# INDEX OF SUBJECTS, 1976

#### A

- Acetalisation, role of, in resin formation, and the configuration of jalaric acid. Structural investigation of lac resin. Part XI, 2045.
- Acetals, cyclic, from 1,4,5,6,7,7-hexachloronorborn-5-en-2 endo-ylalkarols, 2581.
  - Reactions of keten acetals. Part VI, total syntheses of the anthraquinones (±)-nalgioversin, (±)-isorhodoptilometrin, and (±)-rhodoptilometrin, 613. Part 7, total syntheses of the tetramethyl ethers of the 1-acyl-2,4,5,7-tetrahydroxyanthraquinones rhodolamprometrin and rhodocomatulin, 1852.
- Acetamides, synthesis of, by the reactions of alcohols with sulphuryl chloride in acetonitrile, 2205.
  - Photocyclization of NN-disubstituted benzoylacetamides and acetoacetamides, 2054.
- Acetates. Biosynthesis of fungal metabolites. Part IX, sclerin; feedings with [1,2-13C]acetate and [methyl-13C]-methionine. 2077.
  - Chemistry of santonene. Part XII, photolysis of 4-acetoxysantonene and its 4-epimer: an example of photodecarboxylation of acetates, 442.
- Acetic anhydride-sodium acetate, reaction of 2-amino-2-deoxy-p-gluconic acid with hot, 1001.
  - Amine oxidation. Part XII, reactions of some NN-dimethylbenzylamine N-oxides with acetic anhydride and of some N-acetoxy-NN-dimethylbenzylammonium perperchlorates with acetate ion. The Polonovski reaction, 1801.
  - Reaction of 'myrcene-magnesium' with esters, acetyl chloride, and acetic anhydride: formation of cyclopentenols and cyclopropane derivatives, 1815.
- Acetonitrile-hydrogen peroxide, by-products from the epoxidation of (+)-car-3-ene with. Chemistry of terpenes. Part XXI, 791.
  - Synthesis of acetamides by the reactions of alcohols with sulphuryl chloride in acetonitrile, 2205.
- Acetophenones. Heterodiene syntheses. Part XVI, a new [4 + 2] cycloaddition pathway in the reaction of 2-oxoindolin-3-ylideneacetophenones with ethyl vinyl ether, 1248.
  - Metal-catalysed organic photoreactions. Photo-oxidations of  $\alpha\beta$ -unsaturated ketones and o-methylaceto-phenone in the presence of copper(II) salts, 779.
  - Novel aspects in the synthesis and acid-promoted cyclisation of some 2-diazo-2'-(p-tolylsulphonylamino)acetophenones: electrophilic displacement of an arylsulphonyl group from a sulphonamide, 1757.
- Acetyl chloride. Reaction of 'myrcene-magnesium' with esters, acetyl chloride, and acetic anhydride: formation of cyclopentenols and cyclopropane derivatives, 1815.

# Acetylenes-see also Alkynes.

- chain extension reactions of. Part II, a comparison of the reactions of butyl-lithium with 1-iodoalk-1-ynes and 1-bromoalk-1-ynes, 1609.
- electrophilic, reaction of sulphimides with, 716.

- natural. Part XLIX, polyacetylenes from *Dahlia* scapigera (A. Dietr.) Link and Otto var. scapigera f. scapigera and some *Dahlia* hybrids, 735.
- Addition reactions of heterocyclic compounds. Part LXIII, new structures for some 2:1 molar adducts from dimethyl acetylenedicarboxylate with thiazoles and benzo-imidazoles, -oxazoles, and -thiazoles formed by novel rearrangement. Crystal and molecular structure determinations for tetramethyl 3,8a-dimethylpyrido[2,1-b]thiazole-5,6,7,8-tetracarboxylate and tetramethyl 5-methylpyrido[2,1-b]thiazole-6,7,8,8a-tetracarboxylate, 1269. Part LXIV, indolizines from reactions of hex-3-yne-2,5-dione, but-3-yn-2-one, and allenecarboxylic esters with some nitrogen-containing heterocyclic ylides, 1908.
- Michael condensation of 4-hydroxy-6-methylpyran-2-one with dimethyl acetylenedicarboxylate, 2137.
- Organocobalt complexes. Part VIII, specificity of the cyclopentenone synthesis from acetylenehexacarbonyldicobalt complexes and norbornene derivatives, 30.
- Ring-opening of 2,5-diaryl-3-lithiofurans, 989.
- Acids. A convenient synthesis of βγ-unsaturated carboxylic acids and esters. The isomeric 5-t-butylcyclohex-2enecarboxylic acids, 2279.
  - Light-sensitive amides. Photocleavage of N-acyl-1,2,3,4-tetrahydro-8-nitroquinolines to give free carboxylic acids, 57.
  - Microbial metabolites. Part XI, total synthesis and absolute configuration of (S)-carlosic acid (4-butyryl-2,5-dihydro-3-hydroxy-5-oxofuran-2-acetic acid) and conversion of (R)-5-methyltetronic acid into (R)-carolic acid {3,4-dihydro-8-methylfuro[3,4-b]oxepin-5,6(2H,8H)-dione}, 1485.
  - Organosulphur compounds. Part VIII, reaction of monothiocarboxylic acids with dicyclohexylcarbodi-imide and other reactions leading to monothio-anhydrides, 564.
  - Oxidation and bimoleuclar condensation reactions of 2-alkyliminocyclopentanedithiocarboxylic acids, 2-oxocyclopentanedithiocarboxylic acids, and 3-methyl-5-oxo-1-phenyl- $\Delta^2$ -pyrazoline-4-dithiocarboxylic acid, 1706.
  - Reactions of a 'myrcene-magnesium' complex with aldehydes, ketones, epoxides, carbon dioxide, and acetonitrile, 1809.
  - Remote oxidation of carboxylic acids by peroxodisulphuryl difluoride in fluorosulphuric acid: a general synthesis of lactones, 2035.
- Acridines, some 9-amino- with bulky substituents, synthesis of, 465.
  - Polyhalogenoheterocyclic compounds. Part XXIX, perchloro-acridine,-phenanthridine, and -benzo[h]quinoline, 1069.
- Acridones. Intramolecular cyclisation of 2-aminobenzophenones; a new 9-acridone synthesis, 2089.
- Acroptilin. Chemistry of the Compositae. Part XXXI, absolute configuration of the sesquiterpene lactones cen-

- Acroptilin (contd.)
  - taurepensin (chlorohyssopifolin A), acroptilin (chlorohyssopifolin C), and repin, 1663.
- Acrostalagmus fungus, structures of three new C<sub>16</sub> terpenoids from, 2407.
- Actiniolide, dihydro-, (5,6,7,7a-tetrahydro-4,4,7a-trimethylbenzofuran-2(4H)-one] and 6,7,8,8a-tetrahydro-5,5,8a-trimethylnaphthalene-1,3(5H)-dione from 6,7,8,8a-tetrahydro-2,5,5,8a-tetramethyl-5H-chromen, 532.
- Activating groups for the ring expansion of coumarin by diazoethane: benzoyl, pivaloyl, arylsulphonyl, arylsulphinyl, and nitro, 1260.
- Acylation, alkylation, and Beckmann rearrangement of oximes in the presence of an oxidation-reduction system,
- Acyl chlorides. Pentatomic heteroaromatic cations. Part V, a convenient general method for the preparation of aldehydes from acyl chlorides via 2-substituted 1,3-benzoxathiolylium tetrafluoroborates, 323.
- Adamantane, chemistry of. Part IX, 1,2-difunctional adamantanes; synthesis and reactions of protoadamantane-4-spiro-oxiran, 1893.
  - Nitration and nitrosation reactions of 7-nitro-1,3,5-triaza-adamantane and derivatives, 940.
  - the existence of; non-coplanar double bonds, 234.
- Addition reactions of heterocyclic compounds. Part LXIII, new structures for some 2:1 molar adducts from dimethyl acetylenedicarboxylate with thiazoles and benzo-imidazoles, -oxazoles, and -thiazoles formed by novel rearrangement. Crystal and molecular structure determinations for tetramethyl 3,8a-dimethylpyrido-[2,1-b]thiazole-5,6,7,8-tetracarboxylate and tetramethyl 5-methylpyrido[2,1-b]thiazole-6,7,8,8a-tetracarboxylate, 1269. Part LXIV, indolizines from reactions of hex-3-yne-2,5-dione, but-3-yn-2-one, and allenecarboxylic esters with some nitrogen-containing heterocyclic ylides, 1908. Part LXV, synthesis, tautomerism, and rearrangement of some 2H- and 4H-quinolizine esters, 1911.
  - Addition products of 2-(N-arylformimidoyl)pyridines and carbanions, and their reduction to octahydroindolizine derivatives, 5.
  - Dehydrobromination of 3-bromotricyclo[5.3.1.0³,8]undecane (3-bromo-4-homoisotwistane) and some addition reactions of tricyclo[5.3.1.0³,8]undec-2-ene. Stereochemistry of the formation and reaction of an anti-Bredt compound probed by deuterium substitution, 2133.
  - Electrophilic addition of perfluorofluoro-oxy-compounds to unactivated double bonds, 101.
  - Elimination and addition reactions. Part XXVI, asymmetric induction in additions of nucleophiles and electrophiles to αβ-unsaturated sulphoxides, 492. Part XXVII, addition of amides to electrophilic alkenes, 1543.
- Aflatoxin  $B_1$  and sterigmatocystin, carbon-13 nuclear magnetic resonance assignments and biosynthesis of, 1182.
- Alcohols, axial triterpene, a convenient preparation of: reduction of triterpenoid ketones with bornan-2-exo-yloxyaluminium dichloride, 321.
  - Alkyl aryl sulphides from the interaction of aryl thiocyanates and alcohols under the influence of triphenylphosphine or of trialkyl phosphites, 2394.
  - Factors in the formation of isomerically and optically pure alkyl halides. Part X, reactions of saturated aliphatic alcohols with thionyl chloride, 104.

- Heterocyclic syntheses with malonyl chloride. Part XI, reactions of 2-alkyl- (or -aryl-)thio-7-chloropyrano-[3,4-e][1,3]oxazine-4,5-diones with water and with alcohols, 2462.
- Neighbouring group effects in epoxide ring opening; cisepoxy-alcohols, 1442.
- Reactions of a 'myrcene-magnesium' complex with aldehydes, ketones, epoxides, carbon dioxide, and acetonitrile, 1809.
- Synthesis of acetamides by the reactions of alcohols with sulphuryl chloride in acetonitrile, 2205.
  - of dialkyl sulphites from alcohols in the halogen-pyridine-sulphur dioxide system. Novel behaviour of alkyl chlorosulphates in the pyridine-sulphur dioxide system, 108.
  - of esters from alcohols or alcohols and aldehydes with t-butyl hypoiodite, 383.

### Aldehydes—see also Carbonyl compounds.

- and phosphorus trichloride. Reactions of carbonyl compounds with tervalent phosphorus reagents. Part V, 535.
- A new synthesis of pyrimido[4,5-e]-as-triazine 4-oxides by nitrosative cyclization of aldehyde uracil-6-ylhydrazones in the presence of diethyl azodiformate, 713
- A simple method for the preparation of 'ribonucleoside dialdehydes' and some comments on their structure, 1567.
- Heterocyclic studies. Part XXXVII, ready ring cleavage and decarbonylation of pyrimidine-5-carbaldehydes, 125. Part XXXVIII, synthesis and disproportionation of pyrimido[4,5-b]quinolinium salts, 131.
- Pentatomic heteroaromatic cations. Part V, a convenient general method for the preparation of aldehydes from acyl chlorides via 2-substituted 1,3-benzoxathiolylium tetrafluoroborates, 323. Part VI, new syntheses of aldehydes and ketones by reaction of 1,3-benzodithiolylium salts with Grignard reagents, 1886.
- Photochemical formation of amides from t-butylamine and aromatic aldehydes and ketones, 1511.
- Quinolines and uracils from reactions of isocyanates with aliphatic aldehydes, 1597.
- Reactions of a 'myrcene-magnesium' complex with aldehydes, ketones, epoxides, carbon dioxide, and acetonitrile, 1809.
  - of hydrazones and related compounds with strong bases. Part III, 1,2,4-triazoles, 1,2,4-triazines, and 1,3,5-triazines from aromatic aldehyde azines, 207.
- Synthesis of esters from alcohols or alcohols and aldehydes with t-butyl hypoiodite, 383.
- Alkaloids, new dibenz[d, f]azonine, from Cocculus laurifolius DC, 2197.
  - of the genus Erythroxylum. Part I, E. monogynum Roxb. roots, 1550.
  - A one-step synthesis of the phthalidylisoquinoline alkaloids, cordrastine and hydrastine, 1221.
  - Conversion of secologanin into elenolic acid and 18-oxayohimban alkaloids, 160.
  - Structures of tabernaelegantines A-D and tabernaelegantinines A and B, new indole alkaloids from *Tabernaemontana elegans*, 1432.
  - Studies on the alkaloids of Formosan *Corydalis* species. Part VI, elucidation of the structures of two spirobenzylisoquinoline alkaloids, yenhusomine and yenhusomidine, and two berbine alkaloids, corytenchine

### Alkaloids (contd.)

- and corytenchipine, from Corydalis ochotensis (Turcz.), 63.
- related to the total synthesis of alkaloids in the carpaine and cassine series. Part 6, total synthesis of (+)-azimic acid, 2190.
- Synthesis of the indolo[2',3': 3,4]pyrido[1,2-b][2,7]naph-thyridinone alkaloid nauclefine and its ring-E isomers, 2416.
- Alkanediols. Polyfluorocycloalkenes. Part XII, reaction of decafluorocyclohexane with alkanediols in the presence of base, 573.
- Alkanedithiols. On the reactions of alkanedithiols with picryl halides, 2214.
- Alkanes. Carbene chemistry. Part X, insertion reactions of 1,2,2-trifluoroethylidene into C-H bonds of alkanes containing the t-butyl group and some addition and insertion reactions of 2-chloro-1,2,2-trifluoroethylidene, 513.
  - Electrochemical syntheses. Part VII, isomer distribution in the partial oxidation of n-alkanes, 610.
  - Perfluoroalkyl derivatives of sulphur. Part XVIII, reactions of polyfluoroiodoalkanes with sodium methanethiolate in the presence of dimethyl disulphide, and related reactions, 525.

### Alkenes-see also Olefins.

- gold(III) as an electrophilic oxidant of, 811.
- reactions of thallium(1) azide and iodine with, 840.
- Dichotomous ylide formation from an alkyl(benzyl)phosphonium salt leading to stereoselective alkene syntheses, 1476.
- Elimination and addition reactions. Part XXVII, addition of amides to electrophilic alkenes, 1543.
- Reactions of iodine oxide with alkenes, 1961.
- Alkylation, acylation, and Beckmann rearrangement of oximes in the presence of an oxidation-reduction system, 1708
  - of phenols, intramolecular. Part III, asymmetric induction by a chiral leaving group, 634.
  - of tricarbonyldienyliron cationic complexes with organocadmium reagents: organometallics in synthesis, 954.
  - Chemistry of organoborates. Part 5, alkylation of alkynyltrialkylborate salts, 2419. Part 6, alkylation of alkynylborates with some complex alkylating agents, 2428.
  - Condensed cyclic and bridged-ring systems. Part IV, stereochemically controlled synthesis of some *endo-2*-aryl-6-oxobicyclo[3.2.1]octanes and related compounds through intramolecular alkylations of  $\gamma\delta$ -unsaturated  $\alpha'$ -diazomethyl ketones, 1669.
  - Stabilised enamine anions. Generation and alkylation of anions stabilised as cyclopentadienide enamine systems, 1603.
- Alkyl halides. Organometallic compounds of Group II. Part VII, preparation of 4-alkylpyridines by reactions of some light metals with alkyl halides in pyridine, 1977.

# Alkynes-see also Acetylenes.

- cyclopropanes and benzene derivatives, reactions of, with gold(III), 1983.
- Chain extension reactions of acetylenes. Part II, a comparison of the reactions of butyl-lithium with 1-iodoalk-1-ynes and 1-bromoalk-1-ynes, 1609.
- C-Nucleoside studies. Part III, glucofuranosylethynes from 2,3: 5,6-di-O-isopropylidene-p-mannose, 68.

Allenes. Part 34, reactions of methylindoles and 2,5-dimethylpyrrole with allenic carbenes, 2103.

- polyhalogeno-. Part X, an improved preparation of perfluoro-(3-methylbuta-1,2-diene) and the structure of its dimers, 1173.
- Addition reactions of heterocyclic compounds. Part LXIV, indolizines from reactions of hex-3-yne-2,5-dione, but-3-yn-2-one, and allenecarboxylic esters with some nitrogen-containing heterocyclic ylides, 1908.
- Asymmetric induction and raceinisation in allenic sulphoxides, 2061.
- Cycloaddition reactions of cumulenes. Part IV, a novel mode of reaction of azomethine oxides with 1,1-dimethylallene; formation of a substituted piperidin-4-one, 719.
- Ring-opening of 2,5-diaryl-3-lithiofurans, 989.
- Alloxazines, isoalloxazines, toxoflavins, and fervenulins, syntheses of, by oxidative cyclization of the Michael-type adducts from substituted 6-aminouracils and azo-compounds, 2398.
- Aluminium. Metal catalysis in organic reactions. Part II, products and stereochemical aspects of the isomerizaation of heptenes by the tri-isobutylaluminium-bis-N-methylsalicylideneaminenickel system, 1904.
  - Reduction of triterpenoid ketones with bornan-2-exo-yloxyaluminium dichloride: a convenient preparation of axial triterpene alcohols, 321.
- Ambident nucleophiles. Phosphorus—nitrogen compounds. Part XLIII, reactions of NN-dialkylanilines with phosphorus(v) chlorides; examples of ambident nucleophilic behaviour, 1739.
- Amides, light-sensitive. Photocleavage of N-acyl-1,2,3,4-tetrahydro-8-nitroquinolines to give free carboxylic acids, 57.
  - photochemical formation of, from t-butylamine and aromatic aldehydes and ketones, 1511.
  - Elimination and addition reactions. Part XXVII, addition of amides to electrophilic alkenes, 1543.
  - Intramolecular coupling of diaryl amides by anodic oxidation, 661.
- Amidines, fused polycyclic. Part III, an unexpected mode of cyclisation of 2-phenacylisoquinolinium bromide, 201.
  - v-Triazolo[4,5-d]pyrimidines(8-azapurines). Part XVII; preparation of 1,6-dihydro-8-azapurines by heating 4-amino-5-aminomethyl-N-alkyl-1,2,3-triazoles with orthoesters or amidines, 291.
- Amidinoacetamides in the synthesis of pyrimidines, imidazoles, and purines, 1847.
- N-Amination and subsequent oxidation by bromine of imidazo[1,5-a]pyridines, 1722.
  - of some fused imidazoles and triazoles, 367.
- Amines, N-hydroxy-, oxidation of, by sulphuryl chloride, 2202.
  - secondary aliphatic, reaction of benzofurazan N-oxide with; preparation of NN-dialkyl-N'-(o-nitriphenyl)-hydrazines, 2216.
    - reaction of some azetidin-2-ones with, 1062.
  - Amine oxidation. Part XII, reactions of some NN-dimethylbenzylamine N-oxides with acetic anhydride and of some N-acetoxy-NN-dimethylbenzylammonium perchlorates with acetate ion. The Polonovski reaction, 1801.
  - Behaviour of nitrile oxides towards nucleophiles. Part III, dimerisation of aromatic nitrile oxides catalysed

- Amines (contd.)
  - by trimethylamine, 1825. Part IV, heteromacrocycles from acetonitrile oxide, 1827.
  - Photochemical formation of amides from t-butylamine and aromatic aldehydes and ketones, 1511.
  - Polyfluoroalkyl derivatives of nitrogen. Part XLIII, reactions of N-bromobis(trifluoromethyl)amine with 1-fluoropropene under free-radical and under ionic conditions, 556.
  - Sequential nature of the thermal reaction of stearic acid with some 1,2-diamines, 386.
  - Studies of enzyme-mediated reactions. Part VI, stereochemical course of the dehydrogenation of stereospecifically labelled benzylamines by the amine oxidise from pea seedlings (E.C. 1.4.3.6.), 1052. Part VII, stereospecific syntheses of tritium-labelled (2R)-and (2S)-dopamines: stereochemical course of hydroxylation of dopamine by dopamine β-hydroxylase (E.C. 1.14.17.1), 1056.
    - related to the chemistry of melanins. Part XIV, the alleged formation of a *p*-quinonoid aminochrome by oxidation of 2,4,5-trihydroxyphenethylamine, 339.
  - Syntheses with isoxazoles. Part IV, ring-opening reactions of 4,5,6,7-tetrahydro-4-oxoisoxazolo[2,3-a]-pyridinium salts and related compounds under the influence of tertiary amines, 1241.
- Amino-acids and peptides. Part XVI, synthesis of cyclo-[L-(α-amino)-β-alanylglycyl-D-(α-amino)-β-alanylglycyl] and related fourteen-membered cyclotetra-peptides, 2010. Part XVII, synthesis of cyclo-[(O-t-butyl)-L-seryl-β-alanylglycyl-(O-methyl)-L-β-as-partyl], and observations on the rearrangement of β-aspartyl peptide ester, 2014. Part XVIII, studies relating to the synthesis and conformation of a novel bicyclic peptide system, 2019.
  - Part XXXIX, synthesis of analogues of bradykinin with modifications in positions 1,6, and 9, 220.
  - optically active, formation of. Part VII, an electrochemical synthesis of dichlorobutyrines, 1019.
  - peptides, and enzymes, insoluble complexes of, with metal hydroxides, 962.
  - A new asymmetric transformation of  $\alpha$ -amino-acid esters with (+)-tartaric acid, 475.
  - Polypeptides. Part XIV, a comparative study of the stability towards enzymes of model tripeptides containing α-aza-amino-acids, L-amino-acids, and D-amino-acids, 244.
  - Resolution of esters of phenylglycine with (+)-tartaric acid, 471.
  - Stereochemical studies on the biosynthesis of the  $\alpha\beta$ -didehydro-amino-acid units of mycelianamide, cyclopenin, and cyclopenol, 1564.
  - Synthesis and catalytic properties of peptides containing amino-acids involved in the active centres of hydrolytic enzymes, 589.
    - and conformation of sequential polypeptides containing e-benzyloxycarbonyl-lysine and benzyl esters of aspartic and glutamic acids, 1453.
- Aminoazobenzene, 4-diethyl-, synthesis and electronic absorption spectra of dicyano-derivatives of, 42.
- 6-Aminohexanoic acid. Nature of the cross-linking of proteins by glutaraldehyde. Part I, interaction of glutaraldehyde with the amino-groups of 6-aminohexanoic acid and of α-N-acetyl-lysine, 958.

- Anaesthetics. Evaluation of an empirical structure—activity relationship for property prediction in a structurally diverse group of local anaesthetics, 168.
- Androstanes. Preparation of 3β-hydroxy-5β-androstan-16one, 1350.
- Synthesis of isomeric  $5\alpha$ -androstane-3,15,17 $\beta$ -triols, 1429. Angustidine and  $(\pm)$ -Angustoline. Photocyclisation of enamides. Part X, total syntheses of the yohimbine skeleton: demethoxycarbonyldihydrogambirtannine, angustidine, nauclétine,  $(\pm)$ -angustoline, and related compounds, 1865.
- Anhydrides. Organosulphur compounds. Part VIII, reaction of monothiocarboxylic acids with dicyclohexylcar-bodi-imide and other reactions leading to monothio-anhydrides, 564.
- **Anilides.** Acid-catalysed cyclisation of 2-oxoanilides to 1,3-dihydro-3-hydroxyindol-2-ones, 1556.
- Aniline, NN-dichloroperfluoro-, 143.
  - Phosphorus-nitrogen compounds. Part XLIII, reactions of NN-dialkylanilines with phosphorus(v) chlorides; examples of ambident nucleophilic behaviour, 1739.
- Anthracene cation radicals, formation of, from 9,10-dihydro-9,10-epidioxyanthracene derivatives; peroxide-initiated cationic polymerization of styrene in liquid sulphur dioxide, 87.
  - Absolute configuration of (+)- and (-)-1,2,3,4-tetrahy-droanthracen-2-ol, 676.
- Anthraquinones. Chemistry of the *Coprosma* genus. Part XIV, constituents of five New Zealand species, 1789.
  - Reactions of keten acetals. Part VI, total syntheses of the anthraquinones  $(\pm)$ -nalgiovensin,  $(\pm)$ -isorhodoptilometrin, and  $(\pm)$ -rhodoptilometrin, 613. Part 7, total syntheses of the tetramethyl ethers of the 1-acyl-2,4,5,7-tetrahydroxyanthraquinones rhodolamprometrin and rhodocomatulin, 1852.
- Antibacterials. Semisynthetic aminoglycoside antibacterials. Part I. preparation of selectively protected garamine derivatives, 1088. Part II, synthesis of gentamicin X<sub>2</sub> and related compounds, 1097. Part III, synthesis of analogues of gentamicin X<sub>2</sub> modified at the 3'-position, 1113. Part IV, synthesis of antibiotic JI-20A, gentamicin B, and related compounds, 1126. Part V, synthesis of pentosyl and related derivatives of garamine, 1135.
- Antibiotics—see also Antibacterials.
  - Mass spectral studies on aminocyclitol-aminoglycoside antibiotics, 1078.
  - Revised constitution, absolute configuration, and conformation of griseoviridin, a modified cyclic peptide antibiotic, 1996.
  - Syntheses towards the carbohydrate moiety of lincomycin, 950.
  - Total synthesis of bikaverin (6,11-dihydroxy-3,8-dimethoxy-1-methylbenzo[b]xanthen-7,10,12-trione),499.
    - of the macrocyclic antibiotic (±)-pyrenophorin, 1718.
- Anti-Bredt compound, stereochemistry of the formation and reaction of, probed by deuterium substitution. Dehydrobromination of 3-bromotricyclo[5.3.1.0<sup>3,8</sup>]undecane (3-bromo-4-homoisotwistane) and some addition reactions of tricyclo[5.3.1.0<sup>3,8</sup>]undec-2-ene, 2133.
- Arene oxides. Mechanism of aromatic hydroxylation in fungi. Evidence for the formation of arene oxides, 2438.
   Arginine. N<sup>ω</sup> Linked arginine peptides, 259.
- Armentomycin. Formation of optically active amino-acids. Part VII. an electrochemical synthesis of dichlorobuty-rines, 1019.

- Aromatic compounds. A new class of natural steroids, with ring D aromatic, from *Nicardia physaloides* (Solanaceae). X-ray analysis of nic-10, and the structures of nic-1 ('nicandrenone'), 12- and -17, 304.
  - Aromatic enaminones. Part I, ultraviolet absorption of N-arylenaminones derived from dimedone, 2207. musks derived from 1,2,3,4-tetrahydro-1,1,4,4,6,7-hexamethylnaphthalene, 195.
  - Chromogens based on non-benzenoid aromatic systems. Part III, synthesis, spectra, and molecular orbital calculations in the substituted fulvene and 6-azafulvene series, 48.
  - 1,3-Dipolar character of six-membered aromatic rings. Part XI, 1-oxido-3-phenylphthalazinium, 2281. Part XVI, reactions of benzyne with 3-hydroxypyridine, 1-methyl-3-oxidopyridinium, and related compounds, 2285. Part XVIII, adducts from 3-oxido-l-phenylpyridinium and their quaternisation and conversion into tropone derivatives, 2289. Part XX, preparation and dimerisation of 1-(5-nitro-2-pyridyl)- and 1-(4,6-dimethylpyrimidin-2-yl)-3-oxidopyridinium, 2296. Part XXI, thermal cycloadditions of 1-(5-nitro-2-pyridyl)- and 1-(4,6-dimethylpyrimidin-2-yl)-3oxidopyridinium with 2,4, and 6  $\pi$ -electron componnents, 2307. Part XXV, 5-aryl-1-methyl-3-oxidopyridiniums, 2329. Part XXVI, 3-hydroxypyridine and 1-benzyl-3-oxidopyridinium, 2334. XXVII, photochemically induced valence bond tautomerism and dimerisation of 3-oxido-1-phenylpyridinium, 2338.
  - Further examination of the reaction between hexahydro-N-methylcyclohept[b]indole and arenesulphonyl azides. 481.
  - Pentatomic heteroaromatic cations. Part V, a convenient general method for the preparation of aldehydes from acyl chlorides via 2-substituted 1,3-benzoxathiolylium tetrafluoroborates, 323. Part VI. new syntheses of aldehydes and ketones by reaction of 1,3-benzodithiolylium salts with Grignard reagents, 1886.
  - Photochemical formation of amides from t-butylamine and aromatic aldehydes and ketones, 1511.
  - Preparation of benzyne from phenyl benzenesulphonate, 1577.
  - Reactions of hydrazones and related compounds with strong bases. Part III, 1,2,4-triazoles, 1,2,4-triazines, and 1,3,5-triazines from aromatic aldehyde azines, 207.
- Synthesis of hydroquinone diacetates from polycyclic aromatic quinones, 836.
- Aromatisation of 17-methyltestosterone into 1,2,10,15,16,17-hexahydro,10,17,17-trimethylcyclopenta[a]phenanthren-3-one. Trichloroacetic acid-induced rearrangement of steroids, 158.
  - Biosynthesis of porphyrins and related macrocycles. Part V, structural integrity of the type III porphyrinogen macrocycle in an active biological system; studies on the aromatisation of protoporphyrinogen-IX, 266.
- Aspergillus glaucus. Biosynthesis of fungal metabolites. Part VIII, identification of N-benzoyl-L-phenylalanyl-L-phenylalaninol acetate, a metabolite of Aspergillus glaucus, 578.
- Asymmetric induction and racemisation in allenic sulphoxides, 2061.
  - by a chiral leaving group. Intramolecular alkylation of phenols. Part III, 634.

- 8-epi-Austdiol, dihydrodeoxy-, structure of, and absolute configuration of the azaphilones, 204.
- Autoxidation, mild, of certain simple 1-alkyl-2-naphthols, hydroperoxynaphthalenones from, 2570.
- **Avarol**, a rearranged sesquiterpenoid hydroquinone from a marine sponge, absolute configuration of, 1408.
- α-Aza-amino-acids. Polypeptides. Part XIV, a comparative study of the stability towards enzymes of model tripeptides containing α-aza-amino-acids, L-amino-acids, and D-amino-acids, 244.
- **6-Azafulvenes.** Chromogens based on non-benzenoid aromatic systems. Part III, synthesis, spectra, and molecular orbital calculations in the substituted fulvene and 6-azafulvene series, 48.
- Azaheterocyclic compounds, poly-, chemistry of. Part VIII, coupling reactions of 1,2,4-triazole-5-diazonium nitrate with active methylene compounds. A new general route to [1,2,4]triazolo[5,1-c][1,2,4]triazine derivatives, 421.
- 11-Aza-18-norestra-1,3,5(10),9(11)-tetraen-17-one, (±)-8-hydroxy-3-methoxy-, and related compounds, synthesis of. Heterocyclic steroids. Part II, 1889.
- **Azaphilones.** Chemistry of fungi. Part LXVIII, the absolute configuration of (+)-sclerotiorin and of the azaphilones, 1366.
  - Structure of dihydrodeoxy-8-epi-austdiol and the absolute configuration of the azaphilones, 204.
- **8-Azapurines** (*v*-triazolo[4,5-*d*]pyrimidines). Part XVII, preparation of 1.6-dihydro-8-azapurines by heating 4-amino-5-aminomethyl-*N*-alkyl-1,2,3-triazoles with orthoesters of amidines, 291.
- **Azetidinones.** *cis* and *trans*-Azetidin-3-ones from nitrones and copper acetylide, 2382.
  - Reaction of some azetidin-2-ones with secondary amines, 1062.
  - Syntheses based on 1,2-secopenicillins. Part II, preparation of 4-(3-substituted prop-2-ynylthio)azetidin-2-ones, 1612. Part III, hydration of 4-(3-substituted prop-2-ynylthio)azetidin-2-ones and a new cephalosporin synthesis, 1615.
    - of heterocyclic compounds. Part XXXIII, preparation and reactions of 4-(2-dialkylaminophenyl)-azetidin-2-ones, 1725.
- **Azides.** Further examination of the reaction between hexahydro-N-methylcyclohept[b]indole and arenesulphonyl azides, 481.
  - Intramolecular catalysis. Part III, effect of a neighbouring hydroxy-group on the opening of steroidal aziridines with azide anions, 1037.
  - Reaction of thallium(1) azide and iodine with alkenes, 840. v-Triazolines. Part V, rearrangement of triazolines from cyclopropylenamines and toluene-p-sulphonyl azide, 622.
- **Azido-compounds.** Nitrene-induced cyclisations accompanied by rearrangement in thermolyses of aryl 2-azido-phenyl sulphones: a note on quantitative high-speed liquid chromatographic analysis of substituted phenothiazine 5,5-dioxides, 1749.
- Azimic acid. Studies related to the total synthesis of alkaloids in the carpaine and cassine series. Part 6, total synthesis of  $(\pm)$ -azimic acid, 2190.
- Azines. Phthaloylation of amino-azoles and amino-azines, 309.
  - Reactions of hydrazones and related compounds with strong bases. Part III, 1,2,4-triazoles, 1,2,4-triazines, and 1,3,5-triazines from aromatic aldehyde azines, 207.

- Aziridines, 2-phenyl-, and 3-halogenocyclohex-2-enones, reaction between, 2484.
  - Intramolecular catalysis. Part III, effect of a neighbouring hydroxy-group on the opening of steroidal aziridines with azide anions, 1037.
- **Azirines.** Thermal rearrangements of 3,5-diphenylisoxazole, 16.
- **Azobenzene**, 4-diethylamino-, synthesis and electronic absorption spectra of dicyano-derivatives of, 42.
- **Azo-compounds.** A new synthesis of pyrimido[4,5-e]-astriazine 4-oxides by nitrosative cyclization of aldehyde uracil-6-ylhydrazones in the presence of diethyl azodiformate, 713.
  - Application of diethyl azodicarboxylate in the synthesis of spirophosphoranes, 156.
- Cycloaddition reactions of dehydrodithizone. X-ray crystal structures of 5-diethylamino-4-methyl-1-phenyl-3-phenylazopyrazole, 4a,5,6,7,8,8a-hexahydro-6-methyl-8a-morpholino-1-phenyl-3-phenylazo-1H-pyrido[4,3-e][1,3,4]thiadiazine, and 3'-phenyl-5'-phenylazo-2-pyrrolidinospiro-[1H-indene-1,2'(3'H)-[1,3,4]thiadiazole, 1673.
- Syntheses of isoalloxazines, alloxazines, toxoflavins, and fervenulins by oxidative cyclization of the Michaeltype adducts from substituted 6-aminouracils and azocompounds, 2398.
- Azoles. Phthaloylation of amino-azoles and amino-azines, 309.
- Azolotriazines. Chemistry of heterocyclic compounds. Part IX. Triazines and related products. Part XVII. Cyclisation reactions of azolylhydrazones derived from ethyl cyanoacetate and malononitrile. Formation of azolo[5,1-c][1,2,4]triazines, 1496.
- Azolylhydrazones. Chemistry of heterocyclic compounds. Part IX. Triazines and related products. Part XVII. Cyclisation reactions of azolylhydrazones derived from ethyl cyanoacetate and malononitrile. Formation of azolo[5,1-c][1,2,4]triazines, 1496.
- Azomethines. Cycloaddition reactions of cumulenes. Part IV, a novel mode of reaction of azomethine oxides with 1,1-dimethylallene; formation of a substituted piperidin-4-one, 719.
- **Azoxy-compounds** some 1-naphthyl, synthesis and photolysis of, 688.

### $\mathbf{B}$

- Baeyer-Villiger oxidation of  $\alpha$ -substituted cyclobutanones, synthesis of  $\alpha$ -methylene- $\gamma$ -lactones involving, 1934.
- Ballota nigra. Structucture of ballotinone, a diterpenoid from Ballota nigra, 1607.
- Bechmann rearrangement, alkylation, and acylation of oximes in the presence of an oxidation-reduction system, 1708.
- **Benzacridines.** Synthesis of 7,10- and 7,8-dimethylbenz[c]-acridine, 2277.
- Benzaldehydes. Generation of xanthones and benzoxanthones from o-aryloxybenzaldehydes by use of copper(II) halides. 2241.
- Benzamide. Thermal rearrangements of 3,5-diphenylisoxazole, 16.
- Benz[a]anthracene-7,12-quinone, 1,8-dihydroxy-3-methyl-, (tetrangulol), a synthesis of. Naturally occurring quinones. Part XXVI, 997.

- **Benz**[e]azole. Heterocycles by cycloaddition. Part II, cycloaddition—extrusion reactions of five-membered mesoionic compounds with benzyne: preparation of benz[c]-azole and benzo[c]thiophen derivatives, 672.
- Benzene derivatives, alkynes, and cyclopropanes, reactions of, with gold(III),1983.
  - alkyl-, selective diarylmethane formation in the reaction of iron(III) perchlorate with, 1966.
    - thermal insertion of hexafluoropropene into carbon hydrogen bonds in. Fluoro-olefin chemistry. Part IX, 517.
- o-Benzenobenzo[c]xanthen. Orientation of a bridged quinone system. An intramolecular photochemical cyclisation of a bridged quinone system. An intramolecular photochemical cyclisation giving a cyclobutane ring, and a novel simulation by non-photochemical means, 595.
- Benzenoid compounds. Thermal oxygen atom transfer from benz[cd]indazole 1,2-dioxide to benzenoid derivatives, 680.
- Benzidine rearrangement via a cation radical in liquid sulphur dioxide, 1504.
- Benzimidazoisoquinolines. Photocyclisation of 1-styrylimidazoles. A novel route to N-bridgehead compounds, 75
- Benz[cd]indazole 1,2-dioxide, thermal oxygen atom transfer to benzenoid derivatives from, 680.
- Benzoate esters and halogenophosphines. Reactions of carbonyl compounds with tervalent phosphorus reagents Part VI, 741.
- Benzodiazepines. Bromination products of 2,4-dimethyll,5-benzodiazepine, 2353.
  - Photochemical reactions of 1*H*-2,3-benzodiazepines: valence isomerisation of 1,2-diazabutadiene to a diazetine, 362.
- Synthesis of some 1H-1,3-benzodiazepines, 1331.
- **Benzodipyrenone.** Structures of two dimers formed from lomatin (9,10-dihydro-9-hydroxy-8,8-dimethyl-8*H*-benzo[1,2-*b*:3,4-*b*']dipyran-2-one), 1857.
- Benzodithioles. Introduction of cyclic dithioacetal functions into activated methylene compounds by treatment with 2-alkoxy-1,3-benzodithioles, 540.
- 1,3-Benzodithiolylium salts. Pentatomic heteroaromatic cations. Part VI, new syntheses of aldehydes and ketones by reaction of 1,3-benzodithiolylium salts with Grignard reagents, 1886.
- Benzofluoranthenequinones. Constituents of the higher fungi. Part XVI, bulgarhodin and bulgarein, novel benzofluoranthenequinones from the fungus Bulgaria inquinans (Fries), 2149.
- **Benzofuranones.** Synthesis of dihydroactiniolide [5,6,7,7a-tetrahydro-4,4,7a-trimethylbenzofuran-2(4H)-one] and 6,7,8,8a-tetrahydro-5,5,8a-trimethylnaphthalene-1,3(5H)-dione from 6,7,8,8a-tetrahydro-2,5,5,8a-tetramethyl-5H-chromen, 532.
- **Benzofurans.** Synthesis of benzofuran Styrax extractives, 1514.
  - Use of 2,3-dichloropropene and 1,3-dichlorobut-2-ene as synthesis for heterocyclic compounds: synthesis of 2-methylbenzo[b]furans, 2-methylbenzo[b]thiophens, and 4-methyl-2H-chromen, 1.
- Benzofurazan N-oxide, reaction of with secondary aliphatic amines; preparation of NN-dialkyl-N'-(o-nitrophenyl) hydrazines, 2216.
- Benzoic acid, 3,5-dihydroxy-4-methyl-, synthesis of. Chemistry of fungi. Part LXXI, 1382.

- Benzimidazoles. Addition reactions of heterocyclic compounds. Part LXIII, new structures for some 2:1 molar adducts from dimethyl acetylenedicarboxylate with thiazoles and benzo-imidazoles, -oxazoles, and -thiazoles formed by novel rearrangement. Crystal and molecular structure determinations for tetramethyl 3,8a-dimethylpyrido[2,1-b]thiazole-5,6,7,8-tetracarboxylate and tetramethyl 5-methylpyrido[2,1-b]thiazole-6,7,8,8a-tetracarboxylate, 1269.
- Benzonaphthyridines. Photocyclisation of enamides. Part IX, syntheses of benzonaphthyridines by photocyclisation of N-pyridylcyclohex-1-enecarboxamides and pyridine-(N-cyclohex-1-enyl)carboxamides, 1861.
- Benzoperylene. Medium-sized cyclophanes. Part XIX, bridged naphthalenes: structural aspects, carbon-13 nuclear magnetic resonance, and benzoperylene formation, 2051
- **Benzophenanthridines.** Photocyclisation of enamides. Part XI, syntheses of benzo[i]phenanthridines related to aza-steroids, 1868.
- **Benzophenones**, 2-amino-, intramolecular cyclisation of; a new 9-acridone synthesis, 2089.
  - 2-( $\alpha$ -bromoalkyl)- generation and interception of isobenzofurans from, 336.
- Photoreactions of diphosphines with benzophenone, 1924. Benzopyranones. Structure of dihydrodeoxy-8-epi-aust-diol and the absolute configuration of the azaphilones, 204.
- Benzopyrones, conversion of, into spiro[benzopyran-2,2'-furan]s; a route to 2-(1,3-dioxoalkylbenzopyrones, 1553.)
- **Benzoquinolines.** Polyhalogenoheterocyclic compounds. Part XXIX, perchloro-acridine, -phenanthridine, and -benzo[h]quinoline, 1069.
  - The imputed formation of 1,2,3-triazoles, triazines, and triazepines from hydrazinobenzoquinolines and nitrous acid. A correction, 2178.
- Benzo[a]quinolizines, new routes to. Studies on the syntheses of heterocyclic compounds. Part 73, 2547.
- Benzoquinones. A derivative of tricyclo[6.3.1.0<sup>2,7</sup>]dodecane from the reaction between 2,6-dimethyl-1,4-benzoquinone and a quinonylmethyl carbanion; transformations involving nucleophilic attack at carbonyl oxygen, and a rearrangement to a spirobenzofuran derivative related to usnolic acid, 2067.
  - Syntheses of substituted 1,4-naphthoquinones by Diels-Alder addition of methoxycyclohexadienes to substituted 1,4-benzoquinones, 2057.
- Benzo[b]selenophen-2(3H)-one: synthesis and properties, 2452.
- Benzothiazines. Reactions of enamino-ketones. Part II, synthesis of 4H-1,4-benzothiazines, 1146.
- Benzothiazoles. Addition reactions of heterocyclic compounds. Part LXIII, new structures for some 2:1 molar adducts from dimethyl acetylenedicarboxylate with thiazoles and benzo-imidazoles, -oxazoles, and -thiazoles formed by novel rearrangement. Crystal and molecular structure determinations for tetramethyl 3,8a-dimethylpyrido[2,1-b]thiazole-5,6,7,8-tetracarboxylate and tetramethyl 5-methylpyrido[2,1-b]thiazole-6,7,8,8a-tetracarboxylate, 1269.
- **Benzothienoimidazoles.** Approaches to the synthesis of 1H-[1]benzothieno[2,3-d]imidazoles and thieno[2,3-d]imidazoles, 80.
- Benzothiophens. Heterocycles by cycloaddition. Part II, cycloaddition-extrusion reactions of five-membered meso-

- ionic compounds with benzyne: preparation of benz[c]-azole and benzo[c]thiophen derivatives, 672.
- Benzothiophens. 2-(2-Naphthyl)benzo[b]thiophen. Part IV, further aspects of electrophilic substitution, and ring closures to yield pentacyclic derivatives, 683.
  - Use of 2,3-dichloropropene and 1,3-dichlorobut-2-ene as synthons for heterocyclic compounds: syntheses of 2-methylbenzo[b]furans, 2-methylbenzo[b]thiophens, and 4-methyl-2*H*-chromen, 1.
- 1,2,4-Benzoxadiazines, 2161.
- Benzo[b]xanthen-7,10,12-trione, 6,11-dihydroxy-3,8-dimethoxy-1-methyl-(bikaverin), total synthesis of, 499.
- **Benzoxanthones.** Generation of xanthones and benzoxanthones from o-aryloxybenzaldehydes by use of copper(II) halides, 2241.
- 1,3-Benzoxathiolylium tetrafluoroborates, 2-substituted, a convenient general method for the preparation of aldehydes from acyl chlorides via. Pentatomic heteroaromatic cations. Part V, 323.
- Benzoxazoles. Addition reactions of heterocyclic compounds. Part LXIII, new structures for some 2:1 molar adducts from dimethyl acetylenedicarboxylate with thiazoles and benzo-imidazoles, -oxazoles, and -thiazoles formed by novel rearrangements. Crystal and molecular structure determinations for tetramethyl 3,8a-dimethylpyrido[2,1-b]thiazole-5,6,7,8-tetracarboxylate and tetramethyl 5-methylpyrido[2,1-b]thiazole-6,7,8,8a-tetracarboxylate, 1269.
- Benzoyl chloride, reaction of dibenzophospholes with; ring expansion to dibenzo[b,d]phosphorins, 2050.
- Benzoyl group. Activating groups for the ring expansion of coumarin by diazoethane: benzoyl, pivaloyl, arylsulphonyl, arylsulphinyl, and nitro, 1260.
- **Benzoyloxylation** of phenylpyrroles and of octaethylporphyrin. The *meso*-reactivity of porphyrins and related compounds. Part VII, 794.
- Benzylidenetriphenylphosphorane, reaction with carbon disulphide, 692.
- **Benzyne**, preparation of, from phenyl benzenesulphonate, 1577.
  - 1,3-Dipolar character of six-membered aromatic rings. Part XVI, reactions of benzyne with 3-hydroxypyridine, 1-methyl-3-oxidopyridinium, and related compounds, 2285.
  - Heterocycles by cycloaddition. Part II, cycloaddition—extrusion reactions of five-membered mesoionic compounds with benzyne: preparation of benz[c]azole and benzo[c]thiophen derivatives, 672.
- Berbine alkaloids. Studies on the alkaloids of Formosan Corydalis species. Part VI, elucidation of the structures of two spirobenzylisoquinoline alkaloids, yenhusomine and yenhusomidine, and two berbine alkaloids, corytenchine and corytenchirine, from Corydalis ochotensis (Turcz.), 63.
- **Berbines.** Studies on the syntheses of heterocyclic compounds. Part DCL, total synthesis of corytenchirine, 1218.
- Betaines. 1,3-Dipolar character of six-membered aromatic rings. Part XI, 1-oxido-3-phenylphthalazinium, 2281. Part XVI, reactions of benzyne with 3-hydroxypyridine, 1-methyl-3-oxidopyridinium, and related compounds, 2285. Part XVIII, adducts from 3-oxido-1-phenylpyridinium and their quaternisation and conversion into tropone derivatives, 2289. Part XX, preparation and dimerisation of 1-(5-nitro-2-pyridyl)-

### Betaines (contd.)

and 1-(4,6-dimethylpyrimidin-2-yl)-3-oxidopyridinium, 2296. Part XXI, thermal cycloadditions of 1-(5-nitro-2-pyridyl)- and 1-(4,6-dimethylpyrimidin-2-yl)-3-oxidopyridinium with 2,4, and 6  $\pi$ -electron components, 2307. Part XXV, 5-aryl-1-methyl-3-oxidopyridiniums, 2329. Part XXVI, 3-hydroxypyridine and 1-benzyl-3-oxidopyridinium, 2334. Part XXVII, photochemically induced valence bond tautomerism and dimerisation of 3-oxido-1-phenylpyridinium, 2338.

Effects of substituents at phosphorus on the mode of decomposition of phosphonium betaines in protic solvents, 2529.

Bicyclo[4.4.0]dec-1(6)-ene, hexadecafluoro-, an improved synthesis and the oxidation of. Fluorinations with complex metal fluorides. Part 4, 2270.

Bicyclo-octanes. Chiroptical studies. Part LXXXIX, an empirical analysis of the circular dichroism of hexahydroindanones, bicyclo[4.2.0]octan-7-ones, and their polycyclic analogues, 762.

Condensed cyclic and bridged-ring systems. Part IV, stereochemically controlled synthesis of some endo-2-aryl-6-oxobicyclo[3.2.1] octanes and related compounds through intramolecular alkylations of  $\gamma\delta$ -unsaturated  $\alpha'$ -diazomethyl ketones, 1669.

Bidithianyls. Halogeno-1,4-dioxans and their derivatives. Part VIII, direct replacement of chlorine in 2,3-dichloro-1,4-dioxan by sulphur and by nitrogen. Conformations of the products, of a rigid cis-fused hexahydro-1,4-dioxino[2,3-b][1,4]dioxin, and of bi-1,3-dithian-2-yl, 121.

Biflavanoids and a flavanone-chromone from the leaves of Garcinia dulcis (Roxb.) Kurz, 1458.

**Biflavanones.** Rhusflavanone, a new biflavanone from the seeds of wax-tree, 98.

**Biflavonoids.** Constituents of Dragon's Blood. Part II, structure and oxidative conversion of a novel secobiflavonoid, 1570.

**Bikaverin** (6,11-dihydroxy-3,8-dimethoxy-1-methylbenzo-[b]xanthen-7,10,12-trione), total synthesis of, 499.

Biosynthesis and carbon-13 nuclear magnetic resonance assignments of aflatoxin B<sub>1</sub> and sterigmatocystin, 1182. and <sup>13</sup>C nuclear magnetic resonance spectrum of colletodiol. Fungal products. Part XVIII, 184.

of fungal metabolites. Part VIII, identification of N-benzoyl-L-phenylalanyl-L-phenylalaninol acetate, a metabolite of Aspergillus glaucus, 578. Part IX, sclerin: feedings with [1,2-13C]acetate and [methyl-13C]methionine, 2077.

of fusicoccin from [3-13C]- and (4R)-[4-3H<sub>1</sub>]-mevalonic acid. Fusicoccin Part 6, 2221.

acid. Fusicoccin. Part 6, 2221.
of natural products. Part I, incorporations of ent-kaur16-ene and ent-kaur-16-en-15-one into enmein and oridonin, 2098.

of porphyrins and related macrocycles. Part V, structural integrity of the type III porphyrinogen macrocycle in an active biological system; studies on the aromatisation of protoporphyrinogen-IX, 266. Part VI, nature of the rearrangement process leading to the natural type III pophyrins, 273. Part VII, synthesis of specifically labelled [14C1]uroporphyrin-III and of [10,14-13C2]uroporphyrin-III. Conversion of the latter into [10,14-13C2]protoporphyrin-IX; biosynthetic significance of its 13C nuclear magnetic resonance spectrum, 283. Part VIII, enzymic decarboxylation of uroporphyrinogen-III; structure of an intermediate, phyria-

porphyrinogen-III, and synthesis of the corresponding porphyrin and of two isomeric porphyrins, 1008.

of the fungal xanthone ravenelin, 898.

terpenoid, studies in. Part XIV, formation of the sesquiterpene trichodiene, 326. Part XV, biosynthesis of the sesquiterpenoid illudin M, 876. Part XVI, formation of the sesquiterpenoid trichothecin, 1212. Part XVII, biosynthesis of the sesquiterpenoids cyclonerodiol and cyclonerotriol, 1214. Part 18, biosynthesis of culmorin, 2471.

Stereochemical studies on the biosynthesis of the  $\alpha\beta$ -didehydro-amino-acid units of mycelianamide, cyclopenin, and cyclopenol, 1564.

Synthetic and biosynthetic studies of porphyrins. Part I, synthesis of the 'S-411' porphyrin obtained from meconium, 249. Part 2, synthesis of isopempto- and and isochlorocruoro-porphyrins, 2501.

Biphenyls, 4,4'-dihalogeno-, metabolism of, 357.

Intramolecular coupling of diaryl amides by anodic oxidation, 661.

Bisbenzimidazo[1,2-\alpha; 1',2'-\elli][1,5]diazocine, 6,7,14,15-tetrahydro-, synthesis, spectra, and crystal structure of, 312.

Bisnaphthoquinone. Ebenaceae extractives. Part 7, ehretione, a bisnaphthoquinone derived from plumbagin and 7-methyljuglone, 2546.

Bornan-2-exo-yloxyaluminium dichloride, reduction of triterpenoid ketones with: a convenient preparation of axial triterpene alcohols, 321.

Boron. Chemistry of organoborates. Part 5, alkylation of alkynyltrialkylborate salts, 2419. Part 6, alkylation of alkynylborates with some complex alkylating agents, 2428. Part 7, protonation studies of alkynyltrialkylborates, 2435.

Mechanism of the boron trifluoride-catalysed cyclisation of some cyclo-octerylidene derivatives, 2457.

Studies of heterocyclic compounds. Part XX, substitution of 1-oxa-6.6a-dithiapentalenes with arenediazonium fluoroborates: rearrangement into 6.6a-dithia-1,2-diazapentalenes, 880.

trifluoride and a thiol, demethylation of aliphatic methyl ethers with, 2237.

**Bradykinin.** Amino-acids and peptides. Part XXXIX, synthesis of analogues of bradykinin with modifications in positions 1,6, and 9, 220.

Bridged-ring systems. Condensed cyclic and bridged-ring systems. Part IV, stereochemically controlled synthesis of some endo-2-aryl-6-oxobicyclo[3.2.1]octanes and related compounds through intramolecular alkylations of  $\gamma\delta$ -unsaturated  $\alpha'$ -diazomethyl ketones, 1669. Part V, application of the intramolecular oxo-carbenoid insertion reaction to the preparation of two new bridged-ring ketones, 1975.

Bridgehead functionalisation of saturated hydrocarbons with lead(iv) salts, 2576.

Bromination of camphor, further observations on, 359. products of 2,4-dimethyl-1.5-benzodiazepine, 2353. Neighbouring group participation in isoxazole ring bro-

mination. Part II, 1694.

Bromine compounds. Dehydrobromination of 3-bromotricyclo[5.3.1.0<sup>3,8</sup>]undecane (3-bromo-4-homoisotwistane) and some addition reactions of tricyclo[5.3.1.0<sup>3,8</sup>]undec-2-ene. Stereochemistry of the formation and reaction of an anti-Bredt compound probed by deuterium substitution, 2133.

Bromine (contd.)

- Electrocyclic reactions. Part IX, photolysis of trans-trans-2,4-dibromo-1,5-diphenylpenta-1,4-dien-3-one (αα'-dibromodibenzylideneacetone), 695.
- Preparation of medium-ring cycloalkynes from 1-bromotrans-cycloalkene derivatives, 890.
- The cymopols, a group of prenylated bromohydroquinones from the green calcareous alga Cymopolia barbata, 1696.
- X-Ray crystal structures of two pyrethroid insecticides: cis-3-phenoxybenzyl 3-(2,2-dibromovinyl)-2,2-dimethylcyclopropanecarboxylate and the 3-(2,2-dichlorovinyl) analogue, 1231.
- Bromofluorination of phenyl-substituted olefins, stereochemistry of, 971.
- Bulgaria inquinans (Fries). Constituents of the higher fungi. Part XVI, bulgarhodin and bulgarein, novel benzofluoranthenequinones from the fungus Bulgaria inquinans (Fries), 2149.
- Butadienes. Chemistry of tetra-alkoxyethenes. Part VII, thermal [2 + 2] cycloadditions with 1-cyanobutadienes, 1538.
  - Polyhalogenoallenes. Part X, an improved preparation of perfluoro-(3-methylbuta-1,2-diene) and the structure of its dimers, 1173.
- **4,6-Butano-4H-pyrrolo**[3,2,1-ij]quinoline, 6-p-chlorophenyl-sulphonylamino-5-p-chlorophenylsulphonylimino-1,2,5,6-tetrahydro-, action of heat on crystal structure of 7a-p-chlorophenylsulphonylamino-4,5,7a,8,9,10-hexahydro-7H-pyrrolo[3,2,1-de]phenanthridine, 2254.
- t-Butyl hypoiodite, synthesis of esters from alcohols or alcohols and aldehydes with, 383.
- **Butyrines.** Formation of optically active amino-acids. Part VII, an electrochemical synthesis of dichlorobutyrines, 1019.

 $\mathbf{c}$ 

- <sup>13</sup>C nuclear magnetic resonance spectroscopy, determination of the configuration of some penicillin S-oxides by, 1772.
  - spectrum and biosynthesis of colletodiol. Fungal products. Part XVIII, 184.
  - Assignment of <sup>13</sup>C and <sup>1</sup>H resonances of methyl groups in the tri-O-methyl derivatives of methyl pentopyranosides; some observations on the methoxy <sup>13</sup>C chemical shifts, 1351.
  - Biosynthesis of fungal metabolites. Part IX, sclerin: feedings with [1,2-13C]acetate and [methyl-13C]-methionine, 2077.
    - of porphyrins and related macrocycles. Part V, structural integrity of the type III porphyrinogen macrocycle in an active biological system; studies on the aromatisation of protoporphyrinogen-IX, 266. Part VI, nature of the rearrangement process leading to the natural type III porphyrins, 273. Part VII, synthesis of specifically labelled [14C<sub>1</sub>]uroporphyrin-III and of [10,14-13C<sub>2</sub>]uroporphyrin-III. Conversion of the latter into [10,14-13C<sub>2</sub>]protoporphyrin-IX; biosynthetic significance of its <sup>13</sup>C nuclear magnetic resonance spectrum, 283.
  - Carbon-13 nuclear magnetic resonance assignments and biosynthesis of aflatoxin B, and sterigmatocystin, 1182.
  - spectra of flavonoids and related compounds, 2475.

- Fusicoccin. Part 6, biosynthesis of fusicoccin from [3- $^{13}$ C]- and (4R)- $[4-^{3}H_{1}]$ -mevalonic acid, 2221.
- Medium-sized cyclophanes. Part XIX, bridged naphthalenes: structural aspects, carbon-13 nuclear magnetic resonance, and benzoperylene formation, 2051.
- The <sup>13</sup>C nuclear magnetic resonance spectra of kauranoid diterpenes, 114.
- <sup>14</sup>C. Biosynthesis of porphyrins and related macrocycles. Part VII, synthesis of specifically labelled [<sup>14</sup>C<sub>1</sub>] uroporphyrin-III and of [10,14-<sup>13</sup>C<sub>2</sub>]uroporphyrin-III. Conversion of the latter into [10,14-<sup>13</sup>C<sub>2</sub>]protoporphyrin-IX; biosynthetic significance of its <sup>13</sup>C nuclear magnetic resonance spectrum, 283.
- Cadmium. Organometallics in synthesis: alkylation of tricarbonyldienyliron cationic complexes with organocadmium reagents, 954.
- Calciferol and ergosterol, chemistry of the tricarbonyliron complexes of, 829.
- Camphor, further observations on the bromination of, 359. Cannabidiol and  $\Delta^{1}$ -tetrahydrocannabinol metabolites, total syntheses of, 8.
- cis-Caran-4-one, 5-hydroxymethylene-, reduction of, with complex hydrides, 678.
- **Carbanions.** Addition products of 2-(N-arylformimidoyl)-pyridines and carbanions, and their reduction to octahydroindolizine derivatives, 5.
  - A derivative of tricyclo[6.3.1.0<sup>2,7</sup>]dodecane from the reaction between 2,6-dimethyl-1,4-benzoquinone and a quinonylmethyl carbanion; transformations involving nucleophilic attack at carbonyl oxygen, and a rearrangement to a spirobenzofuran derivative related to usnolic acid, 2067.
  - Syntheses with carbanions derived from carbonyl-stabilized sulphonium ylides: a novel route to furan-3(2H)-ones, 1688.
- Carbenes. Allenes. Part 34, reactions of methylindoles and 2,5-dimethylpyrrole with allenic carbenes, 2103.
  - Carbene chemistry. Part X, insertion reactions of 1,2,2-trifluoroethylidene into C-H bonds of alkanes containing the t-butyl group and some addition and insertion reactions of 2-chloro-1,2,2-trifluoroethylidene, 513.
  - Generation and reactions of a 3-furylcarbene and of an isoxazol-4-ylcarbene, 1257.
  - Iodocyclopropanes. Part I, di-iodocarbene adducts of some cyclic olefins, 54.
- Carbocations, stable. Part X, generation, observation, and reactions of ferrocenyl-stabilised cyclopropylalkylium and related ions, 804.
- Carbodi-imides. Cyclisation reactions of  $\alpha$ -hydroxy-imidates with oxally chloride and NN'-dicyclohexylcarbodi-imide, 542.
- Carbohydrates—see also Sugars.
  - Assignment of <sup>13</sup>C and <sup>1</sup>H resonances of methyl groups in the tri-O-methyl derivatives of methyl pentopyranosides; some observations on the methoxy <sup>13</sup>C chemical shifts, 1351.
  - Mass spectral studies on aminocyclitol-aminoglycoside antibiotics, 1078.
  - Nitrogen-containing carbohydrate derivatives. Part XXXII, further studies on the ring-opening of epiminosugars, 801.
  - Semisynthetic aminoglycoside antibacterials. Part I, preparation of selectively protected garamine derivatives, 1088. Part II, synthesis of gentamicin  $X_2$  and related compounds, 1097. Part III, synthesis of

## Carbohydrates (contd.)

- analogues of gentamicin  $\rm X_2$  modified at the 3'-position, 1113. Part IV, synthesis of antibiotic JI-20A, gentamicin B, and related compounds, 1126. Part V, synthesis of pentosyl and related derivatives of garamine, 1135.
- Structure of a polysaccharide from the seeds of Cassia tora. Part II, partial acidic hydrolysis, 1621.
- Syntheses towards the carbohydrate moiety of lincomycin, 950.
- The allyl ether as a protecting group in carbohydrate chemistry. Part IX, synthesis of derivatives of 1,6-anhydro-β-p-galactopyranose, 1395.
- $\alpha$ -Carbon-carbon cleavages, thermal and photochemical, in imines, 1583.
- Carbon dioxide. Reactions of a 'myrcene-magnesium' complex with aldehydes, ketones, epoxides, carbon dioxide, and acetonitrile, 1809.
  - disulphide, reaction of benzylidenetriphenylphosphorane with, 692.
- radicals, reactions of tetraphenyldiphosphine with, 1034. Carbonyl compounds—see also Aldehydes and Ketones.
  - reactions with tervalent phosphorus reagents. Part V, aldehydes and phosphorus trichloride, 535. Part V1, benzoate esters and halogenophosphines, 741.
  - Chemistry of tetra-alkoxyethenes. Part V, thermal cycloaddition with carbonyl compounds, 1048. Part VI, cycloadditions with  $\alpha\beta$ -unsaturated carbonyl compounds and chemistry of the resulting tetra-alkoxydihydropyrans, 1533.
  - Chemistry of the tricarbonyliron complexes of calciferol and ergosterol, 829.
- Carboxamides. O-Nitroaniline derivatives. Part V, cyclisation of N-acylated derivatives of N-benzyl- and N-p-nitrobenzyl-O-nitroaniline: a comparison of carboxamides and sulphonamides, 394.
  - Photocyclisation of enanides. Part IX, syntheses of benzonaphthyridines by photocyclisation of N-pyridylcyclohex-1-enecarboxamides and pyridine -(N-cyclohex-1-enyl)carboxamides, 1861.
- Carenes. Chemistry of terpenes. Part XXI, by-products from the epoxidation of (+)-car-3-ene with acetonitrile hydrogen peroxide, 791.
- Carotenoids and related compounds. Part XXXIV, synthesis of violerythrin and other cyclopentenediones, 2140.
- Carpaine. Studies related to the total synthesis of alkaloids in the carpaine and cassine series. Part 6, total synthesis of  $(\pm)$ -azimic acid, 2190.
- α-Caryopterone. Syntheses of the naturally occurring naphtho[2,3-b]pyran-5,10-quinones α-caryopterone, dihydro-α-caryopterone, and O-methyldihydro-α-caryopterone, 1632.
- Cassia tora, structure of a polysaccharide from the seeds of. Part II, partial acidic hydrolysis, 1621.
- Cassine. Studies related to the total synthesis of alkaloids in the carpaine and cassine series. Part 6, total synthesis of (+)-azimic acid, 2190.
- Catalysis, intramolecular. Part III, effect of a neighbouring hydroxy-group on the opening of steroidal aziridines with azide anions, 1037.
  - metal, in organic reactions. Part II, products and stereochemical aspects of the isomerization of heptenes by the tri-isobutylaluminium-bis-N-methylsalicylideneamine-nickel system, 1904.

- Cation radicals. Benzidine rearrangement via a cation radical in liquid sulphur dioxide, 1504.
  - Formation of anthracene cation radicals from 9.10-dihydro-9.10-epidioxyanthracene derivatives; peroxideinitiated cationic polymerization of styrene in liquid sulphur dioxide, 87.
- Cations, polyfluoroallyl, 2107.
- Centaurepensin. Chemistry of the Compositae. Part XXXI, absolute configuration of the sesquiterpene lactones centaurepensen (chlorohyssopifolin A), acroptilin (chlorohyssopifolin C), and repin, 1663.
- Cephalosporin. Studies on lactams. Part 45, some carbocyclic analogues of cephalosporin, 2193.
  - Syntheses based on 1,2-secopenicillins. Part III, hydration of 4-(3-substituted prop-2-ynylthio)azetidin-2-ones and a new cephalosporin synthesis, 1615.
- Cephems. Transformations of penicillins: new methods of formation and reactions of 6,6-disubstituted penams and 7,7-disubstituted cephems, 1918.
- Chalcone, 2'-hydroxy-, reaction of with hydrazoic acid, 2371. South African plant extractives. Part Ill, helichrysin, a new chalcone glucoside from a *Helichrysum* species, 1819.
- Chiroptical studies. Part LXXXIX, an empirical analysis of the circular dichroism of hexahydroindanones: bicyclo-[4.2.0]octan-7-ones, and their polycyclic analogues, 762.
- Chlorine compounds. Cyclic acetals from 1,4,5,6,7,7-hexachloronorborn-5-en-2-endo-ylalkanols, 2581.
  - Formation of optically active amino-acids. Part VII, an electrochemical synthesis of dichlorobutyrines, 1019.
  - Heterocyclic syntheses with malonyl chloride. Part XI, reactions of 2-alkyl-(or -aryl-)thio-7-chloropyrano-[3,4-e][1,3]oxazine-4,5-diones with water and with alcohols, 2462.
  - Polyhalogenoheterocyclic compounds. Part XXVIII, polychloroindoles, 162. Part XXIX, perchloro-acridine, -phenanthridine, and -benzo[h]quinoline, 1069.
  - Ring cleavage of some pyrazole-4-sulphonyl chlorides by chlorine, 428.
  - Use of 2,3-dichloropropene and 1,3-dichlorobut-2-ene as synthons for heterocyclic compounds: synthesis of 2-methylbenzo[b]furans, 2-methylbenzo[b]thiophens, and 4-methyl-2H-chromen, 1.
  - X-Ray crystal structures of two pyrethroid insecticides: cis-3-phenoxybenzyl 3-(2,2-dibromovinyl)-2,2-dimethyl cyclopropanecarboxylate and the 3-(2,2-dichlorovinyl) analogue, 1231.
- Chlorohyssopifolin A and C. Chemistry of the Compositae. Part XXXI, absolute configuration of the sesquiterpene lactones centaurepensin (chlorohyssopifolin A), acroptilin (chlorohyssopifolin C), and repin, 1663.
- Cholestanes. A ready synthesis of  $5\alpha,14\beta$ -cholest-7-en-3 $\beta$ -ol, 378.
  - Steroids and related studies. Part XXXV, further studies on the Schmidt reaction with cholest-4-ene-3,6-dione, 1210.
- Cholesterol. Fate of C-24 hydrogen atoms of cholesterol during its conversion into tigogenin in *Digitalis lanata*, 1823.
- Chorismic acid and chorismate mutase. The shikimate pathway. Part V, 1776.
- Chromatography. Nitrene-induced cyclisations accompanied by rearrangement in thermolyses of aryl 2-azidophenyl sulphones: a note on quantitative high-speed liquid chromatographic analysis of substituted phenothiazine 5,5-dioxides, 1749.

- **Chromens.** Synthesis of dihydroactiniolide [5,6,7,7a-tetrahydro-4,4,7a-trimethylbenzofuran-2(4H)-one] and 6,7,-8,8a-tetrahydro-5,5,8a-trimethylnaphthalene-1,3(5H)-dione from 6,7,8,8a-tetrahydro-2,5,5,8a-tetramethyl-5H-chromen, 532.
  - 4,6,7-Trimethoxy-5-methylchromen-2-one, a new coumarin from Leonolis nepetaefolia, 2594.
  - Use of 2,3-dichloropropene and 1,3-dichlorobut-2-ene as synthons for heterocyclic compounds: synthesis of 2-methylbenzo[b]furans, 2-methylbenzo[b]thiophens, and 4-methyl-2H-chromen, 1.
- Chromogens based on non-benzenoid aromatic systems. Part III, synthesis, spectra, and molecular orbital calculations in the substituted fulvene and 6-azafulvene series, 48.
- Chromones. Biflavanoids and a flavanone-chromone from the leaves of *Garcinia dulcis* (Roxb.) Kurz, 1458.
- Chrysanthemate, methyl, a photochemical di- $\pi$ -methane rearrangement leading to, 256.
- Cinnolines. Part XVII, reactions of 4-chlorocinnoline-3-carbonitrile and preparation of 2,3-dihydro-3-imino-1*H*-pyrazolo[4,3-c]cinnolines, 592.
- **Citromycin.** Derivatives of hydroxyquinol. Part 4, a synthesis of di-O-methylcitromycin; electronic effects in hydroxyquinol derivatives, 2444.
- Clerodanes. Constituents of *Solidago* species. Part VII, constitution and stereochemistry of the *cis*-clerodanes from *Solidago arguta* Ait. and of related diterpenoids, 1590.
- **Cobalt.** Organocobalt complexes. Part VIII, specificity of the cyclopentenone synthesis from acetylenehexacarbonyldicobalt complexes and norbornene derivatives, 30.
- Cocculus laurifolius DC, new dibenz[d,f]azonine alkaloids from, 2197.
- Colletodiol, <sup>13</sup>C nuclear magnetic resonance spectrum and biosynthesis of. Fungal products. Part XVIII. 184.
- Colorata-4(13),8-dienolide, a new sesquiterpene lactone. Extractives from *Pseudowintera colorata*. Part V, 850.
- Compactin, a new antifungal metabolite from *Penicillium brevicompactum*, crystal and molecular structure of, 1165.
- Complexes, insoluble, of amino-acids, peptides, and enzymes with metal hydroxides, 962.
  - organocobalt. Part VIII, specificity of the cyclopentenone synthesis from acetylenehexacarbonyldicobalt complexes and norbornene derivatives, 30.
  - Chemistry of the tricarbonyliron complexes of calciferol and ergosterol, 829.
  - Organometallics in synthesis: alkylation of tricarbonyldienyliron cationic complexes with organocadmium reagents, 954.
- Compositae, chemistry of the. Part XXXI, absolute configuration of the sesquiterpene lactones centaurepensin (chlorohyssopifolin A), acroptilin (chlorohyssopifolin C), and repin, 1663.
- Condensation, intramolecular, of steroidal  $\alpha$ -acetoxy-ketones, 212.
  - Oxidation and bimolecular condensation reactions of 2-alkyliminocyclopentanedithiocarboxylic acids, 2-oxocyclopentanedithiocarboxylic acids, and 3-methyl-5-oxo-1-phenyl- $\Delta^2$ -pyrazoline-4-dithiocarboxylic acid, 1706.
- Copper. cis- and trans-Azetidin-2-ones from nitrones and copper acetylide, 2382.
  - Generation of xanthones and benzoxanthones from o-aryloxybenzaldehydes by use of copper(11) halides, 2241.

Metal-catalysed organic photoreactions. Photo-oxidations of  $\alpha\beta$ -unsaturated ketones and o-methylaceto-phenone in the presence of copper(II) salts, 779.

- Photo reactions of 3,5-dimethylisoxazole with and without catalytic assistance by copper(II) salts, 783.
- Coprosma genus, chemistry of. Part XIV, constituents of five New Zealand species, 1789.
- Cordrastine. A one-step synthesis of the phthalidylisoquinoline alkaloids, cordrastine and hydrastine, 1221.
- **Corey oxidation** procedure, stereoselective oxidation of fusidic acid derivatives by, 710.
- Corrins, experiments towards the synthesis of. Part XI, attempted synthesis of  $\beta$ -dinitrones by oxidative routes, 1942. Part XII, synthesis and some reactions of  $\beta$ -oxo- $\Delta^1$ -pyrroline 1-oxides, 1944. Part XIII, a new synthesis of 2-cyano- $\Delta^1$ -pyrroline 1-oxides and their behaviour towards a Grignard reagent, 1951. Part XIV, oxidative decarboxylation of 1-hydroxypyrrolidine-2-carboxylic acids and oxidation of some  $\Delta^1$ -pyrroline 1-oxides by hypobromite, 1955.
- Corticotrophin. Tritiated peptides. Part 2, synthesis of two [3,5-3H<sub>2</sub>-Tyr<sup>2</sup>]-analogues of corticotrophin, 2182.
   Part 3, synthesis of [4-3H-Phe<sup>7</sup>]-β-corticotrophin-(1---24)-tetracosapeptide, 2186.
- Corydalis species, Formosan, studies on the alkaloids of. Part VI, elucidation of the structures of two spirobenzylisoquinoline alkaloids, yenhusomine and yenhusomidine, and two berbine alkaloids, corytenchine and corytenchirine, from Corydalis ochotensis (Turcz.), 63.
- Corytenchine and Corytenchirine. Studies on the alkaloids of Formosan Corydalis species. Part VI, elucidation of the structures of two spirobenzylisoquinoline alkaloids, yenhusomine and yenhusomidine, and two herbine alkaloids, corytenchine and corytenchirine, from Corydalis ochotensis (Turcz.), 63.
  - the syntheses of heterocyclic compounds. Part DCL, total synthesis of corytenchirine, 1218.
- Cotton effect. Studies on lactams. Part IV, relation between Cotton effect and conformation of a seven-membered lactam ring, 665.
- Coumarins. Activating groups for the ring expansion of coumarin by diazoethanebenzoyl, pivaloyl, arylsulphonyl, arylsulphinyl, and nitro, 1260.
  - Applications of high-potential quinones. Part X, reactions of 3,4-dihydrocoumarin derivatives, 407.
  - Synthesis of some tetrahydronaphthyl- and flavanyl-coumarins, 1190.
- 4,6,7-Trimethoxy-5-methylchromen-2-one, a new coumarin from *Leonotis nepetaefolia*, 2594.
- Coupling reactions, involving unexpected reactions with electron-rich methyl groups in addition to the expected ring attack. Reaction of 2,4-dinitrobenzenediazonium ions with thiophens. Part 2, 1639.
- Crystal and molecular structure determinations for tetramethyl 3,8a-dimethylpyrido[2,1-b]thiazole-5,6,7,8-tetracarboxylate and tetramethyl 5-methylpyrido-[2,1-b]thiazole-6,7,8,8a-tetracarboxylate. New structures for some 2:1 molar adducts from dimethyl acetylenedicarboxylate with thiazoles and benzo-imidazoles, -oxazoles, and -thiazoles formed by novel rearrangement. Addition reactions of heterocyclic compounds. Part LXIII, 1269.
  - of compactin, a new antifungal metabolite from *Penicillium brevicompactum*, 1165.
  - of secalonic acid A. Fungal metabolites. Part VI, 1820.

- Crystal and molecular structure (contd.)
  - of the imidazolium salt of r-2-hydroxy-c-4-methyl-1,3,2-dioxaphospholan-2-thione. Synthesis and geometrical isomerism in cyclic five-membered phosphorus thioacids. Stereochemistry of organophosphorus in cyclic compounds. Part IV, 371.
  - Synthesis and crystal and molecular structure of a 1,11-methano-steroid, 3-methoxy-1' $\beta$ -methyl-1,11 $\alpha$ -methano-9 $\beta$ -estra-1,3,5(10)-trien-17 $\beta$ -ol, 2374.
- Crystal structures of the dihydro- and  $2\alpha$ -hydroxydihydro-derivatives of phytuberin, 1338.
  - Action of heat on 6-p-chlorophenylsulphonylamino-5-p-chlorophenylsulphonylimino-1,2,5,6-tetrahydro-4,6-butano-4H-pyrrolo[3,2,1-ij]quinoline: crystal structure of 7a-p-chlorophenylsulphonylamino-4,5,7a,8,9,10-hexahydro-7H-pyrrolo[3,2,1-de]phenanthridine, 2254.
  - Synthesis, spectra, and crystal structure of 6,7,14,15-tetrahydrobisbenzimidazo[1,2-a; 1',2'-e][1,5]diazocine, 312
  - X-Ray crystal structures of two pyrethroid insecticides: cis-3-phenoxybenzyl 3-(2,2-dibromovinyl)-2,2-dimethyl cyclopropanecarboxylate and the 3-(2,2-dichlorovinyl) analogue, 1231.
- Culmorin, biosynthesis of. Studies in terpenoid biosynthesis. Part 18, 2471.
- Cumulenes, cycloaddition reactions of. Part IV, a novel mode of reaction of azomethine oxides with 1,1-dimethylallene; formation of a substituted piperidin-4-one, 719.
- Cyanides—see also Nitriles.
  - -induced cyclisation of o-nitroanils. o-Nitroaniline derivatives. Part VI, 399.
- **Cyanobutadienes.** Chemistry of tetra-alkoxyethenes. Part VII, thermal [2+2] cycloadditions with 1-cyanobutadienes, 1538.
- Cyanocarboxylation of activated olefins, 1926.
- 4-Cyanopyridinium salts, nucleophilic replacements in, 454.
  2-Cyano-Δ¹-pyrroline 1-oxides, a new synthesis of, and their behaviour towards a Grignard reagent. Experiments towards the synthesis of corrins. Part XIII, 1951.
- Cycl[3.3.3]azines (pyrido[2,1,6-de]quinolizines). Heterocyclic compounds with bridgehead nitrogen atoms. Part V, 341.
- Cyclisation, acid catalysed, of α-oxo-anilides to 1,3-dihydro-3-hydroxyindol-2-ones, 1556.
  - boron trifluoride-catalysed, of some cyclo-octenylidene derivatives, mechanism of, 2457.
  - intramolecular, of 2-aminobenzophenones; a new 9-acridone synthesis, 2089.
    - of arylalkyl isothiocyanates. Part I, synthesis of 1-substituted 3,4-dihydroisoquinolines, 33.
  - of allyl- and vinyl-phosphine oxides, synthesis of phosphindoline oxides, tetrahydrophosphinoline oxides, and related compounds by, 2556.
  - of (+)- and (-)-S-(2-methylprop-1-enyl)-L-cysteine S-oxides, 1195.
  - of 2,2-dithiodibenzoic acid derivatives. Synthesis of new macrocycles. Part 5, 2574.
  - of 2-phenacylisoquinolinium bromide, an unexpected mode of. Polycyclic fused amidines. Part III, 201.
  - reactions. Part IV, stereochemistry of cyclialkylation of 2-(2-arylethyl)-1,3,3-trimethylcyclohexyl cations and their equivalents, 19.
    - of  $\alpha$ -hydroxy-imidates with oxalyl chloride and NN'-dicyclohexylcarbodi-imide, 542.

A new synthesis of pyrimido[4,5-e]-as-triazine 4-oxides by nitrosative cyclization of aldehyde uracil-6-ylhydrazones in the presence of diethyl azodiformate, 713.

- Condensed cyclic and bridged-ring systems. Part IV, stereochemically controlled synthesis of some endo-2-aryl-6-oxobicyclo[3.2.1]octanes and related compounds through intramolecular alkylations of  $\gamma\delta$ -unsaturated  $\alpha'$ -diazomethyl ketones, 1669.
  - thiophen ring systems. Part XIX, synthesis of 6,7-dihydrothieno[3,2-c]pyridines and 4,5-dihydrothieno-[2,3-c]pyridines by intramolecular cyclisation of 2-(2- or 3-thienyl)ethyl isothiocyanate, 138.
- Conversion of shikonin angelate into [2,2-dimethyl-1-(2-methylcrotonoyloxy)cyclobutyl]-5,8-dihydroxy-1,4-naphthoquinone; a novel cyclisation of a 4-methylpent-3-enyl side chain in a natural quinone, 1579
- Formation of certain substituted 5*H*-pyrrolo[2,3-*b*]pyrazines by thermal cyclisation of pyrazinylhydrazones and a route to 5*H*-pyrazino[2,3-*b*]indole; a synthesis of 5*H*-pyrrolo[2,3-*b*]pyrazine and some of its properties, 1361.
- Nitrene-induced cyclisations accompanied by rearrangement in thermolyses of aryl 2-azidophenyl sulphones: a note on quantitative high-speed liquid chromatographic analysis of substituted phenothiazine 5,5-dioxides, 1749.
- o-Nitroaniline derivatives. Part V, cyclisation of N-acylated derivatives of N-benzyl- and N-p-nitrobenzyl-o-nitroaniline: a comparison of carboxamides and sulphonamides, 394. Part VI, cyanide-induced cyclisation of o-nitroanils, 399.
- Novel aspects in the synthesis and acid-promoted cyclisation of some 2-diazo-2'-(p-tolylsulphonylamino)-acetophenones: electrophilic displacement of an arylsulphonyl group from a sulphonamide, 1757.
- Syntheses of isoalloxazines, alloxazines, toxoflavins, and fervenulins by oxidative cyclization of the Michaeltype adducts from substituted 6-aminouracils and azo-compounds, 2398.
- Thermal cyclisation of pyridazinylhydrazones to give s-triazolo[4,3-b]pyridazines and pyridazino[2,3-a]-benzimidazole, 1363.
- Triazines and related products. Part XVI, synthesis of triazolotriazines by cyclisation of 3-hydrazino-1,2,4-triazines and 3-hydrazino-1,2,4-triazoles, 1492. Part XVII. Chemistry of heterocyclic compounds. Part IX. Cyclisation reactions of azolylhydrazones derived from ethyl cyanoacetate and malononitrile. Formation of azolo[5,1-c][1,2,4]triazines, 1496.
- Cycloaddition reactions, molecular design by. Part 32, transannular cyclization of tricyclo[4.2.2.0<sup>2,5</sup>]deca-3,7-diene derivatives by oxypalladation, 2516.
  - of cumulenes. Part IV, a novel mode of reaction of azomethine oxides with 1,1-dimethylallene; formation of a substituted piperidin-4-one, 719.
  - of dehydrodithizone. X-Ray crystal structures of 5-diethylamino-4-methyl-1-phenyl-3-phenylazopyrazole, 4a,5,6,7,8,8a-hexahydro-6-methyl-8a-morpholino-1-phenyl-3-phenylazo-1H-pyrido[4,3-e][1,3,4]thiadiazine, and 3'-phenyl-5'-phenylazo-2-pyrrolidinospiro-[1H-indene-1,2'(3'H)-[1,3,4]thiadiazole], 1673.
- Cycloaddition. Chemistry of tetra-alkoxyethenes. Part V, thermal cycloaddition with carbonyl compounds, 1048. Part VI, cycloadditions with αβ-unsaturated carbonyl

- Cycloaddition (contd.)
  - compounds and chemistry of the resulting tetra-alkoxy-dihydropyrans, 1533. Part VII, thermal [2+2] cycloadditions with 1-cyanobutadienes, 1538.
  - 1,3-Dipolar character of six-membered aromatic rings. Part XXI, thermal cycloadditions of 1-(5-nitro-2-pyridyl)- and 1-(4,6-dimethylpyrimidin-2-yl)-3-oxidopyridinium with 2.4, and 6 π-electron components, 2307.
  - Heterocycles by cycloaddition. Part II, cycloaddition-extrusion reactions of five-membered mesoionic compounds with benzyne: preparation of benz[c]azole and benzo[c]thiophen derivatives, 672. Part 5, preparation of 7,9-diheteratricyclo[4.2.1.0<sup>2,5</sup>]non-3-en-8-one derivatives from mesoionic compounds, 2562. Part 6, cycloaddition-double fragmentation reactions of mesoionic compounds with an oxabicyclo[2.2.1]heptadiene: synthesis of five- and six-membered heterocycles, 2565.
  - Heterodiene syntheses. Part XVI, a new [4 + 2] cyclo-addition pathway in the reaction of 2-oxoindolin-3-ylideneacetophenones with ethyl vinyl ether, 1248. Part XVII, reactions of 2-oxoindolin-3-ylidene derivatives with enamines: a Michael pathway as an alternative to 1,2- and 1,4-cycloadditions, 1872.
  - $\Delta^2$ -Isoxazoline derivatives. Part X, 1,3-dipolar cycloadditions of nitrones and nitrile oxides with indene, 1,2-dihydronaphthalene, and *trans*-1-phenylpropene, 1518.
  - Stereochemistry of the 1,3-dipolar cycloaddition reaction between N-(phenanthridin-5-io)benzamidate and olefins, 1702.
  - Synthesis of oligosaccharides by cycloaddition. Part II, free and protected O-hexopyranosyl- $(1 \longrightarrow 3)$ -D-glucoses with the  $\alpha$ -D-allo-,  $\alpha$ -D-altro-,  $\alpha$ -L-altro,  $\beta$ -L-altro-, and  $\alpha$ -D-galacto-configurations, 1831.
- Cycloalkanols, 2-benzylidene-, effect of ring size on hydrogenation of, 191.
- Cycloalkenes, polyfluoro. Part XII, reaction of decafluorocyclohexene with alkanediols in the presence of base, 573
  - Iodocyclopropanes. Part I, di-iodocarbene adducts of some cyclic olefins, 54.
  - Preparation of medium-ring cycloalkynes from 1-bromotrans-cycloalkene derivatives, 890.
- **Cycloalkynes.** Preparation of medium-ring cycloalkynes from 1-bromo-trans-cycloalkene derivatives, 890.
- Cyclobutanones,  $\alpha$ -substituted, synthesis of  $\alpha$ -methylene- $\gamma$ -lactones involving Baeyer-Villiger oxidation of, 1934.
- Cycloheptadienes. Sensitised photo-oxidation of 5-methylene-cyclohexa- and -cyclohepta-1,3-diene derivatives, 1796.
- Cycloheptatrienylideneammonium salts, a new route to; restricted rotation about the C-N bond, 1915.
- **Cyclohept**[b]indole, hexahydro-N-methyl-and arenesulphonyl azides, further examination of the reaction between, 481.
- Cyclohexadienes. Sensitised photo-oxidation of 5-methylene-cyclohexa- and -cyclohepta-1,3-diene derivatives, 1796.
  - Syntheses of substituted 1,4-naphthoquinones by Diels-Alder addition of methoxycyclohexadienes to substituted 1,4-benzoquinones, 2057.
- Cyclohexanecarboxylic acids. Synthesis of peptides containing cis- or trans-3- or -4-aminocyclohexanecarboxylic acid residues, 1199.
- Cyclohexanediols. Chiral crown ethers derived from (+)-(1S,2S)-trans-cyclohexane-1,2-diol, 2413.

Cyclohexanediones. Use of cyclohexane-1,3-dione derivatives in the preparation of enaminones, 2211.

- Cyclohexanone, 5-ethyl-2,5-dimethyl-, some derivatives of. Chemistry of fungi. Part LXXIII, 1385.
- 2-methylsulphonyl-, and morpholine, reinvestigation of the reaction between: long-range effect of a chiral centre on the chemical shift equivalence of morpholine protons, 651.
- Reaction between 2-phenylaziridines and 3-halogenocyclohex-2-enones, 2484.
- Cyclohexyl cations, 2-(2-arylethyl)-1,3,3-trimethyl-, and their equivalents, stereochemistry of cyclialkylation of. Cyclisation reactions. Part IV, 19.
- Cyclonerodiol and cyclonerotriol, the sesquiterpenoids, biosynthesis of. Studies in terpenoid biosynthesis. Part XVII, 1214.
- Cyclo-octa-2,4,6-trienone, lithium enolate of, and its reactions with electrophiles, 1838.
- **Cyclo-octenylidene** derivatives, mechanism of the boron trifluoride-catalysed cyclisation of some, **2457**.
- Cyclopenin and Cylopenol. Stereochemical studies on the biosynthesis of the  $\alpha\beta$ -didehydro-amino-acid units of mycelianamide, cyclopenin, and cyclopenol, 1564.
- Cyclopentadienide enamine systems, generation and alkylation of anions stabilised as. Stabilised enamine anions, 1603.
- Cyclopentanones. Chiroptical studies. Part 90, the circular dichroism of cyclopentanones and related compounds. A proposed octant-dissignate effect of C-H bonds, 2171.
- Cyclopenta[a]phenanthren-3-one, 1,2,10,15,16,17-hexahyd-ro-10,17,17-trimethyl-, aromatisation of 17-methyltesto-sterone into. Trichloroacetic acid-induced rearrangement of steroids, 158.
- Cyclopentenediones. Carotenoids and related compounds. Part XXXIV, synthesis of violerythrin and other cyclopentenediones, 2140.
- Cyclopentenols. Reaction of 'myrcene-magnesium' with esters, acetyl chloride, and acetic anhydride: formation of cyclopentenols and cyclopropane derivatives, 1815.
- Cyclopentenone synthesis from acetylenehexacarbonyldicobalt complexes and norbornene derivatives, specificity of. Organocobalt complexes. Part VIII, 30.
  - Photochemistry of 2-(prop-2-enyl)cyclopent-2-enones, 249.
  - Prostaglandins. Part 4, synthesis of  $(\pm)$ -11-deoxy-prostaglandins from 2- $(\omega$ -hydroxyheptyl)cyclopent-2-enones, 2550.
- Cyclophanes, medium-sized. Part XIX, bridged naphthalenes: structural aspects, carbon-13 nuclear magnetic resonance, and benzoperylene formation, 2051.
- **Cyclopropanecarboxa**mide. Isolation, identification, and synthesis of rubesamide, a new naturally occurring cyclopropanecarboxamide from *Fagara rubescens*, 146.
- Cyclopropanes, alkynes, and benzene derivatives, reactions of, with gold(III), 1983.
  - iodo-. Part I, di-iodocarbene adducts of some cyclic olefins. 54.
  - Reaction of 'myrcene-magnesium' with esters, acetyl chloride, and acetic anhydride: formation of cyclopentenols and cyclopropane derivatives, 1815.
  - X-Ray crystal structures of two pyrethroid insecticides: cis-3-phenoxybenzyl 3-(2,2-dibromovinyl)-2,2-dimethylcyclopropanecarboxylate and the 3-(2,2-dichlorovinyl)analogue, 1231.

Cyclopropylalkylium and related ions, ferrocenyl-stabilised, generation, observation, and reactions of. Stable carbocations. Part X, 804.

- Cyclopropylenamines and toluene-p-sulphonyl azide, rearrangement of triazolines from. v-Triazolines. Part V,
- Cymopolia barbata. The cymopols, a group of prenylated bromohydroquinones from the green calcareous alga Cymopolia barbata, 1696.
- Cymopols, a group of prenylated bromohydroquinones from the green calcareous alga Cymopolia barbata, 1696.
- **Cysteine S-oxide.** Cyclization of (+)- and (-)-S-(2-methyl-prop-1-enyl)-L-cysteine S-oxides, 1195.

 $\mathbf{p}$ 

- Dahlia scapigera. Natural acetylenes. Part XLIX, polyacetylenes from Dahlia scapigera (A. Dietr.) Link and Otto var. scapigera f. scapigera and some Dahlia hybrids, 735
- 5-Deazaflavines, syntheses of, 1805.
- Decarbonylation. Heterocyclic studies. Part XXXVII, ready ring cleavage and decarbonylation of pyrimidine-5-carbaldehydes, 125.
- **Dehydrobromination** of 3-bromotricyclo[5.3.1.0<sup>3,8</sup>]undecane (3-bromo-4-homoisotwistane) and some addition reactions of tricyclo[5.3.1.0<sup>3,8</sup>]undec-2-ene. Stereochemistry of the formation and reaction of an anti-Bredt compound probed by deuterium substitution, 2133.
- Dehydrodithizone, cycloaddition reactions of. X-Ray crystal structures of 5-diethylamino-4-methyl-1-phenyl-3-phenylazopyrazole, 4a,5.6,7,8,8a-hexahydro-6-methyl-8a-morpholino-1-phenyl-3-phenylazo-1H-pyrido[4,3-e][1,3,4]thiadiazine, and 3'-phenyl-5'-phenylazo-2-pyrrolidino-spiro-[1H-indene-1,2'(3'H)-[1,3,4]thiadiazole], 1673.
- Dehydrogenative ring closure, palladium-catalysed dibenzofuran synthesis by, 1236.
- **Dehydrohalogenation.** Generation of acyclic trienes and cyclic dienes by mild dehydration and dehydrohalogenation in aprotic media, 1792.
- Demethoxycarbonyldihydrogambirtannine, angustidine, nauclétine, (±)-angustoline, and related compounds: total syntheses of the yohimbine skeleton. Photocyclisation of enamides. Part X, 1865.
- **Demethylation** of aliphatic methyl ethers with a thiol and boron trifluoride, 2237.
- C-Demethylation, oxidative, in phenols, 600.
- Depsidone synthesis. Part II, diploicin and gangaleoidin, 147.
- **Deuteriolysis.** Preparation and properties of cage polycyclic systems. Part IV, hydrogenolyses of homocubane derivatives, 1346.
- **Deuterium.** A highly stereospecific synthesis of (R)- and (S)- $[2-{}^2H_1]$ glycine, 2229.
  - Biosynthesis of porphyrins and related macrocycles. Part V, structural integrity of the type III porphyrinogen macrocycle in an active biological system; studies on the aromatisation of protoporphyrinogen-IX, 266.
  - Dehydrobromination of 3-bromotricyclo[5.3.1.0³,8]undecane (3-bromo-4-homoisotwistane) and some addition reactions of tricyclo[5.3.1.0³,8]undec-2-ene. Stereochemistry of the formation and reaction of an anti-Bredt compound probed by deuterinm substitution, 2133.

Heterocyclic studies. Part XXXVIII, synthesis and disproportionation of pyrimido [4,5-b] quinolinium salts, 131.

- Pyrolyses of pentafluorophenyl prop-2-enyl and [2,3,3-2H<sub>3</sub>]prop-2-enyl ethers. Formation of 1-fluorovinyl 2,3,4-trifluorophenyl ketones *via* internal Diels-Alder reactions, 1463.
- Diarylmethane formation, selective, in the reaction of iron(III) perchlorate with alkylbenzenes, 1966.
- Diazabutadienes. Formation of heterocyclic compounds from 1,3-diazabuta-1,3-diene derivatives, 1528.
  - Photochemical reactions of 1*H*-2,3-benzodiazepines: valence isomerisation of a 1,2-diazabutadiene to a diazetine, 762.
- Diazapentalenes. Studies of heterocyclic compounds. Part X1X, synthesis of 6,6a-dithia- and 6,6a-diselena-1,2-diazapentalenes, 228.
- Diazepines. Formation and acid-catalysed rearrangement of 1,2-diazepin-5-ones, 868.
- **Diazetines.** Photochemical reactions of 1*H*-2,3-benzodiazepines: valence isomerisation of a 1,2-diazabutadiene to a diazetine, 362.
- Diazines. Photoreactions of diazines. Part VI. Pyrimidines. Part LII. Photochemistry of 4,6-disubstituted pyrimidine N-oxides, 1202.
- 1,5-Diazocines. Synthesis, spectra, and crystal structure of 6,7,14,15-tetrahydrobisbenzimidazo[1,2-a; 1',2'-e][1,5]diazocine, 312.
- **Diazo-compounds.** Dependence of product on catalyst in the transition-metal-catalysed decomposition of ethyl 2-allyl-4-diazoacetoacetate, 489.
- Diazoethane. Activating groups for the ring expansion of coumarin by diazoethane: benzoyl, pivaloyl, arylsulphonyl, arylsulphinyl, and nitro, 1260.
- Diazonium compounds. Studies of heterocyclic compounds. Part XX, substitution of 1-oxa-6,6a-dithiopentalenes with arenediazonium fluoroborates: rearrangement into 6,6a-dithia-1,2-diazapentalenes, 880.
- 2-Diazo-2'-(p-tolylsulphonylamino)acetophenones, novel aspects in the synthesis and acid-promoted cyclisation of some: electrophilic displacement of an arylsulphonyl group from a sulphonamide, 1757.
- **Dibenzazepines.** Intramolecular couping of diaryl amides by anodic oxidation, 661.
  - Preparation of some dibenz[b,f][1,4]oxazepines and dibenz[b,e]azepines, 1279.
- **Dibenzazocines.** Intramolecular coupling of diaryl amides by anodic oxidation, 661.
- Dibenz[d,f]azonine alkaloids, new, from Cocculus laurifolius DC, 2197.
- Dibenzocyclodecenes. Conformational behaviour of medium-sized rings. Part III, heterocyclic analogues of 12,13-dihydro-11*H*-dibenzo[*a,e*]cyclononene. 6,11,12,13-tetrahydro-5*H*-dibenzo[*a,e*]cyclononene, and 5,6,7,12,-13,14-hexahydrodibenzo[*a,f*]cyclodecene, 926.
- Dibenzocyclononenes. Conformational behaviour of medium-sized rings. Part III, heterocyclic analogues of 12,13-dihydro-11*H*-dibenzo[*a,e*]cyclononene. 6,11,12,13-tetrahydro-5*H*-dibenzo[*a,e*]cyclononene, and 5,6,7,12,13,-14-hexahydrodibenzo[*a,f*]cyclodecene, 926.
- Dibenzocyclo-octenes. Conformational behaviour of medium-sized rings. Part II. heterocyclic analogues of 5,6,7,12-tetrahydrodibenzo[a,d]cyclo-octene (1,2,4,5-dibenzocyclo-octa-1,4-diene), 913.
- Dibenzofurans. Palladium-catalysed dibenzofuran synthesis by dehydrogenative ring closure, 1236.

**Dibenzophospholes**, reaction with benzoyl chloride; ring expansion to dibenzo[b,d]phosphorins, 2050.

- **Dibenzoxazepines.** Oxidation of some dibenz[b,f][1,4]oxazepines by peracetic acid, 1291.
  - Preparation of some dibenz[b,f][1,4]-oxazepines and dibenz[b,e]azepines, 1279.
  - of the eight monohydroxydibenz[b,f][1,4]oxazepin-11-(10H)-ones, 1286.
- Dibenzylideneacetone. Electrocyclic reactions. Part IX, photolysis of trans,trans-2,4-dibromo-1,5-diphenylpenta-1,4-diene-3-one (αα'-dibromodibenzylideneacetone), 695.
- trans,trans-Dibenzylideneacetone, photochemical cyclisation of. Electrocyclic reactions. Part X, 1880.

NN-Dichloroperfluoroaniline, 143.

- Dicyano-derivatives of 4-diethylaminoazobenzene, synthesis and electronic absorption spectra of, 42.
- Dicyclohexylcarbodi-imide. Organosulphur compounds. Part VIII. reaction of monothiocarboxylic acids with dicyclohexylcarbodi-imide and other reactions leading to monothio-anhydrides, 564.
- Diels-Alder reactions. Pyrolyses of pentafluorophenyl prop-2-enyl and [2,3,3-2H<sub>3</sub>]prop-2-enyl others. Formation of 1-fluorovinyl 2,3,4-trifluorophenyl ketones *via* internal Diels-Alder reactions, 1463.
  - o-Quinonoid compounds. Part X, endo-selectivity in the Diels-Alder additions of non-conjugated olefins to o-quinodimethanes, 1647. Part XI, exo-selectivity in the Diels-Alder reactions of phenyl-substituted o-quinonoid dienes, 1654.
  - Syntheses of substituted 1,4-naphthoquinones by Diels-Alder addition of methoxycyclohexadienes to substituted 1,4-benzoquinones, 2057.
- Dienes. Allylic phosphine oxides as precursors of conjugated dienes of defined geometry, 2386.
  - Generation of acyclic trienes and cyclic dienes by mild dehydration and dehydrohalogenation in aprotic media, 1792.
  - Heterodiene syntheses. Part XVI, a new [4 + 2] cycloaddition pathway in the reaction of 2-oxoindolin-3-ylidineacetophenones with ethyl vinyl ether, 1248. Part XVII, reactions of 2-oxoindolin-3-ylidene derivatives with enamines; a Michael pathway as an alternative to 1,2- and 1,4-cycloadditions, 1872.
  - Organic synthesis using diphenylphosphinoyl as a migrating functional group: diene synthesis, 639.
  - o-Quinonoid compounds. Part XI, exo-selectivity in the Diels—Alder reactions of phenyl-substituted o-quinonoid dienes, 1654.
- Digitalis lanata. Fate of C-24 hydrogen atoms of cholesterol during its conversion into tigogenin in Digitalis lanata, 1823.
- **7,9-Diheteratricyclo**[4.2.1.0<sup>2,5</sup>]non-3-en-8-one derivatives, preparation from mesoionic compounds. Heterocycles by cycloaddition. Part 5, 2562.
- Dimedone. Aromatic enaminones. Part I, ultraviolet absorption of N-aryl enaminones derived from dimedone, 2207.
- Dimerisation of aromatic nitrile oxides catalysed by trimethylamine. Behaviour of nitrile oxides towards nucleophiles. Part III, 1825.
  - 1,3-Dipolar character of six-membered aromatic rings. Part XX, preparation and dimerisation of 1-(5-nitro-2-pyridyl)- and 1-(4,6-dimethylpyrimidin-2-yl)-3-oxidopyridinium, 2296. Part XXVII, photochemically induced valence bond tautomerism and dimerisation of 3-oxido-1-phenylpyridinium, 2338.

Di-π-methane rearrangements of 1,4-dihydro-1,4-methanoand -ethanonaphthalene-5,8-diols, 550.

- Dimethyl diazomalonate, homogeneous catalysis of the decomposition of, in alcohols, 2483.
- 2,4-Dinitrobenzenediazonium ions, reaction with thiophens. Part I, an acidic Gomberg reaction, 1636. Part 2, coupling reactions, involving unexpected reactions with electron-rich methyl groups in addition to the expected ring attack, 1639.
- β-Dinitrones, attempted synthesis of, by oxidative routes. Experiments towards the synthesis of corrins. Part X1, 1942.
- Diospyros montana Roxb., new diospyrin derivatives from. Ebenaceae extractives. Part V, 2155.
- Dioxans. Halogeno-1,4-dioxans and their derivatives. Part VIII, direct replacement of chlorine in 2,3-dichloro-1,4-dioxan by sulphur and by nitrogen. Conformations of the products, of a rigid *cis*-fused hexahydro-1,4-dioxino[2,3-b][1,4]dioxin, and of bi-1,3-dithian-2-yl, 121.
- **Dioxa spiroheptanones.** Reactions of 1,6-dioxaspiro-[3.3]heptan-2-one derivatives, 1769.
- Diphenylmethane. Lithium aluminium hydride-mediated methylation of diphenylmethane and allied compounds by bis-2-(methoxyethyl) ether, 2380.
- N'-Diphenylmethylene-N-phenyl-N-trimethylsilylurea, formation of heterocyclic compounds by use of, 1523.
- Diploicin and gangaleoidin. Depsidone synthesis. Part II, 147
- 1,3-Dipolar character of six-membered aromatic rings. Part XI, 1-oxido-3-phenylphthalazinium, 2281. Part XVI. reactions of benzyne with 3-hydroxypyridine, 1methyl-3-oxidopyridinium, and related compounds, 2285. Part XVIII, adducts from 3-oxido-1-phenylpyridinium and their quaternisation and conversion into tropone derivatives, 2289. Part XX, preparation and dimerisation of 1-(5-nitro-2-pyridyl)- and 1-(4,6-dimethylpyrimidin-2-yl)-3-oxidopyridinium, 2296. Part XXI, thermal cycloadditions of 1-(5-nitro-2-pyridyl)- and 1-(4,6-dimethylpyrimidin-2-yl)-3-oxidopyridinium with 2,4, and 6π-electron components, 2307. Part XXV 5-aryl-1methyl-3-oxidopyridiniums, 2329. Part XXVI, 3-hydroxypyridine and 1-benzyl-3-oxidopyridinium, 2334. Part XXVII, photochemically induced valence bond tautomerism and dimerisation of 3-oxido-1-phenylpyridinium, 2338.
- 1,3-Dipoles, reactivity of allylic phosphonium ylides with. Heterocycles from ylides. Part III, 619.
- **Disdea avara.** Absolute configuration of avarol, a rearranged sesquiterpenoid hydroquinone from a marine sponge, 1408.
- **6,6a-Dithia-1,2-diazapentalenes.** Studies of heterocyclic compounds. Part XX, substitution of 1-oxa-6,6a-dithiapentalenes with arenediazonium fluoroborates: rearrangement into 6,6a-dithia-1,2-diazapentalenes, 880.
- Dithioacetal functions, cyclic, introduction into activated methylene compounds by treatment with 2-alkoxy-1,3-benzodithioles, 540.
- **2,2-Dithiodibenzoic acid** derivatives, cyclization of. Synthesis of new macrocycles. Part 5, 2574.
- **Dopamines.** Studies of enzyme-mediated reactions. Part VII, stereospecific syntheses of tritium-labelled (2R)- and (2S)-dopamines: stereochemical course of hydroxylation of dopamine by dopamine  $\beta$ -hydroxylase (E.C.1.14.17.1), 1056.

- Double bonds, non-coplanar; the existence of adamantene,
- **Dracorubin.** Pigments of 'dragon's blood' resin. Part VIII, synthesis of  $(\pm)$ -dracorubin and of  $(\pm)$ -nordracorubin, 1392.
- **Dragon's blood,** constituents of. Part II, structure and oxidative conversion of a novel secobiflavanoid, 1570. resin, pigments of. Part VIII, synthesis of (±)-dracorubin and of (+)-nordracorubin, 1392.

E

- Ebenaceae extractives. Part V, new diospyrin derivatives from *Diospyros montana* Roxb., 2155. Part 7, ehretione, a bisnaphthoquinone derived from plumbagin and 7-methyljuglone, 2546.
- Ehretione, a bisnaphthoquinone derived from plumbagin and 7-methyljuglone. Ebanaceae extractives. Part 7, 2546.
- **Electrochemistry.** Electrochemical syntheses. Part VII, isomer distribution in the partial oxidation of n-alkanes. 610.
  - Electro-organic reactions. Part V, cathodic pinacolisation of  $\alpha$  and  $\beta$ -ionones, 561.
  - Formation of optically active amino-acids. Part VII, an electrochemical synthesis of dichlorobutyrines, 1019.
- Electrocyclic reactions. Part IX, photolysis of trans, trans-2,4-dibromo-1,5-diphenylpenta-1,4-diene-3-one (αα'-dibromodibenzylideneacetone), 695. Part X, photochemical cyclisation of trans, trans-dibenzylideneacetone, 1880.
- Electrophilic displacement of an arylsulphonyl group from a sulphonamide: novel aspects in the synthesis and acid-promoted cyclisation of some 2-diazo-2'-(p-tolylsulphonyl-amino)acetophenones, 1757.
- Electrophilic substitution. 2-(2-Naphthyl)benzo[b]thiophen. Part IV, further aspects of electrophilic substitution, and ring closures to yield pentacyclic derivatives, 683.
- Elenolic acid and 18-oxayohimban alkaloids, conversion of secologanin into, 160.
- Elimination and addition reactions. Part XXVI, asymmetric induction in additions of nucleophiles and electrophiles to  $\alpha\beta$ -unsaturated sulphoxides, 492. Part XXVII, addition of amides to electrophilic alkenes, 1543.
- Ellipticines. Chemistry of 6H-pyrido[4,3-b]carbazoles. Part V, a simple synthesis of ellipticines, 1155.
  - Reactions and synthetic applications of  $\beta$ -oxo-sulphoxides. Part VI, a new synthesis of the pyrido[4,3-b]carbazoles olivacine and ellipticine, 1479.
- Enamides, photocyclisation of. Part IX, syntheses of benzonaphthyridines by photocyclisation of N-pyridylcyclohex-1-enecarboxamides and pyridine-(N-cyclohex-1-enyl)carboxamides, 1861. Part X, total syntheses of the yohimbine skeleton: demethoxycarbonyldihydrogambirtannine, angustidine, nauclétine, (±)-angustoline, and related compounds, 1865. Part XI, syntheses of benzo[i]phenanthridines related to aza-steroids, 1868.
- Enamines. Enamine chemistry. Part XXI, condensation of L-sodium or L-ethyl prolinate with ketones to give substituted polyhydropyrrolo[1,2-a]-indoles and -pyrrolizines, 904.
  - Heterodiene synthesis. Part XVII, reactions of 2-oxoindolin-3-ylidene derivatives with enamines: a Michael pathway as an alternative to 1,2- and 1,4-cycloadditions, 1872

- Stabilised enamine anions. Generation and alkylation of anions stabilised as cyclopentadienide enamine systems, 1603.
- Enamino-ketones, reactions of. Part II, synthesis of 4H-1,4-benzothiazines, 1146.
- Enaminones, aromatic. Part 1, ultraviolet absorption of N-aryl enaminones derived from dimedone, 2207.
  - use of cyclohexane-1,3-dione derivatives in the preparation of, 2211.
- Enol benzoates of β-diketones, 380.
- Enkephalin. Synthesis of two pentapeptides isolated from porcine brain with receptor-mediate opiate agonist activity, 2488.
- Enmein. Biosynthesis of natural products. Part 1, incorporations of *ent*-kaur-16-ene and *ent*-kaur-16-en-15-one into enmein and oridonin, 2098.
- Enzymes. Hydrous titanium oxides-new supports for the simple immobilisation of enzymes, 329.
  - Insoluble complexes of amino-acids, peptides, and enzymes with metal hydroxides, 962.
  - Polypeptides. Part XIV, a comparative study of the stability towards enzymes of model tripeptides containing α-aza-amino-acids, L-amino-acids, and D-amino-acids, 244.
  - Potential hexokinase inhibitors. Synthesis and properties of 2,3-anhydro-p-allose, 2,3-anhydro-p-ribose, and 2-O-methysulphonyl-p-mannose, 1449.
  - Shikimate pathway. Part V, chorismic acid and chorismate mutase, 1776.
  - Studies of enzyme-mediated reactions. Part VI, stereochemical course of the dehydrogenation of stereospecifically labelled benzylamines by the amine oxidase from pea seedlings (E.C.1.4.3.6.), 1052. Part VII, stereospecific syntheses of tritium-labelled (2R)- and (2S)-dopamines: stereochemical course of hydroxylation of dopamine by dopamine β-hydroxylase (E.C.1.14.17.1), 1056.
    - on pyrophosphates. Part III, a new method for the synthesis of nucleotide coenzymes by means of di-n-butylphosphinothioyl bromide, 1711.
  - Syntheses of macrocyclic enzyme models. Part I, preparation and properties of [20]paracyclophanes, 1320.
  - Synthesis and catalytic properties of peptides containing amino-acids involved in the active centres of hydrolytic enzymes, 589.
- Enzymic decarboxylation of uroporphyrinogen-III: structure of an intermediate, phyriaporphyrinogen-III, and synthesis of the corresponding porphyrin and of two isomeric porphyrins. Biosynthesis of porphyrins and related macrocycles. Part VIII, 1008.
- **Epi-ikshusterol.** Structures of eight new triterpenoids and isolation of other triterpenoids and epi-ikshusterol from the stems of *Lithocarpus cornea*, 23.
- **Epoxidation.** Chemistry of terpenes. Part XXI, by-products from the epoxidation of (+)-car-3-ene with acetonitrile-hydrogen peroxide, 791.
- **Epoxides.** Neighbouring group effects in epoxide ring opening; *cis*-epoxy-alcohols, 1442.
  - participation in the cleavage of some steroidal acetoxyepoxides, 2508.
  - Preparation of polymer-supported peroxy-acids and their use to oxidise olefins to epoxides, 605.
  - Reactions of a 'myrcene-magnesium' complex with aldehydes, ketones, epoxides, carbon dioxide, and acetonitrile, 1809.

- 20,22-Epoxycholesterol, synthesis of the four stereoisomers of. Studies on steroids. Part 37, 2116.
- 1a,2a-Epoxy-4-en-3-ones, steroidal, acid-catalysed ring contraction of. 2363.
- **Ergosterol** and calciferol, chemistry of the tricarbonyliron complexes of, 829.
  - 22,23-dihydro-, synthesis of. Unsaturated steroids. Part I, 826.
- synthetic uses of steroidal ring B diene protection, 821. Erythroxylum genus, alkaloids of. Part 1, E. monogynum Roxb. roots, 1550.
- Esters, synthesis of, from alcohols or alcohols and aldehydes with t-butyl hypoiodite, 383.
  - Preparation of macrocyclic ether-esters, thioether-esters, and ether-thiolesters, 2505.
  - Reaction of 'myrcene-magnesium' with esters, acetyl chloride, and acetic anhydride: formation of cyclopentenols and cyclopropane derivatives, 1815.
  - Some reactions of soft electrophiles with esters and other compounds containing the thiocarbonyl group, 2112.
- Ethenes, tetra-alkoxy-, chemistry of. Part V, thermal cycloaddition with carbonyl compounds, 1048. Part VI, cycloadditions with  $\alpha\beta$ -unsaturated carbonyl compounds and chemistry of the resulting tetra-alkoxydihydropyrans, 1533. Part VII, thermal [2+2] cycloadditions with 1-cyanobutadienes, 1538.
- Ethers, aliphatic methyl, demethylation of, with a thiol and boron trifluoride, 2237.
  - Chiral crown ethers derived from (+)-(1S, 2S)-transcyclohexane-1,2-diol, 2413.
  - Heterodiene syntheses. Part XVI, a new [4 + 2] cycloaddition pathway in the reaction of 2-oxoindolin-3-ylideneacetophenones with ethyl vinyl ether, 1248.
  - Lithium aluminium hydride-mediated methylation of diphenylmethane and allied compounds by bis-2-(methoxyethyl) ether, 2380.
  - Ochnaflavone and its derivatives: a new series of diflavonyl ethers from Ochna squarrosa Linn., 580.
  - Preparation of macrocyclic ether-esters, thioether-esters, and ether-thiolesters, 2505.
  - Pyrolyses of pentafluorophenyl prop-2-enyl and [2,3,3-2H<sub>3</sub>]prop-2-enyl ethers. Formation of 1-fluorovinyl 2,3,4-trifluorophenyl ketones *via* internal Diels-Alder reactions, 1463.
  - Reactions of keten acetals. Part 7, total syntheses of the tetramethyl ethers of the 1-acyl-2,4,5,7-tetrahydroxy-anthraquinones rhodolamprometrin and rhodocomatulin, 1852.
  - Structures of three oxygenated 24-methyl-steroids (nic-3, -7, and -11) from the insect repellant plant *Nicandra physaloides* (Solanaceae): X-ray analysis of nic-3 acetate and nic-11 ethyl ether, 296.
  - The allyl ether as a protecting group in carbohydrate chemistry. Part IX, synthesis of derivatives of 1,6-anhydro-β-D-galactopyranose, 1395.
- Thermal rearrangements of tropolone ethers. Part 4, 2403. Ethylidenes. Carbene chemistry. Part X, insertion reactions of 1,2,2-trifluoroethylidene into C-H bonds of alkanes containing the t-butyl group and some addition and insertion reactions of 2-chloro-1,2,2-trifluoroethylidene, 513.
- **Extrusion.** Heterocycles by cycloaddition. Part II, cycloaddition-extrusion reaction of five-membered mesoionic compounds with benzyne: preparation of benz[c]azole and benzo[c]thiophen derivatives, 672.

- **Fagara rubescens.** Isolation, identification, and synthesis of rubesamide, a new naturally occurring cyclopropane carboxamide from *Fagara rubescens*, 146.
- Farnesenes. Phosphate esters. Part 3, formation of sesquiterpene hydrocarbons from cis, trans- and trans, transfarnesyl diphenyl phosphates, 2524.
- **Ferrocenes.** Stable carbocations. Part X, generation, observation, and reactions of ferrocenyl-stabilised cyclopropylalkylium and related ions, 804.
- Fervenulins, isoalloxazines, alloxazines and toxoflavins, syntheses of, by oxidative cyclization of the Michael-type adducts from substituted 6-aminouracils and azo-compounds, 2398.
- Flavanones. Biflavanoids and flavanone-chromone from the leaves of *Garcinia dulcis* (Roxb.) Kurz, 1458.
  - Ochnaflavone and its derivatives: a new series of diflavonyl ethers from Ochna squarrosa Linn., 580.
- Flavonoids and related compounds, the carbon-13 nuclear magnetic resonance spectra of, 2475.
- Fluorene. Thermal rearrangements of 3,5-diphenylisox-azole. 16.
- Fluorine compounds. Addition of free radicals to unsaturated systems. Part XXII, photochemical addition of trifluoroiodomethane and iodine to perfluoro-(3-methylbut-1-ene) and photochemical dimerisation of the olefin, 1170.
  - Carbene chemistry. Part X, insertion reactions of 1,2,2-trifluoroethylidene into C-H bonds of alkanes containing the t-butyl group and some addition and insertion reactions of 2-chloro-1,2,2-trifluoroethylidene, 513.
  - Electrophilic addition of perfluorofluoro-oxy-compounds to unactivated double bonds, 101.
  - Fluorination of nitriles over cobalt trifluoride and potassium tetrafluorocobaltate, 1930.
    - with complex metal fluorides. Part 4, an improved synthesis and the oxidation of hexadecafluorobicyclo-[4.4.0]dec-1(16)-ene, 2270.
  - Fluoro-olefin chemistry. Part IX, thermal insertion of hexafluoropropene into carbon-hydrogen bonds in alkylbenzenes, 517. Part X, some additions to 1-fluoropropene under ionic and free radical conditions, 2349.
  - Heterocyclic polyfluoro-compounds. Part XXIII, reaction of some 2-, 3-, and 4-substituted pyridine 1-oxides, 5-methylpyrimidine 1-oxide, and quinoline 1-oxide with perfluoro-(2-methylpent-2-ene): synthesis of 2-(1,2,2,2-tetrafluoroethyl)-pyridines or -pyrimidines and their N-oxides and of 2,2,3-trifluoro-2,3-dihydro-3-trifluoromethylfuro[3,2-b]pyridine, 1226.
  - Perfluoroalkyl derivatives of sulphur. Part XVIII, reactions of polyfluoroiodoalkanes with sodium methanethiolate in the presence of dimethyl disulphide, and related reactions, 525. Part XIX, reaction of fluoro-olefins with fluoride ion in the presence of dimethyl disulphide, and related reactions, 1178.
  - Polyfluoroalkyl derivatives of nitrogen. Part XLIII, reactions of N-bromobis(trifluoromethyl)amine with 1-fluoropropene under free-radical and under ionic conditions, 556.
  - Polyfluoroallyl cations, 2107.

- Fluorine compounds (contd.)
  - Polyfluorocycloalkenes. Part XII, reaction of decafluorocyclohexene with alkanediols in the presence of base, 573.
  - Pyrolyses of pentafluorophenyl prop-2-enyl and [2,3,3-2H<sub>3</sub>]prop-2-enyl ethers. Formation of 1-fluorovinyl 2,3,4-trifluorophenyl ketones *via* internal Diels-Alder reactions, 1463.
  - Stereochemistry of iodofluorination of phenyl-substituted olefins with (difluoroiodo)methane, 1745.
  - Studies of heterocyclic compounds. Part XX, substitution of 1-oxa-6,6a-dithiapentalenes with arenediazonium fluoroborates: rearrangement into 6,6a-dithia-1,2-diazapentalenes, 880.
- Formolysis of (16S)-ent-12α-p-tolysulphonyloxykaurane. Ring c functionalised diterpenoids. Part VII, 1042.
- Free radicals. Addition of free radicals to unsaturated systems. Part XXII, photochemical addition of trifluoroiodomethane and iodine to perfluoro-(3-methylbut-1-ene) and photochemical dimerisation of the olefin, 1170.
  - Polyfluoroalkyl derivatives of nitrogen. Part XLIII, reactions of N-bromobis(trifluoromethyl)amine with 1-fluoropropene under free-radical and under ionic conditions, 556.
- Fulvenes. Chromogens based on non-benzenoid aromatic systems. Part III, synthesis, spectra, and molecular orbital calculations in the substituted fulvene and 6-azafulvene series, 48.
- Fungi, mechanism of aromatic hydroxylation in. Evidence for the formation of arene oxides, 2438.
  - and lichens. Part XII, dehydration and isomerization of stictane triterpenoids, 857. Part XIII, comparison of the nuclear magnetic resonance and mass spectra of 17,21-secohopane and 17,21-secoflavicane derivatives, 1316.
  - the chemistry of. Part LXVIII, the absolute configuration of (+)-sclerotiorin and of the azaphilones, 1366. Part LXIX, a new synthesis of the grisane system: X-ray crystallographic examination of (±)-methyl 5,7-dibromo-2'α,5'α-epoxy-4-methoxy-3-oxogrisane-6'β-carboxylate, 1369. Part LXX, synthesis of some xanthones, 1377. Part LXXI, synthesis of 3,5-dihydroxy-4-methylbenzoic acid, 1382. Part LXXII, the trimethylsilyloxy-substituent as a leaving group, 1384. Part LXXIII, some derivatives of 5-ethyl-2,5-dimethylcyclohexanone, 1385.
  - Biosynthesis of fungal metabolites. Part VIII, identification of N-benzoyl-L-phenylalanyl-L-phenylalaninol acetate, a metabolite of Aspergillus glaucus, 578. Part IX, sclerin: feedings with [1,2-13C]acetate and [methyl-13C]methionine, 2077.
    - of the fungal xanthone ravenelin, 898.
  - Constituents of the higher fungi. Part XVI, bulgarhodin and bulgarein, novel benzofluoranthenequinones from the fungus *Bulgaria inquinans* (Fries), 2149.
  - Fungal metabolites. Part VI, crystal and molecular structure of secalonic acid A, 1820.
    - products. Part XVI, conversion of isosteviol and steviol acetate into gibberellin analogues by mutant B1-41a of Gibberella fujikuroi and the preparation of [³H]gibberellin A<sub>20</sub>, 173. Part XVII, microbiological hydroxylation of gibberellin A<sub>9</sub> and its methyl ester, 178. Part XVIII, <sup>13</sup>C nuclear magnetic resonance spectrum and biosynthesis of colletodiol, 184.

- Structures of three new C<sub>16</sub> terpenoids from an Acrostalagmus fungus, 2407.
- Furanones. Syntheses with carbanions derived from carbonyl-stabilized sulphonium ylides: a novel route to furan-3(2H)-ones, 1688.
- Furans. Ring-opening of 2,5-diaryl-3-lithiofurans, 989.
- **Furazans** and furazan oxides. Part VI, new furazano-[3,4-d]pyrimidine N-oxides: preparation and structure, 1327.
- **Furo-oxepindiones.** Microbial metabolites. Part XI, total synthesis and absolute configuration of (S)-carlosic acid (4-butyryl-2,5-dihydro-3-hydroxy-5-oxofuran-2-acetic acid) and conversion of (R)-5-methyltetronic acid into (R)-carolic acid {3,4-dihydro-8-methylfuro[3,4-b]oxepin-5,6-(2H,8H)-dione}, 1485.
- **3-Furylcarbene.** Generation and reactions of a **3-furylcarbene** and of an isoxazol-**4-ylcarbene**, 1257.
- Fusicoccin. Part 6, biosynthesis of fusicoccin from [3- $^{13}$ C]- and (4R)-[4- $^{3}$ H<sub>1</sub>]-mevalonic acid, 2221.
- Fusidic acid derivatives, stereoselective oxidation of, by the Corey oxidation procedure, 710.

G

- Gangaleoidin and diploicin. Depsidone synthesis. Part II, 147.
- Garamines. Semisynthetic aminoglycoside antibacterials. Part I, preparation of selectively protected garamine derivatives, 1088. Part V, synthesis of pentosyl and related derivatives of garamine, 1135.
- Garcinia dulcis (Roxb.) Kurz, biflavanoids and a flavanonechromone from the leaves of, 1458.
- Gentamicin B. Semisynthetic aminoglycoside antibacterals. Part IV, synthesis of antibiotic JI-20A, gentamicin B, and related compounds, 1126.
- Gentamicin  $X_2$ . Semisynthetic aminoglycoside antibacterials. Part II, synthesis of gentamicin  $X_2$  and related compounds, 1097. Part III, synthesis of analogues of gentamicin  $X_2$  modified at the 3'-psoition, 1113.
- Gibberella fujikuroi. Fungal products. Part XVI, conversion of isosteviol and steviol acetate into gibberellin analogues by mutant B1-41a of Gibberella fujikuroi and the preparation of [3H]gibberellin A<sub>20</sub>, 173. Part XVII, microbiological hydroxylation of gibberellin A<sub>9</sub> and its methyl ester, 178.
- Gibberellane-type compounds, ring B contraction of kauranolides and related compounds into. Terpenoids. Part XXXVIII, 2144.
- Gibberellic acid, synthesis of compounds related to. Part V, introduction of the ring B carboxy-group, 944.
- Gibberellins. Partial syntheses of 2-hydroxygibberellins; characterisation of two new gibberellins,  $A_{46}$  and  $A_{47}$ , 1022.
- D-Gluconic acid, 2-amino-2-deoxy-, reaction with hot acetic anhydride-sodium acetate, 1001.
- Glutaraldehyde, nature of the cross-linking of proteins by. Part I, interaction of glutaraldehyde with the aminogroups of 6-aminohexanoic acid and of α-N-acetyl-lysine, 958.
- Glycerols. Preparation of glycerols protected at the 2-hydroxy-group and their application to the synthesis of lipids, 2273.
- Glycines. A highly stereospecific synthesis of (R)- and (S)- $[2^{-2}H_1]$ glycine, 2229.

- Gold(III) as an electrophilic oxidant of alkenes, 811.
  - Reactions of alkynes, cyclopropanes, and benzene derivatives with gold(III), 1983.
- Gomberg reaction. Reaction of 2,4-dinitrobenzenediazonium ions with thiophens. Part 1, an acidic Gomberg reaction, 1636.
- **Grignard reagents,** transhalogenation of mucohalic acids by, 2470.
  - Experiments towards the synthesis of corrins. Part XIII, a new synthesis of 2-cyano- $\Delta^1$ -pyrroline 1-oxides and their behaviour towards a Grignard reagent, 1951.
  - Pentatomic heteroaromatic cations. Part VI, new syntheses of aldehydes and ketones by reaction of 1,3-benzodithiolylium salts with Grignard reagents, 1886.
- Grisanes. Chemistry of fungi. Part LXIX, a new synthesis of the grisane system: X-ray crystallographic examination of  $(\pm)$ -methyl 5,7-dibromo-2' $\alpha$ ,5' $\alpha$ -epoxy-4-methoxy-3-oxogrisane-6' $\beta$ -carboxylate, 1369.
- Griseoviridin, a modified cyclic peptide antibiotic, revised constitution, absolute configuration, and conformation of, 1996.

#### H

- Halogenation. Transhalogenation of mucohalic acids by Grignard reagents, 2470.
- Halogen compounds. Chain extension reactions of acetylenes. Part II, a comparison of the reactions of butyl-lithium with 1-iodoalk-1-ynes and 1-bromoalk-1-ynes, 1609.
  - NN-Dichloroperfluoroaniline, 143.
  - Factors in the formation of isomerically and optically pure alkyl halides. Part X, reactions of saturated
  - aliphatic alcohols with thionyl chloride, 104. Part XI, Vilsmeier reagents for the replacement of a hydroxygroup by chlorine or bromine, 754.
  - Generation of xanthones and benzoxanthones from o-aryloxybenzaldehydes by use of copper(II) halides, 2241.
  - Halogeno-1,4-dioxans and their derivatives. Part VIII, direct replacement of chlorine in 2,3-dichloro-1,4-dioxan by sulphur and by nitrogen. Conformations of the products, of a rigid *cis*-fused hexahydro-1,4-dioxino[2,3-b][1,4]dioxin, and of bi-1,3-dithian-2-yl, 121
  - Heterocyclic synthesis from o-halogeno-acids. Part III, synthesis of 2-methylindole-4-carboxylic acid and related compounds and of some derivatives of 3-phenylisoquinolin-1(2H)-one, 1073.
  - Metabolism of 4,4'-dihalogenobiphenyls, 357.
  - Organometallic compounds of Group II. Part VII. preparation of 4-alkylpyridines by reactions of some light metals with alkyl halides in pyridine, 1977.
  - Polyhalogenoallenes. Part X. an improved preparation of perfluoro-(3-methylbuta-1,2-diene) and the structure of its dimers, 1173.
  - Polyhalogenoheterocyclic compounds. Part XXVIII, polychloroindoles, 162. Part XXIX, perchloroacridine, -phenanthridine, and -benzo[h]quinoline, 1069.
  - Purines, pyrimidines, and imidazoles. Part XLIII, halogenation of N-3-methylbut-2-enylphthalimide; new syntheses of zeatin analogues, 1446.

Reaction between 2-phenylaziridines and 3-halogenocyclohex-2-enones, 2484.

- of carbonyl compounds with tervalent phosphorus reagents. Part VI, benzoate esters and halogenophosphines, 741.
- Synthesis of dialkyl sulphites from alcohols in the halogenpyridine-sulphur dioxide system. Novel behaviour of alkyl chlorosulphates in the pyridine-sulphur dioxide system, 108.
- Helichrysum species, a new chalcone glucoside, helichrysin, from. South African plant extractives. Part III, 1819.
- **Heptenes.** Metal catalysis in organic reactions. Part 11, products and stereochemical aspects of the isomerization of heptenes by the tri-isobutylaluminium-bis-N-methylsalicylideneaminenickel system, 1904.
- Heterocycles. Heterocycles by cycloaddition. Part II, cycloaddition-extrusion reactions of five-membered mesoionic compounds with benzyne: preparation of benz[c]azole and benzo[c]thiophen derivatives, 672. Part 5, preparation of 7,9-diheteratricyclo[4.2.1.0²,5]-non-3-en-8-one derivatives from mesoionic compounds, 2562. Part 6, cycloaddition-double fragmentation reactions of mesoionic compounds with an oxabicyclo[2.2.1]heptadiene: synthesis of five-and six-membered heterocycles, 2565.
  - from ylides. Part III, reactivity of allylic phosphonium ylides with 1,3-dipoles, 619. Part IV, reactivity of 4-arylmethylene-Δ²-pyrazolin-5-ones with stabilized sulphur ylides, 620.
  - Addition reactions of heterocyclic compounds. Part I.XIII, new structures for some 2:1 molar adducts from dimethyl acetylenedicarboxylate with thiazoles and benzo-imidazoles, -oxazoles, and -thiazoles formed by novel rearrangement. Crystal and molecular structure determinations for tetramethyl 3.8a-dimethylpyrido[2,1-b]thiazole-5,6,7,8-tetracarboxylate and tetramethyl 5-methylpyrido[2,1-b]thiazole-6,7,8.8a-tetracarboxylate, 1269. Part LXIV, indolizines from reactions of hex-3-yne-2,5-dione, but-3-yn-2-one, and allenecarboxylic esters with some nitrogen-containing heterocyclic ylides, 1908. Part LXV, synthesis, tautomerism, and rearrangement of some 2H- and 4H-quinolizine esters, 1911.
  - Chemistry of heterocyclic compounds. Part IX. Triazines and related products. Part XVII. Cyclisation reactions of azolylhydrazones derived from ethyl cyanoacetate and malononitrile. Formation of azolo[5,1-c][1,2,4]triazines, 1496.
    - of polyazaheterocyclic compounds. Part VIII, coupling reactions of 1,2,4-triazole-5-diazonium nitrate with active methylene compounds. A new general route to [1,2,4]triazolo[5,1-c][1,2,4]triazine derivatives, 421.
  - Conformational behaviour of medium-sized rings. Part II. heterocyclic analogues of 5,6,7,12-tetrahydro-dibenzo[a,d]cyclo-octene (1,2,4,5-dibenzocyclo-octa-1,4-diene), 913. Part III, heterocyclic analogues of 12,13-dihydro-11H-dibenzo[a,e]cyclononene, 6,11,-12,13-tetrahydro-5H-dibenzo[a,e]cyclononene, and 5,6,7,12,13,14-hexahydrodibenzo[a,f]cyclodecene, 926.
  - Formation of heterocyclic compounds by use of N'-diphenylmethylene-N-phenyl-N-trimethylsilylurea, 1523.
    - from 1,3-diazabuta-1,3-diene derivatives, 1528.

### Heterocycles (contd.)

- Heterocyclic compounds. Part V, reactions of phenyl and benzoyl isocyanates and benzoyl isothiocyanate with hydrazones, 2243.
  - containing phosphorus. Part 30, synthesis of mixed phosphorohydrazides of some new mono-, bi-, and tri-cyclic derivatives, 2093.
  - with bridgehead nitrogen atoms. Part V, pyrido-[2,1,6-de]quinolizines (cycl[3.3.3]azines), 341.
- Heterocyclic polyfluoro-compounds. Part XXIII, reaction of some 2-, 3-, and 4-substituted pyridine 1-oxides, 5-methylpyrimidine 1-oxide, and quino-line 1-oxide with perfluoropropene, and of pyridine 1-oxide with perfluoro-(2-methylpent-2-ene): synthesis of 2-(1,2,2,2-tetrafluoroethyl)-pyridines or -pyrimidines and their N-oxides and of 2,2,3-trifluoro-2,3-dihydro-3-trifluoromethylfuro[3,2-b]pyridine, 1226.
- rearrangements. Part XIV, attempts to activate ring-opening-ring-closure rearrangements with carbon as the central atom, 315.
- steroids. Part II, synthesis of  $(\pm)$ -8-hydroxy-3-methoxy-11-aza-18-norestra-1,3,5(10),9(11)-tetraen-17-one and related compounds, 1889.
- studies. Part XXXVII, ready ring cleavage and decarbonylation of pyrimidine-5-carbaldehydes, 125. Part XXXVIII, synthesis and disproportionation of pyrimido[4,5-b]quinolinium salts, 131. Part XXXIX, ring cleavage of some pyrimidine derivatives in alkali, 1004.
- syntheses with malonyl chloride. Part XI, reactions of 2-alkyl- (or -aryl-)thio-7-chloropyrano[3,4-e][1,3]-oxazine-4,5-diones with water and with alcohols, 2462.
  - from o-halogeno-acids. Part III, synthesis of 2-methyl-indole-4-carboxylic acid and related compounds and of some derivatives of 3-phenylisoquinolin-1(2H)-one, 1073.
  - Part XVI, a new [4 + 2] cycloaddition pathway in the reaction of 2-oxoindolin-3-ylideneacetophenones with ethyl vinyl ether, 1248. Part XVII, reactions of 2-oxoindolin-3-ylidene derivatives with enamines: a Michael pathway as an alternative to 1,2- and 1,4-cycloadditions, 1872.
- N-Oxides, N-imides, and N-ylides of five-membered heterocycles. Part 5, reactions of 2,4,5-triphenyl-3H-pyrrol-3-one 1-oxide, 2259.
- Pentatomic heteroaromatic cations. Part V, a convenient general method for the preparation of aldehydes from aryl chlorides via 2-substituted 1,3-benzoxathiolylium tetrafluoroborates, 323. Part VI, new syntheses of aldehydes and ketones by reaction of 1,3-benzodithiolylium salts with Grignard reagents, 1886.
- Photochemical and thermal reactions of heterocycles. Part I, photolysis, thermolysis, and mass spectral fragmentation of mesoionic 1,2,4-triazol-3-ones, 863.
- Polyhalogenoheterocyclic compounds. Part XXVIII, polychloroindoles, 162. Part XXIX, perchloroacridine, -phenanthridine, and -benzo[h]quinoline, 1069.
- Reactions of heterocycles with thiophosgene. Part VI, reactions of tetrahydropyrazolo[1,5-c]quinazolines, 653.

- Studies of heterocyclic compounds. Part XIX, synthesis of 6,6a-dithia- and 6,6a-diselena-1,2-diazapentalenes, 228. Part XX, substitution of 1-oxa-6,6a-dithia-pentalenes with arenediazonium fluoroborates; rearrangement into 6,6a-dithia-1,2-diazapentalenes, 880.
  - on β-lactams. Part 46, synthesis of nine-membered heterocycles *via* β-lactams, 2343.
  - on the syntheses of heterocyclic compounds. Part DCL, total synthesis of corytenchirine, 1218. Part 73, new routes to benzo[a]quinolizines, 2547.
- Syntheses of heterocyclic compounds. Part XXXIII, preparation and reactions of 4-(2-dialkylamino-phenyl)azetidin-2-ones, 1725.
- Synthesis, spectra, and crystal structure of 6,7,14,15-tetrahydrobisbenzimidazo[1,2-a; 1',2'-e][1,5]diazocine, 312.
- Use of 2,3-dichloropropene and 1,3-dichlorobut-2-ene as synthons for heterocyclic compounds: synthesis of 2-methylbenzo[b]furans, 2-methylbenzo[b]thiophens, and 4-methyl-2H-chromen, 1.
- Vinyl derivatives of heterocyclic systems and their polymers: isoxazole derivatives, 570.
- Homocubanes. Preparation and properties of cage polycyclic systems. Part IV, hydrogenolyses of homocubane derivatives. 1346.
- **4-Homoisotwistane**, 3-bromo-, (3-bromotricyclo[5.3.1.0<sup>3,8</sup>]-undecane), dehydrobromination of, and some addition reactions of tricyclo[5.3.1.0<sup>3,8</sup>]undec-2-ene. Stereochemistry of the formation and reaction of an anti-Bredt compound probed by deuterium substitution, 2133.
- Hückel molecular orbitals. Photodehydrocyclisation of 1-styrylimidazoles; an HMO study, 2038.
- Hydrastine. A one-step synthesis of the phthalidylisoquinoline alkaloids, cordrastine and hydrastine, 1221.
- **Hydrazines.** Reaction of benzofurazan N-oxide with secondary aliphatic amines; preparation of NN-dialkyl-N'-(o-nitrophenyl)hydrazines, 2216.
- **Hydrazino-triazines** and **-triazoles**. Triazines and related products. Part XVI, synthesis of triazolotriazines by cyclisation of 3-hydrazino-1,2,4-triazines and 3-hydrazino-1,2,4-triazoles, 1492.
- Hydrazobenzenes. Benzidine rearrangement via a cation radical in liquid sulphur dioxide, 1504.
- Hydrazoic acid, reaction of 2'-hydroxychalcone with, 2371. Hydrazones. A new synthesis of pyrimido[4,5-e]-as-triazine 4-oxides by nitrosative cyclization of aldehyde uracil-6-ylhydrazones in the presence of diethyl azodiformate, 713.
  - Formation of certain substituted 5*H*-pyrrolo[2,3-*b*]-pyrazines by thermal cyclisation of pyrazinylhydrazones and a route to 5*H*-pyrazino[2,3-*b*]indole; a synthesis of 5*H*-pyrrolo[2,3-*b*]pyrazine and some of its properties, 1361.
  - Heterocyclic compounds. Part V, reactions of phenyl and benzoyl isocyanates and benzoyl isothiocyanate with hydrazones, 2243.
  - Mercurial derivatives from the reactions of substituted hydrazones with mercury(II) acetate and phenylmercury(II) hydroxide, 986.
  - Reactions of hydrazones and related compounds with strong bases. Part III, 1,2,4-triazoles, 1,2,4-triazines, and 1,3,5-triazines from aromatic aldehyde azines, 207.
  - Thermal cyclisation of pyridazinylhydrazones to give s-triazolo[4,3-b]-pyridazines and pyridazino[2,3-a]-benzimidazole, 1363.

- Hydrocarbons, saturated, bridgehead functionalisation of, with lead(IV) salts, 2576.
  - Phosphate esters. Part 3, formation of sesquiterpene hydrocarbons from cis,trans- and trans,trans-farnesyl diphenyl phosphates, 2524.
- **Hydrogenation** of 2-benzylidenecycloalkanols, effect of ring size on, 191.
- **Hydrogenolysis.** Preparation and properties of cage polycyclic systems. Part IV, hydrogenolyses of homocubane derivatives, 1346.
- Hydroquinone diacetates, synthesis of, from polycyclic aromatic quinones, 836.
  - Di- $\pi$ -methane rearrangements of 1,4-dihydro-1,4-methano- and -ethanonaphthalene-5,8-diols, 550.
- **Hydroxylation,** aromatic, in fungi, mechanism of. Evidence for the formation of arene oxides, 2438.
  - microbiological. Part XXII, hydroxylation of 3,20-, 7,20-, and 11,20-dioxygenated  $5\alpha$ -pregnanes, 1842. of  $3\beta$ ,7 $\beta$ -dihydroxykaurenolide, 1666.
    - of gibberellin  $A_9$  and its methyl ester. Fungal products. Part XVII, 178.
- eis-Hydroxylation of steroidal olefins with thallium triacetate, 1660.
- Hydroxyquinol, derivatives of. Part 4, a synthesis of di-O-methylcitromycin; electronic effects in hydroxyquinol derivatives, 2444.
- Hypoxanthines, 8-(methylthio)-, physical properties and chemical reactivity of, 90.
- Hypoxanthinium salts. Thermal decomposition of quaternary hypoxanthinium salts and related purines, 239.

I

- Illudin M. Studies in terpenoid biosynthesis. Part XV, biosynthesis of the sesquiterpenoid illudin M, 876.
- Imidates,  $\alpha$ -hydroxy-, cyclisation reactions with oxalyl chloride and NN'-dicyclohexylcarbodi-imide, 542.
- Imidazo-isoquinolines. Photocyclisation of 1-styrylimidazoles. A novel route to N-bridgehead compounds, 75.
  - Polycyclic fused amidines. Part III, an unexpected mode of cyclisation of 2-phenacylisoquinolinium bromide, 201.
- Imidazoles, purines, and pyrimidines. Part XLIII, halogenation of N-3-methylbut-2-enylphthalimide; new syntheses of zeatin analogues, 1446. Part XLIV, syntheses of some dihydro-1,3-oxazine derivatives and related substituted uracils, 1969.

1-styryl-, 545.

- photocyclisation of. A novel route to N-bridgehead compounds, 75.
- photodehydrocyclisation of; an HMO study, 2038.
- Amidinoacetamides in the synthesis of pyrimidines, imidazoles, and purines, 1847.
- N-Amination and subsequent oxidation of some fused imidazoles and triazoles, 367.
- Imidazolium salts. Stereochemistry of organophosphorus cyclic compounds. Part IV, synthesis and geometrical isomerism in cyclic five-membered phosphorus thioacids. Crystal and molecular structure of the imidazolium salt of r-2-hydroxy-c-4-methyl-1,3,2-dioxaphospholan-2-thione, 371
- Imidazopyridines. The N-amination and subsequent oxidation by bromine of imidazo[1,5-a]pyridines, 1722.

- N-Imides, N-oxides, and N-ylides of five-membered heterocycles. Part 5, reactions of 2,4,5-triphenyl-3H-pyrrol-3-one 1-oxide, 2259.
- Imines, thermal and photochemical  $\alpha$ -carbon-carbon cleavages in, 1583.
- Indanes. Synthesis of isocoumarins via indanones, 1438.
- Indanones. Chiroptical studies. Part LXXXIX, an empirical analysis of the circular dichroism of hexahydroindanones, bicyclo[4.2.0]octan-7-ones, and their polycyclic analogues, 762.
- Indene. \( \Delta^2\)-Isoxazoline derivatives. Part X, 1,3-dipolar cycloadditions of nitrones and nitrile oxides with indene, 1,2-dihydronaphthalene, and trans-1-phenylpropene, 1518.
- Indenofuranones. Synthesis of the germination stimulant  $(\pm)$ -strigol, 410.
- Indole alkaloids. Structures of tabernaelegantines A—D and tabernaelegantinines A and B, new indole alkaloids from *Tabernaemontana elegans*, 1432.
- Indole-4-carboxylic acid, 2-methyl-. Heterocyclic synthesis from o-halogeno-acids. Part III, synthesis of 2-methyl-indole-4-carboxylic acid and related compounds and of some derivatives of 3-phenylisoquinolin-1(2H)-one, 1073.
- Indoles. Acid-catalysed cyclisation of  $\alpha$ -oxo-anilides to 1,3-dihydro-3-hydroxyindol-2-ones, 1556.
  - Allenes. Part 34, reactions of methylindoles and 2,5-dimethylpyrrole with allenic carbenes, 2103.
  - Photochemistry of ethyl 2-cyano-1,2-dihydroquinoline-1-carboxylates (Reissert compounds): synthesis of 2-cyanomethylindole-1-carboxylates, 2587.
  - Polyhalogenoheterocyclic compounds. Part XXVIII, polychloroindoles, 162.
  - Thermal rearrangements of 3,5-diphenylisoxazole, 16.
- Indolizines from reactions of hex-3-yne-2,5-dione, but-3-yn-2-one, and allenecarboxylic esters with some nitrogen-containing heterocyclic ylides. Addition reactions of heterocyclic compounds. Part LXIV, 1908.
  - Addition products of 2-(N-arylformimidoyl)pyridines and carbanions, and their reduction to octahydroindolizine derivatives, 5.
- Indolo[2',3':3,4]pyrido[1,2-b][2,7]naphthyridinone alkaloid, nauclefine, and its ring-E isomers, synthesis of, 2416.
- Intramolecular alkylation of phenols. Part III, asymmetric induction by a chiral leaving group, 634.
  - catalysis. Part III, effect of a neighbouring hydroxygroup on the opening of steroidal aziridines with azide anions, 1037.
  - condensation of steroidal α-acetoxy-ketones, 212.
  - coupling of diaryl amides by anodic oxidation, 661.
  - nucleophilic aromatic substitution, synthesis of 2,3-di-hydro-1*H*-pyrrolo[1,2-*a*]indoles by, 389.
- **Iodination,** selective, of phenols in the *ortho*-position, 1161.
- Iodine compounds. Addition of free radicals to unsaturated systems. Part XXII, photochemical addition of trifluoroiodomethane and iodine to perfluoro-(3-methylbut-1-ene) and photochemical dimerisation of the olefin, 1170.
  - Iodocyclopropanes. Part I, di-iodocarbene adducts of some cyclic olefins, 54.
  - Perfluoroalkyl derivatives of sulphur. Part XVIII, reactions of polyfluoroiodoalkanes with sodium methanethiolate in the presence of dimethyl disulphide, and related reactions, 525.
  - Reaction of thallium(I) acetate-iodine and silver(I) acetate-iodine with norborn-2-ene, 845.

- Iodine (contd.)
  - of iodine oxide with alkenes, 1961.
  - of thallium(1) azide and iodine with alkenes, 840.
  - Stereochemistry of iodofluorination of phenyl-substituted olefins with (difluoroiodo)methane, 1745.
  - Synthesis of alkyl iodides, 416.
  - The iodo-lactones derived from norborn-5-en-2-endo-ylacetic acid and -propionic acid, 2267.
- Ionones. Electro-organic reactions. Part V. cathodic pinacolisation of  $\alpha$  and  $\beta$ -ionones, 561.
- Iron. Chemistry of the tricarbonyliron complexes of calciferol and ergosterol, 829.
  - Organometallics in synthesis: alkylation of tricarbonyldienyliron cationic complexes with organocadmium reagents, 954.
  - Selective diarylmethane formation in the reaction of iron(111) perchlorate with alkylbenzenes, 1966.
  - Stable carbocations. Part X, generation, observation, and reactions of ferrocenyl-stabilised cyclopropylalkylium and related ions, 804.
- Isamic acid and methylisatoid, structures of, 2004.
- **Isoalloxazines,** alloxazines, toxoflavins, and fervenulins, syntheses of, by oxidative cyclisation of the Michael-type adducts from substituted 6-aminouracils and azo-compounds, 2398.
- Isobenzofurans, generation and interception of, from 2-( $\alpha$ -bromoalkyl)benzophenones, 336.
- Isochlorocruoroporphyrins. Synthetic and biosynthetic studies of porphyrins. Part 2, synthesis of isopemptoand isochlorocruoro-porphyrins, 2501.
- Isocoumarins, synthesis of, via indanones, 1438.
- Isocyanates, a new synthesis of, 141.
  - Heterocyclic compounds. Part V, reactions of phenyl and benzoyl isocyanates and benzoyl isothiocyanate with hydrazones, 2243.
  - Quinolines and uracils from reactions of isocyanates with aliphatic aldehydes, 1597.
- Isoflavylium salts, some reactions of. Chemistry of the 'insoluble red' woods. Part XII, 1389.
- Isomerically and optically pure alkyl halides, factors in the formation of. Part X, reactions of saturated aliphatic alcohols with thionyl chloride, 104. Part XI, Vilsmeier reagents for the replacement of a hydroxy-group by chlorine or bromine, 754.
- Isomerisation and dehydration of stictane triterpenoids. Lichens and fungi. Part XII, 857.
  - of benzyl 6-phenoxyacetoxypenicillanates and their S-oxides, 704.
  - Metal catalysis in organic reactions. Part II, products and stereochemical aspects of the isomerisation of heptenes by the tri-isobutylaluminium-bis-N-methylsalicylideneaminenickel systems, 1904.
  - Photochemical reactions of 1*H*-2,3-benzodiazepines: valence isomerisation of a 1,2-diazabutadiene to a diazetine, 362.
  - Photoisomerisation of  $\alpha$ -(thiopyran-2-ylidene) ketones; substituent effects, 166.
- Isomerism. EZ-Isomerism in alkyl phenyl ketone phenylhydrazones and acetaldehyde phenylhydrazone, 456.
  - Stereochemistry of organophosphorus cyclic compounds. Part IV, synthesis and geometrical isomerism in cyclic five-membered phosphorus thioacids. Crystal and molecular structure of the imidazolium salt of *r*-2-hydroxy-*c*-4-methyl-1,3,2-dioxaphospholan-2-thione, 371.

- **Isopemptoporphyrins.** Synthetic and biosynthetic studies of porphyrins. Part 2, synthesis of isopempto- and isochlorocruoro-porphyrins, 2501.
- Isoquinoline alkaloids, phthalidyl-, cordrastine and hydrastine, a one-step synthesis of, 1221.
  - Studies on the alkaloids of Formosan Corydalis species. Part VI, elucidation of the structures of two spirobenzylisoquinoline alkaloids, yenhusomine and yenhusomidine, and two herbine alkaloids, corytenchine and corytenchirine, from Corydalis ochotensis (Turcz.), 63.
- **Isoquinolines.** An improved synthesis of 6-amino-1,2,3,4-tetrahydro-2-methylisoquinoline: elucidation of the stereochemistry of some diastereoisomers of 6-amino-2-methyldecahydroisoquinoline, 757.
  - Heterocyclic synthesis from o-halogeno-acids. Part III, synthesis of 2-methylindole-4-carboxylic acid and related compounds and of some derivatives of 3-phenylisoquinolin-1(2H)-one, 1073.
  - Intramolecular cyclisation of arylalkyl isothiocyanates. Part I, synthesis of 1-substituted 3,4-dihydroisoquinolines, 33.
- Isoquinolinium bromide 2-phenacyl-, an unexpected mode of cyclisation of. Polycyclic fused amidines. Part III, 201.
- (±)-Isorhodoptilometrin. Reactions of keten acetals. Part VI, total syntheses of the anthraquinones (±)-nalgiovensin, (±)-isorhodoptilometrin, and (±)-rhodoptilometrin, 613.
- Isosteviol. Fungal products. Part XVI, conversion of isosteviol and steviol acetate into gibberellin analogues by mutant Bl-41a of Gibberella fujikuroi and the preparation of [3H]gibberellin A<sub>20</sub>, 173.
- **Isothiocyanates,** arylalkyl, intramolecular cyclisation of. Part 1, synthesis of 1-substituted 3,4-dihydroisoquinolines, 33.
  - Condensed thiophen ring systems. Part XIX, synthesis of 6,7-dihydrothieno[3,2-c]pyridines and 4,5-dihydrothieno[2,3-c]pyridines by intramolecular cyclisation of 2-(2- or 3-thienyl)ethyl isothiocyanate, 138.
  - Heterocyclic compounds. Part V, reactions of phenyl and benzoyl isocyanates and benzoyl isothiocyanate with hydrazones, 2243.
- Isoxazoles, syntheses with. Part IV, ring-opening reactions of 4,5,6,7-tetrahydro-4-oxoisoxazolo[2,3-a]pyridinium salts and related compounds under the influence of tertiary amines, 1241.
  - Metal-catalysed organic photoreactions. Photoreactions of 3,5-dimethylisoxazole with and without catalytic assistance by copper(II) salts, 783.
  - Neighbouring group participation in isoxazole ring bromination. Part II, 1694.
  - Reactions of some substituted isoxazoles with organolithium reagents, 994.
  - Thermal rearrangement of 3,5-diphenylisoxazole, 16.
  - Vinyl derivatives of heterocyclic systems and their polymers: isoxazole derivatives, 570.
- Isoxazolines. Δ²-Isoxazoline derivatives. Part X, 1,3-dipolar cycloadditions of nitrones and nitrile oxides with indene, 1,2-dihydronaphthalene, and trans-1-phenyl-propene, 1518.
- Isoxazolo[2,3-a]pyridinium salts, 4,5,6,7-tetrahydro-4-oxo-, and related compounds, ring-opening reactions of, under the influence of tertiary amines. Syntheses with isoxazoles. Part IV, 1241.

**Isoxazol-4-ylcarbene.** Generation and reactions of a 3-furylcarbene and of an isoxazol-4-ylcarbene, 1257.

J

- JI-20A. Semisynthetic aminoglycoside antibacterials. Part IV, synthesis of antibiotic JI-20A, gentamicin B, and related compounds, 1126.
- Jalaric acid. Structural investigation of lac resin. Part XI, the role of acetalisation in resin formation, and the configuration of jalaric acid, 2045.
- Juglone. Ebenaceae extractives. Part 7, ehretione, a bisnaphthoquinone derived from plumbagin and 7-methyljuglone, 2546.

K

- Kauranes. Ring c functionalised diterpenoids. Part VII, formolysis of (16S)-ent-12α-p-tolylsulphonyloxykaurane, 1042.
- Kauranolides. Terpenoids. Part XXXVIII, ring B contraction of kauranolides and related compounds into gibberellane-type compounds, 2144.
- **Kaurenes.** Biosynthesis of natural products. Part 1, incorporations of *ent*-kaur-16-ene and *ent*-kaur-16-en-15-one into enmein and oridonin, 2098.
- Kaurenolide, 3β,7β-dihydroxy-, microbiological hydroxylation of, 1666.
- **Ketens.** Reactions of keten acetals. Part VI, total syntheses of the anthraquinones  $(\pm)$ -nalgiovensin.  $(\pm)$ -isorhodoptilometrin, and  $(\pm)$ -rhodoptilometrin. 613. Part 7, total syntheses of the tetramethyl ethers of the 1-acyl-2,4,5,7-tetrahydroxyanthraquinones rhodolamprometrin and rhodocomatulin, 1852.

Ketones—see also Carbonyl compounds.

- steroidal  $\alpha$ -acetoxy-, intramolecular condensation of, 212. Condensed cyclic and bridged-ring systems. Part 1V, stereochemically controlled synthesis of some endo-2-aryl-6-oxobicyclo[3.2.1]octanes and related compounds through intramolecular alkylations of  $\gamma$ 8-unsaturated  $\alpha'$ -diazomethyl ketones 1669. Part V, application of the intramolecular oxo-carbenoid insertion reaction to the preparation of two new bridged-ring ketones, 1975.
- Enamine chemistry. Part XXI, condensation of L-sodium or L-ethyl prolinate with ketones to give substituted polyhydropyrrolo[1,2a]-indoles and -pyrrolizines, 904.

Enol benzoates of  $\beta$ -diketones, 380.

- Metal-catalysed organic photoreactions. Photo-oxidations of αβ-unsaturated ketones and o-methylaceto-phenone in the presence of copper(II) salts, 779.
  - Photoreaction of  $\alpha\beta$ -unsaturated ketones in alcohols in the presence of titanium(1v) chloride, 788.
- Olefin synthesis by two-fold extrusion processes. Part 3, synthesis and properties of hindered selenoketones (selones), 2079.
- Pentatomic heteroaromatic cations. Part VI, new syntheses of aldehydes and ketones by reaction of 1,3-benzodithiolylium salts with Grignard reagents, 1886.
- Photochemical formation of amides from t-butylamine and aromatic aldehydes and ketones, 1511.

- Photoisomerisation of α-(thiopyran-2-ylidene) ketones; substituent effects, 166.
- Fyrolyses of pentafluorophenyl prop-2-enyl and [2,3,3-2H<sub>3</sub>]prop-2-enyl ethers. Formation of 1-fluorovinyl 2,3,4-trifluorophenyl ketones *via* internal Diels-Alder reactions, 1463.
- Reactions of a 'myrcene-magnesium' complex with aldehydes, ketones, epoxides, carbon dioxide, and acetonitrile, 1809.
  - of enamino-ketones. Part II, synthesis of 4H-1,4-benzothiazines, 1146.
- Reduction of triterpenoid ketones with bornan-2-exo-yloxyaluminium dichloride: a convenient preparation of axial triterpene alcohols, 321.
- Thallium in organic synthesis. Part II, oxidation of steroid ketones by thallium(III) acetate, 111.
- **Koenigs-Knorr** reactions. Part 1, effect of a 2-O-acetyl substituent, the promoter, and the alcohol concentration on the stereoselectivity of reactions of 1,2-cis-glucopyranosyl bromide, 1938.

L

- Lacresin, structural investigation of. Part X, structure and stereochemistry of methyl laccolate  $\gamma$ -lactone and its epimer, 967. Part XI, the role of acetalisation in resin formation, and the configuration of jalaric acid. 2045.
- Lactams, studies on. Part IV, relation between Cotton effect and conformation of a seven-membered lactam ring, 665.
  - Part 45, some carbocyclic analogues of cephalosporin, 2193. Part 46, synthesis of nine-membered heterocycles *via* β-lactams, 2343.
- Lactones, a general synthesis of: remote oxidation of carboxylic acids by peroxodisulphuryl difluoride in fluorosulphuric acid, 2035.
  - A stereospecific route to trisubstituted olefins via  $\beta$ -lactones, 884.
  - Chemistry of the Compositae. Part XXXI, absolute configuration of the sesquiterpene lactones centaure-pensin (chlorohyssopifolin A), acroptilin (chlorohyssopifolin C), and repin, 1663.
  - Extractives from *Pseudowintera colorata*. Part V, a new sesquiterpene lactone, colorata-4(13),8-dienolide, 850.
  - Iodo-lactones derived from norborn-5-en-2-endo-yl-acetic acid and -propionic acid, 2267.
  - Structural investigation of lac resin. Part X, structure and stereochemistry of methyl laccolate  $\gamma$ -lactone and its epimer, 967.
  - Synthesis of  $\alpha$ -methylene- $\gamma$ -lactones involving Baeyer-Villiger oxidation of  $\alpha$ -substituted cyclobutanones, 1934.
- Lead. Bridgehead functionalisation of saturated hydrocarbons with lead(1v) salts, 2576.
- Leonotis nepetaefolia. 4,6,7-Trimethoxy-5-methylchromen-2-one, a new coumarin from Leonotis nepetaefolia, 2594.
- Lichens and fungi. Part XII, dehydration and isomerization of stictane triterpenoids, 857. Part XIII, comparison of the nuclear magnetic resonance and mass spectra of 17,21-secohopane and 17,21-secoflavicane derivatives, 1316.

- Lignans and related phenols. Part XV, remote substituent effects on the rates and products of some reactions of aryltetrahydronaphthalenes, 832.
- Limonoids from Xylocarpus moluccensis (Lam.) M. Roem, 1993.
- Lincomycin, syntheses towards the carbohydrate moiety of, 950.
- Lipids. Preparation of glycerols protected at the 2-hydroxy-group and their application to the synthesis of lipids, 2273.
- Lithium aluminium hydride-mediated methylation of diphenylmethane and allied compounds by bis-2-(methoxyethyl) ether, 2380.
  - enolate of cyclo-octa-2,4,6-trienone and its reactions with electrophiles, 1838.
  - Chain extension reactions of acetylenes. Part II, a comparison of the reactions of butyl-lithium with 1-iodoalk-1-ynes and 1-bromoalk-1-ynes, 1609.
  - Reactions of some substituted isoxazoles with organolithium reagents, 994.
  - Ring-opening of 2,5-diaryl-3-lithiofurans, 989.
- Lithocarpus cornea. Structures of eight new triterpenoids and isolation of other triterpenoids and epi-ikshusterol from the stems of Lithocarpus cornea, 23.
- Lomatin (9,10-dihydro-9-hydroxy-8,8-dimethyl-8*H*-benzo-[1,2-*b*: 3,4-*b*']dipyran-2-one), structures of two dimers formed from, 1857.
- Luteoreticulin, a toxic nitro-containing metabolite of Streptomyces luteoreticuli Arai, synthesis and geometrical configuration of, 404.
- Lysine. Nature of the cross-linking of proteins by glutaral-dehyde. Part I, interaction of glutaraldehyde with the amino-groups of 6-aminohexanoic acid and of  $\alpha$ -N-acetyllysine, 958.

### M

- Macrocycles, new, synthesis of. Part 5, cyclization of 2,2-dithiodibenzoic acid derivatives, 2574.
  - Behaviour of nitrile oxides towards nucleophiles. Part IV, heteromacrocycles from acetonitrile oxide, 1827.
  - Biosynthesis of porphyrins and related macrocycles. Part V, structural integrity of the type III porphyrinogen macrocycle in an active biological system; studies on the aromatisation of protoporphyrinogen-IX, 266.
  - Part VI, nature of the rearrangement process leading to the natural type III porphyrins, 273. Part VII, synthesis of specifically labelled [\$^{14}C\_1\$]uroporphyrin-III and of [\$10,14-\$^{13}C\_2\$]uroporphyrin-III. Conversion of the latter into [\$10,14-\$^{13}C\_2\$]protoporphyrin-IX; biosynthetic significance of its \$^{13}C\$ nuclear magnetic resonance spectrum, 283. Part VIII, enzymic decarboxylation of uroporphyrinogen-III: structure of an intermediate, phyriaporphyrinogen-III, and synthesis of the corresponding porphyrin and of two isomeric porphyrins, 1008.
  - Macrocyclic sulphide synthesis: trithia $[n^{n+1,2n+4}][2n+1]$ -metacyclophanes, 1691.
  - Preparation of macrocyclic ether-esters, thioether-esters, and ether-thiolesters, 2505.
  - Syntheses of macrocyclic enzyme models. Part I, preparation and properties of [20]paracyclophanes, 1320.
  - Total synthesis of the macrocyclic antibiotic ( $\pm$ )-pyrenophorin, 1718.

- Magnesium. Reaction of 'myrcene-magnesium' with esters, acetyl chloride, and acetic anhydride: formation of cyclopentenols and cyclopropane derivatives, 1815.
  - of a 'myrcene-magnesium' complex with aldehydes, ketones, epoxides, carbon dioxide, and acetonitrile, 1809.
- Malononitrile. Chemistry of heterocyclic compounds. Part IX. Triazines and related products. Part XVII. Cyclisation reactions of azolylhydrazones derived from ethylcyanoacetate and malononitrile. Formation of azolo[5,1-c][1,2,4]triazines, 1496.
- Malonyl chloride, heterocyclic syntheses with. Part XI, reactions of 2-alkyl-(or -aryl-)thio-7-chloropyrano[3,4-e][1,3]oxazine-4,5-diones with water and with alcohols, 2462.
- Manganese. Manganese(III)-induced radical additions to 3,7-dimethylocta-1,6-diene, 1762.
- Marthasterais glacialis. Marine steroids. Part III, on the structure of marthasterone glucoside, from the starfish Marthasterais glacialis, 1357.
- Meconium. Synthetic and biosynthetic studies of porphyrins. Part 1, synthesis of the 'S-411' porphyrin obtained from meconium, 2492.
- Melanins, studies related to the chemistry of. Part XIV, the alleged formation of a *p*-quinonoid aminochrome by oxidation of 2,4,5-trihydroxyphenethylamine, 339.
- **p-Mentha-1,5-diene.** Studies in terpenoids. Part XLIV, structure of the adduct from p-mentha-1,5-diene and β-naphthol, and its isomer, 1254.
- Menthenes. Formation of ortho-menthenes by acid-catalysed ring opening of pin-2-ene derivatives, 484.
- Mercury. Mercurial derivatives from the reactions of substituted hydrazones with mercury(II) acetate and phenylmercury(II) hydroxide, 986.
- Mesoionic compounds. Heterocycles by cycloaddition. Part II, cycloaddition-extrusion reactions of five-membered mesoionic compounds with benzyne: preparation of benz[c]azole and benzo[c]thiophen derivatives, 672. Part 5, preparation of 7,9-diheteratricyclo[4.2.1.0<sup>2,5</sup>]non-3-en-8-one derivatives from mesoionic compounds, 2562. Part 6, cycloaddition-double fragmentation reactions of mesoionic compounds with an oxabicyclo[2.2.1]heptadiene: synthesis of five- and six-membered heterocycles, 2565.
- $\begin{tabular}{ll} \textbf{Metabolites,} fungal. & Part VI, crystal and molecular structure of secalonic acid A, 1820. \end{tabular}$ 
  - the biosynthesis of. Part VIII, identification of N-benzoyl-L-phenylalanyl-L-phenylalaninol acetate, a metabolite of Aspergillus glaucus, 578. Part IX, sclerin: feedings with [1,2,-13C]acetate and [methyl-13C]methionine, 2077.
  - microbial. Part XI, total synthesis and absolute configuration of (S)-carlosic acid (4-butyryl-2,5-dihydro-3-hydroxy-5-oxofuran-2-acetic acid) and conversion of (R)-5-methyltetronic acid into (R)-carolic acid {3,4-dihydro-8-methylfuro[3,4-b]oxepin-5,6(2H, 8H)-dione}, 1485.
  - Crystal and molecular structure of compactin, a new antifungal metabolite from *Penicillium brevicompactum*, 1165.
  - Total syntheses of cannabidiol and  $\Delta'$ -tetrahydrocannabinol metabolites, 8.
- **Metacyclophanes.** Macrocyclic sulphide synthesis: trithia- $\lfloor n^{n+1,2n+4} \rfloor \lfloor 2n+1 \rfloor$  metacyclophanes, 1691.

- Metal fluorides, complex, fluorinations with. Part 4, an improved synthesis and the oxidation of hexadecafluorobicyclo[4.4.0]dec-1(6)-ene, 2270.
- Metal hydroxides, insoluble complexes of amino-acids, peptides, and enzymes, with, 962.
- Metals. Metal-catalysed organic photoreactions. Photooxidations of αβ-unsaturated ketones and o-methylacetophenone in the presence of copper(II) salts, 779.
  - Photo-reaction of  $\alpha\beta$ -unsaturated ketones in alcohols in the presence of titanium(IV) chloride, 788.
    - of 3,5-dimethylisoxazole with and without catalytic assistance by copper(II) salts, 783.
- Methane(difluoroiodo)-, stereochemistry of iodofluorination of phenyl-substituted olefins with, 1745.
- Methionine. Biosynthesis of fungal metabolites. Part IX, sclerin: feedings with [1,2-13C]acetate and [methyl-13C]-methionine, 2077.
- Methylation and reduction of 2,8-dioxo-2,8-diamino-, and 2-amino-8-oxo-purines, and the stereochemistry of their 1,4,5,6-tetrahydro-derivatives. Purine studies. Part XX, 1414.
  - of aminopyridazines, 1424.
  - Lithium aluminium hydride-mediated methylation of diphenylmethane and allied compounds by bis-2-(methoxyethyl) ether, 2380.
- Methylene compounds. Chemistry of polyazaheterocyclic compounds. Part VIII, coupling reactions of 1,2,4-triazole-5-diazonium nitrate with active methylene compounds. A new general route to [1,2,4]triazolo[5,1-c][1,2,4]triazine derivatives, 421.
  - Introduction of cyclic dithioacetal functions into activated methylene compounds by treatment with 2-alkoxy-1,3-benzodithioles, 540.
- 5-Methylene-cyclohexa- and -cyclohepta-1,3-diene derivatives, sensitised photo-oxidation of, 1796.
- Methylisatoid and isamic acid, structures of, 2004.
- Mevalonic acid. Fusicoccin. Part 6, biosynthesis of fusicoccin from [3- $^{13}$ C]- and (4R)-[4- $^{13}$ H<sub>1</sub>]-mevalonic acid,
- Michael condensation of 4-hydroxy-6-methylpyran-2-one with dimethylacetylenedicarboxylate, 2137.
  - pathway as an alternative to 1,2-and 1,4-cyclo-additions:reactions of 2-oxoindolin-3-ylidene derivatives with enamines. Heterodiene synthesis. Part XVII, 1872.
- Michael-type adducts. Syntheses of isoalloxazines, alloxazines, toxoflavins, and fervenulins by oxidative cyclization of the Michael-type adducts from substituted 6-aminouracils and azo-compounds, 2398.
- Microbiological hydroxylation. Part XXII, hydroxylation of 3,20-, 7,20-, and 11,20-dioxygenated 5α-pregnanes, 1842.
  - of  $3\beta$ ,  $7\beta$ -dihydroxykaurenolide, 1666.
  - of gibberellin  $A_0$  and its methyl ester. Fungal products. Part XVII, 178.
- Molecular design by cycloaddition reactions. Part 32, transannular cyclization of tricyclo[4.2.2.0<sup>2,5</sup>]deca-3,7-diene derivatives by oxypalladation, 2516.
- Molecular orbital calculations. Chromogens based on nonbenzenoid aromatic systems. Part III, synthesis, spectra, and molecular orbital calculations in the substituted fulvene and 6-azafulvene series, 48.
- Molecular structure- see Crystal and molecular structure.
- Morpholine and 2-methylsulphonylcyclohexanone, reinvestigation of the reaction between: long-range effect of a

- chiral centre on the chemical shift equivalence of morpholine protons, 651.
- Mucohalic acids, transhalogenation of, by Grignard reagents, 2470.
- Musks, aromatic, derived from 1,2,3,4-tetrahydro-1,1,4,4,6,7-hexamethylnaphthalene, 195.
- Mycelianamide. Stereochemical studies on the biosynthesis of the αβ-didehydro-amino-acid units of mycelianamide, cyclopenin, and cyclopenol, 1564.
- 'Myrcene-magnesium' complex, reactions of, with aldehydes, ketones, epoxides, carbon dioxide, and acetonitrile, 1809.
  - reaction with esters, acetyl chloride, and acetic anhydride: formation of cyclopentenols and cyclopropane derivatives, 1815.

#### N

- <sup>15</sup>N. Photoinduced transformations. Part 32, scrambling of unlabelled and [<sup>15</sup>N]nitrogen monoxide in the photo-induced rearrangement of (22S,25S)-5α-veratr-13(17)-enin-11β-yl nitrites to nitrones, 2365.
- (±)-Nalgiovensin. Reactions of keten acetals. Part VI, total syntheses of the anthraquinones (±)-nalgiovensin, (±)-isorhodoptilometrin, and (±)-rhodoptilometrin, 613.
- Naphthalenes. Aromatic musks derived from 1,2,3,4-tetrahydro-1,1,4,4,6,7-hexamethylnaphthalene, 195.
  - Di-π-methane rearrangements of 1,4-dihydro-1,4-methano- and -ethanonaphthalene-5,8-diols, 550.
  - Hydroperoxynaphthalenones from the mild autoxidation of certain simple 1-alkyl-2-naphthols, 2570.
  - Δ²-Isoxazoline derivatives. Part X, 1,3-dipolar cycloadditions of nitrones and nitrile oxides with indene, 1,2-dihydronaphthalene, and trans-1-phenylpropene, 1518.
  - Lignans and related phenols. Part XV, remote substituent effects on the rates and products of some reactions of aryltetrahydronaphthalenes, 832.
  - Medium-sized cyclophanes. Part XIX, bridged naphthalenes: structural aspects, carbon-13 nuclear magnetic resonance, and benzoperylene formation, 2051.
  - Synthesis and photolysis of some 1-naphthyl azoxy-compounds, 688.
  - of dihydroactiniolide [5,6,7,7a-tetrahydro-4,4,7a-tri-methylbenzofuran-2(4H)-one] and 6,7,8,8a-tetrahydro-5,5,8a-trimethylnaphthalene-1,3(5H)-dione from 6,7,8,8a-tetrahydro-2,5,5,8a-tetramethyl-5H-chromen, 532.
- Naphthols. Hydroperoxynaphthalenones from the mild autoxidation of certain simple 1-alkyl-2-naphthols, 2570.
- Studies in terpenoids. Part XLIV, structure of the adduct from p-mentha-1,5-diene and  $\beta$ -naphthol and its isomer, 1254.
- Naphtho[2,3-b]pyran-5,10-quinones. Syntheses of the naturally occurring naphtho[2,3-b]pyran-5,10-quinones  $\alpha$ -caryopterone, dihydro- $\alpha$ -caryopterone, and O-methyl-dihydro- $\alpha$ -caryopterone, 1632.
- Naphthoquinones. Conversion of shikonin angelate into [2,2-dimethyl-1-(2-methylcrotonyloxy)cyclobutyl]-5,8-dihydroxy-1,4-naphthoquinone; a novel cyclisation of a 4-methylpent-3-enyl side chain in a natural quinone, 1579.

# Naphthoquinones (contd.)

- Syntheses of substituted 1,4-naphthoquinones by Diels-Alder addition of methoxycyclohexadienes to substituted 1,4-benzoquinones, 2057.
- Natural products, biosynthesis of. Part 1, incorporations of ent-kaur-16-ene and ent-kaur-16-en-15-one into enmein and oxidonin, 2098.
- Nauclefine. Synthesis of the indolo[2',3': 3,4]pyrido[1,2-b][2,7]naphthyridinone alkaloid nauclefine and its ring-E isomers, 2416.
- Naucletine, demethoxycarbonyldehydrogambirtannine, angustidine, (±)-angustoline, and related compounds: total syntheses of the yohimbine skeleton. Photocyclisation of enamides. Part X, 1865.
- Neighbouring group effects in epoxide ring opening; cisepoxy-alcohols, 1442.
  - participation in isoxazole ring bromination. Part II, 1694.
    - in the cleavage of some steroidal acetoxy-epoxides, 2508.
- Nephroarctin and phenarctin, synthesis of, 943.
- Nicandra physaloides (Solanaceae), a new class of natural steroids, with ring D aromatic, from. X-ray analysis of nic-10, and the structures of nic-1 ('nicandrenone'), -12, and -17, 304.
  - Structures of three oxygenated 24-methyl-steroids (nic-3, -7, and -11) from the insect repellant plant *Nicandra physaloides* (Solanaceae): X-ray analysis of nic-3 acetate and nic-11 ethyl ether, 296.
- Nickel. Metal catalysis in organic reactions. Part II, products and stereochemical aspects of the isomerization of heptenes by the tri-isobutylaluminium-bis-N-methylsalicylideneaminenickel system, 1904.
- Nic-1 (nicandrenone), a naturally occurring ring-D-aromatic steroid, reactions of, 669.
- Nitration and nitrosation reactions of 7-nitro-1,3,5-triazaadamantane and derivatives, 940.
- Nitrenes. Nitrene-induced cyclisations accompanied by rearrangement in thermolyses of aryl 2-azidophenyl sulphones: a note on quantitative high-speed liquid chromatographic analysis of substituted phenothiazine 5,5-dioxides, 1749.
- Nitrile oxides, behaviour towards nucleophiles. Part III, dimerisation of aromatic nitrile oxides catalysed by trimethylamine, 1825. Part IV, heteromacrocycles from acetonitrile oxide, 1827.
  - $\Delta^2$ -Isoxazoline derivatives. Part X, 1,3-dipolar cycloadditions of nitrones and nitrile oxides with indene, 1,2-dihydronaphthalene, and *trans*-1-phenylpropene, 1518.
- Nitriles—see also Cyanides.
- Nitriles, fluorination of, over cobalt trifluoride and potassium tetrafluorocobaltate, 1930.
  - Heterocyclic studies. Part XXXVII, ready ring cleavage and decarbonylation of pyrimidine-5-carbaldehydes, 125.
  - Photochemical decarboxylation of 2-phenyl- $\Delta^2$ -thiazoline-4-carboxylic acid, 1901.
  - Reactions of a 'myrcene-magnesium' complex with aldehydes, ketones, epoxides, carbon dioxide, and acetonitrile, 1809.
- Nitrites. Photoinduced transformations. Part XXX, photorearrangement of (22S-25S)-N-acetylveratra-5,8,-13(17)-trienine-3β-11β,23β-triol 3,23-diacetate 11-nitrite, a fused cyclopentenyl nitrite, to two spiroisoxazolines, 1297. Part XXXI, photoinduced rearrangement of

- (22S,25S)-N-acetyl-5 $\alpha$ -veratra-8,13(17)-dienine-3 $\beta$ ,11 $\beta$ ,-23 $\beta$ -triol 3,23-diacetate 11-nitrite to two spiro-isoxazolines, 1312.
- Nitro-compounds. o-Nitroaniline derivatives. Part V, cyclisation of N-acylated derivatives of N-benzyl- and N-p-nitrobenzyl-o-nitroaniline: a comparison of carboxamides and sulphonamides, 394. Part VI, cyanide-induced cyclisation of o-nitroanils, 399.
  - Reaction of benzofurazan N-oxide with secondary aliphatic amines; preparation of NN-dialkyl-N'-(onitrophenyl)hydrazines, 2216.
  - Halogeno-1,4-dioxans and their derivatives. Part VIII, direct replacement of chlorine in 2,3-dichloro-1,4-dioxan by sulphur and by nitrogen. Conformations of the products, of a rigid cis-fused hexahydro-1,4-dioxino-[2,3-b][[1,4]dioxin, and of bi-1,3-dithian-2-yl, 121.
  - Nitrogen-containing carbohydrate derivatives. Part XXXII, further studies on the ring-opening of epiminosugars, 801.
  - Phosphorus-nitrogen compounds. Part XLIII, reactions of NN-dialkylanilines with phosphorus(v) chlorides; examples of ambident nucleophilic behaviour, 1739.
  - Photoinduced transformations. Part 32, scrambling of unlabelled and [15N]nitrogen monoxide in the photo-induced rearrangement of (22S,25S)-5α-veratr-13(17)-enin-11β-yl nitrites to nitrones, 2365.
  - Polyfluoroalkyl derivatives of nitrogen. Part XLIII, reactions of N-bromobis(trifluoromethyl)amine with 1-fluoropropene under free-radical and under ionic conditions, 556.
- Nitro group. Activating groups for the ring expansion of coumarin by diazoethane: benzoyl, pivaloyl, arylsulphonyl, arylsulphinyl, and nitro, 1260.
  - Solvolysis of secondary alkyl tosylates with  $\beta$ -dimethyl and  $\beta$ -nitro, sulphinyl, sulphonyl, or phosphonyl substituents: fragmentation vs. rearrangement, 2024.
- Nitrones and copper acetylide, cis- and trans- azetidin-2-ones from, 2382.
  - $\Delta^2$ -Isoxazoline derivatives. Part X, 1,3-dipolar cycloadditions of nitrones and nitrile oxides with indene,1,2-dihydronaphthalene, and *trans*-1-phenylpropene, 1518.
- Nitroquinolines. Light-sensitive amides. Photocleavage of N-aryl-1,2,3,4-tetrahydro-8-nitroquinolines to give free carboxylic acids, 57.
- Nitrosation and nitration reactions of 7-nitro-1,3,5-triazaadamantane and derivatives, 940.
- Nitrous acid. The imputed formation of 1,2,3-triazoles, triazines, and triazepines from hydrazinobenzoquinolines and nitrous acid. A correction, 2178.
- Norbornenes. Organocobalt complexes. Part VIII, specificity of the cyclopentenone synthesis from acetylene-hexacarbonyldicobalt complexes and norbornene derivatives, 30.
  - Reaction of thallium(1) acetate-iodine and silver(1) acetate-iodine with norborn-2-ene, 845.
  - The iodo-lactones derived from norborn-5-ene-2-endo-ylacetic acid and -propionic acid, 2267.
- Norborn-5-en-2-endo-ylalkanols, 1,4,5,6,7,7-hexachloro-, the cyclic acetals from, 2581.
- **Nordracorubin.** Pigments of 'dragon's blood 'resin. Part VIII, synthesis of  $(\pm)$ -dracorubin and of  $(\pm)$ -nordracorubin, 1392.
- Nucleophilic displacement reactions of 3,6-dichloropyridazine 1-oxide with sulphur nucleophiles, 1988. replacements in 4-cyanopyridinium salts, 454.

- Nucleosides and Nucleotides. A simple method for the preparation of 'ribonucleoside dialdehydes' and some comments on their structure, 1567.
  - C-Nucleoside studies. Part III, glycofuranosylethynes from 2,3: 5,6-di-O-isopropylidene-D-mannose, 68.
  - Studies on pyrophosphates. Part III, a new method for the synthesis of nucleotide coenzymes by means of din-butylphosphinothioyl bromide, 1711.

C

- Ochna squarrosa Linn., a new series of diflavonyl ethers from: ochnaflavone and its derivatives, 580.
- Octadienes. Manganese(III)-induced radical additions to 3,7-dimethylocta-1,6-diene, 1762.
- Olefins-see also Allenes, and Cycloalkenes.
  - activated, cyanocarboxylation of, 1926.
  - and N-(phenanthridin-5-io)benzamidate, stereochemistry of the 1,3-dipolar cycloaddition reaction between, 1702.
  - phenyl-substituted, stereochemistry of bromofluorination of, 971.
  - steroidal, *cis*-hydroxylation of, with thallium triacetate, 1660.
  - Addition of free radicals to unsaturated systems. Part XXII, photochemical addition of trifluoroiodomethane and iodine to perfluoro-(3-methylbut-1-ene) and photochemical dimerisation of the olefin, 1170.
  - A stereospecific route to trisubstituted olefins via  $\beta$ -lactones, 884.
  - Fluoro-olefin chemistry. Part IX, thermal insertion of hexafluoropropene into carbon-hydrogen bonds in alkylbenzenes, 517. Part X, some additions to 1-fluoropropene under ionic and free-radical conditions, 2349.
  - Non-coplanar double bonds; the existence of adamantene, 234.
  - Olefin synthesis by two-fold extrusion processes. Part 3, synthesis and properties of hindered selenoketones (selones), 2079.
  - Perfluoroalkyl derivatives of nitrogen. Part XLIII, reactions of N-bromobis(trifluoromethyl)amine with 1-fluoropropene under free-radical and under ionic conditions, 556.
    - of sulphur. Part XIX, reaction of fluoro-olefins with fluoride ion in the presence of dimethyl disulphide, and related reactions, 1178.
  - Perfluoroallyl cations, 2107.
  - Preparation of polymer-supported peroxy-acids and their use to oxidise olefins to epoxides, 605.
  - o-Quinonoid compounds. Part X, endo-selectivity in the Diels-Alder additions of non-conjugated olefins to o-quinodimethanes, 1647.
  - Stereochemistry of iodofluorination of phenyl-substituted olefins with (difluoroiodo)methane, 1745.
  - Steroidal sulphur compounds. Part XII, regiospecific formation of steroidal olefins by thermolysis of sulphoxides, 459.
  - Use of 2,3-dichloropropene and 1,3-dichlorobut-2-ene as synthons for heterocyclic compounds: synthesis of 2-methylbenzo[b]furans, 2-methylbenzo[b]thiophens, and 4-methyl-2H-chromen, 1.
- Olivacine. Reactions and synthetic applications of  $\beta$ -oxo-

sulphoxides. Part VI, a new synthesis of the pyrido-[4,3-b]carbazoles olivacine and ellipticine, 1479.

- Organometallic compounds of Group II. Part VII, preparation of 4-alkylpyridines by reactions of some light metals with alkyl halides in pyridine, 1977.
  - Metal catalysis in organic reactions. Part II, products and stereochemical aspects of the isomerization of heptenes by the tri-isobutylaluminium-bis-N-methylsalicylideneamine-nickel system, 1904.
  - Organocobalt complexes. Part VIII, specificity of the cyclopentenone synthesis from acetylenehexacarbonyldicobalt complexes and norbornene derivatives, 30.
  - Organometallics in synthesis: alkylation of tricarbonyldienyliron cationic complexes with organocadmium reagents, 954.
  - Reactions of some substituted isoxazoles with organolithium reagents, 994.
- Oridonin. Biosynthesis of natural products. Part 1, incorporations of *ent*-kaur-16-ene and *ent*-kaur-16-en-15-one into enmein and oridonin, 2098.
- Orthoesters. v-Triazolo[4,5-d]pyrimidines (8-azapurines). Part XVII, preparation of 1,6-dihydro-8-azapurines by heating 4-amino-5-aminomethyl-N-alkyl-1,2,3-triazoles with orthoesters or amidines, 291.
- Oxabicyclo[2.2.1]heptadiene. Heterocycles by cycloaddition. Part 6, cycloaddition—double fragmentation reactions of mesoionic compounds with an oxabicyclo-[2.2.1]heptadiene: synthesis of five- and six-membered heterocycles, 2565.
- 2-Oxabicyclo[3.2.1]oct-3-enes, an alternative synthesis of, 264.
- 1-0xa-6,6a-dithiapentalenes with arenediazonium fluoroborates: rearrangement into 6,6a-dithia-1,2-diazapentalenes. Studies of heterocyclic compounds. Part XX, 880.
- Oxalyl chloride and NN'-dicyclohexylcarbodi-imide, cyclisation reactions of  $\alpha$ -hydroxy-imidates with, 542.
- 8-Oxa-4-thia-1-azabicyclo[4.3.0]non-2-ene-3-carboxylates, 7-oxo-, β-elimination reactions of. Studies related to dihydro-1,4-thiazines. Part VIII, 584.
- Oxathiirans as intermediates in the photolysis of sulphines, 1404.
- **18-Oxayohimban** alkaloids and elenolic acid, conversion of secologanin into, 160.
- Oxazines. Purines, pyrimidines, and imidazoles. Part XLIV, syntheses of some dihydro-1,3-oxazine derivatives and related substituted uracils, 1969.
- Oxazoles. Heterocyclic rearrangements. Part XIV, attempts to activate ring-opening-ring-closure rearrangements with carbon as the central atom, 315.
  - Thermal rearrangements of 3,5-diphenylisoxazole, 16.
- Oxidation and bimolecular condensation reactions of 2-alkyliminocyclopentanedithiocarboxylic acids, 2-oxocyclopentanedithiocarboxylic acids, and 3-methyl-5-oxo-1-phenyl- $\Delta^2$ -pyrazoline-4-dithiocarboxylic acid, 1706.
  - anodic, intramolecular coupling of diaryl amides by, 661. Baeyer-Villiger, of  $\alpha$ -substituted cyclobutanones, synthesis of  $\alpha$ -methylene- $\gamma$ -lactones involving, 1934.
  - of 2-ethylthioindoles with hydrogen peroxide. Oxidative migration of the ethylsulphonyl group, 745.
  - of N-hydroxy-amines by sulphuryl chloride, 2202.
  - of some dibenz[b,f][1,4]oxazepines by peracetic acid, 1291. penicillins and other sulphides by use of a polymersupported peroxy-acid, 2252.

### Oxidation (contd.)

- of steroid ketones by thallium(III) acetate. Thallium in organic synthesis. Part II, 111.
- reduction system, alkylation, acylation, and Beckmann rearrangement of oximes in the presence of, 1708.
- remote, of carboxylic acids by peroxodisulphuryl difluoride in fluorosulphuric acid: a general synthesis of lactones, 2035.
- selective, of two dialkyl sulphides catalysed by ruthenium complexes, 1734.
- stereoselective, of fusidic acid derivatives by the Corey oxidation procedure, 710.
- N-Amination and subsequent oxidation of some fused imidazoles and triazoles, 367.
- Amine oxidation. Part XII, reactions of some NN-dimethylbenzylamine N-oxides with acetic anhydride and of some N-acetoxy-NN-dimethylbenzylammonium perchlorates with acetate ion. The Polonovski reaction, 1801.
- Gold(III) as an electrophilic oxidant of alkenes, 811.
- Photo-oxidation of tanshinone 11 (6,7,8,9-tetrahydro-1,6,6-trimethylphenanthro[1,2-b]furan-10,11-dione), 1716.
- Pyrazine chemistry. Part VII, oxidations of piperazine-2,5-diones and derivatives, 624. Part VIII, oxidations involving 3-arylmethylenepiperazine-2,5-diones. 628.
- Sensitised photo-oxidation of 5-methylene-cyclohexa- and -cyclohepta-1,3-diene derivatives, 1796.
- Studies related to the chemistry of melanins. Part XIV, the alleged formation of a p-quinonoid aminochrome by oxidation of 2,4,5-trihydroxyphenethylamine, 339.
- Syntheses based on 1,2-secopenicillins. Part I, 447.
- The N-amination and subsequent oxidation by bromine of imidazo[1,5-a]pyridines, 1722.
- Oxidative decarboxylation of 1-hydroxypyrrolidine-2-carboxylic acids and oxidation of some  $\Delta^1$ -pyrroline 1-oxides by hypobromite. Experiments towards the synthesis of corrins. Part XIV, 1955.
- **N-Oxides**, N-imides, and N-ylides of five-membered heterocycles. Part 5, reactions of 2,4,5-triphenyl-3H-pyrrol-3-one 1-oxide, 2259.
  - Amine oxidation. Part XII, reactions of some NN-dimethylbenzylamine N-oxides with acetic anhydride and of some N-acetoxy-NN-dimethylbenzylammonium perchlorates with acetate ion. The Polonovski reaction, 1801.
  - Heterocyclic polyfluoro-compounds. Part XXIII, reaction of some 2-, 3-, and 4-substituted pyridine 1-oxides, 5-methylpyrimidine 1-oxide and quinoline 1-oxide with perfluoro-propene, and of pyridine 1-oxide with perfluoro-(2-methylpent-2-ene): synthesis of 2-(1,2,2,2-tetrafluoroethyl)-pyridines or -pyrimidines and their N-oxides and of 2,2,3-trifluoro-2,3-dihydro-3-trifluoromethylfuro[3,2-b]pyridine, 1226.
  - Synthesis of 1*H*-1,2,4-triazole 2-oxides and annelated derivatives, 2166.
- **S-Oxides.** Cyclization of (+)- and (-)-S-(2-methylprop-1-enyl)-L-cysteine S-oxides, 1195.
  - Determination of the configuration of some penicillin S-oxides by <sup>13</sup>C nuclear magnetic resonance spectroscopy, 1772.
  - Isomerisation of benzyl 6-phenoxyacetoxypenicillanates and their S-oxides, 704.

- Oximes. Alkylation, acylation, and Beckmann rearrangement of oximes in the presence of an oxidation-reduction system, 1708.
- Oxirans. Chemistry of adamantane. Part IX, 1,2-difunctional adamantanes; synthesis and reactions of protoadamantane-4-spiro-oxiran, 1893.
- Oxo-carbenoid insertion reaction, intramolecular, application to the preparation of two new bridged-ring ketones. Condensed cyclic and bridged-ring systems. Part V, 1975.
- **2-Oxoindolin-3-ylideneacetophenones.** Heterodiene syntheses. Part XVI, a new [4+2] cycloaddition pathway in the reaction of 2-oxoindolin-3-ylideneacetophenones with ethyl vinyl ether, 1248.
- 2-Oxoindolin-3-ylidene derivatives, reactions with enamines: a Michael pathway as an alternative to 1,2- and 1,4-cyclo-additions. Heterodiene synthesis. Part XVII, 1872.
- $\beta$ -Oxo- $\Delta^1$ -pyrroline 1-oxides, synthesis and some reactions of. Experiments towards the synthesis of corrins. Part XII, 1944.

### P

- Palladium-catalysed dibenzofuran synthesis by dehydrogenative ring closure, 1236.
  - Molecular design by cycloaddition reactions. Part 32, transannular cyclization of tricyclo [4.2.2.0<sup>2,5</sup>]deca-3,7-diene derivatives by oxypalladation, 2516.
- Paracyclophanes. Syntheses of macrocyclic enzyme models. Part I, preparation and properties of [20]paracyclophanes, 1320.
- Pea seedlings. Studies of enzyme-mediated reactions. Part VI, stereochemical course of the dehydrogenation of stereospecifically labelled benzylamines by the amine oxidase from pea seedlings (E.C.1.4.3.6.), 1052.
- Penams. Transformations of penicillins: new methods of formation and reactions of 6,6-disubstituted penams and 7,7-disubstituted cephems, 1918.
- Penicillins, transformations of: new methods of formation and reactions of 6,6-disubstituted penams and 7,7-disubstituted cephems, 1918.
  - Determination of the configuration of some penicillin S-oxides by <sup>13</sup>C nuclear magnetic resonance spectroscopy, 1772.
  - Isomerisation of benzyl 6-phenoxyacetoxypenicillanates and their S-oxides, 704.
  - Oxidation of some penicillins and other sulphides by use of a polymer-supported peroxy-acid, 2252.
  - Syntheses based on 1,2-secopenicillins. Part I, oxidation, 447. Part II, preparation of 4-(3-substituted prop-2-ynylthio)azetidin-2-ones, 1612. Part III, hydration of 4-(3-substituted prop-2-ynylthio)azetidin-2-ones and a new cephalosporin synthesis, 1615.
  - Thermal rearrangement of 2,2,4,4-tetramethylthietan-3-one 1-oxide; a reaction related to the ring expansion of the penicillin S-oxides, 2590.
- **Penicillium brevicompactum.** Crystal and molecular structure of compactin, a new antifungal metabolite from *Penicillium brevicompactum*, 1165.
- Pentacyclo [7.3.0.0<sup>2,7</sup>.0<sup>4,11</sup>.0<sup>5,10</sup>] dodecane. Orientation of a bridged quinone system. An intramolecular photochemical cyclisation giving a cyclobutane ring, and a novel simulation by non-photochemical means, 595.

- **Pentacyclononanes.** Preparation and properties of cage polycyclic systems. Part IV, hydrogenolyses of homocubane derivatives, 1346.
- Pentadienes. Electrocyclic reactions. Part IX, photolysis of trans, trans-2, 4-dibromo-1,5-diphenylpenta-1,4-dien-3-one (αα'-dibromodibenzylideneacetone), 695.
- Pentenes. Heterocyclic polyfluoro-compounds. Part XXIII, reaction of some 2-, 3-, and 4-substituted pyridine 1-oxides, 5-methylpyrimidine 1-oxide, and quinoline 1-oxide with perfluoropropene, and of pyridine 1-oxide with perfluoro-(2-methylpent-2-ene): synthesis of 2-(1,2,2,2-tetrafluoroethyl)-pyridines or -pyrimidines and their N-oxides and of 2,2,3-trifluoro-2,3-dihydro-3-trifluoromethylfuro[3,2-b]pyridine, 1226.
- Peptides and amino-acids. Part XVI, synthesis of cyclo-[L-(α-amino)-β-alanylglycyl-D-(α-amino)-β-alanylglycyl] and related fourteen-membered cyclotetrapeptides, 2010. Part XVII, synthesis of cyclo[(O-tbutyl)-L-seryl-β-alanyl-glycyl-(O-methyl)-L-β-aspartyl], and observations on the rearrangement of β-aspartyl peptide esters, 2014. Part XVIII, studies relating to the synthesis and conformation of a novel bicyclic peptide system, 2019.
  - Part XXXIX, synthesis of analogues of bradykinin with modifications in positions 1,6, and 9, 220.
  - containing *cis* or *trans*-3- or 4-aminocyclohexanecarboxy-lic acid residues, synthesis of, 1199.
  - poly-. Part XIV, a comparative study of the stability towards enzymes of model tripeptides containing α-aza-amino-acids, L-amino-acids, and D-amino-acids, 244.
  - tritiated. Part 2, synthesis of two [3,5-3H<sub>2</sub>-Tyr<sup>2</sup>]-analogues of corticotrophin, 2182. Part 3, synthesis of [4-3H-Phe<sup>7</sup>]-β-corticotrophin-(1-24)-tetracosapeptide, 2186.
  - Enkephalin. Synthesis of two pentapeptides isolated from porcine brain with receptor-mediated opiate agonist activity, 2488.
  - Insoluble complexes of amino-acids, peptides, and enzymes with metal hydroxides, 962.
  - $N^{\omega}$ -Linked arginine peptides, 259.
  - Synthesis and catalytic properties of peptides containing amino-acids involved in the active centres of hydrolytic enzymes, 589.
    - and conformation of sequential polypeptides containing ε-benzyloxycarbonyl-lysine and benzyl esters of aspartic and glutamic acids, 1453.
- Pericopsis species, phytochemical examination of, 186.
   Peroxy-acids. Oxidation of some penicillins and other sulphides by use of a polymer-supported peroxy-acid, 2252
  - Preparation of polymer-supported peroxy-acids and their use to oxidise olefins to epoxides, 605.
- α-Phellandrene. Studies in terpenoids. Part XLIV, structure of the adduct from p-mentha-1,5-diene and β-naphthol, and its isomer, 1254.
- Phenanthrenes. Synthetic studies on terpenoids. Part XVIII. stereocontrolled synthesis of (±)1,2,3,4,4a,9,10,-10aα-octahydro-1α-methylphenanthrene-1β,4aβ-dicar
  - boxylic acid and the methoxy-analogue: a potential intermediate for diterpenoid syntheses, 722.
- Phenanthridines. Polyhalogenoheterocyclic compounds. Part XXIX, perchloro-acridine,-phenanthridine, and benzo[h]quinoline, 1069.
- N-(Phenanthridin-5-io)benzamidate and olefins, stereo-

- chemistry of the 1,3-dipolar cycloaddition reaction between, 1702.
- Phenanthro[1,2-b]furan-10,11-dione, 6,7,8,9-tetrahydro-1,6,6-trimethyl-, (tanshinone 11), photo-oxidation of, 1716.
- Phenarctin and nephroarctin. synthesis of, 943.
- Phenazine-1-carboxylic acids, some methoxy- and hydroxy-, synthesis of, 2248.
- Phenols, intramolecular alkylation of. Part III, asymmetric induction by a chiral leaving group, 634. oxidative C-demethylation in, 600.
  - Lignans and related phenols. Part XV, remote substituent effects on the rates and products of some reactions of aryltetrahydronaphthalenes, 832.
- Selective iodination of phenols in the *ortho*-position, 1161. Phenothiazine dioxides. Nitrene-induced cyclisations accompanied by rearrangement in thermolyses of aryl 2-azidophenyl sulphones: a note on quantitative high-speed liquid chromatographic analysis of substituted phenothiazine 5,5-dioxides, 1749.
- Phenylhydrazones. EZ-Isomerism in alkyl phenyl ketone phenylhydrazones and acetaldehyde phenylhydrazone, 456. [1,3]Phenylthio shift in the rearrangement of allyl sulphides, mechanism of, 2125.
- Phosphorus compounds. Alkyl aryl sulphides from the interaction of aryl thiocyanates and alcohols under the influence of triphenylphosphine or of trialkyl phosphites, 2394.
  - Allylic phosphine oxides as precursors of conjugated dienes of defined geometry, 2386.
  - Application of diethyl azodicarboxylate in the synthesis of spirophosphoranes, 156.
  - Dichotomous ylide formation from an alkyl(benzyl)phosphonium salt leading to stereoselective alkene syntheses. 1476.
  - Effects of substituents at phosphorus on the mode of decomposition of phosphonium betaines in protic solvents, 2529.
  - Heterocycles from ylides. Part III, reactivity of allylic phosphonium ylides with 1,3-dipoles, 619.
    - compounds containing phosphorus. Part 30, synthesis of mixed phosphorohydrazides and of some new mono-, bi-, and tri-cyclic derivatives, 2093.
  - New, ready degradation reactions of bisphosphines, 1205. Organic synthesis using diphenylphosphinoyl as a migrating functional group: diene synthesis, 639.
  - Phosphate esters. Part 3, formation of sesquiterpene hydrocarbons from cis-, trans- and trans, transfarnesyl diphenyl phosphates, 2524.
  - Phosphorus-nitrogen compounds. Part XLIII, reactions of NN-dialkylanilines with phosphorus(v) chlorides; examples of ambident nucleophilic behaviour, 1739.
  - Phosphorylated sugars. Part XX, synthesis of 3-deoxy-D-manno-octulosonic acid 8-(dihydrogen phosphate), 1628
  - Photoreactions of diphosphines with benzophenone, 1924. Reaction of benzylidenetriphenylphosphorane with carbon disulphide, 692.
    - of dibenzophospholes with benzoyl chloride; ring exsion to dibenzo[b,d]phosphorins, 2050.
    - of carbonyl compounds with tervalent phosphorus reagents. Part V, aldehydes and phosphorus trichloride, 535. Part VI, benzoate esters and halogenophosphines, 741.

- Phosphorus compounds. Reactions of tetraphenyldiphosphine with carbon radicals, 1034.
  - Solvolysis of secondary alkyl tosylates with β-dimethyl and β-nitro, sulphinyl, sulphonyl, or phosphonoyl substituents: fragmentation vs. rearrangement, 2024.
  - Stereochemistry of organophosphorus cyclic compounds. Part IV, synthesis and geometrical isomerism in cyclic five-membered phosphorus thio acids. Crystal and molecular structure of the imidazolium salt of *r*-2-hydroxy-*c*-4-methyl-1,3,2-dioxaphospholan-2-thione, 371.
  - Studies on pyrophosphates. Part III, a new method for the synthesis of nucleotide coenzymes by means of di-n-butylphosphinothioyl bromide, 1711.
  - Synthesis of phosphindoline oxides, tetrahydrophosphinoline oxides, and related compounds by cyclisation of allyl- and vinyl-phosphine oxides, 2556.
- Photochemistry of ethyl 2-cyano-1,2-dihydroquinoline-1-carboxylates (Reissert compounds): synthesis of 2-cyanomethylindole-1-carboxylates, 2587.
  - of 2-(prop-2-enyl)cyclopent-2-enones, 249.
  - Addition of free radicals to unsaturated systems. Part XXII, photochemical addition of trifluoroiodomethane and iodine to perfluoro-(3-methylbut-1-ene) and photochemical dimerisation of the olefin, 1170.
  - Chemistry of santonene. Part XI, products of photolysis of 4-hydroxysantonene and its 4-epimer, their structures, and some pyrolysis studies, 433.
  - Di- $\pi$ -methane rearrangements of 1,4-dihydro-1,4-methano- and -ethanonaphthalene-5,8-diols, 550.
  - 1,3-Dipolar character of six-membered aromatic rings. Part XXVII, photochemically induced valence bond tautomerism and dimerisation of 3-oxido-1-phenyl-pyridinium, 2338.
  - Electrocyclic reactions. Part IX, photolysis of trans,trans-2,4-dibromo-1,5-diphenylpenta-1,4-dien-3-one (αα'-dibromodibenzylideneacetone), 695. Part X, photochemical cyclisation of trans,trans-dibenzylideneacetone, 1880.
  - Experiments on the synthesis of tetracycline. Part XIV, closure of ring B by base-catalysed photocyclisation, 503.
  - Light-sensitive amides. Photocleavage of N-acyl-1,2,3,4-tetrahydro-8-nitroquinolines to give free carboxylic acids, 57.
  - Metal-catalysed organic photoreactions. Photo-oxidations of  $\alpha\beta$ -unsaturated ketones and o-methylaceto-phenone in the presence of copper(II) salts, 779.
    - Photoreaction of  $\alpha\beta$ -unsaturated ketones in alcohols in the presence of titanium(iv) chloride, 788.
    - Photoreactions of 3,5-dimethylisoxazole with and without catalytic assistance by copper(II) salts, 783.
  - Orientation of a bridged quinone system. An intramolecular photochemical cyclisation giving a cyclobutane ring, and a novel simulation by non-photochemical means, 595.
  - Oxathiirans as intermediates in the photolysis of sulphines, 1404.
  - Photochemical and thermal reactions of heterocycles. Part I, photolysis, thermolysis, and mass spectral fragmentation of mesoionic 1,2,4-triazol-3-ones, 863. decarboxylation of 2-phenyl- $\Delta^2$ -thiazoline-4-carboxylic acid, 1901.
    - di- $\pi$ -methane rearrangement leading to methyl chrysanthemate, 256.

- formation of amides from t-butylamine and aromatic aldehydes and ketones, 1511.
- reactions of 1*H*-2,3-benzodiazepines: valence isomerisation of a 1,2-diazabutadiene to a diazetine, 362.
- Photocyclisation of NN-disubstituted benzoylacetamides and acetoacetamides, 2054.
  - of enamides. Part IX, syntheses of benzonaphthyridines by photocyclisation of N-pyridylcyclohex-1-enecarboxamides and pyridine-(N-cyclohex-1-enyl)-carboxamides, 1861. Part X, total syntheses of the yohimbine skeleton: demethoxycarbonyldihydrogambirtannine, angustidine, nauclétine, (±)-angustoline, and related compounds, 1865. Part XI, syntheses of benzo[i]phenanthridines related to azasteroids, 1868.
  - of 1-styrylimidazoles. A novel route to N-bridgehead compounds, 75.
- Photodehydrocyclisation of 1-styrylimidazoles; an HMO study, 2038.
- Photoinduced transformations. Part XXX, photorearrangement of (22S,25S)-N-acetylveratra-5,8,13-(17)-trienine-3β,11β,23β-triol3,23-diacetate11-nitrite, a fused cyclopentenyl nitrite, to two spiroisoxazolines, 1297. Part XXXI, photoinduced rearrangement of (22S,25S)-N-acetyl-5α-veratra-8,13(17)-dienine-3β,-11β,23β-triol 3,23-diacetate 11-nitrite to two spiro-isoxazolines, 1312. Part 32, scrambling of unlabelled and [I5N]nitrogen monoxide in the photo-induced rearrangement of (22S,25S)-N-5α-veratr-13(17)-enin-11β-yl nitrites to nitrones, 2365.
- Photoisomerisation of α-(thiopyran-2-ylidene) ketones; substituent effects, 166.
- Photo-oxidation of tanshinone 11 (6,7,8,9-tetrahydro-1,6,6-trimethylphenanthro[1,2-b]furan-10,11-dione, 1716
- Photoreactions of diphosphines with benzophenone, 1924. Pyrimidines. Part LII. Photoreactions of diazines. Part VI. Photochemistry of 4,6-disubstituted pyrimidine N-oxides, 1202.
- Sensitised photo-oxidation of 5-methylene-cyclohexaand -cyclohepta-1,3-diene derivatives, 1796.
- Synthesis and photolysis of some 1-naphthyl azoxy-compounds, 688.
- Thermal and photochemical  $\alpha$ -carbon-carbon cleavages in imines, 1583.
- Phthalazinium, 1-oxido-3-phenyl-. 1,3-Dipolar character of six-membered aromatic rings. Part XI, 2281.
- Phthalimide, N-3-methylbut-2-enyl-, halogenation of; new syntheses of zeatin analogues. Purines, pyrimidines, and imidazoles. Part XLIII, 1446.
- Phthaloylation of amino-azoles and amino-azines, 309.
- Phytochemistry. Phytochemical examination of *Pericopsis* species, 186.
- Phytoene. Synthesis of poly-Z-isomers of 2,6,11,15-tetramethylhexadeca-2,6,8,10,14-pentaene, a C<sub>20</sub> analogue of phytoene. Re-examination of the stereochemistry of a new isomer of phytoene from *Rhodospirillum rubrum*, 1029.
- Phytuberin, crystal structures of the dihydro- and  $2\alpha$ -hydroxydihydro-derivatives of, 1338.
- Picryl halides, on the reactions of alkanedithiols with, 2214. Pigments of 'dragons blood' resin. Part VIII, synthesis of  $(\pm)$ -dracorubin and of  $(\pm)$ -nordracorubin, 1392.
- **Pinacol.** Electro-organic reactions. Part V, cathodic pinacolisation of  $\alpha$  and  $\beta$ -ionones, 561.

**Pinenes.** Formation of *ortho*-menthenes by acid-catalysed ring opening of pin-2-ene derivatives, 484.

- Piperazic acids (hexahydropyridazine-3-carboxylic acids), application of 1,2,4-triazoline-3,5-diones in the synthesis of, 2390.
- Piperazine-2,5-diones and derivatives, oxidations of. Pyrazine chemistry. Part VII, 624.
  - 3-arylmethylene-, oxidations involving. Pyrazine chemistry. Part VIII, 628.
- Piperidines, 3-substituted 1-benzyl-, and substituted 1-benzylpyrrolidines, rearrangements during the synthesis of, 938.
  - Cycloaddition reactions of cumulenes. Part IV, a novel mode of reaction of azomethine oxides with 1,1-dimethylallene; formation of a substituted piperidin-4-one, 719.
- Pivaloyl group. Activating groups for the ring expansion of coumarin by diazoethane: benzoyl, pivaloyl, arylsulphonyl, arylsulphinyl, and nitro, 1260.
- Plumbagin. Ebenaceae extractives. Part 7, ehretione, a bisnaphthoquinone derived from plumbagin and 7-methyljuglone, 2546.
- **Polonovski reaction.** Reactions of some NN-dimethylbenzylamine N-oxides with acetic anhydride and of some N-acetoxy-NN-dimethylbenzylammonium perchlorates with acetate ion. Amine oxidation. Part XII, 1801.
- **Polycycles.** 2-(2-Naphthyl)benzo[b]thiophen. Part IV, further aspects of electrophilic substitution, and ring closures to yield pentacyclic derivatives, 683.
  - Polycyclic fused amidines. Part III, an unexpected mode of cyclisation of 2-phenacylisoquinolinium bromide, 201.
  - Preparation and properties of cage polycyclic systems. Part IV, hydrogenolyses of homocubane derivatives, 1346.
  - Synthesis of hydroquinone diacetates from polycyclic aromatic quinones, 836.
- **Polymerization.** Formation of anthracene cation radicals from 9,10-dihydro-9,10-epidioxyanthracene derivatives; peroxide-initiated cationic polymerization of styrene in liquid sulphur dioxide, 87.
- **Polymers.** Oxidation of some penicillins and other sulphides by use of a polymer-supported peroxy-acid, 2252.
  - Preparation of polymer-supported peroxy-acids and their use to oxidise olefins to epoxides, 605.
  - Vinyl derivatives of heterocyclic systems and their polymers: isoxazole derivatives, 570.
- **Polypodium juglandifolium**, structures of four new triterpenes from the rhizomes of, 117.
- **Porphyrins** and related compounds, the *meso*-reactivity of. Part VII, benzoyloxylation of phenylpyrroles and of octaethylporphyrin, 794.
  - synthetic and biosynthetic studies of. Part I, synthesis of the 'S-411 'porphyrin obtained from meconium, 2492. Part 2, synthesis of isopempto- and isochlorocruoro-porphyrins, 2501.
  - Biosynthesis of porphyrins and related macrocycles. Part V, structural integrity of the type III porphyrinogen macrocycle in an active biological system; studies on the aromatisation of protoporphyrinogen-IX, 266. Part VI, nature of the rearrangement process leading to the natural type III porphyrins, 273. Part VII, synthesis of specifically labelled [14C<sub>1</sub>]uroporphyrin-III and of [10,14-13C<sub>2</sub>]uroporphyrin-III. Conversion of

- the latter into [10,14-<sup>13</sup>C<sub>2</sub>]protoporphyrin-IX; biosynthetic significance of its <sup>13</sup>C nuclear magnetic resonance spectrum, 283. Part VIII, enzymic decarboxylation of uroporphyrinogen-III: structure of an intermediate, phyriaporphyrinogen-III, and synthesis of the corresponding porphyrin and of two isomeric porphyrins, 1008.
- Pregnanes. Alkylated steroids. Part I,  $16\alpha$ -substituted  $17\alpha$ -methylpregnanes, 1558.
  - Microbiological hydroxylation. Part XXII, hydroxylation of 3,20-, 7,20-, and 11,20-dioxygenated 5α-pregnanes, 1842.
  - $5\beta$ -Pregn-6-ene-3α, 17, 20-triols, 452.
  - Synthesis of 18-substituted steroids. Part III, reactions of 18-substituted pregnan-20-enes, 1064.
- $5\beta$ -Pregn-6-ene-3α,17,20-triols, 452.
- Prolinates. Enamine chemistry. Part XXI, condensation of L-sodium or L-ethyl prolinate with ketones to give substituted polyhydropyrrolo[1,2-a]-indoles and -pyrrolizines, 904.
- Propens. Heterocyclic polyfluoro-compounds. Part XXIII, reaction of some 2-, 3-, and 4-substituted pyridine 1-oxides, 5-methylpyrimidine 1-oxide, and quinoline 1-oxide with perfluoropropene, and of pyridine 1-oxide with perfluoro-(2-methylpent-2-ene): synthesis of 2-(1,2,2,2-tetrafluoroethyl)-pyridines or -pyrimidines and their N-oxides and of 2,2,3-trifluoro-2,3-dihydro-3-trifluoromethylfuro[3,2-b]pyridine, 1226.
  - Δ²-Isoxazoline derivatives. Part X, 1,3-dipolar cycloadditions of nitrones and nitrile oxides with indene, 1,2-dihydronaphthalene, and trans-1-phenylpropene, 1518
- **Prostaglandins.** Part 4, synthesis of  $(\pm)$ -11-deoxyprostaglandins from 2- $(\omega$ -hydroxyheptyl)cyclopent-2-enones, 2550.
- Proteins. The nature of the cross-linking of proteins by glutaraldehyde. Part I, interaction of glutaraldehyde with the amino-groups of 6-aminohexanoic acid and of α-N-acetyl-lysine, 958.
- Protoadamantane-4-spiro-oxiran, synthesis and reactions of; 1,2-difunctional adamantanes. Chemistry of adamantane. Part IX, 1893.
- **Protonation** studies of alkynyltrialkylborates. Chemistry of organoborates. Part 7, 2435.
- Protoporphyrin-IX. Biosynthesis of porphyrins and related macrocycles. Part VII, synthesis of specifically labelled [\$^{14}C\_1\$]uroporphyrin-III and of [\$10,14-\$^{13}C\_2\$]uroporphyrin-III. Conversion of the latter into [\$10,14-\$^{13}C\_2\$]protoporphyrin-IX; biosynthetic significance of its \$^{13}C\$ nuclear magnetic resonance spectrum, 283.
- Protoporphyrinogen-IX. Biosynthesis of porphyrins and related macrocycles. Part V, structural integrity of the type III porphyrinogen macrocycle in an active biological system; studies on the aromatisation of protoporphyrinogen-IX, 266.
- **Pseudowintera colorata**, extractives from. Part V, a new sesquiterpene lactone, colorata-4(13),8-dienolide, 850. **Purines**, a new, general synthesis of, 1547.
  - pyrimidines, and imidazoles. Part XLIII, halogenation of N-3-methylbut-2-enylphthalimide; new syntheses of zeatin analogues, 1446. Part XLIV, syntheses of some dihydro-1,3-oxazine derivatives and related substituted uracils, 1969.
  - Amidinoacetamides in the synthesis of pyrimidines, imidazoles, and purines, 1847.

- Purines (contd.)
  - Purine studies. Part XX, methylation and reduction of 2,8-dioxo-, 2,8-diamino-, and 2-amino-8-oxo-purines, and the stereochemistry of their 1,4,5,6-tetrahydro-derivatives, 1414.
  - Reactions of 2-, 6-, and 8-monosubstituted 1- and 3- methylpurines with hydroxide ions in water, 151.
  - Thermal decomposition of quaternary hypoxanthinium salts and related purines, 239.
- Pyranones. Michael condensation of 4-hydroxy-6-methyl-pyran-2-one with dimethyl acetylenedicarboxylate, 2137.
- **Pyrano-oxazinediones.** Heterocyclic syntheses with malonyl chloride. Part XI, reactions of 2-alkyl- (or -aryl-)thio-7-chloropyrano[3,4-e][1,3]oxazine-4,5-diones with water and with alcohols, 2462.
- Pyrans. Chemistry of tetra-alkoxyethenes. Part VI, cycloadditions with αβ-unsaturated carbonyl compounds and chemistry of the resulting tetra-alkoxydihydropyrans, 1533.
- Pyrazines. Pyrazine chemistry. Part VII, oxidations of piperazine-2,5-diones and derivatives, 624. Part VIII, oxidations involving 3-arylmethylenepiperazine-2,5-diones, 628.
- **Pyrazinoindole.** Formation of certain substituted 5*H*-pyrrolo[2,3-*b*]pyrazines by thermal cyclisation of pyrazinylhydrazones and a route to 5*H*-pyrazino[2,3-*b*]indole; a synthesis of 5*H*-pyrrolo[2,3-*b*]pyrazine and some of its properties, 1361.
- **Pyrazinylhydrazones.** Formation of certain substituted 5*H*-pyrrolo[2,3-*b*]pyrazines by thermal cyclisation of pyrazinylhydrazones and a route to 5*H*-pyrazino[2,3-*b*]indole; a synthesis of 5*H*-pyrrolo[2,3-*b*]pyrazine and some of its properties, 1361.
- Pyrazole-4-sulphonyl chlorides, ring cleavage of some, by chlorine, 428.
- $\Delta^2$ -Pyrazoline-4-dithiocarboxylic acid, 3-methyl-5-oxo-1-phenyl-, 2-alkyliminocyclopentanedithiocarboxylic acids, and 2-oxocyclopentanedithiocarboxylic acids, oxidation and bimolecular condensation reactions of, 1706.
- **Pyrazolines.** Heterocycles from ylides. Part IV, reactivity of 4-arylmethylene- $\Delta^2$ -pyrazolin-5-ones with stabilized sulphur ylides, 620.
- 1*H*-Pyrazolo[4,3-*c*]cinnolines, 2,3-dihydro-3-imino-, preparation of, and reactions of 4-chlorocinnoline-3-carbonitrile. Cinnolines. Part XVII, 592.
- **Pyrazolopyridines.** Part IV, preparation and tautomerism of 6-cyano- and 6-ethoxycarbonyl-1,4-dihydropyrazolo-[4,3-b]pyridin-7-ones, 507.
- Pyrazoloquinazolines. Reactions of heterocycles with thiophosgene. Part VI, reactions of tetrahydropyrazolo[1,5-c]quinazolines, 653.
- $(\pm)$ -Pyrenophorin, the macrocyclic antibiotic, total synthesis of, 1718.
- **Pyrethroids.** X-Ray crystal structures of two pyrethroid insecticides: *cis-*3-phenoxybenzyl 3-(2,2-dibromovinyl)-2,2-dimethylcyclopropanecarboxylate and the 3-(2,2-dichlorovinyl) analogue, 1231.
- Pyridazine-3-carboxylic acids, hexahydro- (piperazic acids), application of 1,2,4-triazoline-3,5-diones in the synthesis of 2390.
- Pyridazine 1-oxide, 3,6-dichloro-, nucleophilic displacement reactions of, with sulphur nucleophiles, 1988.
- Pyridazines, amino-, methylation of, 1424.

- **Pyridazinobenzimidazole.** Thermal cyclisation of pyridazinylhydrazones to give s-triazolo[4,3-b]pyridazines and pyridazino[2,3-a]benzimidazole, 1363.
- **Pyridines.** Addition products of 2-(N-arylformamidoyl)-pyridines and carbanions, and their reduction to octahydroindolizine derivatives, 5.
  - 1,3-Dipolar character of six-membered aromatic rings. Part XVI, reactions of benzyne with 3-hydroxypyridine, 1-methyl-3-oxidopyridinium, and related compounds, 2285. Part XXVI, 3-hydroxypyridine and 1-benzyl-3-oxidopyridinium, 2334.
  - Heterocyclic polyfluoro-compounds. Part XXIII, reaction of some 2-, 3-, and 4-substituted pyridine 1-oxides, 5-methylpyrimidine 1-oxide, and quinoline 1-oxide with perfluoropropene, and of pyridine 1-oxide with perfluoro-(2-methylpent-2-ene): synthesis of 2-(1,2,2,2-tetrafluoroethyl)-pyridines or -pyrimidines and their N-oxides and of 2,2,3-trifluoro-2,3-dihydro-3-trifluoromethylfuro[3,2-b]pyridine, 1226.
  - Heterocyclic rearrangements. Part XIV, attempts to activate ring-opening-ring-closure rearrangements with carbon as the central atom, 315.
  - Organometallic compounds of Group II. Part VII, preparation of 4-alkylpyridines by reactions of some light metals with alkyl halides in pyridine, 1977.
  - Synthesis of dialkyl sulphites from alcohols in the halogenpyridine-sulphur dioxide system. Novel behaviour of alkyl chlorosulphates in the pyridine-sulphur dioxide system, 108.
- Pyridinium compounds. 1,3-Dipolar character of sixmembered aromatic rings. Part XVIII, adducts from 3-oxido-1-phenylpyridinium and their quaternisation and conversion into tropone derivatives, 2289. Part XX, preparation and dimerisation of 1-(5-nitro-2-pyridyl)- and 1-(4,6-dimethylpyrimidin-2-yl)-3-oxidopyridinium, 2296. Part XXI, thermal cycloadditions of 1-(5-nitro-2-pyridyl)-and 1-(4,6-dimethylpyrimidin-2-yl)-3-oxidopyridinium with 2, 4, and 6π-electron components, 2307. Part XXV, 5-aryl-1-methyl-3-oxidopyridiniums, 2329. Part XXVI, 3-hydroxypyridine and 1-benzyl-3-oxidopyridinium. 2334. Part XXVII, photochemically induced valence bond tautomerism and dimerisation of 3-oxido-1-phenylpyridinium, 2338.
- salts, reduction of some 1-substituted, 45.
  - Nucleophilic replacements in 4-cyanopyridinium salts, 454.
- ylides. Preparation and reactions of pyridinium tetrazol-5-ylmethylides. N-Oxides and related compounds. Part 1.IV, 909.
- **Pyridocarbazoles.** Chemistry of 6*H*-pyrido[4,3-*b*]carbazoles. Part V, a simple synthesis of ellipticines, 1155.
  - Reactions and synthetic applications of  $\beta$ -oxo-sulphoxides. Part VI, a new synthesis of the pyrido[4,3-b]carbazoles olivacine and ellipticine, 1479.
- Pyrido[2,1,6-de]quinolizines (cycl[3.3.3]azines). Heterocyclic compounds with bridgehead nitrogen atoms. Part V, 341.
- Pyridothiadiazines. Cycloaddition reactions of dehydrodithizone. X-Ray crystal structures of 5-diethylamino-4-methyl-1-phenyl-3-phenylazopyrazole, 4a.5,6,7,8,8a-hexahydro-6-methyl-8a-morpholino-1-phenyl-3-phenylazo-1H-pyrido[4,3-e][1,3,4]thiadiazine, and 3'-phenyl-5'-phenylazo-2-pyrrolidinospiro[1H-indene-1,2'(3'H)-[1,3,4]-thiadiazole], 1673.

Pyridothiazoles. Addition reactions of heterocyclic compounds. Part LXIII, new structures for some 2:1 molar adducts from dimethyl acetylenedicarboxylate with thiazoles and benzo-imidazoles, -oxazoles, and -thiazoles formed by novel rearrangement. Crystal and molecular structure determinations for tetramethyl 3,8a-dimethyl-pyrido[2,1-b]thiazole-5,6,7,8-tetracarboxylate and tetramethyl 5-methylpyrido[2,1-b]thiazole-6,7,8,8a-tetracarboxylate, 1269.

Pyrimidine N-oxides. Pyrimidines. Part L1I. Photoreactions of diazines. Part VI. Photochemistry of 4,6-disubstituted pyrimidine N-oxides, 1202.

Pyrimidines—see also Uracils.

purines, and imidazoles. Part XLIII, halogenation of N-3-methylbut-2-enylphthalimide; new syntheses of zeatin analogues, 1446. Part LXIV, synthesis of some dihydro-1,3-oxazine derivatives and related substituted uracils, 1969.

Amidinoacetamides in the synthesis of pyrimidines, imidazoles, and purines, 1847.

Heterocyclic polyfluoro-compounds. Part XXIII, reaction of some 2-, 3-, and 4-substituted pyridine 1-oxides, 5-methylpyrimidine 1-oxide, and quinoline 1-oxide with perfluoropropene, and of pyridine 1-oxide with perfluoro-(2-methylpent-2-ene): synthesis of 2-(1,2,2,2-tetrafluoroethyl)-pyridines or -pyrimidines and their N-oxides and of 2,2,3-trifluoro-2,3-dihydro-3-trifluoromethylfuro[3,2-b]pyridine, 1226.

studies. Part XXXVII, ready ring cleavage and decarbonylation of pyrimidine-5-carbaldehydes, 125. Part XXXVIII, synthesis and disproportionation of pyrimido[4,5-b]quinolinium salts, 131. Part XXIX, ring cleavage of some pyrimidine derivatives in alkali, 1004.

Pyrimidinium salts, some 1,2-dihydro-, preparation and properties of, 1784.

Pyrimidoquinolinediones. Syntheses of 5-deazaflavines, 1805

Pyrimido[4,5-b]quinolinium salts, synthesis and disproportionation of. Heterocyclic studies. Part XXXVIII,

Pyrimido[4,5-e]-as-triazine 4-oxides, a new synthesis of, by nitrosative cyclization of aldehyde uracil-6-ylhydrazones in the presence of diethyl azodiformate, 713.

Pyrroles. Allenes. Part 34, reactions of methylindoles and 2,5-dimethylpyrrole with allenic carbenes, 2103. The meso-reactivity of porphyrins and related compounds. Part VII, benzoyloxylation of phenylpyrroles and of octaethylporphyrin, 794.

Pyrrolidinecarboxylic acids. Experiments towards the synthesis of corrins. Part XIV, oxidative decarboxylation of l-hydroxypyrrolidine-2-carboxylic acids and oxidation of some  $\Delta^1$ -pyrroline 1-oxides by hypobromite, 1955.

Pyrrolidines, substituted 1-benzyl-, and 3-substituted 1-benzylpiperidines, rearrangements during the synthesis of, 938.

2-Pyrrolidinospiro-[1 *H*-indene-1,2'(3'*H*)-[1,3,4]thiadiazole], 3'-phenyl-5'-phenylazo-, 5-diethylamino-4-methyl-1-phenyl-3-phenylazopyrazole, and 4a,5,6,7,8,8a-hexahydro-6-methyl-8a-morpholino-1-phenyl-3-phenylazo-1*H*-pyrido[4,3-e][1,3,4]thiadiazine, *X*-ray crystal structures of. Cycloaddition reactions of dehydrodithizone, 1673.

 $\Delta^{1}$ -Pyrroline 1-oxides. Experiments towards the synthesis of corrins. Part XII, synthesis and some reactions of

β-oxo-Δ<sup>1</sup>-pyrroline 1-oxides, 1944. Part XIII, a new synthesis of 2-cyano-Δ<sup>1</sup>-pyrroline 1-oxides and their behaviour towards a Grignard reagent, 1951. Part XIV, oxidative decarboxylation of 1-hydroxypyrrolidine-2-carboxylic acids and oxidation of some Δ<sup>1</sup>-pyrroline 1-oxides by hypobromite, 1955.

**Pyrroloindoles.** Enamine chemistry. Part XXI, condensation of L-sodium or L-ethyl prolinate with ketones to give substituted polyhydropyrrolo[1,2-a]-indoles and -pyrrolizines, 904.

**Pyrroloindoles.** Synthesis of 2,3-dihydro-1*H*-pyrrolo[1,2-a]indoles by intramolecular nucleophilic aromatic substitution, 389.

**Pyrrolones.** N-Oxides, N-imides, and N-ylides of five-membered heterocycles. Part 5, reactions of 2,4,5-triphenyl-3H-pyrrol-3-one 1-oxide, 2259.

Pyrrolo[3,2,1-de]phenanthridine, 7a-p-chlorophenylsul-phonylamino-4,5,7a,8,9,10-hexahydro-7H-; crystal structure of: action of heat on 6-p-chlorophenylsulphonylamino-5-p-chlorophenylsulphonylimino-1,2,5,6-tetra-hydro-4,6-butano-4H-pyrrolo[3,2,1-ij]quinoline, 2254.

Pyrrolopyrazines. Formation of certain substituted 5*H*-pyrrolo[2,3-*b*]pyrazines by thermal cyclisation of pyrazinylhydrazones and a route to 5*H*-pyrazino[2,3-*b*]indole; a synthesis of 5*H*-pyrrolo[2,3-*b*]pyrazine and some of its properties, 1361.

**Pyrrolopyrimidines.** 2-Aminopyrrolo[1,2-a]- and 3-aminopyrrolo[1,2-c]-pyrimidines, 1991.

Pyrrolopyrrolizines. Enamine chemistry. Part XXI, condensation of L-sodium or L-ethyl prolinate with ketones to give substituted polyhydropyrrolo[1,2-a]-indoles and -pyrrolizines, 904.

**Pyrroloquinolines.** Convenient routes to pyrrolo[3,2-b]-, pyrrolo[3,2-c]-, and pyrrolo[2,3-c]-quinolines, and a study of the pyrolysis of 2-quinolylhydrazones, 2121.

Q

Quinolines and uracils from reactions of isocyanates with aliphatic aldehydes, 1597.

Heterocyclic polyfluoro-compounds. Part XXIII, reaction of some 2-, 3-, and 4-substituted pyridine 1-oxides, 5-methylpyrimidine 1-oxide, and quinoline 1-oxide with perfluoropropene, and of pyridine 1-oxide with perfluoro-(2-methylpent-2-ene): synthesis of 2-(1,2,2,2-tetrafluoroethyl)-pyridines or -pyrimidines and their N-oxides and of 2,2,3-trifluoro-2,3-dihydro-3-trifluoromethylfuro[3,2-b]pyridine, 1226.

Photochemistry of ethyl 2-cyano-1,2-dihydroquinoline-1-carboxylates (Reissert compounds): synthesis of 2-cyanomethylindole-1-carboxylates, 2587.

5,6,7,8-Tetrahydroquinolines. Part I, a novel synthesis of 7,8-dihydroquinolin-5(6H)-ones, 975. Part II, preparation and reactions of substituted 5,6,7,8-tetrahydroquinoline-8-carboxylic esters, 977. Part III, synthesis of 5,6,7,8-tetrahydroquinoline-8-thiocarboxamides, 983.

Quinolizine esters. Addition reactions of heterocyclic compounds. Part LXV, synthesis, tautomerism, and rearrangement of some 2*H*- and 4*H*-quinolizine esters, 1911.

Quinolylhydrazones. Convenient routes to pyrrolo[3,2-b]-, pyrrolo[3,2-c]-, and pyrrolo[2,3-c]-quinolines, and a study of the pyrolysis of 2-quinolylhydrazones, 2121.

- Quinones, high-potential, applications of. Part X, reactions of 3,4-dihydrocoumarin derivatives, 407.
  - naturally occurring. Part XXVI, a synthesis of tetrangulol (1,8-dihydroxy-3-methylbenz[a]anthracene-7,12-quinone), 997.
  - polycyclic aromatic, synthesis of hydroquinone diacetates from. 836.
  - Absolute configuration of avarol, a rearranged sesquiterpenoid hydroquinone from a marine sponge, 1408.
  - Constituents of the higher fungi. Part XVI, bulgarhodin and bulgarein, novel benzofluoranthenequinones from the fungus *Bulgaria inquinans* (Fries), 2149.
  - Conversion of shikonin angelate into [2,2-dimethyl-1-(2-methylcrotonoyloxy)cyclobutyl]-5,8-dihydroxy-1,4-naphthoquinone; a novel cyclisation of a 4-methyl-pent-3-enyl side chain in a natural quinone, 1579.
  - Orientation of a bridged quinone system. An intramolecular photochemical cyclisation giving a cyclobutane ring, and a novel simulation by non-photochemical means, 595.
  - Syntheses of the naturally occurring naphtho[2,3-b]-pyran-5,10-quinones  $\alpha$ -caryopterone, dihydro- $\alpha$ -caryopterone, and O-methyldihydro- $\alpha$ -caryopterone, 1632.
  - The cymopols, a group of prenylated bromohydroquinones from the green calcareous alga *Cymopolia barbata*, 1696.
- Quinonoid aminochromes. Studies related to the chemistry of melanins. Part XIV, the alleged formation of a p-quinonoid aminochrome by oxidation of 2,4,5-tri-hydroxyphenethylamine, 339.
- o-Quinonoid compounds. Part X, endo-selectivity in the Diels-Alder additions of non-conjugated olefins to o-quinodimethanes, 1647. Part XI, exo-selectivity in the Diels-Alder reactions of phenyl-substituted o-quinonoid dienes, 1654.

# R

Racemisation. Asymmetric induction and racemisation in allenic sulphoxides, 2061.

Radical additions to 3,7-dimethylocta-1,6-diene, manganese(III)-induced, 1762.

Ravenelin, the fungal xanthone, biosynthesis of, 898.

- Rearrangements during the synthesis of substituted 1-benzylpyrrolidines and 3-substituted 1-benzylpiperidines, 938.
  - A photochemical di-π-methane rearrangement leading to methyl chrysanthemate, 256.
  - Mechanism of the [1,3]phenylthio shift in the rearrangement of allyl sulphides, 2125.
- Reduction and methylation of 2,8-dioxo-, 2,8-diamino-, and 2-amino-8-oxo-purines, and the stereochemistry of their 1,4,5,6-tetrahydro-derivatives. Purine studies. Part XX. 1414.
  - of 5-hydroxymethylene-cis-caran-4-one with complex hydrides, 678.
  - of triterpenoid ketones with bornan-2-exo-yloxyaluminium dichloride: a convenient preparation of axial triterpene alcohols, 321.
- Reissert compounds (ethyl 2-cyano-1,2-dihydroquinoline-1-carboxylates), photochemistry of: synthesis of 2-cyanomethylindole-1-carboxylates, 2587.
- Repin. Chemistry of the Compositae. Part XXXI, absolute configuration of the sesquiterpene lactones cen-

- taurepensin (chlorohyssopifolin A), acroptilin (chlorohyssopifolin C), and repin, 1663.
- Rhizopus nigricans. Fungal products. Part XVII, microbiological hydroxylation of gibberellin A<sub>9</sub> and its methyl ester, 178.
- Rhodolamprometrin and Rhodocomatulin. Reactions of keten acetals. Part 7, total syntheses of the tetramethyl ethers of the 1-acyl-2,4,5,7-tetrahydroxyanthraquinones rhodolamprometrin and rhodocomatulin, 1852.
- (±)-Rhodoptilometrin. Reactions of keten acetals. Part VI, total syntheses of the anthraquinones (±)-nalgiovensin, (±)-isorhodoptilometrin, and (±)-rhodoptilometrin, 613.
- Rhodospirillum rubrum. Synthesis of poly-Z-isomers of 2,6,11,15-tetramethylhexadeca-2,6,8,10,14-pentaene, a C<sub>20</sub> analogue of phytoene. Re-examination of the stereochemistry of a new isomer of phytoene from Rhodospirillum rubrum, 1029.
- Rhusflavanone, a new biflavanone from the seeds of waxtree, 98.
- Ring cleavage of some pyrazole-4-sulphonyl chlorides by chlorine, 428.
  - pyrimidine derivatives in alkali. Heterocyclic studies. Part XXXIX, 1004.
- Ring contraction, acid-catalysed, of steroidal  $1\alpha, 2\alpha$ -epoxy-4-en-3-ones, 2363.
- Ring expansion of the penicillin S-oxides, a reaction related to; thermal rearrangement of 2,2,4,4-tetramethyl-thietan-3-one 1-oxide, 2590.
  - to dibenzo[b,d]phosphorins; reaction of dibenzophospholes with benzoyl chloride, 2050.
  - Activating groups for the ring expansion of coumarin by diazoethane; benzoyl, pivaloyl, arylsulphonyl, arylsulphinyl, and nitro, 1260.
- Ring-opening of 2,5-diaryl-3-lithiofurans, 989.
  - -ring-closure rearrangements with carbon as the central atom, attempts to activate. Heterocyclic rearrangements. Part XIV, 315.
- Rubesamide, a new naturally occurring cyclopropanecarboxamide from *Fagara rubescens*, isolation, identification, and synthesis of, 146.
- Ruthenium. Selective oxidation of two dialkyl sulphides catalysed by ruthenium complexes, 1734.

# S

- Santonene, chemistry of. Part XI, products of photolysis of 4-hydroxysantonene and its 4-epimer, their structures, and some pyrolysis studies, 433. Part XII, photolysis of 4-acetoxysantonene and its 4-epimer: an example of photodecarboxylation of acetates, 442.
- Schmidt reaction. Steroids and related studies. Part XXXV, further studies on the Schmidt reaction with cholest-4-ene-3,6-dione, 1210.
- Sclerin: feedings with [1,2-13C]acetate and [methyl-13C]-methionine. Biosynthesis of fungal metabolites. Part IX, 2077.
- ( $\pm$ )-Sclerotiorin. Chemistry of fungi. Part LXVIII, the absolute configuration of ( $\pm$ )-sclerotiorin and of the azaphilones, 1366.
- Secalonic acid A, crystal and molecular structure of. Fungal metabolites. Part VI, 1820.

Secoflavicane. Lichens and fungi. Part XIII, comparison of the nuclear magnetic resonance and mass spectra of 17,21-secohopane and 17,21-secoflavicane derivatives, 1316.

- Secohopane. Lichens and fungi. Part XIII, comparison of the nuclear magnetic resonance and mass spectra of 17,21-secohopane and 17,21-secoflavicane derivatives, 1316.
- Secologanin, conversion into elenolic acid and 18-oxayohimban alkaloids, 160.
- Secopenicillins. Syntheses based on 1,2-secopenicillins. Part I, oxidation, 447. Part II, preparation of 4-(3-substituted prop-2-ynylthio)azetidin-2-ones, 1612. Part III, hydration of 4-(3-substituted prop-2-ynylthio)azetidin-2-ones and a new cephalosporin synthesis, 1615.
- Selenium. Benzo[b]selenophen-2(3H)-one: synthesis and properties, 2452.
  - Olefin synthesis by two-fold extrusion processes. Part 3, synthesis and properties of hindered selenoketones (selones), 2079.
  - Studies of heterocyclic compounds. Part XIX, synthesis of 6,6a-dithia- and 6,6a-diselena-1,2-diazapentalenes, 228.
- Shikimate pathway. Part V, chorismic acid and chorismate mutase, 1776.
- Shikonin angelate, conversion into [2,2-dimethyl-1-(2-methylcrotonoyloxy)cyclobutyl]-5,8-dihydroxy-1,4-naph-thoquinone; a novel cyclisation of a 4-methylpent-3-enyl side chain in a natural quinone, 1579.
- Silicon. Chemistry of fungi. Part LXXII, the trimethyl-silyloxy-substituent as a leaving group, 1384.
  - Formation of heterocyclic compounds by use of N'-diphenylmethylene-N-phenyl-N-trimethylsilylurea, 1523.
- Silver. Reaction of thallium(1) acetate-iodine and silver(1) acetate-iodine with norborn-2-ene, 845.
- Sodium arenethiolates, behaviour of 4-nitro-3-thienyl phenyl sulphone towards, in methanol; cine-substitution in the thiophen series, 2264.
- **Solidago** species, constituents of. Part VII, constitution and stereochemistry of the *cis*-clerodanes from *Solidago arguta* Ait. and of related diterpenoids, 1590.
- Solvolysis of secondary alkyl tosylates with  $\beta$ -dimethyl and  $\beta$ -nitro, sulphinyl, sulphonyl, or phosphonoyl substituents: fragmentation vs. rearrangement, 2024.
- South African plant extractives. Part III, helichrysin, a new chalcone glucoside from a Helichrysum species, 1819.
- Spectra. Synthesis, spectra, and crystal structure of 6,7, 14,15-tetrahydrobisbenzimidazo[1,2-a; 1',2'-e][1,5]-diazocine, 312.
  - circular dichroism. Chiroptical studies. Part LXXXIX, an empirical analysis of the circular dichroism of hexahydroindanones, bicyclo[4.2.0]octan-7-ones, and their polycyclic analogues, 762. Part 90, the circular dichroism of cyclopentanones and related compounds. A proposed octant-dissignate effect of C-H bonds, 2171.
  - electronic absorption, and synthesis, of dicyano-derivatives of 4-diethylaminoazobenzene, 42.
    - Chromogens based on non-benzenoid aromatic systems. Part III, synthesis, spectra, and molecular orbital calculations in the substituted fulvene and 6-azafulvene series, 48.
  - mass. Lichens and fungi. Part XIII, comparison of the nuclear magnetic resonance and mass spectra of 17,21-seconopane and 17,21-seconflavicane derivatives, 1316.

Mass spectral studies on aminocyclitol-aminoglycoside antibiotics, 1078.

- Photochemical and thermal reactions of heterocycles. Part I, photolysis, thermolysis, and mass spectral fragmentation of mesoionic 1,2,4-triazole-3-ones, 863.
- nuclear magnetic resonance. Assignment of <sup>13</sup>C and <sup>1</sup>H resonances of methyl groups in the tri-O-methyl derivatives of methyl pentopyranosides; some observations on the methoxy <sup>13</sup>C chemical shifts, 1351.
  - Biosynthesis of porphyrins and related macrocycles. Part VII, synthesis of specifically labelled [14C<sub>1</sub>]-uroporphyrin-III and of [10,14-13C<sub>2</sub>]uroporphyrin-III. Conversion of the latter into [10,14-13C<sub>2</sub>]-protoporphyrin-IX; biosynthetic significance of its <sup>13</sup>C nuclear magnetic resonance spectrum, 283
  - Carbon-13 nuclear magnetic resonance assignments and biosynthesis of aflatoxin  $B_1$  and sterigmatocystin, 1182.
  - Carbon-13 nuclear magnetic resonance spectra of flavonoids and related compounds, 2475.
  - Determination of the configuration of some penicillin S-oxides by <sup>13</sup>C nuclear magnetic resonance spectroscopy, 1772.
  - Fungal products. Part XVIII, <sup>13</sup>C nuclear magnetic resonance spectrum and biosynthesis of colletodiol, 184.
  - Lichens and fungi. Part XIII, comparison of the nuclear magnetic resonance and mass spectra of 17,21-secohopane and 17,21-secoflavicane derivatives, 1316.
  - Medium-sized cyclophanes. Part XIX, bridged naphthalenes: structural aspects, carbon-13 nuclear magnetic resonance, and benzoperylene formation, 2051.
  - The <sup>13</sup>C nuclear magnetic resonance spectra of kauranoid diterpenes, 114.
- ultraviolet absorption. Aromatic enaminones. Part I, ultraviolet absorption of N-aryl enaminones derived from dimedone, 2207.
- Spirobenzofurans. A derivative of tricyclo[6.3.1.0<sup>2,7</sup>]dodecane from the reaction between 2,6-dimethyl-1,4-benzoquinone and a quinonylmethyl carbanion; transformations involving nucleophilic attack at carbonyl oxygen, and a rearrangement to a spirobenzofuran derivative related to usnolic acid, 2067.
- Spiro[benzopyran-2,2'-furan]s, conversion of benzopyrones into; a route to 2-(1,3-dioxoalkyl)benzopyrones, 1553.
- Spiroindolequinazolines. Structures of isamic acid and methylisatoid, 2004.
- Spiro-isoxazolines. Photoinduced transformations. Part XXX, photorearrangement of (22S,25S)-N-acetylveratra-5,8,13(17)-trienine-3β,11β,23β-triol 3,23-diacetate 11-nitrite, a fused cyclopentenyl nitrite, to two spiro-isoxazolines, 1297. Part XXXI, photoinduced rearrangement of (22S,25S)-N-acetyl-5α-veratra-8,13(17)-dienine-3β,11β,23β-triol 3,23-diacetate 11-nitrite to two spiro-isoxazolines, 1312.
- Spiro[oxetan-oxetanone]system. Reactions of 1,6-dioxaspiro[3.3]heptan-2-one derivatives, 1769.
- Stearic acid. Sequential nature of the thermal reaction of stearic acid with some 1,2-diamines, 386.
- Stereochemistry of bromofluorination of phenyl-substituted olefins, 971.

### Stereochemistry (contd.)

- of cyclialkylation of 2-(2-arylethyl)-1,3,3-trimethylcyclohexyl cations and their equivalents. Cyclisation reactions. Part IV, 19.
- of iodofluorination of phenyl-substituted olefins with (difluoroiodo)methane, 1745.
- of organophosphorus cyclic compounds. Part IV, synthesis and geometrical phosphorus thioacids. Crystal and molecular structure of the imidazolium salt of *r*-2-hydroxy-*c*-4-methyl-1,3,2-dioxaphospholan-2-thione, 371.
- of the 1,3-dipolar cycloaddition reaction between N-(phenanthridin-5-io)benzamidate and olefins, 1702.
- of the formation and reaction of an anti-Bredt compound probed by deuterium substitution. Dehydrobromination of 3-bromotricyclo[5.3.1.0<sup>3,8</sup>]undecane (3-bromo-4-homoisotwistane) and some addition reactions of tricyclo[5.3.1.0<sup>3,8</sup>]undec-2-ene, 2133.
- Absolute configuration of (+)- and (-)-1,2,3,4-tetrahy-droanthracen-2-ol, 676.
  - of avarol, a rearranged sesquiterpenoid hydroquinone from a marine sponge, 1408.
- Amino-acids and peptides. Part XVIII, studies relating to the synthesis and conformation of a novel bicyclic peptide system, 2019.
- An improved synthesis of 6-amino-1,2,3,4-tetrahydro-2-methylisoquinoline: elucidation of the stereochemistry of some diastereoisomers of 6-amino-2-methyldecahydroisoquinoline, 757.
- A stereospecific route to trisubstituted olefins via  $\beta$ -lactones, 884.
- Biosynthesis of porphyrins and related macrocycles. Part VIII, enzymic decarboxylation of uroporphyrinogen-III; structure of an intermediate, phyriaporphyrinogen-III, and synthesis of the corresponding porphyrin and of two isomeric porphyrins, 1008.
- Chemistry of fungi. Part LXVIII, the absolute configuration of (+)-sclerotiorin and of the azaphilones,
  - of the Compositae. Part XXXI, absolute configuration of the sesquiterpene lactones centaurepensin (chlorohyssopifolin A), acroptilin (chlorohyssopifolin C), and repin, 1663.
- Chiroptical studies. Part LXXXIX, an empirical analysis of the circular dichroism of hexahydroindanones, bicyclo[4.2.0]octan-7-ones, and their polycyclic analogues, 762.
- Condensed cyclic and bridged-ring systems. Part IV, stereochemically controlled synthesis of some endo-2-aryl-6-oxobicyclo[3.2.1]octanes and related compounds through intramolecular alkylations of  $\gamma\delta$ -unsaturated  $\alpha'$ -diazomethyl ketones, 1669.
- Conformational behaviour of medium-sized rings. Part II. heterocyclic analogues of 5,6,7,12-tetrahydro-dibenzo[a,d]cyclo-octene(1,2,4,5-dibenzocyclo-octa-1,4-diene), 913. Part III, heterocyclic analogues of 12,13-dihydro-11H-dibenzo[a,e]cyclononene,6,11,12,-13-tetrahydro-5H-dibenzo[a,e]cyclononene, and 5,6,-7,12,13,14-hexahydrodibenzo[a,f]cyclodecene, 926.
- Constituents of Solidago species. Part VII, constitution and stereochemistry of the cis-clerodanes from Solidago arguta Ait. and of related diterpenoids, 1590.
- Dichotomous ylide formation from an alkyl(benzyl)phosphonium salt leading to stereoselective alkene syntheses, 1476.

Elimination and addition reactions. Part XXVI, asymmetric induction in additions of nucleophiles and electrophiles to αβ-unsaturated sulphoxides, 492.

- Halogeno-1,4-dioxans and their derivatives. Part VIII, direct replacement of chlorine in 2,3-dichloro-1,4-dioxan by sulphur and by nitrogen. Conformations of the products, of a rigid cis-fused hexahydro-1,4-dioxino[2,3-b][1,4]dioxin, and of bi-1,3-dithian-2-yl, 121.
- Intramolecular alkylation of phenols. Part III, asymmetric induction by a chiral leaving group, 634.
- Metal catalysis in organic reactions. Part II, products and stereochemical aspects of the isomerization of heptenes by the tri-isobutylaluminium-bis-N-methylsalicylideneaminenickel system, 1904.
- Microbial metabolites. Part XI, total synthesis and absolute configuration of (S)-carlosic acid (4-butyryl-2,5-dihydro-3-hydroxy-5-oxofuran-2-acetic acid) and conversion of (R)-5-methyltetronic acid into (R)-carolic acid {3,4-dihydro-8-methylfuro[3,4-b]oxe-pin-5,6(2H,8H)-dione}, 1485.
- Non-coplanar double bonds; the existence of adamantene, 234.
- Organic synthesis using diphenylphosphinoyl as a migrating functional group: diene synthesis, 639.
- Purine studies. Part XX, methylation and reduction of 2,8-dioxo-, 2,8-diamino- and 2-amino-8-oxo-purines, and the stereochemistry of their 1,4,5,6-tetrahydro-derivatives, 1414.
- Revised constitution, absolute configuration, and conformation of griseoviridin, a modified cyclic peptide antibiotic, 1996.
- Stereochemical studies on the biosynthesis of the  $\alpha\beta$ -didehydro-amino-acid units of mycelianamide, cyclopenin, and cyclopenol, 1564.
- Structural investigation of lac resin. Part X, structure and stereochemistry of methyl laccolate  $\gamma$ -lactone and its epimer, 967.
- Structure of dihydrodeoxy-8-epi-austdiol and the absolute configuration of the azaphilones, 204.
- Studies of enzyme-mediated reactions. Part VI, stereochemical course of the dehydrogenation of stereospecifically labelled benzylamines by the amine oxidase from pea seedlings (E.C.1.4.3.6.), 1052. Part VII, stereospecific syntheses of tritium-labelled (2R)- and (2S)-dopamines: stereochemical course of hydroxylation of dopamine by dopamine β-hydroxylase (E.C.1.14.17.1), 1056.
  - on lactams. Part IV, relation between Cotton effect and conformation of a seven-membered lactam ring, 665.
  - on steroids. Part 37, synthesis of the four stereoisomers of 20,22-epoxycholesterol, 2116.
  - on the syntheses of heterocyclic compounds. Part DCL, total synthesis of corytenchirine, 1218.
- Synthesis and conformation of sequential polypeptides containing ε-benzoyloxycarbonyl-lysine and benzyl esters of aspartic and glutamic acids, 1453.
  - and geometrical configuration of luteoreticulin, a toxic nitro-containing metabolite of *Streptomyces luteoreticuli* Arai, 404.
  - of poly-Z-isomers of 2,6,11,15-tetramethylhexadeca-2,6,8,10,14-pentaene, a  $C_{20}$  analogue of phytoene. Re-examination of the stereochemistry of a new isomer of phytoene from *Rhodospirillum rubrum*, 1029.

- Stereochemistry (contd.)
  - of sterically hindered stilbenes of biological importance, 1466.
  - Synthetic studies on terpenoids. Part XVIII, stereocontrolled synthesis of  $(\pm)$ -1,2,3,4,4a,9,10,10a $\alpha$ -octahydro-1 $\alpha$ -methylphenanthrene-1 $\beta$ ,4a $\beta$ -dicarboxylic acid and the 7-methoxy-analogue: a potential intermediate for diterpenoid syntheses, 722.
- Stereoselectivity. Koenigs-Knorr reactions. Part I, effects of a 2-O-acetyl substituent, the promoter, and the alcohol concentration on the stereoselectivity of reactions of 1,2-cis-glucopyranosyl bromide, 1938.
- Stereospecific synthesis. A highly stereospecific synthesis of (R)- and (S)-[2- ${}^{2}H_{1}]$ glycine, 2229.
- Sterigmatocystin and aflatoxin B<sub>1</sub>, carbon-13 nuclear magnetic resonance assignments and biosynthesis of, 1182.
- Steroids, alkylated. Part I, 16α-substituted 17α-methyl-pregnanes, 1558.
  - and related studies. Part XXXV, further studies on the Schmidt reaction with cholest-4-ene-3,6-dione, 1210.
  - heterocyclic. Part II, synthesis of  $(\pm)$ -8-hydroxy-3-methoxy-11-aza-18-norestra-1,3,5(10),9(11)-tetraen-17-one and related compounds, 1889.
  - marine. Part III, on the structure of marthasterone glucoside, from the starfish *Marthasterais glacialis*, 1357.
  - studies on. Part 37, synthesis of the four stereoisomers of 20,22-epoxycholesterol, 2116.
  - 18-substituted, synthesis of. Part III, reactions of 18-substituted pregnan-20-ones, 1064.
  - unsaturated. Part I, synthesis of 22,23-dihydroergosterol, 826.
  - Acid-catalysed ring contraction of steroidal  $1\alpha, 2\alpha$ -epoxy-4-en-3-ones, 2363.
  - A new class of natural steroids, with ring D aromatic, from *Nicandra physaloides* (Solanaceae). X-ray analysis of Nic-10, and the structures of Nic-1 ('nicandrenone'),-12, and -17, 304.
  - A ready synthesis of 5α,14β-cholest-7-en-3β-ol, 378.
  - Chemistry of the tricarbonyliron complexes of calciferol and ergosterol, 829.
  - cis-Hydroxylation of stereoidal olefins with thallium triacetate, 1660.
  - Intramolecular catalysis. Part III, effect of a neighbouring hydroxy-group on the opening of steroidal aziridines with azide anions, 1037.
    - condensation of steroidal α-acetoxy-ketones, 212.
  - Neighbouring group participation in the cleavage of some steroidal acetoxy-epoxides, 2508.
  - Photocyclisation of enamides. Part XI, syntheses of benzo[i]phenanthridines related to aza-steroids, 1868.
  - Preparation of  $3\beta$ -hydroxy- $5\alpha$ -androstan-16-one, 1350.
  - Reactions of Nic-1 (nicandrenone), a naturally occurring ring-D-aromatic steroid, 669.
  - Steroidal sulphur compounds. Part XII, regiospecific formation of steroidal olefins by thermolysis of sulphoxides, 459.
  - Structures of eight new triterpenoids and isolation of other triterpenoids and epi-ikshusterol from the stems of *Lithocarpus cornea*, 23.
    - of three oxygenated 24-methyl-steroids (Nic-3,-7, and -11) from the insect repellant plant *Nicandra physal-oides* (Solanaceae): X-ray analysis of Nic-3 acetate and Nic-11 ethyl ether, 296.

- Synthesis and crystal and molecular structure of a 1,11-methano-steroid, 3-methoxy-l'β-methyl-l,11α-methano-9β-estra-1,3,5(10)-trien-17β-ol, 2374.
  - of isomeric 5α-androstane-3,15,17β-triols, 1429.
- Synthetic uses of steroidal ring B diene protection: 22,23-dihydroergosterol, 821.
- Thallium in organic synthesis. Part II, oxidation of steroid ketones by thallium(III) acetate, 111.
- Total synthesis of 12-methyl-19-nor-steroids, 1643.
- Trichloroacetic acid-induced rearrangement of steroids. Aromatisation of 17-methyltestosterone into 1,2,10,-15,16,17-hexahydro-10,17,17-trimethylcyclopenta[a]-phenanthren-3-one, 158.
- Withaphysalin C, a naturally occurring 13,14-seco-steroid, 1244.
- Steviol acetate. Fungal products. Part XVI, conversion of isosteviol and steviol acetate into gibberellin analogues by mutant Bl-41a of Gibberella fujikuroi and the preparation of [3H]gibberellin A<sub>20</sub>, 173.
- Stilbenes. Synthesis of sterically hindered stilbenes of biological importance, 1466.
- Streptomyces luteoreticuli Arai. Synthesis and geometrical configuration of luteoreticulin, a toxic nitrocontaining metabolite of Streptomyces luteoreticuli Arai, 404. (±)-Strigol, the germination stimulant, synthesis of, 410.
- Structure. Evaluation of an empirical structure activity relationship for property prediction in a structurally diverse group of local anaesthetics, 168.
- Styrax species. Synthesis of benzofuran Styrax extractives, 1514.
- Styrene. Formation of anthracene cation radicals from 9,10-dihydro-9,10-epidioxyanthracene derivatives; peroxide-initiated cationic polymerization of styrene in liquid sulphur dioxide, 87.
- 1-Styrylimidazoles, 545.
- Sugars—see also Carbohydrates.
  - phosphorylated. Part XX, synthesis of 3-deoxy-D-manno-octulosonic acid 8-(dihydrogen phosphate), 1628.
  - Koenigs-Knorr reactions. Part I, effects of a 2-O-acetyl substituent, the promoter, and the alcohol concentration on the stereoselectivity of reactions of 1,2-cis-glucopyranosyl bromide, 1938.
  - Marine steroids. Part III, on the structure of marthasterone glucoside, from the starfish *Marthasterais glacialis*, 1357.
  - C-Nucleoside studies. Part III, glycofuranosylethynes from 2,3: 5,6-di-O-isopropylidene-p-mannose, 68.
  - Potential hexokinase inhibitors. Synthesis and properties of 2,3-anhydro-D-allose, 2,3-anhydro-D-ribose, and 2-O-methylsulphonyl-D-mannose, 1449.
  - Synthesis of oligosaccharides by cycloaddition. Part II, free and protected O-hexopyranosyl-(1 → 3)-D-glucoses with the α-D-allo-, α-D-altro-, α-L-altro-, β-L-altro-, and α-D-galacto-configurations, 1831.
  - Thio-sugars. Part I, 4-thiotetrose derivatives via Pummerer rearrangement, 2533.
- Sulphines, oxathiirans as intermediates in the photolysis of, 1404.
- Sulphinyl group. Activating groups for the ring expansion of coumarin by diazoethane: benzoyl, pivaloyl, arylsulphonyl, arylsulphinyl, and nitro, 1260.
- Sulphinyl groups. Solvolysis of secondary alkyl tosylates with  $\beta$ -dimethyl and  $\beta$ -nitro, sulphinyl, sulphonyl, or phosphonyl substituents: fragmentation vs. rearrangement, 2024.

- Sulphonamides. o-Nitroaniline derivatives. Part V, cyclisation of N-acylated derivatives of N-benzyl- and N-p-nitrobenzyl-o-nitroaniline: a comparison of carboxamides and sulphonamides, 394.
- Sulphonate, phenyl benzene-, preparation of benzyne from, 1577.
- Sulphonium ylides, carbonyl-stabilized, syntheses with carbanions derived from: a novel route to furan-3(2H)-ones, 1688.
- Sulphonyl group. Activating groups for the ring expansion of coumarin by diazoethane: benzoyl, pivaloyl, arylsulphonyl, arylsulphinyl, and nitro, 1260.
  - Solvolysis of secondary alkyl tosylates with  $\beta$ -dimethyl and  $\beta$ -nitro, sulphinyl, sulphonyl, or phosphonoyl substituents: fragmentation vs, rearrangement, 2024.
- Sulphur compounds—see also Thia- and Thio-compounds. organo-. Part VIII, reaction of monothiocarboxylic acids with dicyclohexylcarbodi-imide and other reactions leading to monothio-anhydrides, 564.
  - steroidal. Part XII, regiospecific formation of steroidal olefins by thermolysis of sulphoxides, 459.
  - Alkyl aryl sulphides from the interaction of aryl thiocyanates and alcohols under the influence of triphenylphosphine or of trialkyl phosphites, 2394.
  - Asymmetric induction and racemisation in allenic sulphoxides, 2061.
  - Cyclization of (+)- and (-)-S-(2-methylprop-1-enyl)-L-cysteine S-oxides, 1195.
  - Cycloaddition reactions of dehydrodithizone. X-Ray crystal structures of 5-diethylamino-4-methyl-1-phenyl-3-phenylazopyrazole, 4a,5,6,7,8,8a-hexahydro-6-methyl-8a-mopholino-1-phenyl-3-phenylazo-1H-pyrido[4,3-e][1,3,4]thiadiazine, and 3'-phenyl-5'-phenylazo-2-pyrrolidinospiro-[1H-indene-1,2'(3'H)-[1,3,4]thiadiazole], 1673.
  - Elimination and addition reactions. Part XXVI, asymmetric induction in additions of nucleophiles and electrophiles to αβ-unsaturated sulphoxides, 492.
  - Further examination of the reaction between hexahydro-N-methylcyclohept[b]indole and arenesulphonyl azides, 481.
- Sulphur. Halogeno-1,4-dioxans and their derivatives.
  - Part VIII, direct replacement of chlorine in 2,3. dichloro-1,4-dioxan by sulphur and by nitrogen-Conformations of the products of a rigid *cis*-fused hexahydro-1,4-dioxino[2,3-b][1,4]dioxin, and of bi-1,3-dithian-2-yl, 121.
  - compounds. Heterocycles from ylides. Part IV, reactivity of 4-arylmethylene-Δ<sup>2</sup>-pyrazolin-5-ones with stabilized sulphur ylides, 620.
    - Heterocyclic syntheses with malonyl chloride. Part XI, reactions of 2-alkyl- (or-aryl-) thio-7-chloropyrano[3,4-e][1,3]oxazine-4,5-diones with water and with alcohols, 2462.
    - Macrocyclic sulphide synthesis: trithia $[n^{n+1, 2n+4}]$ -[2n+1]metacyclophanes, 1691.
    - Mechanism of the [1,3]phenylthio shift in the rearrangement of allyl sulphides, 2125.
    - Nitrene-induced cyclisations accompanied by rearrangement in thermolyses of aryl 2-azidophenyl sulphones: a note on quantitative high-speed liquid chromatographic analysis of substituted phenothiazine 5,5-dioxides, 1749.
    - Novel aspects in the synthesis and acid-promoted cyclisation of some 2-diazo-2'-(p-tolylsulphonylamino)-

acetophenones: electrophilic displacement of an arylsulphonyl group from a sulphonamide, 1757.

- Nucleophilic displacement reactions of 3,6-dichloropyridazine 1-oxide with sulphur nucleophiles, 1988.
- On the reactions of alkanedithiols with picryl halides, 2214.
- Oxidation and bimolecular condensation reactions of 2-alkyliminocyclopentanedithiocarboxylic acids, 2-oxocyclopentanedithiocarboxylic acids, and 3-methyl-5-oxo-1-phenyl- $\Delta^2$ -pyrazoline-4-dithiocarboxylic acid, 1706.
- Oxidation of some penicillins and other sulphides by use of a polymer-supported peroxy-acid, 2252.
- Perfluoroalkyl derivatives of sulphur. Part XVIII, reactions of polyfluoroiodoalkanes with sodium methanethiolate in the presence of dimethyl disulphide, and related reactions, 525. Part XIX, reaction of fluoro-olefins with fluoride ion in the presence of dimethyl disulphide, and related reactions, 1178.
- Physical properties and chemical reactivity of 8-(methylthio)hypoxanthines, 90.
- Preparation of macrocyclic ether-esters, thioether-esters, and ether-thiolesters, 2505.
- Reaction of sulphimides with electrophilicacetylenes, 716.
- Reactions and synthetic applications of β-oxo-sulphoxides. Part VI, a new synthesis of the pyrido-[4,3-b]carbazoles olivacine and ellipticine, 1479.
- of 2-, 6-, and 8-monosubstituted 1- and 3-methylpurines with hydroxide ions in water, 151.
- Ring cleavage of some pyrazole-4-sulphonyl chlorides by chlorine, 428.
- Ring-c-functionalised diterpenoids. Part VII, formolysis of (16S)-ent-12α-p-tolylsulphonyloxykaurane, 1042.
- Selective oxidation of two dialkyl sulphides catalysed by ruthenium complexes, 1734.
- Stereochemistry of organophosphorus cyclic compounds. Part IV, synthesis and geometrical isomerism in cyclic five-membered phosphorus thioacids. Crystal and molecular structure of the imidazolium salt of r-2-hydroxy-c-4-methyl-1,3,2-dioxaphospholan-2-thione, 371.
- Studies of heterocyclic compounds. Part XIX, synthesis of 6,6a-dithia- and 6,6a-diselena-1,2-diazapentalenes, 228.
- cine-Substitution in the thiophen series; the behaviour of 4-nitro-3-thienylphenyl sulphone towards sodium arenethiolates in methanol, 2264.
- Syntheses based on 1,2-secopenicillins. Part II, preparation of 4-(3-substituted prop-2-ynylthio)azetidin-2-ones, 1612. Part III, hydration of 4-(3-substituted prop-2-ynylthio)azetidin-2-ones and a new cephalosporin synthesis, 1615.
- Synthesis of dialkyl sulphites from alcohols in the halogen-pyridine-sulphur dioxide system. Novel behaviour of alkyl chlorosulphates in the pyridine-sulphur dioxide system, 108.
- Thio-sugars. Part I, 4-thiotetrose derivatives via Pummerer rearrangement, 2533.
- Sulphur dioxide, liquid, benzidine rearrangement via a cation radical in, 1504.
  - Synthesis of dialkyl sulphites from alcohols in the halogenpyridine-sulphur dioxide system. Novel behaviour of

- Sulphur dioxide (contd.)
  - alkyl chlorosulphates in the pyridine-sulphur dioxide system, 108.
- Sulphuryl chloride, oxidation of N-hydroxy-amines by, 2202. Synthesis of acetamides by the reactions of alcohols with sulphuryl chloride in acetonitrile, 2205.

T

- **Tabernaemontana elegans.** Structures of tabernaelegantines A—D and tabernaelegantinines A and B, new indole alkaloids from *Tabernaemontana elegans*, 1432.
- Tanshinone II (6,7,8,9-tetrahydro-1,6,6-trimethylphenan-thro[1,2-b]furan-10,11-dione), photo-oxidation of, 1716.
- (+)-Tartaric acid, a new asymmetric transformation of  $\alpha$ -amino-acid esters with, 475.
- resolution of esters of phenylglycine with, 471.
- Tautomerism and preparation of 6-cyano- and 6-ethoxy-carbonyl-1,4-dihydropyrazolo[4,3-b]pyridin-7-ones. Pyrazolopyridines. Part IV, 507.
  - Addition reactions of heterocyclic compounds. Part LXV, synthesis, tautomerism, and rearrangement of some 2*H* and 4*H*-quinolizine esters, 1911.
  - 1,3-Dipolar character of six-membered aromatic rings. Part XXVII, photochemically induced valence bond tautomerism and dimerisation of 3-oxido-1-phenyl-pyridinium, 2338.
- **Terpenes.** Absolute configuration of avarol, a rearranged sesquiterpenoid hydroquinone from a marine sponge, 1408.
  - Chemistry of terpenes. Part XXI, by-products from the epoxidation of (+)-car-3-ene with acetonitrile-hydrogen peroxide, 791.
    - of the Compositae. Part XXXI, absolute configuration of the sesquiterpene lactones centaurepensin (chlorohyssopifolin A), acroptilin (chlorohyssopifolin C), and repin, 1663.
  - Constituents of Solidago species. Part VII, constitution and stereochemistry of the cis-clerodanes from Solidago arguta Ait. and of related diterpenoids, 1590.
  - Crystal structures of the dihydro- and 2α-hydroxydihydroderivatives of phytuberin, 1338.
  - Extractives from *Pseudowintera colorata*. Part V, a new sesquiterpene lactone, colorata-4(13),8-dienolide, 850.
  - Lichens and fungi. Part XII, dehydration and isomerization of stictane triterpenoids, 857.
  - Phosphate esters. Part 3, formation of sesquiterpene hydrocarbons from *cis,trans* and *trans,trans*-farnesyl diphenyl phosphates, 2524.
  - Photochemical di- $\pi$ -methane rearrangement leading to methyl chrysanthemate, 256.
  - Reduction of triterpenoid ketones with bornan-2-exoyloxyaluminium dichloride: a convenient preparation of axial triterpene alcohols, 321.
  - Ring c functionalised diterpenoids. Part VII, formolysis of (16S)-ent-12α-p-tolylsulphonyloxykaurane, 1042.
  - Structure of ballotinone, a diterpenoid from Ballota nigra, 1607.
    - of eight new triterpenoids and isolation of other triterpenoids and epi-ikshusterol from the stems of Lithocarpus cornea, 23.
    - of four new triterpenes from the rhizomes of Polypodium juglandifolium, 117.

- of three new C<sub>16</sub> terpenoids from an Acrostalagmus fungus, 2407.
- Studies in terpenoid biosynthesis. Part XIV, formation of the sesquiterpene trichlodiene, 326. Part XV, biosynthesis of the sesquiterpenoid illudin N, 876. Part XVI, formation of the sesquiterpenoid trichothecin, 1212. Part XVII, biosynthesis of the sesquiterpenoids cyclonerodiol and cyclonerotriol, 1214. Part 18, biosynthesis of culmorin, 2471.
  - Part XLIV, structure of the adduct from p-mentha-1,5-diene and  $\beta$ -naphthol, and its isomer, 1254.
  - Part XVIII, stereocontrolled synthesis of  $(\pm)$ -1,2,3,4,-4a,9,10,10a $\alpha$ -octahydro-1 $\alpha$ -methylphenanthrene-1 $\beta$ ,-4a $\beta$ -dicarboxylic acid and the 7-methoxy analogue: a potential intermediate for diterpenoid syntheses, 722.
- Terpenoids. Part XXXVIII, ring B contraction of kauranolides and related compounds into gibberellane-type compounds, 2144.
- The <sup>13</sup>C nuclear magnetic resonance spectra of kauranoid diterpenes, 114.
- Tetra-azenes. Preparation and reactions of cis-1,4-diph-thaloyltetra-az-2-ene, 1150.
- Tetracycline, experiments on the synthesis of. Part XIV, closure of ring B by base-catalysed photocyclisation, 503.
- **5,6,7,8-Tetrahydroquinolines.** Part I, a novel synthesis of **7,8-dihydroquinolin-5**(6*H*)-ones, **975**.
- 2,6,11,15-Tetramethylhexadeca-2,6,8,10,14-pentaene, a C<sub>20</sub> analogue of phytoene, synthesis of poly-Z-isomers of. Re-examination of the stereochemistry of a new isomer of phytoene from *Rhodospirillum rubrum*, 1029.
- Tetrangulol. Naturally occurring quinones. Part XXVI, a synthesis of tetrangulol (1,8-dihydroxy-3-methylbenz-[a]anthracene-7,12-quinone), 997.
- **Tetrazoles.** Preparation and reactions of pyridinium tetrazol-5-ylmethylides. N-oxide and related compounds. Part LIV, 909.
- Thallium in organic synthesis. Part II, oxidation of steroid ketones by thallium(III) acetate, 111.
- triacetate, cis-hydroxylation of steroidal olefins with, 1660. Reaction of thallium(I) acetate-iodine and silver(I) acetate-iodine with norborn-2-ene, 845.
  - of thallium(-) azide and iodine with alkenes, 840.
- Thebaines. Synthesis of compounds related to endo-6,4-ethenotetrahydrothebaines, 644.
- Thermolytic and similar reactions. Action of heat on 6-p-chlorophenylsulphonylamino-5-p-chlorophenylsulphonylimino-1,2,5,6-tetrahydro-4,6-butano-4H-pyrrolo[3,2,1-ij]quinoline: crystal structure of 7a-p-chlorophenylsulphonylamino-4,5,7a,8,9,10-hexahydro-7H-pyrrolo[3,2,1-de]phenanthridine, 2254.
  - Convenient routes to pyrrolo[3,2-b]-, pyrrolo[3,2-c]-, and pyrrolo[2,3-c]-quinolines, and a study of the pyrolysis of 2-quinolylhydrazones, 2121.
  - Nitrene-induced cyclisations accompanied by rearrangement in thermolyses of aryl 2-azidophenyl sulphones: a note on quantitative high-speed liquid chromatographic analysis of substituted phenothiazine 5,5-dioxides, 1749.
  - Photochemical and thermal reactions of heterocycles. Part I, photolysis, thermolysis, and mass spectral fragmentation of mesoionic 1,2,4-triazol-3-ones, 863.
  - Pyrolyses of pentafluorophenyl prop-2-enyl and [2,3,3-2H<sub>3</sub>]prop-2-enyl ethers. Formation of 1-fluorovinyl 2,3,4-trifluorophenyl ketones *via* internal Diels-Alder reactions, 1463.

## Thermolytic reactions (contd.)

- Sequential nature of the thermal reaction of stearic acid with some 1,2-diamines, 386.
- Steroidal sulphur compounds. Part XII, regiospecific formation of steroidal olefins by thermolysis of sulphoxides, 459.
- Thermal and photochemical α-carbon-carbon cleavages in imines, 1583.
  - decomposition of quaternary hypoxanthinium salts and related purines, 239.
  - oxygen atom transfer from benz[cd]indazole 1,2-dioxide to benzenoid derivatives, 680.
  - rearrangement of 2,2,4,4-tetramethylthietan-3-one 1-oxide; a reaction related to the ring expansion of the pencillin S-oxides, 2590.
- of 3,5-diphenylisoxazole, 16.
- of tropolone ethers. Part 4, 2403.

# Thia-see also Sulphur.

- Thiazines. Studies related to dihydro-1,4-thiazines. Part VIII, β-elimination reactions of 7-oxo-8-oxa-4-thia-1-aza-bicyclo[4.3.0[non-2-ene-3-carboxylates, 584. Part 9, thermal equilibration of thiazine and thiazoline S-oxides, 2540.
- Thiazoles. Addition reactions of heterocyclic compounds. Part LXIII, new structures for some 2:1 molar adducts from dimethyl acetylenedicarboxylate with thiazoles and benzo-imidazoles, -oxazoles, and -thiazoles formed by novel rearrangement. Crystal and molecular structure determinations for tetramethyl 3,8a-dimethylpyrido[2,1-b]thiazole-5,6,7,8-tetracarboxylate and tetramethyl 5-methylpyrido[2,1-b]thiazole-6,7,8,8a-tetracarboxylate, 1269.
  - Photochemical decarboxylation of 2-phenyl- $\Delta^2$ -thiazoline-4-carboxylic acid, 1901.
- $\Delta^2\text{-Thiazoline-4-carboxylic}$  acid, 2-phenyl-, photochemical decarboxylation of, 1901.
- Thiazoline S-oxides and thiazine, thermal equilibration of. Studies related to dihydro-1,4-thiazines. Part 9, 2540.
- Thiazolines. Photochemical decarboxylation of 2-phenyl- $\Delta^2$ -thiazoline-4-carboxylic acid, 1901.
- Thienoimidazoles. Approaches to the synthesis of 1*H*-[1]benzothieno[2,3-*d*]imidazoles and thieno[2,3-*d*]imidazoles, 80.
- Thienopyridines. Condensed thiophen ring systems. Part XIX, synthesis of 6,7-dihydrothieno[3,2-c]pyridines and 4,5-dihydrothieno[2,3-c]pyridines by intramolecular cyclisation of 2-(2- or 3-thienyl)ethyl isothiocyanate, 138.
- **Thietans.** Thermal rearrangement of 2,2,4,4-tetramethyl-thietan-3-one 1-oxide; a reaction related to the ring expansion of the penicillin S-oxides, 2590.
- Thio—see also Sulphur.
- Thiocarbonyl group. Some reactions of soft electrophiles with esters and other compounds containing the thiocarbonyl group, 2112.
- Thiocarboxamides. 5,6,7,8-Tetrahydroquinolines. Part III, synthesis of 5,6,7,8-tetrahydroquinoline-8-thiocarboxamides, 983.
- **Thiocyanates.** Alkyl aryl sulphides from the interaction of aryl thiocyanates and alcohols under the influence of triphenylphosphine or of trialkyl phosphites, 2394.
- Thiohydrazides and related compounds, some reactions of, 38.
- Thioinden-1-ones, 3-benzyl-, base-catalysed reactions of, 818.
- **Thioindoles,** 2-ethyl-, oxidation of, with hydrogen peroxide. Oxidative migration of the ethylsulphonyl group, 745.

- Thiols. Demethylation of aliphatic methyl ethers with a thiol and boron trifluoride, 2237.
- Thionyl chloride, reactions of saturated aliphatic alcohols with. Factors in the formation of isomerically and optically pure alkyl halides. Part X, 104.
- Thiophens. Condensed thiophen ring systems. Part XIX, synthesis of 6,7-dihydrothieno[3,2-c]pyridines and 4,5-dihydrothieno[2,3-c]pyridines by intramolecular cyclisation of 2-(2- or 3-thienyl)ethyl isothiocyanate, 138.
  - Reaction of 2,4-dinitrobenzenediazonium ions with thiophens. Part I, an acidic Gomberg reaction, 1636. Part 2, coupling reactions, involving unexpected reactions with electron-rich methyl groups in addition to the expected ring attack, 1639.
  - Some derivatives of 2- and 3-phenylthiophen, 2355.
- cine-Substitution in the thiophen series; the behaviour of 4-nitro-3-thienyl phenyl sulphone towards sodium arenethiolates in methanol, 2264.
- Thiophosgene, reactions of heterocycles with. Part VI, reactions of tetrahydropyrazolo[1,5-c]quinazolines, 653.
- Thiopyrano-compounds. Synthesis and properties of methyl 3,4-dihydro-4-oxo-1*H*-2-benzothiopyran-3-carboxylate and related thiopyrano-compounds, 749.
- α-(Thiopyran-2-ylidene) ketones, photoisomerisation of; substituent effects, 166.
- Tigogenin. Fate of C-24 hydrogen atoms of cholesterol during its conversion into tigogenin in *Digitalis lanata*, 1823.
- Titanium. Hydrous titanium oxides—new supports for the simple immobilisation of enzymes, 329.
  - Metal-catalysed organic photoreactions. Photoreaction of αβ-unsaturated ketones in alcohols in the presence of titanium(1V) chloride, 788.
- Toluene-p-sulphonyl azide and cyclopropylenamines, rearrangement of triazolines from. v-Triazolines. Part V.
- Tosylates. Solvolysis of secondary alkyl tosylates with  $\beta$ -dimethyl and  $\beta$ -nitro, sulphinyl, sulphonyl, or phosphonoyl substituents: fragmentation vs. rearrangement, 2024.
- **Toxoflavins,** isoalloxazines, alloxazines, and fervenulins, syntheses of, by oxidative cyclization of the Michael-type adducts from substituted 6-aminouracils and azo-compounds, 2398.
- Transformations, photoinduced. Part XXXI, photoinduced rearrangement of (22S,25S)-N-acetyl-5α-veratra-8,13(17)-dienine-3β,11β,23β-triol 3,23-diacetate 11-nitrite to two spiro-isoxazolines, 1312. Part 32, scrambling of unlabelled and [15N]nitrogen monoxide in the photoinduced rearrangement of (22S,25S)-5α-veratr-13(17)-enin-11β-yl nitrites to nitrones, 2365.
- **Transition metals.** Dependence of product on catalyst in the transition-metal-catalysed decomposition of ethyl 2-allyl-4-diazoacetoacetate, 489.
- **Triazepines.** The imputed formation of 1,2,3-triazoles, triazines, and triazepines from hydrazinobenzoquinolines and nitrous acid. A correction, 2178.
- Triazines and related products. Part XVI, synthesis of triazolotriazines by cyclisation of 3-hydrazino-1,2,4-triazines and 3-hydrazino-1,2,4-triazoles, 1492. Part XVII. Chemistry of heterocyclic compounds. Part IX. Cyclisation reactions of azolylhydrazones derived from ethyl cyanoacetate and malononitrile. Formation of azolo[5,1-c][1,2,4]triazines, 1496.
  - 1,6-Dihydro-1,2,4-triazines, 83.

- Triazines (contd.)
  - 3,5-Disubstituted 6-benzyl-1,2,4-triazines: syntheses and reactions, 2521.
  - Reactions of hydrazones and related compounds with strong bases. Part III, 1,2,4-triazoles, 1,2,4-triazines, and 1,3,5-triazines from aromatic aldehyde azines, 207.
  - The imputed formation of 1,2,3-triazoles, triazines, and triazepines from hydrazinobenzoquinolines and nitrous acid. A correction, 2178.
- 1,2,4-Triazole-5-diazonium nitrate, coupling reactions of, with active methylene compounds. A new general route to [1,2,4]triazolo[5,1-c][1,2,4]triazine derivatives. Chemistry of polyazaheterocyclic compounds. Part VIII, 421.
- **Triazoles.** N-Amination and subsequent oxidation of some fused imidazoles and triazoles, 367.
  - Photochemical and thermal reactions of heterocycles. Part I, photolysis, thermolysis, and mass spectral fragmentation of mesoionic 1,2,4-triazol-3-ones, 863.
  - Reactions of hydrazones and related compounds with strong bases. Part III, 1,2,4-triazoles, 1,2,4-triazines, and 1,3,5-triazines from aromatic aldehyde azines, 207.
  - Synthesis of 1*H*-1,2,4-triazole 2-oxides and annelated derivatives, 2166.
  - The imputed formation of 1,2,3-triazoles, triazines, and triazepines from hydrazinobenzoquinolines and nitrous acid. A correction, 2178.
  - v-Triazolo[4,5-d]pyrimidines (8-azapurines). Part XVII, preparation of 1,6-dihydro-8-azapurines by heating 4-amino-5-aminomethyl-N-alkyl-1,2,3-triazoles with orthoesters or amidines, 291.
- **Triazolinediones.** Application of 1,2,4-triazoline-3,5-diones in the synthesis of the piperazic acids (hexahydropyridazine-3-carboxylic acids), 2390.
- v-Triazolines. Part V, rearrangement of triazolines from cyclopropylenamines and toluene-p-sulphonyl azide, 622.
- **Triazolopyridazines.** Thermal cyclisation of pyridazinylhydrazones to give s-triazolo[4,3-b]pyridazines and pyridazino[2,3-a]benzimidazole, 1363.
- v-Triazolo[4,5-d]pyrimidines (8-azapurines). Part XVII, preparation of 1,6-dihydro-8-azapurines by heating 4-amino-5-aminomethyl-N-alkyl-1,2,3-triazoles with orthoesters or amidines, 291.
- Triazolotriazines. Chemistry of polyazaheterocyclic compounds. Part VIII, coupling reactions of 1,2,4-triazole-5-diazonium nitrate with active methylene compounds. A new general route to [1,2,4]triazolo[5,1-c]-[1,2,4]triazine derivatives, 421.
  - Triazines and related products. Part XVI, synthesis of triazolotriazines by cyclisation of 3-hydrazino-1,2,4-triazines and 3-hydrazino-1,2,4-triazoles, 1492.
- Trichloroacetic acid-induced rearrangement of steroids. Aromatisation of 17-methyltestosterone into 1,2,10,15,16,-17-hexahydro-10,17,17-trimethylcyclopenta[a]phenanthren-3-one, 158.
- **Trichodiene.** Studies in terpenoid biosynthesis. Part XIV, formation of the sesquiterpene trichodiene, 326.
- Trichothecin. Studies in terpenoid biosynthesis. Part XVI, formation of the sesquiterpenoid trichothecin, 1212.
- Tricyclo[4.2.2.0<sup>2,5</sup>]deca-3,7-diene derivatives, transannular cyclization of, by oxypalladation. Molecular design by cycloaddition reactions. Part 32, 2516.
- Tricyclododecane. A derivative of tricyclo[6.3.1.0²,²]-dodecane from the reaction between 2,6-dimethyl-1,4-benzoquinone and a quinonylmethyl carbanion; transformations involving nucleophilic attack at carbonyl

- oxygen, and a rearrangement to a spirobenzofuran derivative related to usnolic acid, 2067.
- Tricycloundecanes. Dehydrobromination of 3-bromotricyclo[5.3.1.0<sup>3,8</sup>]undecane (3-bromo-4-homoisotwistane) and some addition reactions of tricyclo[5.3.1.0<sup>3,8</sup>]undec2-ene. Stereochemistry of the formation and reaction of an anti-Bredt compound probed by deuterium substitution, 2133.
- Trienes. Generation of acyclic trienes and cyclic dienes by mild dehydration and dehydrohalogenation in aprotic media, 1792.
- Trimethyl phosphite-copper(I) iodide. Homogeneous catalysis of the decomposition of dimethyl diazomalonate in alcohols, 2483.
- Trithia[ $n^{n+1,2n+4}$ ][2n+1]metacyclophanes: macrocyclic sulphide synthesis, 1691.
- Tritium. Biosynthesis of porphyrins and related macrocycles. Part V, structural integrity of the type III porphyrinogen macrocycle in an active biological system; studies on the aromatisation of protoporphyrinogen-IX, 266.
  - Fungal products. Part XVI, conversion of isosteviol and steviol acetate into gibberellin analogues by mutant B1-41a of Gibberella fujikuroi and the preparation of [3H]gibberellin A<sub>20</sub>, 173.
  - Fusicoccin. Part 6, biosynthesis of fusicoccin from [3-13C]- and (4R)-[4-3H<sub>1</sub>]-mevalonic acid, 2221.
  - Stereochemical studies on the biosynthesis of the αβ-didehydro-amino-acid units of mycelianamide, cyclopenin, and cyclopenol, 1564.
  - Studies of enzyme-mediated reactions. Part VI, stereochemical course of the dehydrogenation of stereospecifically labelled benzylamines by the amine oxidase from pea seedlings (E.C.1.4.3.6.), 1052. Part VII, stereospecific syntheses of tritium-labelled (2R)- and (2S)-dopamines: stereochemical course of hydroxylation of dopamine by dopamine β-hydroxylase (E.C.1.14.17.1), 1056.
  - Tritiated peptides. Part 2, synthesis of two  $[3,5^{-3}H_2-Tyr^2]$ -analogues of corticotrophin, 2182. Part 3, synthesis of  $[4^{-3}HPhe^7]$ - $\beta$ -corticotrophin-(1-24)-tetracosapeptide, 2186.
- Tropanes. Alkaloids of the genus Erythroxylum. Part I, E. monogynum Roxb. roots, 1550.
- Tropolone ethers, thermal rearrangements of. Part 4, 2403.
- Tropones. 1,3-Dipolar character of six-membered aromatic rings. Part XVIII, adducts from 3-oxido-1-phenyl-pyridinium and their quaternisation and conversion into tropone derivatives, 2289.

U

- Ullmann reaction. Depsidone synthesis. Part II, diploicin and gangaleoidin, 147.
- β,γ-Unsaturated carboxylic acids and esters, convenient synthesis of. The isomeric 5-t-butylcyclohex-2-ene-carboxylic acids, 2279.
- Uracils and quinolines from reactions of isocyanates with aliphatic aldehydes, 1597.
  - A new synthesis of pyrimido[4,5-e]-as-triazine 4-oxides by nitrosative cyclization of aldehyde uracil-6-ylhydrazones in the presence of diethyl azodiformate, 713.

Uracils (contd.)

- Purines, pyrimidines, and imidazoles. Part XLIV, syntheses of some dihydro-1,3-oxazine derivatives and related substituted uracils, 1969.
- Syntheses of isoalloxazines, alloxazines, toxoflavins, and fervenulins by oxidative cyclization of the Michael-type adducts from substituted 6-aminouracils and azocompounds, 2398.
- Ureas. Formation of heterocyclic compounds by use of N'-diphenylmethylene-N-phenyl-N-trimethylsilylurea, 1523.
- Uroporphyrins. Biosynthesis of porphyrins and related macrocycles. Part VII, synthesis of specifically labelled [14C<sub>1</sub>]uroporphyrin-III and of [10,14-13C<sub>2</sub>]uroporphyrin-III. Conversion of the latter into [10,14-13C<sub>2</sub>]protoporphyrin-IX; biosynthetic significance of its <sup>13</sup>C nuclear magnetic resonance spectrum, 283.
- Usnolic acid. A derivative of tricyclo[6.3.1.0<sup>2,7</sup>-]dodecane from the reaction between 2,6-dimethyl-1,4-benzoquinone and a quinonylmethyl carbanion; transformations involving nucleophilic attack at carbonyl oxygen, and a rearrangement into a spirobenzofuran derivative related to usnolic acid, 2067.

#### V

- (22S,25S)-5α-Veratra-8,13(17)-dienine-3β,11β,23β-triol3,23-diacetate 11-nitrite, N-acetyl-, photoinduced rearrangement to two spiro-isoxazolines. Photoinduced transformations. Part XXXI, 1312.
- (22S,25S)-Veratra-5,8,13(17)-trienine-3β,11β,23β-triol 3, 23-diacetate 11-nitrite, N-acetyl- a fused cyclopentenyl nitrite, photorearrangement of, to two spiroisoxazolines. Photoinduced transformations. Part XXX, 1297.
- Vilsmeier reagents for the replacement of a hydroxy-group by chlorine or bromine. Factors in the formation of isomerically and optically pure alkyl halides. Part XI, 754.
- Vinyl compounds. Synthesis of phosphindoline oxides, tetrahydrophosphinoline oxides, and related compounds by cyclisation of allyl- and vinyl-phosphine oxides, 2556.
- Violerythrin and other cyclopentenediones, synthesis of. Carotenoids and related compounds. Part XXXIV, 2140.
- Vitamins. Synthesis of  $24\xi$ , 25-dihydroxyprovitamin D<sub>3</sub>, 727.
  - of 25-hydroxyprovitamin  $D_3$  and 25 $\xi$ ,26-dihydroxyprovitamin  $D_3$ , 731.

### W

- Water. Heterocyclic syntheses with malonyl chloride. Part XI, reactions of 2-alkyl-(or -aryl-)thio-7-chloropyrano[3,4-e][1,3]oxazine-4,5-diones with water and with alcohols, 2462.
- Wax-tree, a new biflavanone, rhusflavanone, from the seeds of 98.
- Withaphysalin C, a naturally occurring 13,14-seco-steroid, 1244.
- Woods, 'insoluble red', chemistry of. Part XII, some reactions of isoflavylium salts, 1389.

 $\mathbf{X}$ 

- **Xanthines.** Synthesis and properties of 7-hydroxyxanthine and its derivatives, 1507.
- Xanthones. Biosynthesis of the fungal xanthone ravenelin, 898.
  - Chemistry of fungi. Part LXX, synthesis of some xanthones, 1377.
  - Generation of xanthones and benzoxanthones from oaryloxybenzaldehydes by use of copper(II) halides, 2241.
- X-Ray analysis of nic-3 acetate and nic-11 ethyl ether: structures of three oxygenated 24-methyl-steroids (nic-3, -7, and -11) from the insect repellant plant Nicandra physaloides (Solanaceae), 296.
  - of nic-10, and the structures of nic-1 ('nicandrenone'), -12, and -17. A new class of natural steroids, with ring D aromatic, from *Nicandra physaloides* (Solanaceae) 304.
- X-Ray crystal structures of 5-diethylamino-4-methyl-1-phenyl-3-phenylazopyrazole, 4a.5.6,7,8,8a-hexahydro-6-methyl-8a-morpholino-1-phenyl-3-phenylazo-1H-py-rido[4,3-e][1,3,4]thiadiazine, and 3'-phenyl-5'-phenylazo-2-pyrrolidinospiro-[1H-indene-1.2'(3'H)-[1,3,4]-thiadiazole]. Cycloaddition reactions of dehydro-dithizone, 1673.
  - of two pyrethroid insecticides: *cis-3*-phenoxybenzyl 3-(2.2-dibromovinyl)-2.2-dimethylcyclopropane carboxylate and the 3-(2,2-dichlorovinyl) analogue, 1231.
- X-Rays. Chemistry of fungi. Part LXVIII, the absolute configuration of (+)-sclerotiorin and of the azaphilones, 1366. Part LXIX, a new synthesis of the grisane system: X-ray crystallographic examination of (±)-methyl 5,7-dibromo-2'α,5'α-epoxy-4-methoxy-3-oxogrisane-6'β-carboxylate, 1369.
  - Crystal structures of the dihydro- and  $2\alpha$ -hydroxydihydro-derivatives of phytuberin, 1338.
- Xylocarpus moluccensis (Lam.) M. Roem, limonoids from, 1993.

### Y

- Yenhusomine and Yenhusomidine. Studies on the alkaloids of Formosan Corydalis species. Part VI, elucidation of the structures of two spirobenzylisoquinoline alkaloids, yenhusomine and yenhusomidine, and two berbine alkaloids, corytenchine and corytenchirine, from Corydalis ochotensis (Turcz.), 63.
- Ylides, heterocycles from. Part III, reactivity of allylic phosphonium ylides with 1,3-dipoles, 619. Part IV, reactivity of 4-arylmethylene- $\Delta^2$ -pyrazolin-5-ones with stabilized sulphur ylides, 620.
  - Addition reactions of heterocyclic compounds. Part LXIV, indolizines from reactions of hex-3-yne-2,5-dione, but-3-yn-2-one, and allenecarboxylic esters with some nitrogen-containing heterocyclic ylides, 1908.
  - Dichotomous ylide formation from an alkyl(benzyl)phosphonium salt leading to stereoselective alkene syntheses, 1476.
  - N-Oxide and related compounds. Part LIV, preparation and reactions of pyridinium tetrazol-5-ylmethylides, 909.

### Ylides (contd.)

N-imides, and N-ylides, of five-membered heterocycles. Part 5, reactions of 2,4,5-triphenyl-3H-pyrrol-3-one 1-oxide, 2259.

Syntheses with carbanions derived from carbonyl-stabilized sulphonium ylides: a novel route to furan-3(2H)-ones, 1688.

Yohimbine skeleton, total syntheses of: demethoxycar-bonyldihydrogambirtannine, angustidine, nauclétine,  $(\pm)$ -

angustoline, and related compounds. Photocyclisaton of enamides. Part X, 1865.

# $\boldsymbol{z}$

Zeatins. Purines, pyrimidines, and imidazoles. Part XLIII, halogenation of N-3-methylbut-2-enylphthalimide; new syntheses of zeatin analogues, 1446.