alcohol also reacts, non-enzymatically, with the antennal protein; and both these interactions seem to be necessary for olfactory perception by the cabbage looper.

The close analogies between olfaction and juvenile hormone activity have been pointed out (*J. Insect Physiol.*, **15**, 73; 1969). The hormone likewise must be rapidly inactivated if it is to be kept under control; and the chief mode of inactivation is by means of an esterase which hydrolyses the terpenoid ester to the carboxylic acid, which is devoid of hormonal activity.

KCN and photosystem one

from our Photosynthesis Correspondent

THERE now seems to be no doubt that KCN inhibits photosynthesis by specifically blocking electron flow through photosystem one (S1). It has long been recognised that KCN will inhibit photosynthesis but its mode and site of action have not been clearly understood. Izawa *et al.* (*Biochim. biophys. Acta*, **314**, 328; 1973) now convincingly demonstrate that this compound inhibits electron transfer between cytochrome *f* (cyt *f*) and P700.

Izawa *et al.* used differential spectrophotometry and electron paramagnetic resonance (EPR) to monitor changes in the redox states of these two components which are closely associated with S1 activity. Oxidation of the S1 reaction centre can be detected either by an absorbancy change at 700 nm (for this reason it is called P700) or as an EPR signal with a *g* value of 2.0025. Cyt *f* acts as an electron donor to P700 and is oxidised by light preferentially absorbed by S1 (S1 light). When photosystem two (S2) light is superimposed on S1 light the oxidation levels of cyt *f* and P700 are reduced. These were classical observations first made in Duysen's laboratory in Holland some years ago which clearly demonstrated that S1 and S2 act in series and that cyt *f* and P700 are on the reducing side of the S2 water splitting reaction centre. As expected it was found that in the presence of 3-(3,4-dichlorophenyl)-1, 1-dimethylurea (DCMU), a compound which blocks electron flow from S2 to S1, the reduction of oxidised cyt *f* and P700 by S2 light was inhibited.

Izawa *et al.* were able to demonstrate these properties in their spinach chloroplast preparations, but when the chloroplasts were incubated with KCN, S1 light only photo-oxidised P700 and not cyt *f*. Moreover, when cyt *f* was chemically oxidised the action of S2 light was to reverse this oxidation. On the other hand KCN severely restricted the net flow of electrons from S2 to photo-oxidised P700. These observations indicate without doubt that KCN acts by blocking electron flow between cyt *f* and P700. Izawa and colleagues argue that KCN interacts with plastocyanin, as suggested from *in vitro* experiments, and that this copper containing protein is the intermediate electron carrier between cyt *f* and P700.

Their general ideas have additional support from experiments involving the use of the artificial electron doning agents, diaminodurene, reduced 2.6-dichlorophenol indophenol and reduced N-methylphenazonium methosulphate (PMS) all of which bring about the reduction of oxidised cyt *f* and P700 in DCMU insensitive reactions. It was found with these artificial systems that KCN usually inhibited the reduction of P700 but not cyt *f* although leak past the KCN block was obtained in some conditions such as high PMS concentrations (>30 μM). Unlike normal electron flow this component did not support photophosphorylation.

This work of Izawa *et al.* not only gives good support to an old argument that cyt *f* is not the primary electron donor to S1 but also demonstrates that KCN can be used as a new and powerful tool for investigating S1 reactions in isolated coupled chloroplasts.

Satellites advance geodetic research

from a Correspondent

UNDER the auspices of the International Association of Geodesy, an important symposium on the Earth's gravitational field and secular variations in position was held in Sydney from November 26 to 30.

Through the Earth and Ocean Physics Applications Project (EOPAP) of NASA, the GEOS-C is due to be launched in 1974, and will utilise many of the techniques evolved through the ranging reflectors placed on the Moon by the Apollo astronauts. Many of the papers presented at the symposium described techniques for use with such satellites as elevated targets for ranging with pulsed lasers. The astonishingly high accuracy possible with these new methods will shortly become standard expectations in surveying and in geophysical and oceanographic research.

In an invited presentation, P. V. Angus-Leppan (University of New South Wales) assessed the future prospects for "four-dimensional geodesy", a term which describes the new high-precision techniques for providing position and gravity, and their changes within a short time span. He pointed out that the accuracies of one part in 10^8, which are being approached in these measurements, will shortly allow direct measurements of the velocity of movement of continental plates; from geological inference these plates are currently believed to be moving at a rate of about a few centimetres per year. To achieve the required accuracy, a network of observing stations must be set up on a global scale with international coordination. Angus-Leppan said that each station would constitute the fundamental geodetic observatory for its region and it would include, in a set of comprehensive facilities, laser ranging systems to both the Moon and artificial satellites, an antenna for interconnecting stations by very long baseline interferometry (VLBI), Doppler satellite instruments and a base for absolute gravity measurements.

Progress in the VLBI technique was discussed by several contributors. P. F. MacDoran (Jet Propulsion Laboratory, California Institute of Technology) reported that observations of intense extragalactic radio sources (notably QSOs) with two separated dish antennas operating at S-band wavelengths (13 cm) gave accuracies of a few centimetres for three-dimensional surveying over short separations of 16 km. In addition to measuring variations in universal time, intercontinental baselines (8,400 km) have been measured in VLBI tests between Goldstone, California, and Madrid, Spain. MacDoran predicted that, if a transportable 9 m diameter dish antenna were operated in conjunction with a fixed dish, like the 64 m ones at Goldstone and Madrid, accuracies of a few centimetres in three-dimensional positions would be practical for separations of up to several hundred kilometres, using X-band wavelengths (4 cm).

The importance of accurately calibrated measurements of position and gravity with time was emphasised by the geophysically-minded delegates. These measurements lead to estimates of slow, yet important, lateral and vertical velocities of crustal plates. Direct tests will then be possible for recent theories for predicting earthquakes related to dilatancy of rocks. Four Americans (D. E. Smith, R. Kolenkiewicz, R. W. Agreen and P. J. Dunn) described SAFE which has recently started to use satellite ranging techniques for measuring the motion between two points 900 km apart on opposite sides of the San Andreas fault system in California. Over a 7-yr period, the experimenters believe they will determine the average relative motion of the two sides of the fault to an accuracy of about 5 mm yr^{-1}.

The geoid is defined as the equipotential surface of the Earth's gravitational field corresponding to 'mean sea level', but, as R. S. Mather (University of New South Wales) pointed out, geodetic levelling results and mean sea level (as defined by tide gauge readings) do not correspond. The 'mounds' in the sea, with amplitudes of up to 2 m and wave-