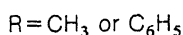
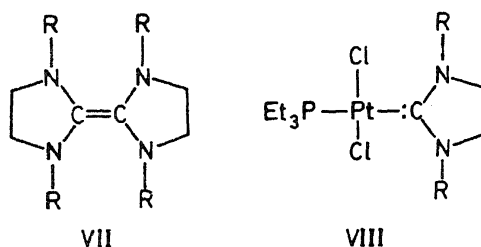


carbenes than meets the eye at first glance.

The year 1981 may be regarded as a watershed in the development of the chemistry of multiple-bonded heavier main-group elements. In that year, stable compounds containing a silicon-carbon, silicon-silicon and phosphorus-phosphorus double bonds were isolated and their structures established by single-crystal X-ray diffraction⁸. The isolation of such compounds was made possible by the incorporation of sterically bulky substituents such as adamantyl or 2,4,6-tris(*tert*-butyl) phenyl groups. It is indeed surprising that it took nearly another decade for the isolation of a carbene such as IV, considering the fact that nucleophilic carbene complexes of the type VIII were investigated extensively by Lappert and coworkers⁹ in the University of Sussex, UK in the early seventies. The carbene complexes of type VIII were prepared from the electron-rich olefin precursor VII, which contains an imidazolidine skeleton. Such are the vagaries and vicissitudes of scientific discoveries: often a small step leading to significant pro-



gress may take several years for no apparent reasons.

The isolation of stable, 'bottleable' carbenes such as IV and VI has opened up a vast area of study of the electronic structures and chemical reactivity of this exciting class of compounds.

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First 3D structure of a DNA virus

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The three-dimensional structure of the single-stranded-DNA (ss-DNA) canine parvovirus reported¹ by Rossmann's group at Purdue University, USA, is the first report of a DNA-virus structure determined at near-atomic resolution by X-ray crystallographic procedures.

Parvoviruses cause a number of diseases in animals, including man. Young or unborn animals are specially susceptible to autonomous parvoviruses. Canine parvovirus is a remarkable example of the emergence of a new pathogen. It spread widely within a few months of its first discovery in 1978 and is now endemic in all populations of canids.

Canine parvovirus particles are spherical in shape, approximately 255 Å in diameter, and have a relative mass of 5.5 to 6.2 million daltons. The viral

protein coat encapsulates an ss-DNA genome of about 5000 nucleotides. The number and type of distinct structural proteins in different parvovirus capsids are variable. Canine parvovirus protein coat consists of 60 copies of a combination of three proteins, VP2, VP3 and VP1. In contrast, empty virus particles—devoid of their DNA—contain predominantly VP2. The viral protein subunits are organized in icosahedral symmetry. Despite the complexity of organization of the protein subunits and nucleic acid, the virus is found to form exceptionally well-ordered crystals under favourable conditions. The three-dimensional structure of this virus has now been determined by X-ray diffraction techniques. Rossmann and coworkers have been able to determine this large structure essentially by exploiting the

phase information hidden in the molecular symmetry of the virus particle. Rossmann himself has been responsible for the development of much of the theoretical background required for structure determination or refinement of biological macromolecules by this method.

The final electron-density map computed at 3.25-Å resolution allowed confident tracing of the 584 residues of VP2, except for the amino-terminal 38 residues. The viral coat protein folds into a structure, a part of which resembles the now familiar eight-stranded β-barrel motif found in several ss-RNA plant and animal viruses (Figure 1). The barrel structure not only conforms to the standard topology, but also includes some of the helical intrusions between β-strands found in the structure