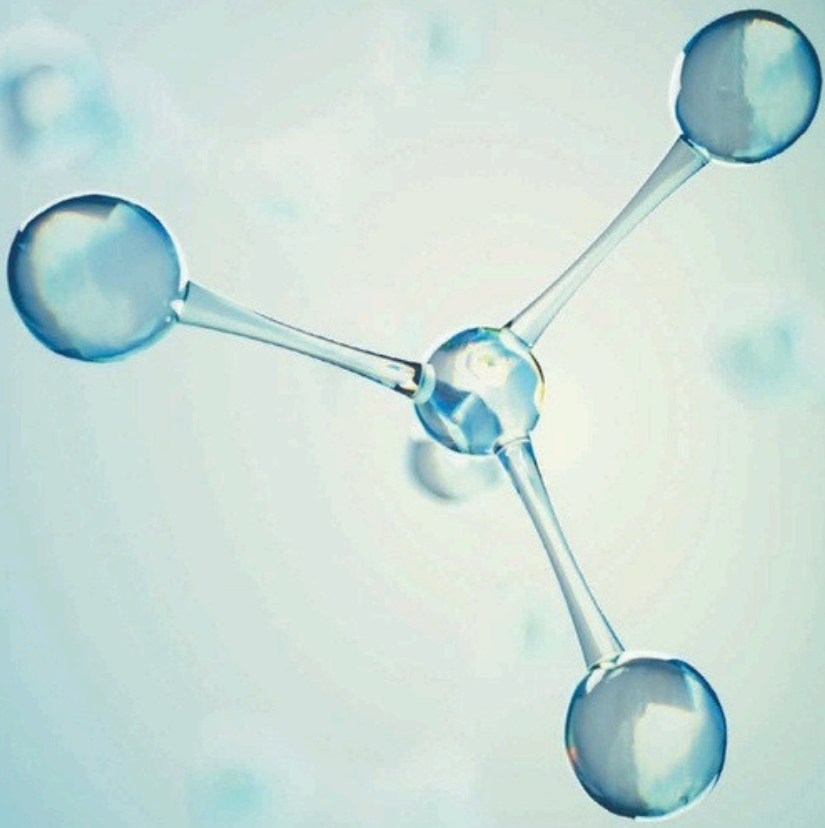
PHOSPHORAMIDITES

KOLON LIFE SCIENCE

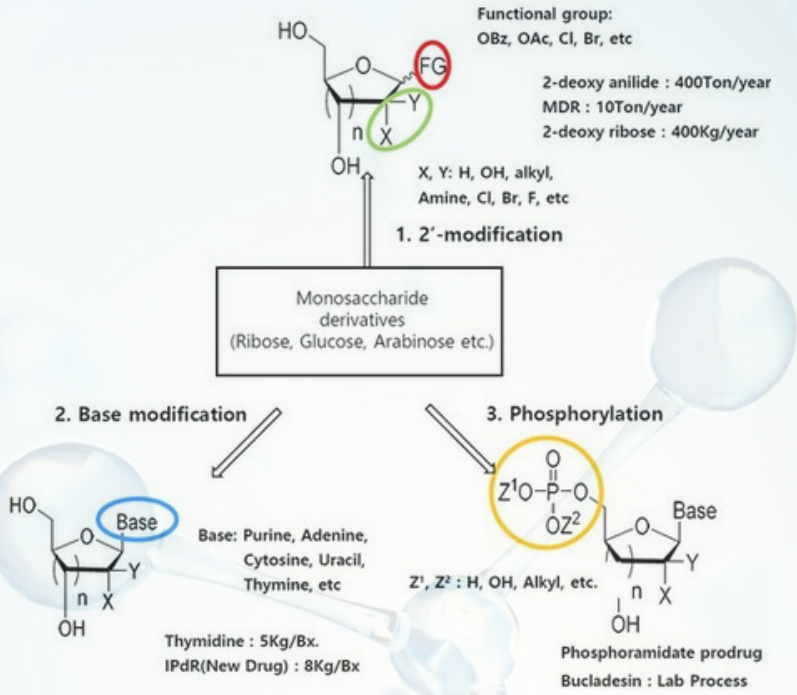


SPE
Summit Pharmaceuticals Europe

Overview

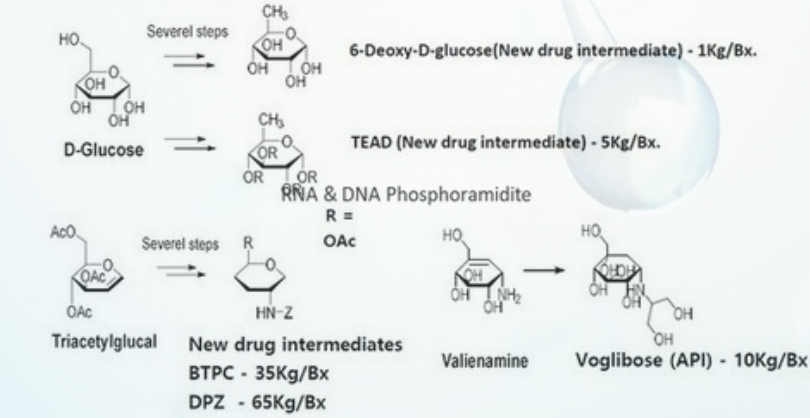
Kolon has been supplying refined high-purity APIs and Intermedites using our core techbnology, Sugar Chemistry. Our sugar chemistry consists of (1) control of functional groups (2) various refinement & crystallization methods (3) scale-up experience

KLS Sugar / Nucleoside Chemistry

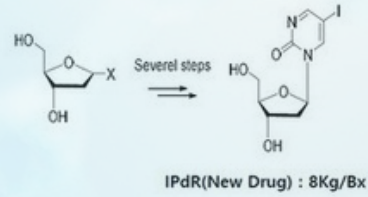


New Drug Intermediate / API

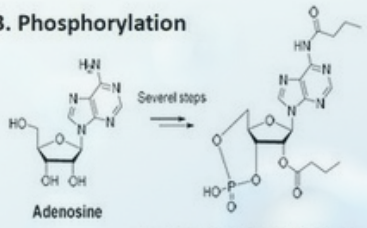
1. 2'-Modification derivatives



2. Base modification



3. Phosphorylation

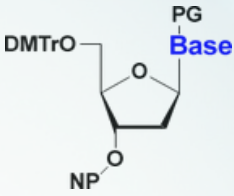


Product List

Kolon has completed the synthesis of 23 Phosphoramidites through sugar / nucleoside chemistry.
Each of them can incorporate flow chemistry, scale up, specific quality control and customization

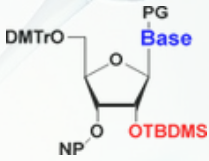
DNA Phosphoramidites

·dA(Bz)-CE Phosphoramidite (98796-53-3)
·dC(Bz)-CE Phosphoramidite (102212-98-6)
·dC(Ac)-CE Phosphoramidite (154110-40-4)
·5mC-dC(Bz)-CE Phosphoramidite (105931-57-5)
·dG(iBu)-CE Phosphoramidite (93183-15-4)
·dT-CE Phosphoramidite (98796-51-1)



TBDMS-RNA Phosphoramidites

·rA(Bz)-CE Phosphoramidite (104992-55-4)
·rC(Ac)-CE Phosphoramidite (121058-88-6)
·rG(iBu)-CE Phosphoramidite (147201-04-5)
·rG(dmf)-CE Phosphoramidite (149559-87-5)
·rU-CE Phosphoramidite (118362-03-1)



2'-Modified Phosphoramidites (2'-OMe)

·2'-OMe rA(Bz)-CE Phosphoramidite (110782-31-5)
·2'-OMe rC(Ac)-CE Phosphoramidite (199593-09-4)
·2'-OMe rG(iBu)-CE Phosphoramidite (150780-67-9)
·2'-OMe rU-CE Phosphoramidite (110764-79-9)

2'-Modified Phosphoramidites (2'-OMOE)

·2'-MOE rA(Bz)-CE Phosphoramidite (251647-53-7)
·2'-MOE 5mC(Bz)-CE Phosphoramidite (163759-94-2)
·2'-MOE rG(iBu)-CE Phosphoramidite (251647-55-9)
·2'-MOE 5mU-CE Phosphoramidite (163878-63-5)

2'-Modified Phosphoramidites (2'-F)

·2'-F dA(Bz)-CE Phosphoramidite (136834-22-5)
·2'-F dC(Ac)-CE Phosphoramidite (159414-99-0)
·2'-F dG(iBu)-CE Phosphoramidite (144089-97-4)
·2'-F dU-CE Phosphoramidite (146954-75-8)

Quality Control

As the basic quality control methods for Phosphoramidites, Kolon conducts **^{1}H NMR, ^{31}P NMR, UV, TLC,HPLC, GC/MS and MASS Spectrum** are used for stricter management of impurities that has adverse effects on Oligo synthesis.

- ^{1}H NMR
- ^{31}P NMR
- UV –The UV test provides 4 values of data
- TLC
- HPLC >98%
- LC/MS
- GC/MS
- ESI-MS

Differentiation

- Securing product competitiveness through differentiated process development
- Preoccupation of the market through early establishment of GMP process

Stage 1. Fast Follower

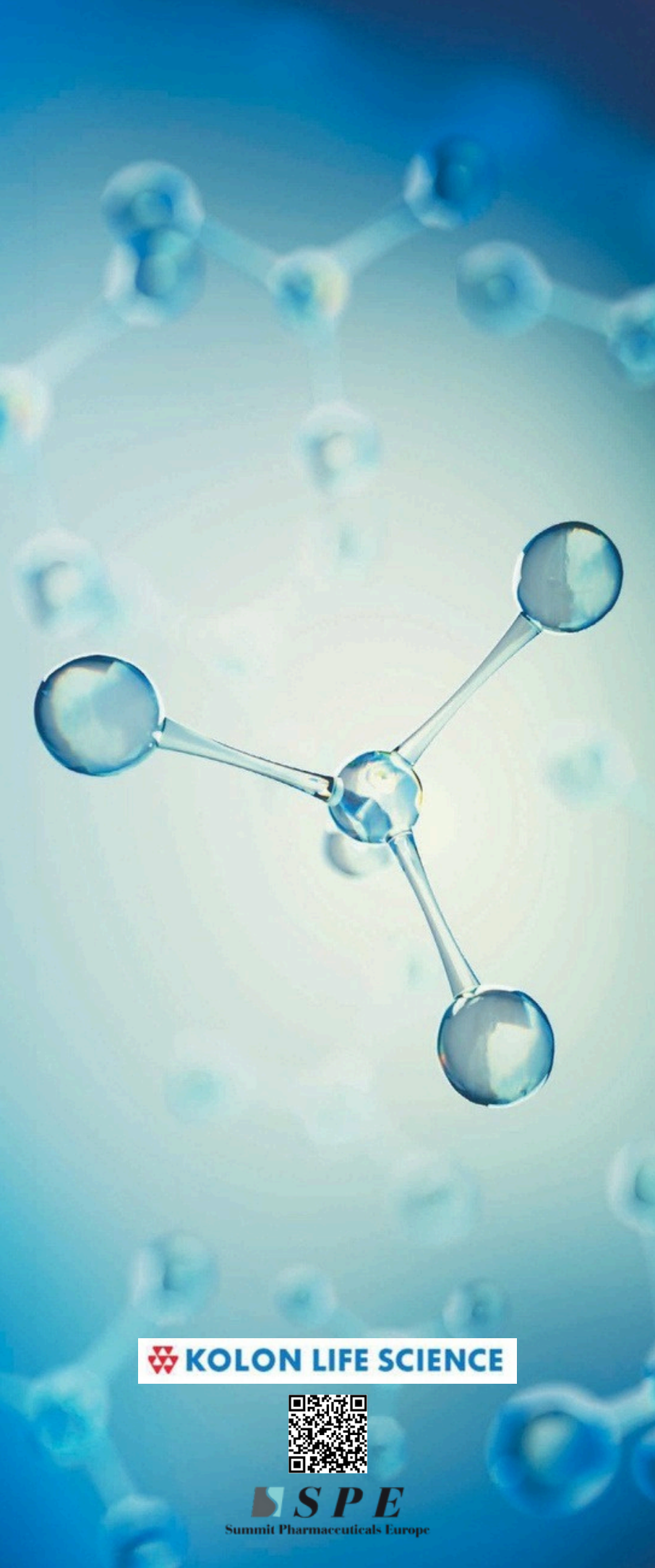
- **Completion of general-purpose phosphoramidite development through competitor's product analysis**
  · Continuously expanding the product portfolio with customer requests
- **Collaboration with top 3 oligonucleotide makers around the world**

Stage 2. Differentiation

- **Securing cost competitiveness through differentiated process development**
  · Reduce manufacturing costs by developing switchable continuous manufacturing process suitable for small-scale multi-variety production
  · Development of crystallization process to replace column process
- **Diversification of Portfolio and development of customization**
  · Development of a product line that can be used to manufacturer oligonucleotides in the future (Diester, Triester, etc.)
  · Development of various product lines to meet customer needs (Back-bone modification, 5'-capping, etc.)

Stage 3. First Mover

- **Production facility of 300 KG per year in the Kilo-Lab Center in 2025**
- **A production base of 3 MT per year will be established in the GMP plant in 2027**
  · There is a high probability that regulation will be strengthened as the RNA market grows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