Sulmona has also in S. Maria della Tomba a good example of pure Gothic. S. Francesco d’Assisi occupies the site of an older and larger church, the Romanesque portal of which still stands at the end of the Corso Ovidio, and forms the entrance to the meat market. Opposite is a picturesque aqueduct of 1266 with pointed arches. S. Agostino has a good Gothic portal. The Ospedale Civico, next to the church of the Annunziata, begun in the first half of the 15th century, shows an interesting mixture of Gothic and Renaissance styles. the window of the Palazzo Tabassi is similar, and both are due to Lombard masters. In the court of the grammar school is a fine 15th- century statue of Ovid, the most celebrated native of the town, whose memory is preserved among the peasants in songs and folk-lore. The Porta Napoli is an interesting gate of the early 14th century. Innocent VII. was a native of the town. In thc vicinity of the town is Monte Morrone where Pietro di Morone lived (c. 1254) as a hermit and founded a monastery for his hermits, who after his elevation to the papacy as Celes­tine V. took the name of Celestines; the monastery (S. Spirito) remained till 1870, when it was transformed into a prison. There are some ruins of the imperial period, attributed, ground­lessly, to the house of Ovid near it. The church contains a Gothic tomb of 1412 by a German master, in which Renaissance influence is, according to Burckhardt, traceable for the first time in south Italy in the realistic characterization of the portrait figures.

Sulmo, a city of the Paeligni, is first mentioned during the Second Punic War (211 b.c.). It was the second town of the Paeligni in importance, Corfinium coming first. It became a Roman colony probably in the reign of Augustus, and as a muni­cipium it continued to flourish throughout the empire. It was situated 7 m. south-east of Corfinium on the road to Aesernia, and was famous for its ironsmiths. Hardly any remains of the ancient city exist above ground, owing to frequent earth­quakes. A number *of* discoveries of tombs (both archaic and of the Roman period), &c., have however been made (cf. A. de Nino, in *Notizie degli Scavi,* passim). Charles V. erected it into a principality, which he bestowed on Charles Lannoy, who had captured Francis I. at the battle of Pavia. It ultimately passed to the Corno and Borghese families. The bishopric is known as that of Valva and Sulmona.

**SULPHONAL,** or acetone diethyl sulphone (CH3)2C(SO2C2H5)2, a valuable hypnotic prepared by condensing acetone with ethyl mercaptan in the presence of hydrochloric acid, the mer­captol (CH3)2C(SC2H5)2 formed being subsequently oxidized by potassium permanganate (E. Baumann, *Ber.,* 1886, 19, p. 2808). It is also formed by the action of alcoholic potash and methyl iodide on ethylidene diethyl sulphine, CH3∙CH(SO2C2H5)2 (which is formed by the oxidation of dithioacetal with potassium permanganate). It crystallizes in prisms melting at 125° C., which are practically insoluble in cold water, but dissolve in 15 parts of hot and also in alcohol and ether.

It is the *sulphonalum* of the B.P., and the *sulphomethanum* of the U.S.P. It produces lengthened sleep in functional nervous insomnia, and is also useful in insanity, being given with mucilage of acacia or in hot liquids, owing to its insolubility, or in large capsules. Its hypnotic power is not equal to that of chloral, but as it is not a depressant to the heart or respiration it can be used when morphine or chloral are contra-indicated. It is, however, very uncertain in its action, often failing to produce sleep when taken at bedtime, but producing drowsiness and sleep the following day. The drowsiness the next day following a medicinal dose can be avoided by a saline laxative the morning after its administration. It is unwise to use it continuously for more than a few days at a time, as it tends to produce the sulphonal habit, which is attended by marked toxic effects, disturbances of digestion, giddiness, staggering gait and even paralysis of the lower extremities. These effects are accompanied by skin eruptions, and the urine becomes of a dark red colour (haematoporphinuria). Sulphonal is cumulative in its effects. Many fatal cases of sulphonal poisoning are on record, both from chronic poisoning and from a single large dose. Trional (CH3)(C2H6)C(SO2C2H5)2, and tetronal, (C2H5)2C(SO2C2H5)2, are also hypnotics. They are faster in action than sulphonal, and trional does not disorder the digestion.

**SULPHONIC ACIDS,** in organic chemistry, a group **of** com­pounds of the type R∙SO3H, where R is an alkyl or an aryl group.

*Aliphatic Sulphonic Acids.—*The members of this class may be prepared by the direct sulphonation of some paraffins (I. WorstaU, *Amer. Chem. J own.,* 1898, 20, p. 664) ; by the oxidation of mercaptans with concentrated nitric acid (H. Kopp, *Ann.,* 1840, 35, p. 346) ; in the form of their salts from the alkyl halides and alkaline sulphites, and as esters from the alkyl halides and silver sulphite. They are colourless oils or crystalline solids which are extremely hygroscopic, very soluble in water and have a strongly acid reaction. They are unaffected by heating with aqueous alkalis or acids and are stable towards concentrated nitric acid. Phosphorus pentachloride converts them into the corresponding acid chlorides, R∙SO2Cl, which are decomposed slowly by water. These chlorides, on reduction by zinc and sulphuric acid, pass readily into the mercaptans, whilst if zinc dust and alcohol be used they are converted into the sulphinic acids, R∙SO2H.

*Methyl sulphonic acid,* CH3∙SO2H, was obtained by H. Kolbe *(Ann.,* 1845, 54, p. 174) by reducing trichloromethyl sulphonic chloride (formed from chlorine and carbon bisulphide in the presence of water : CS2+5CI2+2H2O =CCl3∙SO2Cl+4HCl+SCl2) with sodium amalgam. It is a colourless syrup which decomposes when heated above 130° C. The corresponding acid chloride is an extremely stable solid which melts at 135° C. It is formed by the action of carbon bisulphide on potassium bichromate in the presence of nitric and hydrochloric acids (Loew, *Zeit. f. Chem.,* 1869, p. 82). When heated under pressure it decomposes with the final produc­tion of carbonyl and thionyl chlorides: CCl3∙SO2Cl = CCl4+SO2 = COCl2+SOCl2. *Ethyl sulphonic acid,* C2H6SO3H, is a crystalline deli­quescent solid formed by oxidizing ethyl mercaptan or by reducing vinyl sulphonic acid, CH2:CH∙SO3H (Kohler, *Amer. Chem. Journ.,* 1898, 20, p. 687).

Thiosulphonic acids of the type R∙SO2∙SH are formed by the action of the sulphochlorides on a concentrated solution of potassium sulphide: R∙SO2Cl + K2S = R∙SO2K+S+KCI =KCl+ R·SO2·SK; or by the action of the salt of a sulphinic acid on an alkaline sulphide in the presence of iodine (Otto, *Ber.,* 1891, 24, p. 144).

*Aromatic Sulphonic Acids.*—Thc acids of this group are very similar to the corresponding afiphatic sulphonic acids and are usually obtained by the direct heating of an aromatic hydro­carbon with concentrated sulphuric acid, fuming sulphuric acid or sulphur chlorhydrin. After the action is completed they may frequently be “ salted out ” by adding common salt to the acid solution until no more dissolves, when the sodium salt of the acid separates (L. Gattermann, *Ber.,* 1891, 24, p. 2121). They are also formed by oxidizing thiophenols or by decompos­ing diazonium salts with sulphurous acid. The free acids are usually hygroscopic, crystalline solids which are readily soluble in water. When heated under pressure with concentrated hydrochloric acid to about 150° C. they yield hydrocarbons and sulphuric acid. The salts usually crystalize well, and those of the alkali metals are employed in the preparation of phenols, unto which they pass when fused with the caustic alkalis. When distilled with potassium cyanide they yield the aromatic nitriles. The sulphonic acids with phosphorus penta­chloride are converted into sulphochlorides which are stable to cold water, but with ammonia they yield sulphonamides, R∙SO2NH2, and with alcohols esters of the sulphonic acids.

*Benzene sulphonic acid,* C6H5∙SO3H,11/2H2O, crystallizes in small plates and is very deliquescent. *Benzene sulphochloride,* C6H6SO2Cl, is a colourless fuming liquid which boils at 120° C. (10 mm.). The aminobenzene sulphonic acids, particularly the meta and para compounds, are of importance owing to their employment in the colour industry. The direct sulphonation of aniline yields the para acid, *sulphanilic acid,* C6H4NH2)(SO2H), which crystallizes in small plates and is sparingly soluble in cold water. When fused with caustic potash it yields aniline, whilst oxidation with chromic acid yields benzoquinone. In constitution it is probably to be regarded O

. When diazotized in acid solution and coupled with dimethyl aniline it yields helianthine,