtained in approx. the same or a little higher yield from (**I**) and boiling aq. C_5H_5N (1 : 1 vol.) for 4½ days. Hydrolysis of (**I**) with even very dil. NaOH is unsatisfactory since much deamination occurs. H. B.

Morpholine periodide.—See B., 1941, III, 256.

Phenthiazines.—See B., 1943, II, 310.

Carbocyanines.—See B., 1943, II, 312.

Ultra-violet absorption of dyes in solution.—See A., 1943, I, 271.

Light absorption and energy propagation by loose complexes in organic dyes.—See A., 1943, I, 297.

Quinoxaline cyanines. II. A. H. Cook and C. A. Perry. **III.** A. H. Cook and R. F. Naylor (*J.C.S.*, 1943, 394—397, 397—401; cf. A., 1943, II, 47).—II. 3-Keto-2-methyl-3 : 4-dihydroquinoxaline and its 4-*N*-Me and -Ph compounds give quaternary salts by addition to the basic N in the 1-position. In these salts the 2-Me is reactive and has been condensed with HCO_2H derivatives and aldehydes or equiv. compounds to give symmetrical and unsymmetrical oxygenated cyanines. Except for diminished solubility these deep blue dyes resemble those derived from true quinoxalines. The following are described: [2-(3-*hydroxy*-1-*methylquinoxaline*][(4-*dimethylaminophenyl*)]*dimethincyanine iodide*, m.p. 225—227°; [2-(3-*keto*-1-*methyl*-3 : 4-*dihydroquinoxaline*)][2-(1 : 3 : 3-*trimethylindoline*)]-*trimethincyanine iodide*; [*bis*-2-(3-*hydroxy*-1-*methylquinoxaline*)]*trimethincyanine acetate*, m.p. 280° (decomp.); [2-(3-*keto*-1-*methyl*-3 : 4-*dihydroquinoxaline*)][2-(1-*methylquinoline*)]-, m.p. 246°, [2-(3-*hydroxy*-1-*methylquinoxaline*)][2-(1-*methylbenzoxazole*)]-, m.p. 244°, and [2-(3-*hydroxy*-1-*ethylquinoxaline*)][2-(1-*ethylbenzthiazole*)]-*trimethinecyanine iodide*, m.p. 260°; 2-*keto*-1 : 3-*dimethyl*-1 : 2-*dihydroquinoxaline methiodide*, m.p. 178° (decomp.); [2-(3-*keto*-1 : 4-*dimethyldihydroquinoxaline*)]-[4-*dimethylaminophenyl*)]*dimethincyanine sulphate* (*base*, m.p. 186°), and -[2-(1 : 3 : 3-*trimethylindoline*)]*trimethincyanine chloride*, m.p. 135°; [2-*bis*-(3-*keto*-1 : 4-*dimethyldihydroquinoxaline*)]*trimethincyanine sulphate*, m.p. 227°; [2-(3-*keto*-4-*methyl*-1-*ethyldihydroquinoxaline*)][2-(1-*ethylbenzthiazole*)]*trimethincyanine iodide*, m.p. 180°; [2-(3-*keto*-4-*phenyl*-1-*methyldihydroquinoxaline*)][(4-*dimethylaminophenyl*)]*dimethincyanine chloride*, m.p. 198—199° (*base*, m.p. 210°; corresponding *Et chloride*, m.p. 281°); [2-(3-*keto*-4-*phenyl*-1-*methyl*-3 : 4-*dihydroquinoxaline*)]-[2-(1 : 3 : 3-*trimethylindoline*)]*trimethincyanine chloride*, m.p. 252°, -[2-(1-*methylquinoline*)]*trimethincyanine sulphate*, m.p. 244° (decomp.), and -[2-(1-*methylbenzthiazole*)]*trimethincyanine chloride*, m.p. 235° (decomp.); [*bis*-2-(3-*keto*-4-*phenyl*-1-*methyldihydroquinoxaline*)]*trimethincyanine sulphate*, m.p. 287°; and 2-*keto*-3-*benzyl*-1 : 2-*dihydroquinoxaline*, m.p. 196°, and the 2-*keto*-1-*phenyl* compound, m.p. 166°.

III. Two quinoxalinemonomethincyanines have been obtained but attempts to extend the series have been unsuccessful. Several quinoxalines carrying reactive Me have been condensed with $Et_2C_2O_4$, and the resulting pyruvic acids or esters converted into diquinoxalinylmethanes by reaction with aromatic *o*-diamines. Although it has not been possible to quaternise these compounds to obtain monomethincyanines, the striking colours of their acid solutions are probably indicative of the colour of the unprepared cyanines. The following are described: [2-(1-*methylbenzthiazole*)]-[2-(3-*keto*-1 : 4-*dimethyl*-3 : 4-*dihydroquinoxaline*)]*monomethincyanine-iodide*, m.p. 242°, and -[2-(1-*phenyl*-3-*methylquinoxaline*)]*monomethincyanine iodide*, m.p. 188°; 1-*phenyl*-3-*methylquinoxaline*-2-*aldoxime chloride*, m.p. 283°; *Et* 2-*keto*-1-*methyl*-1 : 2-*dihydroquinoxaline*-3-*pyruvate*, m.p. 170° (*acid*, m.p. 218°; *oxime*, m.p. 158·5°; *phenylhydrazone*, m.p. 202°), and its *condensation product*, m.p. 228°, with *o*-OH·C_6H_4·CHO, 3-(2-*keto*-1-*methyldihydroquinoxalinyl*)-3-(2-*keto*-*dihydroquinoxalinyl*)*methane*, m.p. 355° and -1-*phenyldihydroquinoxalyl*)*methane*, m.p. 300°; *bis*-3-(2-*keto*-1-*methyl*-1 : 2-*dihydroquinoxalinyl*)*methane*, m.p. 331°; *Et* 2-*keto*-1-*phenyl*-1 : 2-*dihydroquinoxaline*-3-*pyruvate*, m.p. 224° [*acid*, m.p. 226° (decomp.)]; 3-(2-*keto*-1-*phenyldihydroquinoxalyl*)-3-(2-*ketodihydroquinoxalyl*)*methane*, m.p. 372°; *Et* 3-*methyl*-4-*quinazolonyl*-2-*pyruvate*, m.p. 173° (*phenylhydrazone*, m.p. 168—169°); 2-(3-*methyl*-4-*quinazolonyl*)-3-(2-*ketodihydroquinoxalyl*)*methane*, m.p. 354°, -1-*methyl*-, m.p. 293°, and -1-*phenyl*-*dihydroquinoxalyl*)*methane*, m.p. 265°; 2-*carbethoxy*-3-(3′-*methyl*-2′-*quinoxalyl*)*indole*, m.p. 153°, and -(2′-*keto*-1′-*methyldihydro*-3′-*quinoxalyl*)*indole*, m.p. 246°; and 3-(2-*keto*-1-*methyldihydroquinoxalyl*)-3-(2-*keto*-1-*phenyl*-, m.p. 290° (decomp.), and -(2-*keto*-*dihydroquinoxalyl*)*methane hydrochloride*, decomp. >300°. F. R. S.

VII.—ALKALOIDS.

Constitution of ψ-conhydrine. E. Späth and R. Lorenz (*Ber.*, 1941, **74**, [*B*], 599—603).—The structure of ψ-conhydrine [3-hydroxy-6-*n*-propylpiperidine] is now proved (cf. A., 1933, 516). Dihydro-ψ-conhydrinemethine (*loc. cit.*) is α-dimethylamino-octan-β-ol since it is oxidised (aq. AcOH–CrO_3 at 70°) to *α-dimethylamino-octan-β-one* (**I**), b.p. 75—80°/10 mm. (*aurichloride*, m.p. 83·5—84·5°; *methiodide*, m.p. 156—156·5°; methopicrate, m.p. 114—116°). *n*-C_6H_{13}·COCl and Et_2O–CH_2N_2 give α-chloro-octan-β-one, b.p. 91—96°/10 mm. (and surprisingly some *n*-C_6H_{13}·CO_2Et), converted by aq. $NHMe_2$ into (**I**). H. B.

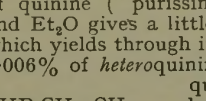
The alkaloid in *Eclipta alba* (Hassk). S. N. Pal and M. Narasimham (*J. Indian Chem. Soc.*, 1943, **20**, 181).—3·1 g. of alkaloid, extracted from 4 kg. of the air-dried plant, was nicotine. S. A. M.

Synthesis in the series of cinchona alkaloids. II. Synthesis of 6′-methoxyruban-9-ol. V. Prelog, R. Seiwerth, S. Heimbach-Juhász, and P. Stern (*Ber.*, 1941, **74**, [*B*], 647—652).—The yield of product from Et quininate and β-1-benzoyl-4-piperidylpropionate depends greatly on the quality of the NaOEt used for condensation. Na powder in boiling C_6H_6 gives 88% of the CO-ester, hydrolysed to 6′-methoxyrubatoxan-9-one (**I**). With Br in 48% HBr and light (quartz lamp) (**I**) gives the 8-Br-derivative, converted by 5% Na_2CO_3 + Et_2O then N-NaOH into 6′-methoxyruban-9-one (**II**), m.p. 90—91° [picrate, m.p. 211—211·5° (lit. 173—174°); picrolonate, m.p. 226° (lit. 148—150°)] (cf. Rabe *et al.*, A., 1922, i, 361). Bromination in the dark followed by the above procedure gives (**II**) and (probably) *5′-bromo-6′-methoxyrubatoxan-9-one*, m.p. 270—271°. Reduction (H_2, PtO_2, MeOH) of (**II**) affords mainly 6′-methoxyruban-9-ol-*A* (**III**) (*picrate*, m.p. 224—225°) and a little -*B* [*picrate*, m.p. 226°, and 210° with that of (**III**)]. The *dihydrochloride*, m.p. 239—240°, of (**III**) is active against bird malaria and possesses pharmacological similarity to quinine (*e.g.*, blood pressure; action on smooth muscle) and quinidine (*e.g.*, action on frog's heart). The difference between these findings and those of Rabe *et al.* (see below) is unexplained. H. B

Cinchona alkaloids. XXXII. Synthesis of 6′-methoxyruban-9-ols; mode of action of quinine and quinidine. P. Rabe and G. Hagen (*Ber.*, 1941, **74**, [*B*], 636—647).—Et β-1-benzoyl-4-piperidylpropionate (improved prep.) is condensed (NaOEt; no solvent) with Et quininate and the product hydrolysed (18% HCl) to 6′-methoxyrubatoxan-9-one, which with Br in 40% HBr gives the impure 8-Br-derivative dihydrobromide. This with aq. Na_2CO_3 + Et_2O at 0° affords 6′-methoxyruban-9-one (**I**), m.p. 89° (cf. A., 1922, i, 361), and some ? dibromomethoxyrubanone, m.p. 66°. Cryst. (**I**) is a racemate; in solution (or when molten) it gives by a keto–enol change two enantiostereoisomerides and two *cis*–*trans*-isomerides. Reduction (H_2, Pd-black, 3—4% HCl) of (**I**) affords a mixture of four stereoisomeric 6′-methoxyruban-9-ols. The (++)-(−−)-*racemate*, $(C_{18}H_{23}O_2N_2)_2,6H_2O$ (**II**), m.p. (anhyd.) 179° (the signs refer to the configuration of $C_{(8)}$ and $C_{(9)}$ respectively), is readily separated from the oily (+ −)-(− +)-racemate (**III**) through its sparing solubility in moist Et_2O. (**II**) is resolved through the H *d*- and *l*-tartrates whilst (**III**) is resolved through the neutral dianisoyl-*d*- and -*l*-tartrates. The dianisoyl-*d*- and -*l*-tartaric acids used have $[\alpha]_D^{17}$ −166° and $[\alpha]_D^{5}$ +148° in EtOH, respectively. Thus are obtained (++)-*6′-methoxyruban-9-ol* (**IV**) (+H_2O), m.p. (anhyd.) 187°, $[\alpha]_D^{17}$ +173·8° in EtOH [*hydrochloride*, m.p. 221° (decomp.), $[\alpha]_D^{9}$ +130·3° in EtOH; *H* d-*tartrate* (+3H_2O), m.p. 150—155° (decomp.) (sinters 115°), $[\alpha]_D^{15}$ +124·1° in EtOH, m.p. (anhyd.) ~169° (decomp.)], (− −)-*6′-methoxyruban-9-ol* (**V**), m.p. 187°, $[\alpha]_D^{20}$ −173·5° in EtOH [hydrochloride, m.p. 219° (decomp.), $[\alpha]_D^{9}$ −130·4° in EtOH; H *l*-tartrate (+3H_2O), m.p. 150—155° (decomp.) (sinters 107°), $[\alpha]_D^{16}$ −123·7° in EtOH; l-*tartrate* (+H_2O), m.p. 234° (decomp.), $[\alpha]_D^{20}$ −135·1° in H_2O; *H dianisoyl*-d-*tartrate* (+MeOH), m.p. 188° (decomp.), $[\alpha]_D^{20}$ (MeOH-free) −158·8° in EtOH], (+ −)-6′-methoxyruban-9-ol. oil, $[\alpha]_D^{18}$ +23·5° in EtOH [*hydrochloride*, m.p. 221—223°

(decomp.), $[\alpha]_D^{17}$ +12·57° in EtOH; *dianisoyl*-d-*tartrate* (+5H_2O), m.p. 155° (decomp.), $[\alpha]_D^{19}$ −66·4° in EtOH], and (− +)-6′-methoxyruban-9-ol, an oil, $[\alpha]_D^{14}$ −23·25° in EtOH [*hydrochloride*, m.p. 222—223°, $[\alpha]_D^{16}$ −14·4° in EtOH; H *d*-tartrate, m.p. 135° (decomp.), $[\alpha]_D^{20}$ +11·68° in H_2O; dianisoyl-*l*-, m.p. ~155° (decomp.), $[\alpha]_D^{19}$ +50·02° in EtOH, and -*d*-tartrate, m.p. 125—143° (decomp.), $[\alpha]_D^{20}$ −73·29° in EtOH]. These are converted by HCl-$CHCl_3$ and then PCl_5 at room temp. into the respective 9-*chloro*-6′-*methoxyrubans*, m.p. 99° (sintering), $[\alpha]_D^{19}$ +25·6° in EtOH (**VI**), m.p. 98—100° (sintering), $[\alpha]_D^{19}$ −24·71° in EtOH (**VII**), m.p. ~101—102°, $[\alpha]_D^{20}$ +79·1° in EtOH (**VIII**), and m.p. ~101—102°, $[\alpha]_D^{19}$ −79·02° in EtOH (**IX**). Reduction (H_2, Pd–$CaCO_3$, EtOH–KOH) of (**VI**) and (**VIII**) gives (+)-6′-methoxyruban, $[\alpha]_D^{20}$ +129° in EtOH (hydrate, m.p. 66°); (**VII**) and (**IX**) similarly give (−)-6′-methoxyruban, $[\alpha]_D^{19}$ −129·5° in EtOH (no hydrate). (**V**) has no action against bird malaria. (**IV**) has a surprisingly favourable action in disturbances of cardiac rhythm. H. B.

Cinchona alkaloids. XXXIII. *hetero***Quinine, a 1 : 1-hydramine.** P. Rabe (*Ber.*, 1941, **74**, [*B*], 725—728).—Fractional distribution of quinine ("purissimum praecipitatum") between aq. HCO_2H and Et_2O gives a little resinous material (most weakly basic part) which yields through its neutral sulphate, m.p. 218° (darkens 210°), 0·006% of *hetero*quinine (**I**) (*A*, R = CH:CH_2, R′ = 6-methoxy-4-quinolyl), m.p. 167°. (**I**) is insol. in alkali hydroxide (distinction from cupreine) and gives the thalleioquine reaction. Attempts to isolate (**I**) from a viscous product (termed quinoidine) obtained from the mother-liquors after processing cinchona bark were unsuccessful; (**I**) may have been present since the most weakly basic part, an oil, gave the thalleioquine reaction. Attention is directed to *hetero*hydrocinchonine (A., 1935, 99). H. B.



(*A*.)

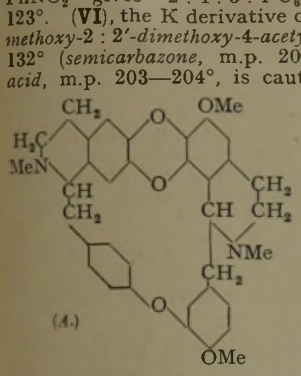
Ergot alkaloids. VII. Alkaloids of the ergotoxine group; ergocrystine, ergocryptine, and ergocornine. A. Stoll and A. Hofmann (*Helv. Chim. Acta*, 1943, **26**, 1570—1601).—Ergotoxine (**I**) preps. are usually mixtures of three well-defined alkaloids, ergocristine (**II**), *ergocryptine* (**III**), and *ergocornine* (**IV**). The name (**I**) is retained as a group designation for preps. described and used under this name. (**I**) is treated with two equivs. of *l*-di-*p*-toluoyltartaric acid in 90% EtOH, whereby a copious crystallisation of the mixed salts occurs. This is dissolved in abs. EtOH, from which the bulk of the *l*-di-*p*-toluoyltartrate of (**II**) separates. The main pptn. of alkaloidal salts occurs when the mother liquor is diluted to 80% with H_2O. A small further quantity is secured by diluting the filtrate to 50%, leaving in solution only a small proportion of salt which is recovered as base and united with subsequent end fractions. The operations are repeated with the heterogeneous cryst. fractions and the most freely sol. portions are treated with abs. and then with 70% MeOH. The method is nearly quant. A detailed description of the treatment of various preps. of (**I**) is given. The *l*-di-*p*-toluoyltartrates are more stable than other alkaloidal salts but their stability is only relative. To prevent transformation into the dextrorotatory isomerides of the alkaloids or their oxidative decomp. by air or light and to obtain lightly coloured materials the salts must remain in solution for the least possible time; if crystallisation does not occur within a few min. it generally does not occur at all. Unless absolutely necessary, the solutions should not be warmed and, if necessary, the heating should be restricted to a few sec. Solid substances and, particularly, solutions should be protected from light. The following are described: (**II**), best cryst. from $COMe_2$ from which it separates with 1 $COMe_2$, m.p. 160—175° (decomp.), $[\alpha]_D^{20}$ −183°, $[\alpha]_{5461}^{20}$ −217° in $CHCl_3$, $[\alpha]_D^{20}$ −93°, $[\alpha]_{5461}^{20}$ −107° in C_5H_5N [*l*-*di*-p-*toluoyltartrate*, m.p. 191° (decomp.), $[\alpha]_D^{20}$ +58° in abs. EtOH; hydrochloride, m.p. 205° (decomp.); phosphate, m.p. 195° (decomp.); *ethanesulphonate*, m.p. 207° (decomp.); d-*tartrate*, m.p. (indef.) 185—190° (decomp.)]; ergocristinine, new m.p. 226° (decomp.), $[\alpha]_D^{20}$ +462°, $[\alpha]_{5461}^{20}$ +576° in C_5H_5N, $[\alpha]_D^{20}$ +383°, $[\alpha]_{5461}^{20}$ +479° in $COMe_2$; (**III**), m.p. 212° (decomp.), $[\alpha]_D^{20}$ −187°, $[\alpha]_{5461}^{20}$ −226° in $CHCl_3$; $[\alpha]_D^{20}$ −112°, $[\alpha]_{5461}^{20}$ −133° in C_5H_5N [l-(l-*di*-p-*toluoyltartrate*, m.p. 186° (decomp.), $[\alpha]_D^{20}$ +103° in abs. EtOH; *hydrochloride*, m.p. (indef.) 208° (decomp.); *phosphate*, m.p. 198—200° (decomp.); d-*tartrate*, m.p. (indef.), 209° (decomp.); *ethanesulphonate*, m.p. 204° (decomp.)], converted by boiling MeOH into *ergocryptinine*, m.p. 240—242° (decomp.) $[\alpha]_D^{20}$ +408°, $[\alpha]_{5461}^{20}$ +508° in $CHCl_3$, $[\alpha]_D^{20}$ +479°, $[\alpha]_{5461}^{20}$ +596° in C_5H_5N, $[\alpha]_D^{20}$ +396°, $[\alpha]_{5461}^{20}$ +493° in $COMe_2$; (**IV**), m.p. 182—184° (decomp.), $[\alpha]_D^{20}$ −188°, $[\alpha]_{5461}^{20}$ −226° in $CHCl_3$, $[\alpha]_D^{20}$ −105°, $[\alpha]_{5461}^{20}$ −122° in C_5H_5N [*H* l-*di*-p-*toluoyltartrate*, m.p. 180—181° (decomp.), $[\alpha]_D^{20}$ +103° in abs. EtOH; *hydrochloride*, m.p. 223° (decomp.); *hydrobromide*, m.p. 225° (decomp.); *phosphate*, m.p. 190—195° (decomp.); non-cryst. *d*-tartrate; very stable and cryst. *ethanesulphonate*, m.p. 209° (decomp.)], converted by boiling MeOH into *ergocorninine*, m.p. 228° (decomp.), $[\alpha]_D^{20}$ +409°, $[\alpha]_{5461}^{20}$ +512° in $CHCl_3$, $[\alpha]_D^{20}$ +500°, $[\alpha]_{5461}^{20}$ +624° in C_5H_5N, $[\alpha]_D^{20}$ +414°, $[\alpha]_{5461}^{20}$ +517° in $COMe_2$. Photomicrographs of the crystals of the six alkaloids are given. A historical survey of (**I**) and ergotinine is given and the literature data are examined critically from the viewpoint of the new observations. M.p. are corr. H. W.

Ergot alkaloids. VIII. Products of the fission of ergocristine, ergocryptine, and ergocornine. A. Stoll, A. Hofmann, and B. Becker (*Helv. Chim. Acta*, 1943, **26**, 1602—1613).—Alkaline hydrolysis of ergocristinc (**I**) gives *d*-lysergic acid (**II**), NH_3, $COPr^{\beta}{\cdot}CO_2H$, *dl*-proline, and *dl*-phenylalanine. The mol. sum of these 5 products less 4 mols. of H_2O is $C_{35}H_{39}O_5N_4$, identical with the formula determined analytically. (**I**) thus contains the structural units present in ergotinine preps. Treatment of ergocryptine (**III**) with N_2H_4 leads to *dl-iso*lyserghydrazide in good yield. Thermal fission gives $COPr^{\beta}{\cdot}CO{\cdot}NH_2$ and a non-distillable, viscous oil which affords *l*-leucyl-*d*-prolyl-lactam, m.p. 148—150°, $[\alpha]_D^{20}$ +92°, $[\alpha]_{5461}^{20}$ +109° in H_2O, hydrolysed by acid to *l*-leucine, m.p. 280° (decomp.), $[\alpha]_D^{20}$ −10·8°, $[\alpha]_{5461}^{20}$ −13·4° in H_2O, and *d*-proline (**IV**), characterised as the salt $C_5H_9O_2N,CdCl_2,H_2O$, m.p. 210°. The results agree with the analytically established formula $C_{32}H_{41}O_5N_5$. Alkaline hydrolysis of ergocornine (**V**) affords (**II**). Its thermal decomp. leads to $COPr^{\beta}{\cdot}CO{\cdot}NH_2$ and l-*valyl*-d-*prolyl-lactam*, m.p. 147—149°, $[\alpha]_D^{20}$ +88°, $[\alpha]_{5461}^{20}$ +107° in H_2O, hydrolysed by boiling conc. HCl to *l*(+)-valine, $[\alpha]_D^{20}$ +32° in 20% HCl, and (**IV**), characterised as dimethyl-*d*-prolinebetaine aurichloride, m.p. 245°. Among the ergot alkaloids, the ergotamine group (ergotamine–ergotaminine; ergosine–ergosinine) is characterised by giving $AcCO_2H$ as α-CO-acid. The ergotoxine group [(**I**)–ergocrystinine; (**III**)–ergocryptinine; (**V**)–ergocorninine] gives rise to $COPr^{\beta}{\cdot}CO_2H$ analogously. Differing in principle but still containing (**II**) as main component are ergobasine–ergobasinine in which (**II**) is present as the *l*-β-hydroxy*iso*propylamide. H. W.

Veratrine alkaloids. XX. Further correlations in the veratrine group. Relationship between the veratrine bases and solanidine. L. C. Craig and W. A. Jacobs (*J. Biol. Chem.*, 1943, **149**, 451—464; cf. A., 1943, II, 246).—The unsaturated hexacyclic character of the veratrine bases is discussed. Attempts to hydrogenate (H_2–PtO_2) germine (**I**) failed, but *iso*germine (**II**) gives (PtO_2–MeOH) *dihydroisogermine*, m.p. 277—278° (previous darkening and softening), $[\alpha]_D^{28}$ −61° in C_5H_5N. *Dihydrogermine*, m.p. 265° (shrinks at >258° to a resin), $[\alpha]_D^{28}$ −57° in C_5H_5N (*hydrochloride*, decomp. >250°), is obtained from (**I**) and Na–$Bu^{\alpha}OH$. Rubijervine (**III**) and *iso*rubijervine (**IV**) give (H_2–PtO_2–MeOH–AcOH) *dihydrorubijervine*, m.p. 222° (its Ac_2 derivative, m.p. 216—219°, retains the original basic character), and -iso*rubijervine*, m.p. 244° (previous softening), respectively. (**I**) and aq. NaOH–MeOH at 50° yield (**II**), but similar attempts to isomerise (**III**) or (**IV**) were unsuccessful. Jervine, $C_{27}H_{39}O_3N$ (pentacyclic), remains in a special class, as it reacts as a *sec.* base and contains <2 conjugated double linkings which can be hydrogenated to tetrahydrojervine. (**IV**) readily forms a digitonide (cryst. within 30 min.), suggesting a 3(β)-OH group in the A ring of a steroid. (**III**) yields a digitonide on long keeping, but (**I**), (**II**), cevine, and protoverine do not. Veratrine alkaloids behave in some ways differently from solanidine (**V**) and related compounds. Methyl*cyclo*pentenophenanthrene is not isolated from the dehydrogenation of a veratrine base. Dehydrogenation of (**V**) gives (chromatographic separation) γ-methyl-1 : 2-*cyclo*pentenophenanthrene, m.p. 126—127°, 2-methyl-, m.p. 120—121°, and 1 : 2-dimethyl-phenanthrene, m.p. 146—148°, and a small amount of a *substance*, $C_{27}H_{41}N$ or $C_{26}H_{37}N$, m.p. 183—197°; no fluorene hydrocarbon was isolated. Constitutions of the veratrine alkaloids are discussed, but they are not clear. A. T. P.

Biscoclaurine alkaloids: constitutions of chondodendrine and trilobine. F. Faltis, L. Holzinger, P. Ita, and R. Schwarz (*Ber.*, 1941, **74**, [*B*], 79—97; cf. A., 1936, 1003).—Chondodendrine is degraded to a mixture of 6 : 4′-dicarboxy-2 : 3-dimethoxy-5-vinyldiphenyl ether (**I**) (the sole product from *iso*chondodendrine) and an isomeride (**II**). To establish the structure of (**II**) [already degraded to 4-carboxy-2 : 2′-dimethoxydiphenyl ether (**III**); *loc. cit.*] as 5 : 5′-dicarboxy-2 : 2′-dimethoxy-4-vinyldiphenyl ether, it was necessary to synthesise 4 : 5 : 5′-tricarboxy-2 : 2′-dimethoxydiphenyl ether (**IV**) (cf. King, A., 1939, II, 458). 4 : 5 : 1 : 2-$C_6H_2Br_2(CO_2Me)_2$, KOMe, and Cu at 170—180° give *Me*$_2$ 4-*bromo*-5-*methoxyphthalate* (**V**), m.p. 82—84° [free *acid*, m.p. 195·5°, effervescing at 192°, purified with difficulty from traces of 4 : 5 : 1 : 2-$C_6H_2Br_2(CO_2H)_2$]. iso*Vanillinoxime*, m.p. 145—145·5°, and hot Ac_2O afford *O*-*acetylvanillonitrile*, m.p. 122° (once, at room temp., iso*vanillinoxime acetate*, m.p. 109·5°), hydrolysed (NaOH) to 3 : 4 : 1-C_6H_3(OH)(OMe)·CN, m.p. 131·5—132°. Ullmann condensation between (**V**) and 3 : 4 : 1-C_6H_3(OK)(OMe)·CO_2Me gives little (**IV**), and 3 : 4 : 1-$C_6H_3(OMe)_2{\cdot}CO_2H$ is a troublesome by-product. *o*-OK·C_6H_4·OMe, 3 : 4 : 1-$C_6H_3Br(OMe){\cdot}CO_2Me$ (**VI**), m.p. 95·5—96°, and Cu at 180° give *p*-OMe·$C_6H_4{\cdot}CO_2Me$ (**VII**) mixed with some (**VI**) and 5-*carboxy*-2 : 2′-*dimethoxydiphenyl ether*, m.p. 167·5—168·5° [*Me* ester, m.p. 59·5—60°; in one experiment the phenolic portion contained (?) 2-*bromo*-2′-*hydroxy*-6 : 3′-*dimethoxydiphenyl ether*, m.p. 160—165°, possibly formed subsequently to transference of Br from (**VI**) to *o*-OH·C_6H_4·OMe]. (**VI**), KOPh, and Cu at 190° give some PhOMe, (**VII**), (**VI**), and 5-*carboxy*-2-*methoxydiphenyl ether*, m.p. 187—187·5° (*Me* ester, b.p. 120—140°/0·05 mm.). *Me* 4-*bromo*-3-*methoxybenzoate* (**VIII**), m.p. 55—55·8° (from the acid and CH_2N_2). *o*-ONa·C_6H_4·OMe, and Cu at 190° give impure *m*-OMe·$C_6H_4{\cdot}CO_2Me$, (**VIII**), and (**III**), m.p. 163—164°. The Ullmann condensation

between (VI) and Me_2 4-*hydroxy*-5-*methoxyphthalate*, m.p. 93—94°, is very unsatisfactory and the main products are (**VII**) and 4 : 5 : 1 : 2-$C_6H_2(OMe)_2(CO_2Me)_2$. The ordinary diphenyl ether synthesis appears to have reached the limit of its scope in the prep. of these tricarboxylic acids, since transference of halogen and alkyl groups takes place readily as a result of the accumulation of CO_2Me groups. More satisfactory results are obtained with intermediates of a lower state of oxidation where side-chains can be converted into CO_2H subsequent to Ullmann condensation. iso*Vanillin semicarbazone*, m.p. 212° (decomp.), NaOEt, and $N_2H_4.H_2O$ at 160° give 1 : 3 : 4-$C_6H_3Me(OH)\cdot OMe$, which with AcCl and $AlCl_3$ in $PhNO_2$ gives 2 : 4 : 5 : 1-$C_6H_2Me(OH)(OMe)\cdot COMe$ (**IX**), m.p. 123°. (**VI**), the K derivative of (**IX**), and Cu at 190° afford 5′-*carbomethoxy*-2 : 2′-*dimethoxy*-4-*acetyl*-5-*methyldiphenyl ether*, m.p. 131·5—132° (*semicarbazone*, m.p. 203—203·5° with decomp.); the free *acid*, m.p. 203—204°, is cautiously oxidised by $KMnO_4$ to the *glyoxylic acid*, $C_{18}H_{16}O_8$, m.p. 203° (*phenylhydrazone*, m.p. 187—189°), which is further oxidised (H_2O_2) to 4 : 5′-*dicarboxy*-2 : 2′-*dimethoxy*-5-*methyldiphenyl ether* (**X**), m.p. 250—251° (Me_2 ester, m.p. 123—124°). (**X**) is oxidised by hot alkaline $KMnO_4$ to (**IV**), mixed m.p. with the acid from the degradation of chondodendrine showing no depression. The biogenesis of this type of alkaloid is postulated to start with an enzymic dehydrogenation of coclaurine, followed by a continuous series of dehydrogenations and methylations via magnoline and trilobamine to tetrandrine and to trilobine, for which (or for *iso*trilobine) structure (*A*) is advanced. J. Wa.



(*A*.)

Active principles of bark of *Aegle marmelos*, Correa. A. Mookerjee (*Current Sci.*, 1943, **12**, 209).—Young bark of both Bengal and Bihar origin yields (*a*) a *coumarin* (0·03%), m.p. 123°, (*b*) an *alkaloid* (0·003%), m.p. 175°, and (*c*) umbelliferone. Old bark of both regions yields umbelliferone and a different *coumarin* (0·6%), m.p. 187—188°; old Bengal bark yields the same alkaloid as the young bark, but old Bihar bark yields a new *alkaloid* (0·3%), m.p. 142°. P. G. M.

VIII.—ORGANO-METALLIC COMPOUNDS.

Mercurated aliphatic nitriles.—See B., 1943, III, 280.

IX.—PROTEINS.

Chemistry of chromatin. A. E. Mirsky and A. W. Pollister (*Trans. New York Acad. Sci.*, 1943, [II], **5**, 190—198).—A lecture summary of some of the authors' work in this field. H. W.

(A) **Recovery of crystalline thyroxine from iodinated casein.** (B) **Recovery of *l*-thyroxine by direct acid hydrolysis of iodinated casein.** E. P. Reineke and C. W. Turner (*J. Biol. Chem.*, 1943, **149**, 555—561, 563—570).—(A) Iodinated casein (**I**) is hydrolysed by boiling aq. $Ba(OH)_2$, and in 2 experiments 100 g. gave 424 and 385 mg. of cryst. thyroxine (**II**), m.p. 230—232° (identified by I content, spectrographic absorption, and biological assay), respectively. (**I**) shows thyroidal activity equiv. to 3% that of *dl*-thyroxine (**III**). Since (**II**) is apparently formed in the protein in only the active *l*-form, the highest yield accounts for 28% of the activity of the original protein. Hydrolysis also gives an impure substance (3·4 mg.), insol. in acids, with activity equiv. to 2% of (**II**). Thus if all activity of (**I**) is assumed to be due to (**II**), the thyroidal activity of (**I**), as measured by the guinea-pig assay, is completely accounted for.

(B) Hydrolysis of (**I**) by equal parts of 32% aq. H_2SO_4 and BuOH allows the products to be extracted in the BuOH; 0·1% of cryst. *l*-thyroxine (**IV**), m.p. 236—238°, $[\alpha]_D$ −4·2° in EtOH–aq. NaOH. 65% I, is isolated. The use of 20% HCl in the hydrolysis gives a lower yield of (**IV**). (**IV**) has apparently twice the potency of (**III**), as shown by its elevation of CO_2 output and loss of body wt. of guinea-pigs. Synthesis of (**III**) in an iodinated protein is probably due to oxidative coupling of 2 mols. of di-iodotyrosine and the elimination of one side-chain. A. T. P.

X.—MISCELLANEOUS UNCLASSIFIABLE SUBSTANCES.

Lignin. XLII. Pressure hydrogenation of lignin and lignin-containing waste liquors of the pine. K. Freudenberg, W. Lautsch, G. Piazolo, and A. Scheffer (*Ber.*, 1941, **74**, [*B*], 171—183).—Pine lignin (**I**) is hydrogenated in presence of aq. alkali at 80—140 atm. and ~250° or ~340° in attempts to crack the phenylpropane units with production of C_6H_6, PhMe, or PhEt derivatives or their hydrogenation products; at ~340° S-containing substances (waste liquors) can be successfully reduced. Using 5% alkali at 260° with a catalyst of moderate activity, (**I**) gives 45—50% of phenols, of which 15% [calc. on (**I**)] are monocyclic [*o*-$OH\cdot C_6H_4\cdot OMe$, creosol, *o*-$C_6H_4(OH)_2$, etc.] and traces of nuclear-hydrogenated lignin degradation products. Under the same conditions with Raney Ni or Rupe Ni, 36—40% of nuclear-hydrogenated products are obtained of which 15% consists of *cyclo*hexanols. At 340°, there are formed 13—15% of phenols and (mainly) nuclear-reduced products containing considerable amounts of *cyclo*pentanols; 40% of neutral products, comprising 20% of monocyclic alcohols out of 27% of distillable material, is obtained, thus accounting for 53—55% of (**I**); the degree of activity of the catalyst or even its presence is of secondary importance. Lignin derivatives containing S (sulphite waste- or black-liquor) are best hydrogenated at 340° without a catalyst, affording corresponding yields of the same products. When *o*-$OH\cdot C_6H_4\cdot OMe$, 1 : 4 : 3-$C_6H_3Me(OH)\cdot OMe$ or 1 : 4 : 3-$CHMe{:}CH\cdot C_6H_3(OH)\cdot OMe$ is hydrogenated at 260°/100 atm. *cyclo*hexanol, 1-methyl- and 1-propyl-*cyclo*hexanol are obtained respectively. J. Wa.

Lignin. XLIII. Distillation of lignin in hydrogen. K. Freudenberg and K. Adam (*Ber.*, 1941, **74**, [*B*], 387—397).—The yield of products obtained by dry distillation of lignin (**I**) is increased in H_2 but only decisively in presence of a hydrogenation catalyst. Ni is used either by pptg. $Ni(OH)_2$ or $NiCO_3$ on the (**I**) or, more simply and better, by passing $Ni(CO)_4$ over dry (**I**) at 180°. The Ni–(**I**) mixture is then heated rapidly to ~220° and temp. increased at such a rate (control necessary at 240°, 320°, and 350°) that distillation is uniform. Small amounts (27 g.) of (**I**) are distilled in glass tubes; larger quantities (250 g.) in a specially constructed apparatus (illustrated). The Et_2O-sol. distillates (*A*) from various (**I**) generally contained 65—70% of distillable phenols (*B*). The yields of (*A*) were larger and those of (*B*) smaller in the small-scale experiments; the composition of (*B*) also varied in the two cases. (*A*) contained small amounts of acids (HCO_2H, AcOH, and traces of $EtCO_2H$) and neutral products [up to 7% of (**I**)] in addition to (*B*) [up to 35% of (**I**)]. The following are identified in the distillate from pine-(**I**): PhOH, *p*-$C_6H_4Et\cdot OH$, guaiacol, *p*-creosol, *o*- and *p*-ethylguaiacol, *iso*eugenol, *o*-$C_6H_4(OH)_2$, 4 : 1 : 2-$C_6H_3Pr(OH)_2$ and -$C_6H_3Me(OH)_2$, PhMe, *o*-$C_6H_4Et\cdot OMe$, 4 : 1 : 2-$C_6H_3Me(OMe)_2$, 2-methyl*cyclo*pentanol, *cyclo*hexanediol, MeOH, and EtOH. All the products are in harmony with the view that (**I**) is a phenylpropane derivative. The residue from the experiments with pptd. $Ni(OH)_2$ or $NiCO_3$ ignites in air at 30—40° and can be used as a hydrogenating catalyst. H. B.

Lignin. XIII. Cleavage of wood by nitration. H. Friese and W. Lüdecke (*Ber.*, 1941, **74**, [*B*], 308—313).—Under suitable conditions, *e.g.*, in AcOH or CCl_4–AcOH, wood meal can be nitrated so that only nitro-N and no ester-N is introduced, no evolution of N oxides is observed, and OMe falls by ~1·7%. The nitro-wood (**I**) retains its structure and whereas wood cannot be titrated with NaOH (phenolphthalein), (**I**) consumes 1 mol. of NaOH per NO_2; this titration is a time reaction and the nitrogenous component dissolves, leaving a swollen cellulosic mass. (**I**) takes up Na from NaOMe–MeOH without dissolving but H_2O dissolves out about half of the product, leaving N-free cellulose. Alkali and CS_2 rapidly dissolve (**I**). No so-called lignin estimation can be carried out with 66% H_2SO_4. Wood meal is unaffected by AcOH–$NaNO_2$. Isolated lignin cannot be nitrated without partial decomp. or without evolution of N oxides and a sharp fall in OMe (15 → 4%) is observed. Nitrolignin (**II**) from (**I**) has 2 N : 27 C whereas ligninsulphonic acid has only 1 S : 27 C, and the latter can be further nitrated. When (**I**) is treated with $Ca(HSO_3)_2$ the (**II**) is extensively broken down and no insight into the reaction is gained. Methylated wood (OMe 36%) swells on nitration and the product has 1·8% N and 19·3% OMe. J. Wa.

Beech bark (*Fagus sylvatica*). I. E. Clotofski, H. Weikert, and H. Nick (*Ber.*, 1941, **74**, [*B*], 299—307).—Distillation of finely-ground bark with superheated steam or steam under reduced pressure gave no identifiable Et_2O-sol. material. Extraction with org. solvents gives the following recoveries calc. on air-dried bark: EtOH 9·2, $COMe_2$ 7·6, dioxan 12·8, MeOH 12·2%; other solvents immiscible with H_2O give poorer results. The hot MeOH extract deposits a fraction (*A*) on cooling and the material in the mother-liquors is recovered and separated into H_2O-sol. (*B*) and H_2O-insol. (*C*) fractions. (*A*) consists of a *paraffin*, m.p. 63—65°, and a wax giving, on saponification, an *alcohol*, $C_{20}H_{42}O$ (arachidyl? or eicosyl?) m.p. 73°, and an *acid*, $C_{20}H_{42}O_2$, m.p. 57—58°. (*B*) contains tannins and, on hydrolysis, gives 40% of sugars and 57% of phlobaphens. (*C*) is separated into Na_2CO_3-sol. material, consisting of a mixture of higher fatty and resin acids, and Na_2CO_3-insol. material, which, on saponification, gives an alcohol (arachidyl ?), m.p. 72·5—73°, Hess' phytosterol, m.p. 132°, a substance, m.p. 225—227°, giving cholesterol reactions, and an *acid*, $C_{24}H_{28}O_2$ (carnaubic?), m.p. 70—71°. The extracted bark (OMe 6·13%) is hydrolysed with 12% H_2SO_4 (residue 90·9%, OMe 6·78%), then with 65% H_2SO_4 (residue 42·2%, OMe 12·32%); pentoses, but not hexoses, are liberated in the first stage, and both in the second (*phenylosazone*, $C_{18}H_{22}O_4N_4$, m.p. 204—205°). The behaviour of the extracted bark towards Schweitzer's reagent and Na_2SO_3 is reported. J. Wa.

Pigment, $C_{10}H_{12}O_3N$, from *Actinomyces*.—See A., 1943, III, 845.

XI.—ANALYSIS.

Purification of substances by partial fusion and warm absorption.—See A., 1943, I, 320.

Determination of small concentrations of electrolytes.—See A., 1943, I, 313.

Spectroscopic method for the analysis of multi-component mixtures and its infra-red application.—See A., 1943, I, 319.

Silver vanadate : use in micro-combustion of organic compounds. G. Ingram (*J.S.C.I.*, 1943, **62**, 175—176).—Ag_3VO_4 is a satisfactory oxidation filling, which also absorbs halogen and S etc. in the combustion of org. compounds. Possible substitutes for PbO_2, prepared by suspending suitable oxides on $AgCrO_4$, are capable of absorbing N oxides.

Micro-method for halogen determination in organic molecules according to A. Stepanow's principle. I. Irimescu and E. Chirnoagă (*Z. anal. Chem.*, 1942, **125**, 32—37).—The org. substance is dissolved in anhyd. EtOH and metallic Na added. Reaction to form Na halide is soon completed; H_2O is added, and the solution warmed. The halide is then determined gravimetrically as the Ag salt, or by Volhard's method. Reaction is effected in a specially-designed vessel to which a cooling condenser is attached. The method is unsuitable for liquid org. substances. A determination requires 40—70 min. Details of apparatus and procedure, and test data on aromatic org. substances, are recorded. L. S. T.

Dumas nitrogen determinations.—See A., 1943, I, 310, 321.

Micro-analysis of sulphur in organic substances. N. E. Gelman (*Zavod. Lab.*, 1939, **8**, 673—677).—Ter Meulen's semi-micro-method (A., 1934, 424) is adapted to determination of S in 3—5 mg. of volatile or non-volatile org. substances; halogen, As, N, or CNS′ does not interfere. The error $\not>0{\cdot}16\%$. R. T.

Determination of small quantities of boric acid in organic substances. E. G. Beckett and M. F. H. Webster (*Analyst*, 1943, **68**, 306).—When the sample is ashed with Na_2CO_3, dissolved in conc. H_2SO_4, and heated at 150° with 4 : 4′-diamino-1 : 1′-dianthraquinonylamine the optical density at ~6200 A. is a measure of B_2O_3 content. L. A. D.

Polarographic determination of vanadium [in organic compounds].—See A., 1943, I, 317.

Characteristic reactions of citric and tartaric acid. A. Steigmann (*J.S.C.I.*, 1943, **62**, 176).—The hydroxy-pyrroles and -pyridines formed by melting aliphatic OH-acids with $CO(NH_2)_2$ at 160—200° condense with suitable aldehydes in AcOH solution forming dyes which are characteristic for citric and tartaric acid.

Effect of citrate on rotation of molybdate complexes of malate, citramalate, and *iso*citrate.—See A., 1943, II, 350.

Anomalous amino-nitrogen values. H. E. Carter and S. R. Dickman (*J. Biol. Chem.*, 1943, **149**, 571—572).—*o*-, *m*-, and *p*-$C_6H_4(OH)_2$ submitted to the Van Slyke procedure at 24—28° for 30 min. give respectively vals. of 0·58, 1·03, and 0·36 atoms of NH_2-N per mol. Similarly, chrysogenin (N-free) appears to contain 2·73% N. Crude penicillin liberates N_2 from HNO_2, although other evidence indicates the absence of NH_2-N. R. L. E.

Volumetric determination of glucose. M. Niculescu and N. Căplescu (*Z. anal. Chem.*, 1943, **25**, 416—423).—The glucose (**I**) solution is oxidised by warming with standard aq. $K_2Cr_2O_7$ and conc. H_2SO_4. After dilution, the excess of $K_2Cr_2O_7$ is found by titration with aq. Fe NH_4 sulphate solution, using $K_3Fe(CN)_6$ as external indicator. The (**I**) to be determined should be 10—25 mg. and the quantities of $K_2Cr_2O_7$ and H_2SO_4 given must be adhered to. Test data and details of procedure are given. L. S. T.

Determination of free and bound hexuronic acid. K. Freudenberg, H. Gudjons, and G. Dumpert (*Ber.*, 1941, **74**, [*B*], 245—247).—Apparatus and technique are described for decomp. hexuronic acids and polyuronides in a stream of N_2 with 20M-$ZnCl_2$ solution at 160—165° and collecting CO_2 after suitable removal of furfuraldehyde and other anticipated volatile products. J. Wa.

Determination of amino-acids by the solubility-product method. S. Moore and W. H. Stein (*J. Biol. Chem.*, 1943, **150**, 113—130).—The principle of the method is that the solubility at 0° of a sparingly sol. salt of an NH_2-acid [that formed with an aromatic sulphonic acid (**I**) is normally used] is determined in the solution under investigation with and without the addition of a known amount of free (**I**). From the results and the (previously determined) solubility product of the salt, the concn. of the NH_2-acid in the solution is calc. The theory of the method as applied to the determination of leucine (**II**) and glycine (**III**) is discussed, and the experimental technique is described in very full detail. 1 : 2 : 5-$C_6H_3MeBr{\cdot}SO_3H$ is suitable for (**II**), and 5 : 1-$NO_2{\cdot}C_{10}H_6{\cdot}SO_3H$ for (**III**). Other NH_2-acids interfere only in certain unusual circumstances. Using this method, the (**II**) content of ovalbumin was found to be 9·0%, and the (**III**) content of silk fibroin 43·8%. E. C. W.

Use of glass fluorescent standard in the determination of aneurin (vitamin-B_1). G. Vastagh and F. Szeghö (*Z. anal. Chem.*, 1942, **125**, 23—32).—The conditions under which the Zeiss glass fluorescence standard can be used in the thiochrome method for determining vitamin-B_1 have been investigated. The relationship between the quantity of -B_1 and the fluorescence intensity obtained with the glass standard is not linear. This is due, not to optical causes, but mainly to the unfavourable distribution coeff. between the aq. alkaline solution and the Bu$^\beta$OH solution of thiochrome (**I**), which makes quant. extraction difficult. Filter-paper and the Bu$^\beta$OH itself also have a fluorescence that cannot be neglected. Addition of NaCl improves extraction. The procedure described for the oxidation of -B_1 to (**I**), the extraction of (**I**), and the use of the glass standard permits the employment of a type of step photometry to the determination of -B_1 without the repeated prep. of comparison solutions. L. S. T.

Determination of piperazine. III. A. Castiglioni (*Z. anal. Chem.*, 1941, **121**, 347—348; cf. A., 1941, II, 388).—10 c.c. of piperazine solution in 95% EtOH are treated with 10 c.c. of 5% $H_2C_2O_4$ in 95% EtOH, and the whole is set aside for 8—10 hr. The ppt. is collected, washed with 95% EtOH, dried at 100—105°, and weighed. $(CH_2)_6N_4$ gives a ppt. with $H_2C_2O_4$, and must be absent. Salicylic and quininic acids do not interfere. L. S. T.

Nephelometric determination of nicotine. K. B. Trifonova (*Zavod. Lab.*, 1939, **8**, 731).—Nicotine is determined by comparing the turbidity developed in test and standard solutions on addition of 1% silicotungstic acid. R. T.

Detection of native protein with pH indicators. M. Ishidate and T. Sakaguchi (*Ber.*, 1941, **74**, [*B*], 163—170).—The protein error (P.E.) of indicators is further developed as a spot test for native protein (cf. Feigl and Anger, *Mikrochim. Acta*, 1937, **2**, 107). Of 27 indicators used, tetrabromophenolphthalein ester (**I**) is the most sensitive as it can detect casein, hæmoglobin, ovalbumin, and gelatin in limiting concns. of 0·004—0·005% (2—2·5 μg.); next in order come Congo-red, bromophenol-blue, dimethyl-yellow, and metanil-yellow. Only dyes effective as pH indicators in the range 1·2—5·5 are found to be effective, and the P.E. is max. at about the isoelectric point and min. at pH ~2·5. The P.E. is first determined and then the protein is broken down with HCl or NaOH and, after neutralisation, the P.E. is again determined. Differences are marked with (**I**) and negligible with other indicators. J. Wa.

Determination of gelatin.—See A., 1943, III, 928.

Total nitrogen content of ovalbumin and other proteins. A. C. Chibnall, M. W. Rees, and E. F. Williams (*Biochem. J.*, 1943, **37**, 354—359).—The Kjeldahl process may give low vals. for the N content of proteins. This is due to the digestion period being too short (with proteins and protein hydrolysates it should be continued for $\not<8$ hr. after the digest has cleared) and to the pronounced hygroscopic activity of anhyd. proteins which necessitates that moisture and N contents should be determined on separate samples of air-dried material. Using the technique described, the following vals. have been obtained for the N content of moisture- and ash-free protein : ovalbumin (native and uncoagulated) 15·76, edestin 18·7, β-lactoglobulin 15·58, casein 15·73, amandin 18·75, insulin 15·54, and horse carboxyhæmoglobin (moisture- but not ash-free) 16·8%. H. G. R.

Foreman method for determination of dicarboxylic acids in protein hydrolysates. K. Bailey, A. C. Chibnall, M. W. Rees, and E. F. Williams (*Biochem J.*, 1943, **37**, 360—372).—Cystine (**I**) in the hydrolysate undergoes partial dismutation into the sulphinic and sulphonic acids during treatment with CaO and is pptd. with the Ca dicarboxylates by EtOH together with small amounts of (**I**), tyrosine, serine (**II**), and other bases. The Ca salts of the dismutation products are very insol. and interfere with the determination of aspartic acid (**III**) as Ca salt (**IV**). (**I**) may be removed as the Cu^I mercaptide prior to the CaO–EtOH treatment. A small amount of the more insol. NH_2-acids (methionine, tyrosine, leucine, and phenylalanine) contaminates the mercaptide ppt. but there is no loss of dicarboxylic acids or arginine and the purity of (**IV**) is such that no crystallisation is necessary. Significant amounts of both (**III**) and glutamic acid (**V**) may be isolated from the CaO–EtOH filtrate after removal of the bases and most of the NH_2-acid. The solubility of the Ca glutamate is relatively high, especially when some of the acid is *dl*-, but that of (**IV**) appeared to be small. A modified procedure gives vals. for the (**III**) and (**V**) contents of proteins accurate to within 2%. The application of solubility correction to results obtained by one complete CaO–EtOH treatment gives vals. > those in literature. The "hydroxyglutamic acid" fractions previously reported are mixtures of (**III**) and (**V**), dibasic dismutation products of (**I**), and (**II**) and its decomp. products in varying proportions, and no indication of the presence of any other dicarboxylic acid has been obtained. The results obtained by previous workers with Foreman's method are valueless from the point of view of the Bergmann–Niemann hypothesis. H. G. R.

INDEX OF AUTHORS' NAMES, A., II.

DECEMBER, 1943.

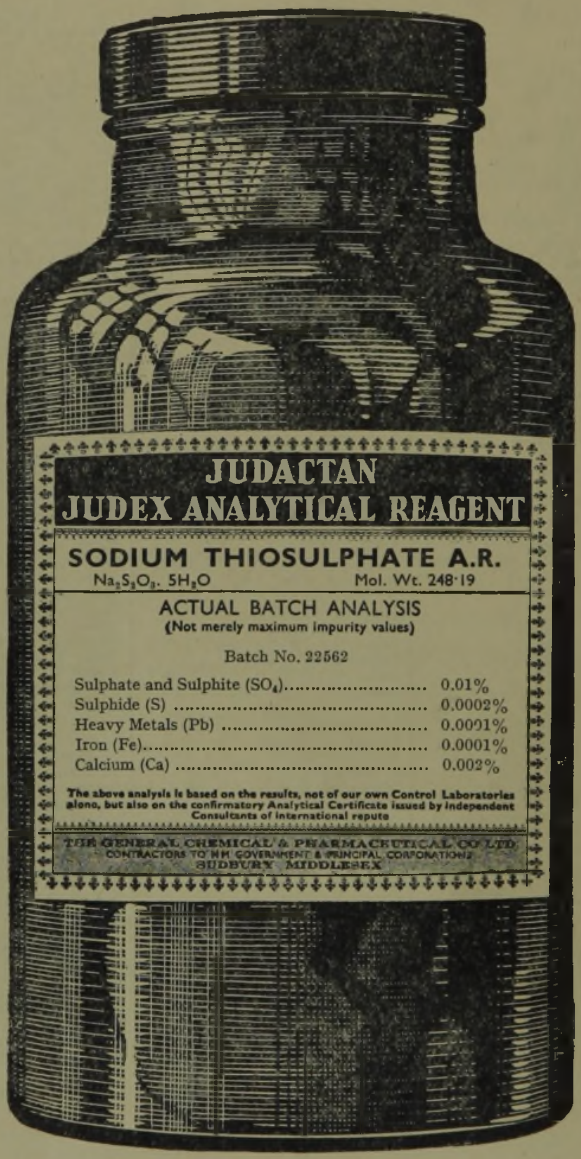
JUDACTAN

ANALYTICAL REAGENTS WITH ACTUAL BATCH ANALYSIS

ACTUAL

BATCH

ANALYSIS



Each Batch subjected to INDEPENDENT ANALYSIS before label is printed

You are invited to compare the above actual batch analysis with the purities guaranteed by the specifications of any competing maker in this Country or abroad

THE GENERAL CHEMICAL & PHARMACEUTICAL CO. LTD.

Chemical Manufacturers, Judex Works, Sudbury, Middlesex

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