

## CURRICULUM VITAE

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### Personal Information

Name: MORIHIRO Kunihiro  
Date of Birth: July 24, 1984  
Place of Birth: Shimane, Japan  
Gender: Male  
Nationality: Japanese  
Present Address: Department of Chemistry and Biotechnology, Graduate School of Engineering, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan  
E-mail: morihiro@chembio.t.u-tokyo.ac.jp  
Language: Japanese and English

### Education/Career

2008.3 **B.Sc**  
Department of Pharmaceutical Sciences, Osaka University  
(Professor Takeshi Imanishi)

2010.3 **M.Sc**  
Graduate School of Pharmaceutical Sciences, Osaka University  
(Professor Satoshi Obika)

2013.3 **Ph.D.**  
Graduate School of Pharmaceutical Sciences, Osaka University  
(Professor Satoshi Obika)

2013.4-2015.3 **Postdoctoral Fellow**  
National Institute of Biomedical Innovation (NIBIO) (Invited Project Leader Satoshi Obika)

2015.4-2017.2 **JSPS Postdoctoral Fellow for Research Abroad**  
Department of Chemistry, University of Pittsburgh, United States  
(Professor Alexander Deiters)

2017.3-2024.1 **Research Associate**  
Department of Chemistry and Biotechnology, Graduate School of Engineering, The University of Tokyo (Professor Akimitsu Okamoto)

2024.2- **Associate Professor**

Department of Chemistry and Biotechnology, Graduate School of Engineering, The University of Tokyo (Professor Akimitsu Okamoto)

#### Fellowships and Grant

2023.4-2026.3	AMED Innovative Drug Discovery and Development
2022.4-2023.3	JST ACT-X Acceleration Phase
2021.4-2024.3	JSPS Grant-in-Aid for Scientific Research(C)
2020.4-2022.3	JSPS Grant-in-Aid for Scientific Research on Innovative Areas
2019.10-2022.3	JST ACT-X
2019.4-2021.3	JSPS Grant-in-Aid for Young Scientists
2015.4-2017.2	JSPS Postdoctoral Fellowship for Research Abroad
2013.8-2015.3	JSPS Grant-in-Aid for Research Activity Start-up
2010.4-2013.3	JSPS Research Fellowship for Young Scientists (DC1)

#### Publication (\*Corresponding Author(s))

- 40) "Selective Inhibition of Cancer Cell Migration Using a pH-Responsive Nucleobase-Modified DNA Aptamer"  
Yuyuan Chen, **Kunihiko Morihiko**\* (co-first author), Yui Nemoto, Akito Ichimura, Ryosuke Ueki, Shinsuke Sando, Akimitsu Okamoto\*  
*Chem. Sci.* in press.
- 39) "Fluorocarbon–DNA Conjugates for Enhanced Cellular Delivery: Formation of a Densely Packed DNA Nano-Assembly"  
Minako Narita, Ai Kohata\*, Taiichi Kageyama, Honoka Watanabe, Kohsuke Aikawa\*, Daisuke Kawaguchi, **Kunihiko Morihiko**, Akimitsu Okamoto, Takashi Okazoe  
*ChemBioChem* **2024**, e202400436.
- 38) "Copper-Mediated siRNA Activation for Conditional Control of Gene Expression"  
**Kunihiko Morihiko**\*, Yasuhiro Tomida, Honami Ando, Akimitsu Okamoto\*  
*Bioorg. Med. Chem. Lett.* in press.
- 37) "RNA Oncologic Therapeutics: Intracellular Hairpin RNA Assembly Enables MicroRNA-Triggered Anticancer Functionality"  
**Kunihiko Morihiko**\*, Shunto Morita, Manami Baba, Naoki Harada, Jongmin Yum, Mitsuru Naito, Kanjiro Miyata, Genta Nagae, Akimitsu Okamoto\*  
*J. Am. Chem. Soc.* **2024**, 146, 1346-1355.
- 36) "Cellular Penetration and Intracellular Dynamics of Perfluorocarbon-Conjugated DNA/RNA as a Potential Means of Conditional Nucleic Acid Delivery"

Masako Takatsu, **Kunihiko Morihiko** (co-first author), Honoka Watanabe, Mizue Yuki, Takara Hattori, Kentaro Noi, Kohsuke Aikawa,\* Keiichi Noguchi, Masafumi Yohda, Takashi Okazoe, Akimitsu Okamoto\*

*ACS Chem. Biol.* **2023**, *18*, 2590-2598.

- 35) "Nucleic Acid-to-Small Molecule Converter through Amplified Hairpin DNA Circuits"  
**Kunihiko Morihiko**\*, Yasuhiro Tomida, Daisuke Fukui, Manami Hasegawa, Akimitsu Okamoto\*  
*Angew. Chem. Int. Ed.* **2023**, *62*, e202306587.
- 34) "Interstrand Crosslinking Oligonucleotides Elucidate the Influence of Metal Ions on Methylation Status in Repetitive DNA Elements"  
Liu Shan, **Kunihiko Morihiko** (co-first author), Fumika Takeuchi, Yufeng Li, Akimitsu Okamoto\*  
*Front. Chem.* **2023**, *11*, 1122474. (Invited article)
- 33) "Oncolytic Hairpin DNA Pair: Selective Cytotoxic Inducer through MicroRNA-Triggered DNA Self-Assembly"  
**Kunihiko Morihiko**\*, Hiraki Osumi, Shunto Morita, Takara Hattori, Manami Baba, Naoki Harada, Riuko Ohashi, Akimitsu Okamoto\*  
*J. Am. Chem. Soc.* **2023**, *145*, 135-142.  
*Selected as the supplementary cover art*  
*Recommended in Faculty Opinions*
- 32) "Identification of Nucleobase Chemical Modifications that Reduce the Hepatotoxicity of Gapmer Antisense Oligonucleotides"  
Tokuyuki Yoshida, **Kunihiko Morihiko** (co-first author), Yuki Naito, Atsushi Mikami, Yuuya Kasahara, Takao Inoue\*, Satoshi Obika\*  
*Nucleic Acids Res.* **2022**, *50*, 7224-7234.
- 31) "*anti-syn* Unnatural Base Pair Enables Alphabet-Expanded DNA Self-Assembly"  
**Kunihiko Morihiko**, Yuya Moriyama, Yui Nemoto, Hiraki Osumi, Akimitsu Okamoto\*  
*J. Am. Chem. Soc.* **2021**, *143*, 14207-14217.
- 30) "Floxuridine Oligomers Activated under Hypoxic Environment"  
**Kunihiko Morihiko**, Takuro Ishinabe, Masako Takatsu, Hiraki Osumi, Tsuyoshi Osawa, Akimitsu Okamoto\*  
*J. Am. Chem. Soc.* **2021**, *143*, 3340-3347.
- 29) "Azobenzene-Modified DNA Aptamers Evolved by Capillary Electrophoresis (CE)-SELEX Method"  
**Kunihiko Morihiko**\*, Osamu Hasegawa, Yuuya Kasahara, Shohei Mori, Toshiro Kasai, Masayasu Kuwahara, Satoshi Obika\*  
*Bioorg. Med. Chem. Lett.* **2021**, *31*, 127607.

- 28) "Synthesis and Evaluation of Artificial Nucleic Acid Bearing an Oxanorbornane Scaffold"  
Hibiki Komine, Shohei Mori, **Kunihiko Morihiro**\*, Kenta Ishida, Takumi Okuda, Yuuya Kasahara, Hiroshi Aoyama, Takao Yamaguchi\*, Satoshi Obika\*  
*Molecules* **2020**, 25, 1732. (Invited article)
- 27) "Live Cell Sensing of Telomerase Activity by Hybridization-Sensitive Fluorescent Oligonucleotide Probes"  
Jiazhao Chen, **Kunihiko Morihiro** (co-first author), Daisuke Fukui, Lihao Guo, Akimitsu Okamoto\*  
*ChemBioChem* **2020**, 21, 1022-1027.
- 26) "A Highly Constrained Nucleic Acid Analog Based on  $\alpha$ -L-Threosamine"  
**Kunihiko Morihiro**, Akimitsu Okamoto\*  
*Nucleosides Nucleotides Nucleic Acids* **2020**, 39, 270-279. (Invited article)
- 25) "Phosphine-Activated Lysine Analogues for Fast Chemical Control of Protein Subcellular Localization and SUMOylation"  
Joshua S. Wesalo, Ji Luo, **Kunihiko Morihiro**, Jihe Liu, Alexander Deiters\*  
*ChemBioChem* **2020**, 21, 141-148.  
*Selected as a Very Important Paper*  
*Selected as a Cover Feature*
- 24) "A Hydrogen Peroxide-Activatable Gemcitabine Prodrug for the Selective Treatment of Pancreatic Ductal Adenocarcinoma"  
Katsunori Matsushita, Takumi Okuda, Shohei Mori, Masamitsu Konno, Hidetoshi Eguchi, Ayumu Asai, Jun Koseki, Yoshifumi Iwagami, Daisaku Yamada, Hirofumi Akita, Tadafumi Asaoka, Takehiro Noda, Koichi Kawamoto, Kunihito Gotoh, Shogo Kobayashi, Yuuya Kasahara, **Kunihiko Morihiro**, Taroh Satoh, Yuichiro Doki, Masaki Mori, Hideshi Ishii\*, Satoshi Obika\*  
*ChemMedChem* **2019**, 14, 1384-1391.  
*Selected as the outside front cover art*
- 23) "Aryl Azides as Phosphine-Activated Switches for Small Molecule Function"  
Bradley Lukask, **Kunihiko Morihiro**, Alexander Deiters\*  
*Sci. Rep.* **2019**, 9, 1470.
- 22) "Hydrogen Peroxide-Triggered Gene Silencing in Mammalian Cells through Boronated Antisense Oligonucleotides"  
Shohei Mori, **Kunihiko Morihiro**\*, Takumi Okuda, Yuuya Kasahara, Satoshi Obika\*  
*Chem. Sci.* **2018**, 9, 1112-1118.  
*Selected as the outside front cover art*
- 21) "Small Molecule Release and Activation through DNA Computing"

**Kunihiko Morihiko**, Nicholas Ankenbruck, Bradley Lukasak, Alexander Deiters\*

*J. Am. Chem. Soc.* **2017**, *139*, 13909-13915.

- 20) "Synthesis and Properties of 7-Deazapurine and 8-Aza-7-Deazapurine Locked Nucleic Acid Analogs: The Effect of Glycosidic Torsion Angle"

Takashi Hara, Tetsuya Kodama,\* Yumi Takegaki, **Kunihiko Morihiko**, Kosuke Ramon Ito, Satoshi Obika\*

*J. Org. Chem.* **2017**, *82*, 25-36.

*Selected as a Featured Article*

- 19) "Biological Applications of Xeno Nucleic Acids"

**Kunihiko Morihiko**, Yuuya Kasahara, Satoshi Obika\*

*Mol. Biosyst.* **2017**, *13*, 235-245. (Invited Review)

*Selected as the outside front cover art*

- 18) "Systematic Evaluation of Biophysical and Functional Characteristics of Selenomethylene Locked Nucleic Acid Mediated Inhibition of miR-21"

Smita Nahar, Amrita Singh, **Kunihiko Morihiko**, Yoshihiro Moai, Tetsuya Kodama, Satoshi Obika, Souvik Maiti\*

*Biochemistry* **2016**, *55*, 7023-7032.

- 17) "Small Molecule Control of Protein Function through Staudinger Reduction"

Ji Luo, Qingyang Liu, **Kunihiko Morihiko**, Alexander Deiters\*

*Nat. Chem.* **2016**, *8*, 1027-1034.

- 16) "Synthesis and Properties of 4-(Diarylmethylene)imidazolinone-Conjugated Fluorescent Nucleic Acids"

Takumi Okuda, Shohei Mori, Yuuya Kasahara, **Kunihiko Morihiko**, Masahiro Ikejiri, Kazuyuki Miyashita, Satoshi Obika\*

*Tetrahedron Lett.* **2016**, *14*, 3129-3132.

- 15) "Wavelength-Selective Light-Triggered Strand Exchange Reaction"

**Kunihiko Morihiko**, Tetsuya Kodama, Shohei Mori, Shin-ichi Tsunoda, Satoshi Obika\*

*Org. Biomol. Chem.* **2016**, *14*, 1555-1558.

- 14) "Consecutive Incorporation of Functionalized Nucleotides with Amphiphilic Side Chains by Novel KOD Polymerase Mutant"

Hidekazu Hoshino, Yuuya Kasahara, Hiroto Fujita, Masayasu Kuwahara,\* **Kunihiko Morihiko**, Shin-ichi Tsunoda, Satoshi Obika\*

*Bioorg. Med. Chem. Lett.* **2016**, *26*, 530-533.

- 13) "Polymerase Incorporation of a 2'-Deoxynucleoside-5'-Triphosphate Bearing a 4-Hydroxy-2-Mercaptobenzimidazole Nucleobase Analogue"

**Kunihiko Morihiko**,\* Hidekazu Hoshino, Osamu Hasegawa, Yuuya Kasahara, Kohsuke Nakajima, Masayasu Kuwahara, Shin-ichi Tsunoda, Satoshi Obika\*

*Bioorg. Med. Chem. Lett.* **2015**, 25, 2888-2891.

- 12) "C5-Azobenzene-Functionalized Locked Nucleic Acid Uridine: Isomerization Property, Hybridization Ability, and Enzymatic Stability"

**Kunihiko Morihiko**,\* Osamu Hasegawa, Shohei Mori, Shin-ichi Tsunoda, Satoshi Obika\*

*Org. Biomol. Chem.* **2015**, 13, 5209-5214.

- 11) "Synthesis and Properties of 2'-Deoxyuridine Analogues Bearing Various Azobenzene Derivatives at the C5 Position"

Shohei Mori, **Kunihiko Morihiko**,\* Yuuya Kasahara, Shin-ichi Tsunoda, Satoshi Obika\*

*Chemosensors* **2015**, 3, 36-54. (Invited Paper)

- 10) "C5-Azobenzene-substituted 2'-Deoxyuridine-Containing Oligodeoxynucleotides for Photo-Switching Hybridization"

Shohei Mori, **Kunihiko Morihiko**,\* Satoshi Obika\*

*Molecules* **2014**, 19, 5109-5118. (Invited Paper)

- 9) "Synthesis and Characterization of Benzylidene Acetal Type Bridged Nucleic Acids (BA-BNAs)"  
Tetsuya Kodama, **Kunihiko Morihiko**, Satoshi Obika\*

*Curr. Protoc. Nucleic Acid Chem.* **2014**, 1.31.1-1.31.22. (Invited Protocol)

- 8) "Development of External Stimuli-Responsive Nucleic Acids by Sugar-, Backbone- and Nucleobase-Modification"

**Kunihiko Morihiko**, Tetsuya Kodama, Satoshi Obika\*

*Synlett* **2014**, 25, 1499-1510. (Invited Account)

- 7) "Photoinduced Changes in Hydrogen Bonding Patterns of 8-Thiopurine Nucleobase Analogues in a DNA Strand"

**Kunihiko Morihiko**, Tetsuya Kodama, Shohei Mori, Satoshi Obika\*

*Org. Biomol. Chem.* **2014**, 12, 2468-2473.

- 6) "Light-Triggered Strand Exchange Reaction Using the Change in the Hydrogen Bonding Pattern of a Nucleobase Analogue"

**Kunihiko Morihiko**, Tetsuya Kodama, Reiko Waki, Satoshi Obika\*

*Chem. Sci.* **2014**, 5, 744-750.

- 5) "Selenomethylene Locked Nucleic Acid Enables Reversible Hybridization in Response to Redox Changes"

**Kunihiko Morihiko**, Tetsuya Kodama, Kentefu, Yoshihiro Moai, Rakesh N. Veedu, Satoshi Obika\*

*Angew. Chem. Int. Ed.* **2013**, 52, 5074-5078.

- 4) "Synthesis of Selenomethylene-Locked Nucleic Acid (SeLNA)-Modified Oligonucleotides by Polymerases"  
Megan Wheeler, Antoine Chardon, Astrid Goubet, **Kunihiko Morihiko**, Sze Yee Tsan, Stacey L. Edwards, Tetsuya Kodama, Satoshi Obika, Rakesh N. Veedu\*  
*Chem. Commun.* **2012**, 48, 11020-11022.
- 3) "Benzylidene Acetal Type Bridged Nucleic Acids: Changes in Properties upon Cleavage of the Bridge Triggered by External Stimuli"  
**Kunihiko Morihiko**, Tetsuya Kodama, Satoshi Obika\*  
*Chem. Eur. J.* **2011**, 17, 7918-7926.
- 2) "Effect of 3'-End Capping of Aptamer with Various 2',4'-Bridged Nucleotides: Enzymatic Post-modification toward a Practical Use of Polyclonal Aptamers"  
Yuuya Kasahara, Shunsuke Kitadume, **Kunihiko Morihiko**, Masayasu Kuwahara,\* Hiroaki Ozaki, Hiroaki Sawai, Takeshi Imanishi, Satoshi Obika  
*Bioorg. Med. Chem. Lett.* **2010**, 20, 1626-1629.
- 1) "Synthesis of Light-Responsive Bridged Nucleic Acid and Change in Affinity with Complementary ssRNA"  
**Kunihiko Morihiko**, Tetsuya Kodama, Masaru Nishida, Takeshi Imanishi, Satoshi Obika\*  
*ChemBioChem* **2009**, 10, 1784-1788.