

# Genomica Marina

## Epigenetics

*Principles:* epigenetics and chromatin dynamics; nucleosome positioning; histone modifications; chromatin remodeling complexes.

*Methods:* MNase digestion, FAIRE (Formaldehyde Assisted Isolation of Regulatory Elements), ChIP (Chromatin ImmunoPrecipitation), MSP (Methylation-Specific PCR), COBRA (Combined Bisulfite Restriction Analysis), MeDIP (Methyl-DNA ImmunoPrecipitation), 3C (Chromosome Conformation Capture).

*Applications in marine biology:* Examples from recently published papers.

## mRNA turnover regulation

*Principles:* Molecular mechanisms of decay. Cytoplasmic surveillance mechanisms. Regulation of mRNA stability by ARE sequences and ARE-binding proteins. Alternative PolyAdenylation (APA). UPR (Unfolded Protein Response).

*Methods:* NORTHERN BLOTTING, DOT PLOT, PCR (Polymerase Chain Reaction), qPCR (quantitative PCR), MICROARRAY, HIGH-THROUGHPUT SEQUENCING TECHNOLOGIES, *in situ* hybridization (ISH), RUN-ON, PULSE & CHASE.

*Applications in marine biology:* Examples from recently published papers.

## Protein synthesis regulation

*Principles:* Regulation of global and specific mRNA translation. Regulation of polyA tail length.

*Methods:* Polysome Profiling. Western blotting and 2-DE (Two dimensional gel electrophoresis).

*Applications in marine biology:* Examples from recently published papers.

## Genome Editing

Methods and applications in marine biology: ZFNs, TALENs, CRISPR/Cas9.

## Bioinformatic tools

Methods and applications in marine biology: DATABASEs, alignment programs.

## Practical Activities

RNA extraction and analysis by qPCR method.

## COURSE MATERIAL:

- **Lecture notes**
- **scientific reviews:**

1. Bell O, Tiwari VK, Thomä NH, Schübeler D. 2011. Determinants and dynamics of genome accessibility. *Nat Rev Genet.* 12:554-564.
2. Wu X, Brewer G. 2012. The regulation of mRNA stability in mammalian cells: 2.0. *Gene.* 500:10-21.
3. Kong J, Lasko P. 2012. Translational control in cellular and developmental processes. *Nat Rev Genet.* 13:383-394.
4. LaFontaine JS, Fathe K, Smyth HD. 2015. Delivery and therapeutic applications of gene editing technologies ZFNs, TALENs, and CRISPR/Cas9. *Int J Pharm.* 494:180-194.