is, therefore, what course does this path follow in the cord? In the first place it must be noted that the path contains a synapse for the peripheral neurone whether belonging to the epicritic tactual gτoup or to the deep tactual group ends in the cord, probably not far, *i.e,* not more than four or five segments, from its place of entrance. The rest of the headward path must therefore run through one secondary neurone at least, it may be through a series of such arranged as a headward running line of relays. It is, however, more probable that one long secondary neurone reaching the bulb covers the whole of the remaining spinal part of the trajectory. The part of the headward-running path formed by the intraspinal part of the peripheral neurone (primary afferent neurone) lies certainly in the dorsal column of the cord of the same lateral half as the side from which the neurone entered, *i.e.* in the right dorsal column if the neurone entered by a spinal root of the right side. The secondary neurone continuing the path lies, however, in the ventral column of the crossed half of the cord. The junction or synapse between the primary and secondary neurone lies, of course, in the grey matter of the spinal cord.

The spinal path of impulses which when they reach the brain occasion pain has been determined chiefly in regard to pain referred to the skin. The primary afferent neurones bringing these impulses to the cord are the protopathic of Head mentioned above. These, there is much evidence to show, terminate in the grey matter of the cord not far from their point of entrance into the cord, that is, they terminate intraspinally nearer their point of entrance than do the corresponding primary afferent neurones for touch. From the local spinal grey matter the pain-path is continued headward in the lateral white columns of the cord by secondary afferent neurones. These secondary afferent neurones run chiefly in the lateral column of the opposite half of the cord from that which the primary afferent neurones entered; but some run up the lateral column of the same side as that by which the primary neurones entered. The synapse between the primary afferent neurone and the secondary afferent neurone of this path lies probably in the grey matter called substantia gelatinosa of the dorsal horn.

The spinal path taken by the impulses concerned with sensa­tions of heat and cold seems to agree closely with that taken by the impulses subserving skin pain. The position of the nerve-fibres belonging to the secondary afferent neurones of the pain and temperature path has been fairly successfully identified with that of the spinal tract called Gowers' tract. The uncrossed portion of the temperature path appears, however, to be relatively smaller as compared with its crossed portion than is that of pain.

There is much evidence that impulses contributory to " mus­cular sense ” pass headward along the spinal cord and in their course remain for the most part uncrossed. This course would in so far agree with the course taken by the intraspinal continua­tions of the primary afferent neurones which form the long fibres of the dorsal columns. These are known to run to the bulb without transgressing the median plane at all. In addition to this uncrossed tract there is another, namely, that offered by the dorsal cerebellar tract, a tract of secondary neurones connected through the grey matter of the vesicular column of Clarke with primary afferent neurones of the ipselateral side. Either or both of these uncrossed tracts may be the path taken by the impulses subserving muscular sense, and there is experi­mental evidence in favour of such a possibility, but the question cannot be considered as definitely answered at present.

Besides the paths followed by headward-running impulses the spinal cord contains paths for impulses passing along it backwards from the brain. These paths lie almost entirely in the ventrolateral columns of the cord. The fibres of which they are composed cross but little in the cord. Their sources are various, some come from the hind brain and some from the mid brain, and in the higher mammalia, especially in man and in the anthropoid apes, a large tract of fibres in the lateral column (the crossed pyramidal tract) comes from the cortex of the neopallium of the fore brain. This last tract is

the main medium by which impulses initiated by electrical stimulation of the motor cortex reach the moto-neurones of the cord and through them influence the activity of the skeletal muscles. Of the function of the other tracts descending from the brain into the cord little is known except that mediately or immediately they excite or inhibit the spinal moto-neurones by various levels. How they harmonize one with another in their action or what their purpose in normal life may be is at present little more than conjecture. Such terms, therefore, as “ paths for volition,” &c., are at present too schematic in their basis to warrant their discussion here. (C. S. S.)

**SPINEL,** a name now given to a group of minerals, of which the typical member is a magnesium aluminate, sometimes used as a gem-stone, to which the term " spinel ” was originally restricted. The name comes from the French *spinelie* (diminutive of Lat. *spina),* perhaps suggested by the sharp angles of the crystals. All spinels crystallize in the cubic system, usually in octahedra, and often twinned as in the accompanying figure, which is a form so characteristic as to be called the "spinel twin.” The hardness of spinel is about that of topaz (8) and its specific gravity near that of diamond. Professor A. H. Church gives the range in variously coloured spinels as 3∙582 to 3∙715. Pure spinel is colourless, but most varieties are coloured, no doubt in many cases with iron and probably in some with chro­mium. The deep red spinel is known as “ spinel-ruby,” or “ ruby-spinel,” and has often been taken for true ruby, from which it is distinguished, however, by being singly refracting and therefore not dichroic, as well as by its inferior hardness and density. The "balas ruby ” is a rose-red spinel, said to derive its name from Balkh, the capital of Badakshan (Balaxia), where it occurs with rubies, and was formerly worked, chiefly in the Shighnan valley, in the upper Oxus basin. Rubicelle is a spinel in which the red colour tends to orange, whilst in almandine-spinel it passes into violet. Stones of the colour of vinegar are called vinegar-spinel. When the colour is blue the mineral is known as sapphire-spinel, and when green as chloro-spinel.

The spinels used in jewelry are found mostly in gem-gravels, where, however, the octahedral form is often well preserved. The chief localities are Ceylon, Siam and Upper Burma. In all these localities the spinels accompany the coloured corun­dums, and their close association with true rubies led Tavernier to call spinel “ the mother of ruby.” Formerly there was much confusion between the two minerals, and probably many stones described as monster rubies have been spinels. The great historic “ ruby” set in the Maltese cross in front of the Imperial state crown of England is really a spinel. This fine stone was given to Edward the Black Prince by Pedro the Cruel, king of Castile, on the victory of Najera in 1367, and it was afterwards worn by Henry V. at the battle of Agincourt, when it narrowly escaped destruction. V. Ball described, in 1894, a spinel weighing 1331/2 carats, engraved with a Persian inscription, then in the possession of Lady Carew.

All the isomorphous minerals known as the group of spinellids, of which spinel is the type, crystallize in regular octahedra and have a composition conforming to the general formula R''R2"'O4 ( = R"O∙R2,"O3). Ordinary spinel is MgAl2O4. A black opaque spinel in which Fe partly replaces Mg is known as pleonaste (*πλεovάστoς*, abundant, from the number of faces on certain crystals) or ceylonite, from the island of Ceylon, but sometimes written ceylanite. It occurs in gneiss, often with cordierite, and is found also in the ejected blocks of Monte Somma, Vesuvius. Large crystals come from Warwick and Amity, Orange county, New York, U.S.A. The black spinels arc generally green or brown when viewed in thin sections by transmitted light. In some cases spinel is evidently a result of contact metamorphism, whilst in others it has crystallized out of a molten magma, as illustrated by the experiments of J. Moro- zewicz. A chrome-spinel with the formula (Mg,Fe) (Al,Fe,Cr)2O4 is named picotite, after Picot de la Peyrouse, who described it. Picotite occurs in the form of black grains and crystals in certain olivine rocks and in serpentine. A black iron-spinel (FeAl2O4),