K_p. Recently Rostoker and Falthammar (*J. Geophys. Res.*, **72**, 5853; 1967) made an extensive detailed comparison and, apart from clinching the close correlation, discovered a relation with the main phases of magnetic storms as well as the more common substorms seen by Fairfield and Cahill.

Rostoker and Falthammar used hourly means of the interplanetary field and, because the duration of a typical substorm is about half an hour, the true correlation may be even stronger than the one they found. Main phases last several hours, and hourly means should be adequate for them, but it should be kept in mind that the interplanetary field can change completely several times in an hour. Rostoker and Falthammar find that, for about 90 per cent of their cases, substorms are associated with a single hourly mean southward component of the interplanetary field of more than about $3\gamma(1\gamma = 10^{-5}$ G), while main phases are associated with two or more consecutive positive values, which need not be quite so strong. They also find that, when the recovery from the main phase is simple, it always occurs when the southward component decreases.

The study of magnetograms both from the ground and from space immediately shows a degree of complication comparable to meteorology, but, just as in meteorology there are some simple associations between kinds of weather and wind directions, there is clearly an association between magnetic storms and the southward interplanetary field.

Cell Wall Amino Alcohols

from our Microbiology Correspondent

LAST year, Tomasz (*Science*, **157**, 694; 1967) reported the occurrence of choline in the cell walls of pneumococci. The precise relationship of choline to the other wall constituents is unresolved, but it appears to be linked co-valently to teichoic acid or polysaccharide entities. The nutritional requirement of pneumococci for choline has been known for many years, but its discovery in cell walls, instead of in phospholipid, has allowed a number of physiological phenomena to be analysed. Tomasz and Mosser have discussed previously the requirement of choline metabolism for genetic "competence", the process whereby exogenous DNA is absorbed and the bacteria are transformed (*Proc. US Nat. Acad. Sci.*, **55**, 58; 1966). In the latest phase of this investigation, Tomasz (*Proc. US Nat. Acad. Sci.*, **59**, 86; 1968) has examined the effects of choline analogues on various cellular properties. The fate of both the mono- and di-methylamino derivatives and the parent member of the series, ethanolamine, has been followed and it seems that pneumococci are unable to methylate ethanolamine or the derivatives to choline. Although ethanolamine (EA), mono-methylamino ethanolamine (MEA) and di-methylamino ethanolamine (DEA) are incorporated into wall material, the physiological properties of the altered walls show a trend towards the normality of the choline-containing cells in the order DEA > MEA > EA.

An obvious effect of ethanolamine on pneumococci was the prevention of cell separation. Long chains of several hundred cells were produced, whereas in choline-supplemented media single and two-celled arrangements were predominant. Furthermore, stationary phase populations of EA-containing cells did not autolyse but remained stable for several weeks; "normal" cells autolysed within 20 h of the onset of stationary conditions. The autolytic enzyme system from choline-grown pneumococci was without action on the EA cells. Pneumococci are sensitive to low concentrations of deoxycholate and lysis follows this treatment; again, the EA cells proved to be resistant, although higher levels of the detergent adversely affected their viability. Perhaps the most interesting data relate to the incapacity of EA cultures to undergo genetic transformation—in other words, loss of competence. All of these abnormal properties could be removed by addition of choline, provided that the culture was still growing: deoxycholate sensitivity reappeared after 10 min, competence after 2 h and cell separation after about 6 h.

All aspects of choline and analogue incorporation into pneumococcal cells walls appear to be identical, which suggests that the amino alcohols are incorporated into a similar wall complex at a finite number of sites. The mechanism of the ethanolamine effects has not been elucidated. It may involve an all-inclusive primary effect inhibiting the action of the autolytic system, or a general disorientation of the wall components which disturbs several independent surface properties. The blocking of competency in cells containing EA is significant as the first unequivocal correlation between a primary wall structure and genetic transformation. Addition of the competence activator protein did not induce competence in the EA cells, neither did such cells produce the activator. Thus these EA-incompetent pneumococci are functionally analogous to the heritable incompetent mutants described previously by Tomasz.

Muscle Building

from our Molecular Biology Correspondent

UNTIL quite recently, the only tractable cell-free protein synthesizing system of mammalian origin was the reticulocyte. This had the great advantage of producing essentially one protein as the end product, which could be isolated and identified. Since then a few other systems have been made to function with reasonable efficiency, the limiting factor in general being the concentration of nucleases present in the tissue. One of the most satisfactory, by virtue of low nuclease activity, and because the ribosomes are not attached to a membrane, is chick embryo muscle. This was shown by Rich and his associates to produce myosin with high efficiency.

The same workers (Heywood and Rich, *Proc. Nat. Acad. Sci. US*, **59**, 590; 1968) now describe a spectacular experiment in which synthesis of the three most prevalent muscle proteins could be separately observed *in vitro*. This result stems from the observation that the extracted polysomes give rise to several populations in a sucrose density-gradient sedimentation. Four fractions were isolated, the heaviest consisting of polysomes made up of 50–60 ribosomes, the second of 15–25 ribosomes, the third of 5–9 ribosomes and the lightest of monomers and dimers. The first three fractions incorporated amino-acids with high efficiency. If it is now assumed that the polysomes are joined by intact messenger RNA, the length of the latter turns out to correspond roughly to the length of *m*RNA molecules specifying polypeptides of molecular weights equiva-