The following twelve homologous series have been synthesized and their mesomorphic behaviour studied.

1. **MESOCENS WITH A LATERAL SUBSTITUENT**
   I  \(4'(4''-n\text{-Alkoxybenzoyloxy})-3\text{-methoxy benzaldehydes.}\)
   II \(4'(4''-n\text{-Alkoxybenzoyloxy})-3\text{-methoxy benzylidene-4''-toluidines.}\)
   III \(4'(4''-n\text{-Alkoxybenzoyloxy})-3\text{-methoxy benzylidene-4''-ethyl anilines.}\)
   IV \(4'(4''-n\text{-Alkoxybenzoyloxy})-3\text{-methoxy benzylidene-4''-anisidines.}\)
   V  \(4'(4''-n\text{-Alkoxybenzoyloxy})-3\text{-methoxy benzylidene-4''-phenetidines.}\)
   VI \(4'(4''-n\text{-Alkoxybenzoyloxy})-3\text{-methoxy benzylidene-4''-nitroanilines.}\)

2a. **MESOCENSIC PHENOLS**
   VII \(4'(4''-n\text{-Alkoxybenzoyloxy})\text{benzylidene-4''-aminophenols.}\)
   VII \(4'(4''-n\text{-Alkoxybenzoyloxy})\text{benzylidene-2''-aminophenols.}\)

2b. **MESOCENS WITH TWO ESTER GROUPS**
   IX Methyl \(4'-(4''-n\text{-alkoxybenzoyloxy})\text{benzylidene-4''-aminobenzoates.}\)

3. **MESOCENS WITH AMIDE LINKAGE**
   X \(4'(4''-n\text{-Alkoxybenzoyloxy})-4''-n\text{-heptyloxy benzanilides.}\)
4. HETEROCYCLIC MESOGENS AND THEIR BENZENE ANALOGUES

XI 4(Furylacryloyloxy)benzylidene-4'-n-alkoxyanilines.
XII 4(Cinnamoyloxy)benzylidene-4'-n-alkoxyanilines.

1. MESOGENS WITH A LATERAL SUBSTITUENT

Series (I) is non-mesogenic, whereas the homologous series without a lateral substituent exhibits mesomorphism (177). The absence of mesomorphism in the present series can be attributed to small length-to-breadth ratio due to the introduction of a lateral substituent.

Series (II) to (V) exhibit pure nematic mesophase except the octadecyloxy derivative of series (III) which exhibits smectic mesophase as a monotropic phase along with the nematic phase. The nematic-isotropic transition temperatures exhibit usual odd-even effect. The higher members exhibit nematic mesophase around 80°C to 100°C. Many of the compounds do not crystallize up to 40°C to 50°C due to the marked super cooling tendencies. This may be the useful character for incorporating these mesogens in low-temperature mesogenic mixtures. The group efficiency order obtained for the promotion of nematic mesophase in the present study is similar to the one obtained by Gray (69).
Series (VI) has an end nitro group and it behaves like normal nematogenic homologous series. The nematic-isotropic and smectic-isotropic transition temperature curves exhibit interesting behaviour. The nematic-isotropic transition curves falls and merges with the rising smectic-isotropic curve exhibiting a minimum. The smectic-isotropic transition temperature curve rises to the maximum and then levels off. The nematic-isotropic transition temperature curves exhibits usual odd-even effect and the smectic-nematic transition temperature curve rises as usual. The re-entrant nematic mesophase is not observed in any of the member of the series. Extended group efficiency order for the nematogenic series is similar to the one obtained by Gray (69).

2a. **MESOGENIC PHENOLS**

Series (VII) is the first extensive mesogenic homologous series having a phenolic end group. It behaves like a normal nematogenic homologous series, i.e., first few members are purely nematic, middle members are both smectic and nematic while the last members are purely smectic in nature. The nematic-isotropic transition temperatures exhibit usual odd-even effect. The intermolecular hydrogen bonding present in the compounds of series (VII) make them thermally stable, but the thermal stabilities of the series are not as high as expected to justify the presence of intermolecular
hydrogen bonding. This behaviour is explained by postulating a secondary structure arising out of the intermolecular hydrogen bonding between nitrogen of azomethine linkage and the hydrogen of end phenolic group. Both the types of hydrogen bondings are supported by IR spectra.

Series (VIII) has a lateral phenolic group, hence it is shorter and little broader than series (VII). It is thermally less stable compared to series (VII), but is more smectogenic. The smectic mesophase appears quite early and the nematic mesophase is eliminated early in the series. This behaviour can be attributed to the intramolecular hydrogen bonding which is supported by IR spectra. The plot of transition temperatures versus number of the carbon atoms in alkoxy chain exhibits similar trend observed in the case of series (VI). The nematic-isotropic transition temperature curve exhibits a minimum. Even though smectic mesophase appears quite early in the series, smectic-nematic transition temperature curve does not alternate. This may probably be due to the steep rise in smectic-nematic transition temperatures.

2b. MESOGENS WITH TWO ESTER GROUPS

Series (IX) possesses two ester groups, one as a central linkage and other as an end group. The smectic and nematic thermal stabilities are very high compared to other end groups. The smectic mesophase commences quite early in the series due
to the smectic inducing tendency of an ester group as its dipole is acting across the major axes of the molecules. The nematic mesophase is eliminated early in the series making the last members purely smectic. The nematic-isotropic transition temperatures exhibit alternation for odd and even carbon atoms. The smectic-nematic transition temperatures do not exhibit such alternations.

3. **MESOGENS WITH AMIDE LINKAGE**

Series (X) has an ester and an amide linkages. It is the first extensive mesogenic homologous series having an amide central linkage. It is believed that the amide linkage will be deterrent to the mesogenic properties, but the comparision of the smectic and nematic thermal stabilities of the present series (X) with the other related mesogenic homologous series reveals that the amide linkage imparts much higher smectic and nematic thermal stabilities contradicting the above belief. The presence of intermolecular hydrogen bonding also contributes to the mesogenic thermal stabilities. The IR spectra confirms the intermolecular hydrogen bonding. Smectic mesophase commences from ethoxy derivative. The nematic-isotropic transition temperature curves exhibit usual odd-even effect. It is interesting to note that the smectic-nematic transition temperatures also exhibit odd-even alternations. For the first time the effect of an amide central linkage on mesomorphism is evaluated.
4. METEROCYCLIC MESOGENS AND THEIR BENZENE ANALOGUES

Series (XI) contains a furyl group at one end while in series (XII) the furyl group is replaced by phenyl group. The mesogenic characters of both these series are almost similar. There is very little difference in the thermal stabilities of these two series. This implies that the presence of an oxo-heterocyclic ring, at one end of the molecules is not much deterrent to the mesophase thermal stabilities.