Several $\Delta^5$-pyrrolin-4,5-diones (A) were synthesized by condensation of suitable enamines with oxalyl chloride. Acetophenone methylimine gave 1-Me-2-ph-$\Delta^5$ in 5% yield. Enamines prepared from $\beta$-ketoesters and $\beta$-diketones afforded satisfactory results. Thus, 2-ph-3-COOEt-$\Delta^5$(I), 1-Me-2-ph-3-COOEt-$\Delta^5$(II), Me-2-COOEt-3-phCO-$\Delta^5$, 1-ph-2-COOEt-3-phCO-$\Delta^5$(III) and 1-ph-2-Me-3-COOEt-$\Delta^5$ were prepared. Formation of 1-oxo-2-(\alpha-aminobenzylidene)-succinic anhydride (B) was also observed. B was converted to 2-ph-3-COOH-$\Delta^5$ on short treatment with alkali, and to ph-C(NH$_2$)=CHCO-COOCH$_3$(IV) by heating in MeOH, which afforded 2-ph-$\Delta^5$ on sublimation. $\Delta^5$ (yellow ~ red) easily take up protic solvent to form colorless adducts; these changes were illustrated by UV absorptions.

Heating of I with butadiene in CH$_2$Cl$_2$ or DMF at 120° gave an 1,2-adduct (10%), 2,3-dioxo-4-carboethoxy-5-vinyl-7-phenyl-4,7-cis-bicyclo[3,2,0]1-azacycloheptane (V), while at 180° it gave 1,4-adduct (10%), Diels-Alder product (VI). The former was identical with the photoadduct of I and butadiene, and rearranged by acid treatment to VI. The yield of VI markedly increased by changing the solvent to Ac$_2$O. II gave analogous results, in which Ac$_2$O was not effective. III yielded at 120-140° an 1,4-adduct, Diels-Alder product (VII) and an abnormal adduct, 1-phenyl-2,3-dioxo-4-phenyl-6-vinyl-7-carboethoxy-2,3,6,7,7a-pentahydropyrano[4,3-b]pyrrole in ratio of 1:5, while at 180° it gave only VII.

These evidence indicated that the first step of the reaction is the formation of 1,2-adduct which rearranged thermally to 1,4-adduct. This apparant violence of the Woodward-Hoffman rule can be explained by nucleophilic addition of butadiene to C$_2$, then followed electrophilic C-C bond formation at C$_3$, giving cyclobutane derivative (1,2-adduct), which by 1,3-sigmatropic or ionic manner rearranged to an 1,4-adduct.