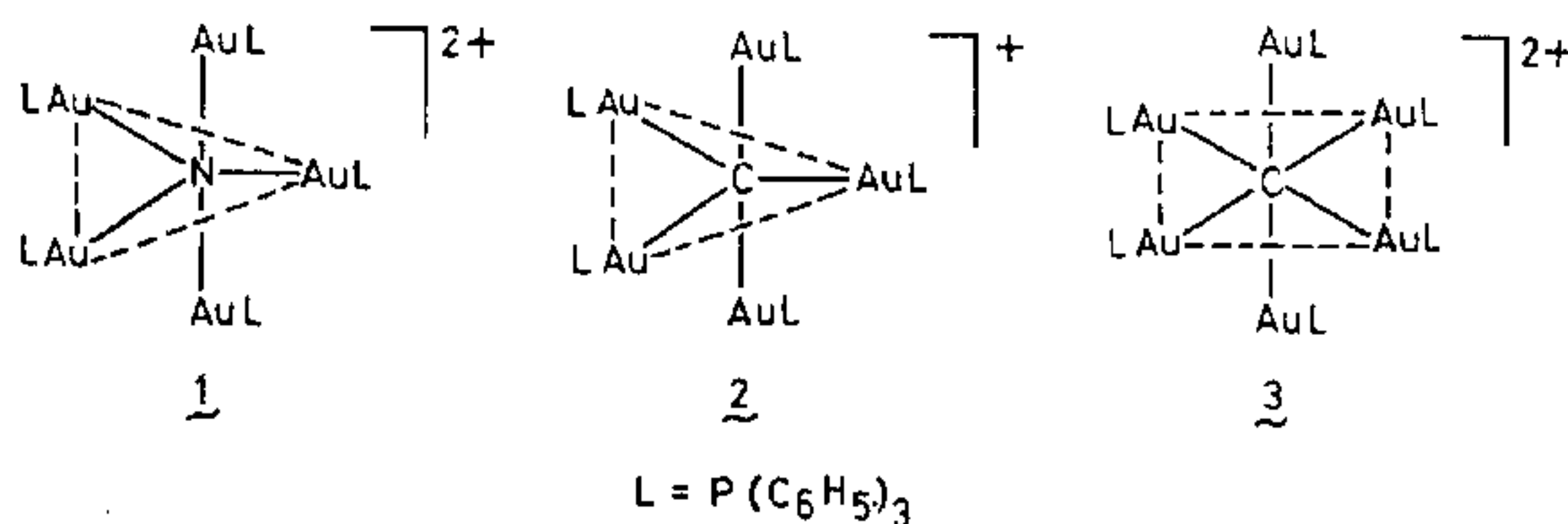
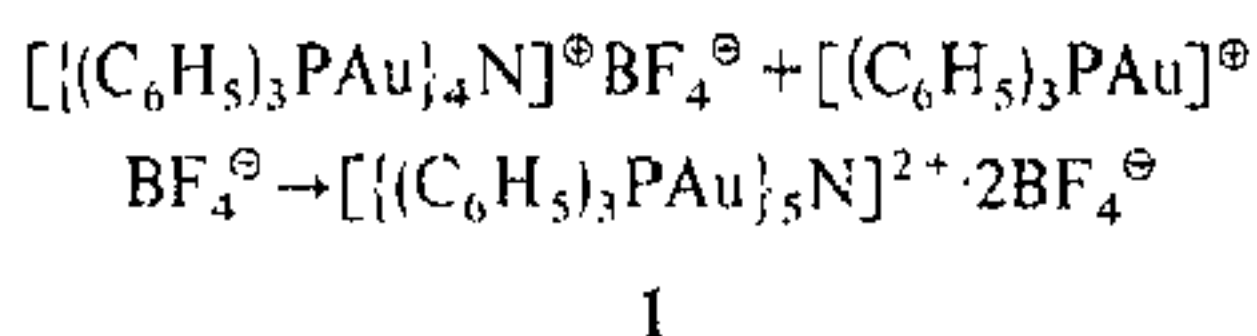


Unusual polynuclear gold compounds containing hyper-coordinated carbon and nitrogen

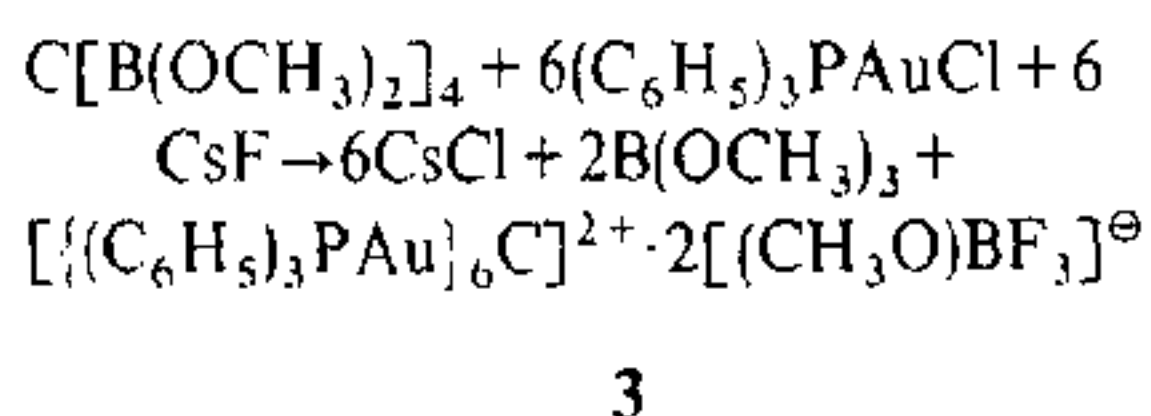
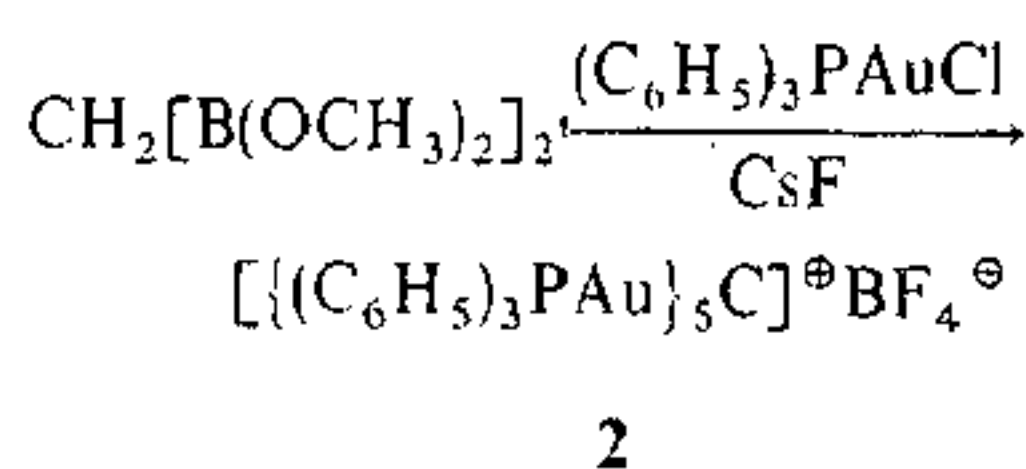
S. S. Krishnamurthy

The tetravalency of carbon has been a central tenet of organic chemistry for well over a century. In later years, several metal organyls have been prepared in which an organic group such as methyl or phenyl forms a bridge between two metal centres. Whilst an element such as phosphorus belonging to the third row of the Periodic Table can expand its valence shell and achieve high coordination numbers as in PF_5 or PF_6^- , such penta- and hexacoordinated nitrogen compounds are not known. Although a recent theoretical study has pointed to the existence of NF_5 as a stable entity¹, all attempts to prepare this compound has proved futile². Now comes the surprising and remarkable discovery by Schmidbauer and his coworkers³ (from the Technical University of Munich, Federal Republic of Germany) of a polynuclear gold compound (1) containing a five coordinated nitrogen. The compound has been synthesized by the following route:



(The anionic part is omitted in these structures)

These authors also briefly mention that another German group has prepared the trication, $[\{(\text{C}_6\text{H}_5)_3\text{PAu}\}_6\text{N}\}^{3+}$ containing a hexacoordinated nitrogen. Schmidbauer's recent report on pentacoordinated nitrogen follows his earlier work^{4,5} on polynuclear gold compounds containing a penta- or a hexacoordinated carbon:



The structures of the unusual compounds 1, 2 and 3 have been confirmed by single crystal X-ray diffraction and are shown in Scheme 1.

The uncovering of the unusual compounds 1, 2 and 3 raises several interesting questions on the nature of bonding in these compounds. Mingos and coworkers⁶ have shown that a

molecular orbital description involving delocalized orbitals can be formulated to explain the nature of bonding in gold clusters. In this respect, the propensity of bonding of the $\text{AuP}(\text{C}_6\text{H}_5)_3$ fragment is similar to that of a hydrogen or a lithium atom. In other words, these groups may be regarded as 'isolobal' a term which implies the presence of 'orbital lobes' for bonding which are similar in their shapes and energies^{7,8}. As Schmidbauer and co-workers conclude, aggregation of gold atoms at small main-group element centers (termed 'aurophilicity') appears to be a general phenomenon.

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