

## **BAB 5**

### **SIMPULAN**

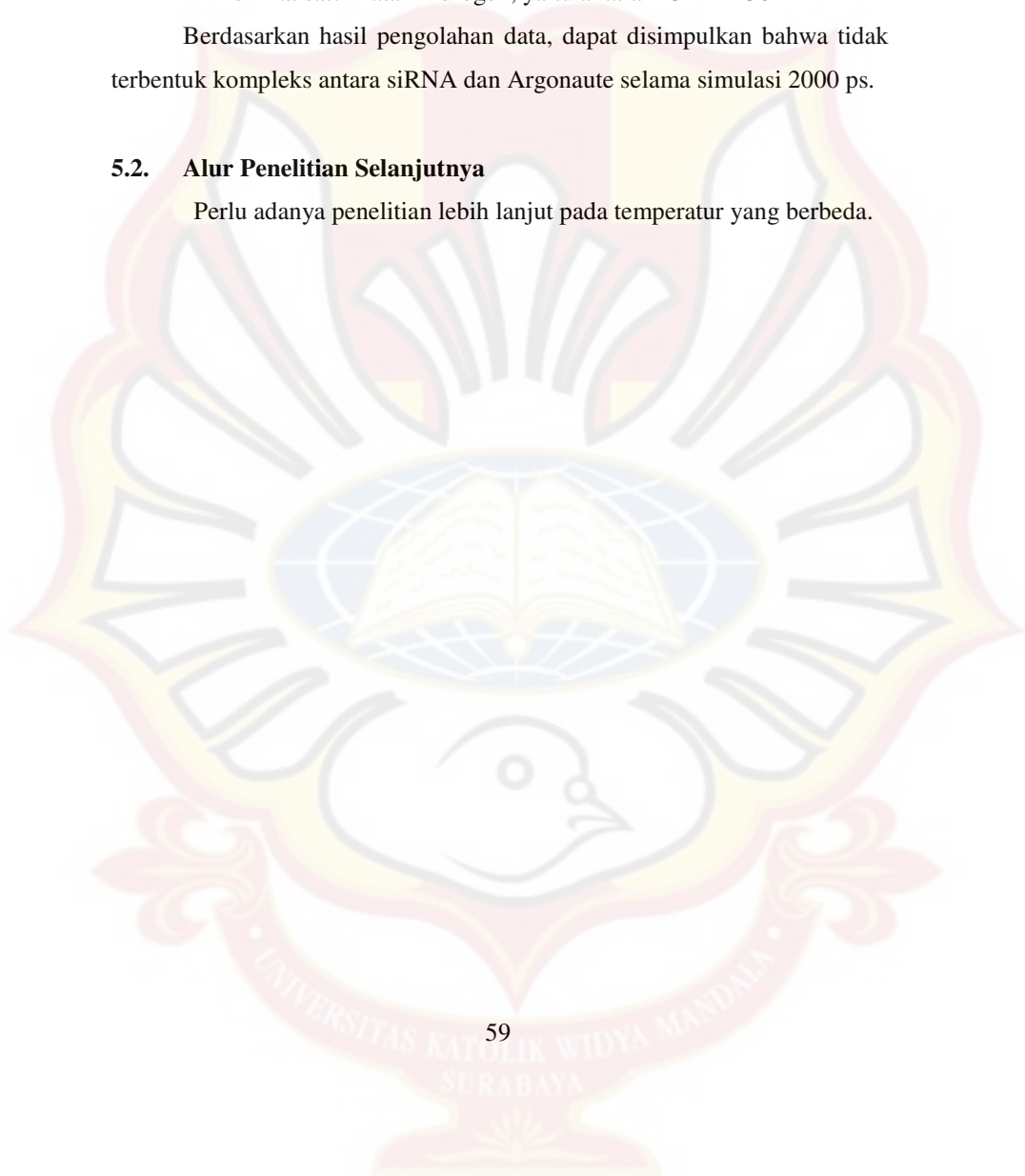
#### **5.1. Simpulan**

- Protein Argonaute lebih konvergens dibanding siRNA
- siRNA lebih fleksibel dibandingkan dengan protein
- Terlihat satu ikatan hidrogen, yaitu antara RG4-ARG64

Berdasarkan hasil pengolahan data, dapat disimpulkan bahwa tidak terbentuk kompleks antara siRNA dan Argonaute selama simulasi 2000 ps.

#### **5.2. Alur Penelitian Selanjutnya**

Perlu adanya penelitian lebih lanjut pada temperatur yang berbeda.



## DAFTAR PUSTAKA

- Adams, A., 2005, RNA Therapeutic enter clinical trials, **The Scientist**.
- Agrawal, N., Dasaradhi, P. V., Mohmmmed, A., Malhotra, P., Bhatnagar, R. K. and Mukherjee, S. K., 2003, RNA interference: biology, mechanism, and applications, **Microbiol. Mol. Biol. Rev.**, 67, 657-685.
- Anantharaman, V., Koonin, E. and Aravind, L., 2002, "Comparative genomics and evolution of proteins involved in RNA metabolism", **Nucleic Acids Res.**, 30 (7), 1427-64.
- Berendsen, H. J. C., 1995, Molecular Dynamics Simulations : The limits and beyond, **proceedings of the 2<sup>nd</sup> international symposium on algorithms for macromolecular modelling**, Berlin, May 21-24, 1997.
- Bernstein, E., Caudy, A. A., Hammond, S. M. and Hannon, G., 2001, Role for a bidentate ribonuclease in the initiation step of RNA interference, **Nature**, 409, 363-366.
- Brooks, B. R., Bruccoleri, R. E., Olafson, B. D., States, D. J., Swaminathan, S. and Karplus, M., 1983, CHARMM: a program for macromolecular energy, minimization, and dynamics calculations, **J. Comput. Chem.**, 4, 187-217.
- Carmell, M. A., Xuan, Z., Zhang, M. Q. and Hannon, G. J., 2002, The Argonaute family: tentacles that reach into RNAi, developmental control, stem cell maintenance, and tumorigenesis, **Genes Dev.**, 16, 2733-2742.
- Chen, J., Wall, N. R., Kocher, K., Duclos, N., Fabbro, D., Neuberger, D., Griffin, J. D., Shi, Y. and Gilliland, D. G., 2004, Stable expression of small interfering RNA sensitizes TEL-PDGFR to inhibition with imatinib or rapamycin. **Journal of Clinical Investigation**, 113, 1784-1791.
- Couzin, J., 2002, Small RNAs make big splash, **Science**, 298, 2296-2297.
- Darden, T. A., York, D. M. and Pedersen, L. G., 1993, Particle mesh Ewald: an N-log(N) method for Ewald sums in large systems, **J. Chem. Phys.**, 98, 10089-10092.

Elbashir, S. M., Harborth, J., Lendeckel, W., Yalcin, A., Weber, K. and Tuschl, T., 2001, Duplexes of 21-nucleotide RNAs mediate RNA interference in mammalian cell culture, **Nature**, 411, 494-498.

Fire, A., Xu, S., Montgomery, M. K., Kostas, S. A., Driver, S. E. and Mello, C. C., 1998, Potent and specific genetic interference by double-stranded RNA in *Caenorhabditis elegans*, **Nature**, 391, 806-811.

Frenkel, D. and Smit, B., 2002, **Understanding Molecular Simulation: from Algorithms to Applications**, USA: Academic Press., Sandiego, California.

Hamilton, A. and Baulcombe, D., 1999, A species of small antisense RNA in posttranscriptional gene silencing in plants, **Science**, 286, 950-952.

Harvey, S. C., 1989, Treatment of electrostatic effects in macromolecular modelling, **Proteins**, 5, 78-92.

Höck, J. and Meister, G., 2008, The Argonaute Protein Family, **Genome biology**, 9, 210.

Holmes, B., 2003, Gene therapy may switch off Huntington's, **The Scientist**.

Ikeda, K., Satoh, M., Pauley, K. M., Fritzler, M. J., Reeves, W. H. and Chan, E. K. L., 2006, Detection of the Argonaute Protein Ago2 and microRNAs in the RNA Induced Silencing Complex (RISC) Using a Monoclonal Antibody, **J. Immunol. Methods**, 317(1-2), 38-44.

Kawasaki, H. and Taira, K., 2004, Induction of DNA methylation and gene silencing by short interfering RNAs in human cells, **E-pub of print Nature**, 1038/nature2889, Aug 15.

Lieberman, J., Song, E., Lee, S. and Shankar, P., 2003, Interfering with Disease: Opportunities and roadblocks to harnessing RNA interferences, **TRENDS in Molecular Medicine.**, 9, 9.

Lucentini, J., 2004, Silencing cancer. **The Scientist**, 18, 14-15.

- Ma, J. B., Ye, K. and Patel, D. J., 2004, Structural basis for overhang-specific small interfering RNA recognition by the PAZ domain, **Nature**, 429, 318-322.
- Ma, J., Yuan, Y., Meister, G., Pei, Y., Tuschl, T. and Patel, D., 2005, Structural basis for 5'-end-specific recognition of guide RNA by the A. fulgidus Piwi protein, **Nature**, 434 (7033), 666–670.
- Murray, R. F., Harper, H. W., Granner, D. K., Mayes, P. A. & Rodwell, V. W., 2006, **Harper's Illustrated Biochemistry**, New York: Lange Medical Books/McGraw-Hill, ISBN 0-07-146197-3.
- Norberg, J. and Nilsson, L., 2000, On the truncation of long-range electrostatic interactions in DNA, **Biophys. J.**, 79, 1537–1553.
- Pande, V. and Nilson, L., 2008, Insights into structure, dynamics and hydration of locked nucleic acid (LNA) strand-based duplexes from molecular dynamics simulations, **Nucleic Acids Research**, 36, 1508-1516.
- Rand, T. A., Petersen, S., Du, F. and Wang, X., 2005, Argonaute2 cleaves the anti-guide strand of siRNA during RISC activation, **Cell**, 123, 621-629.
- Reynolds, J. A. and Tanford, C., 2003, **Nature's Robots: A History of Protein** (*Oxford Paperbacks*), Oxford University Press, USA, p. 15, ISBN 0-19-860694-X.
- Saenger, W., 1984, **Principle of Nucleic Acid Structure**, Springer-Verlag, New York, 119.
- Sen, G. L. and Blau, H. M., 2005, Argonaute 2 RISC resides in sites of mammalian mRNA decay known as cytoplasmic bodies, **Nat. Cell. Biol.**, 7, 633-636.
- Song, J. J., Liu, J., Tolia, N. H., Schneiderman, J., Smith, S. K., Martienssen, R. A., Hannon, G. J. and Joshua, T. L., 2003, The crystal structure of the Argonaute2 PAZ domain reveals an RNA binding motif in RNAi effector complexes, **Nat. Struct. Biol.**, 10, 1026–1032.
- Sumner, J. B., 1926, The isolation and crystallization of the enzyme urease. Preliminary paper, **Journal of Biological Chemistry**, 69, 435–441.

Van Der Spoel, D., Lindahl, E., Hess, B., Groenhof, G., Mark, A. E. and Berendsen, H. J. C., 2005, GROMACS: Fast, Flexible, and Free. **J. of Comput. Chem.**, 16, 1701-1718.

Van Gasteren, W. F., 1998, Validation of Molecular Dynamics Simulation, **J. Chem. Phys.**, 108, 6109-6116.

Weiner, P. K. and Kollmann, P. A., 1981, AMBER: Assisted Model Building with Energy Refinement. A General Program for Modelling Molecules and Their Interactions, **J. Comput. Chem.**, 2, 287-303.

Yague, E., Higgins, C. F. and Raguz, S., 2004, Complete reversal of multidrug resistance by stable expression of small interfering RNAs targeting MDR1, **Gene Therapy**, 11, 1170-1174.

