

Supporting Information

Graphene Quantum Dots Obstruct the Membrane Axis of Alzheimer's Amyloid Beta

Huayuan Tang,¹ Yuhuan Li,^{2,3} Aleksandr Kakinen,⁴ Nicholas Andrikopoulos,³ Yunxiang Sun,⁵
Eunbi Kwak,^{3,6} Thomas P. Davis,^{3,4} Feng Ding^{1*} and Pu Chun Ke^{3,4,6*}

¹Department of Physics and Astronomy, Clemson University, Clemson, SC 29634, United States

²Liver Cancer Institute, Zhongshan Hospital, Key Laboratory of Carcinogenesis and Cancer
Invasion, Ministry of Education, Fudan University, Shanghai, 200032, China

³Drug Delivery, Disposition and Dynamics, Monash Institute of Pharmaceutical Sciences,
Monash University, 381 Royal Parade, Parkville, VIC 3052, Australia

⁴Australian Institute for Bioengineering and Nanotechnology,
The University of Queensland, Brisbane Qld 4072, Australia

⁵School of Physical Science and Technology, Ningbo University, Ningbo 315211, China

⁶The GBA National Institute for Nanotechnology Innovation, 136 Kaiyuan Avenue, Guangzhou,
510700, China

Corresponding Authors

Email: Feng Ding, fding@clemson.edu; Pu Chun Ke, pu-chun.ke@monash.edu

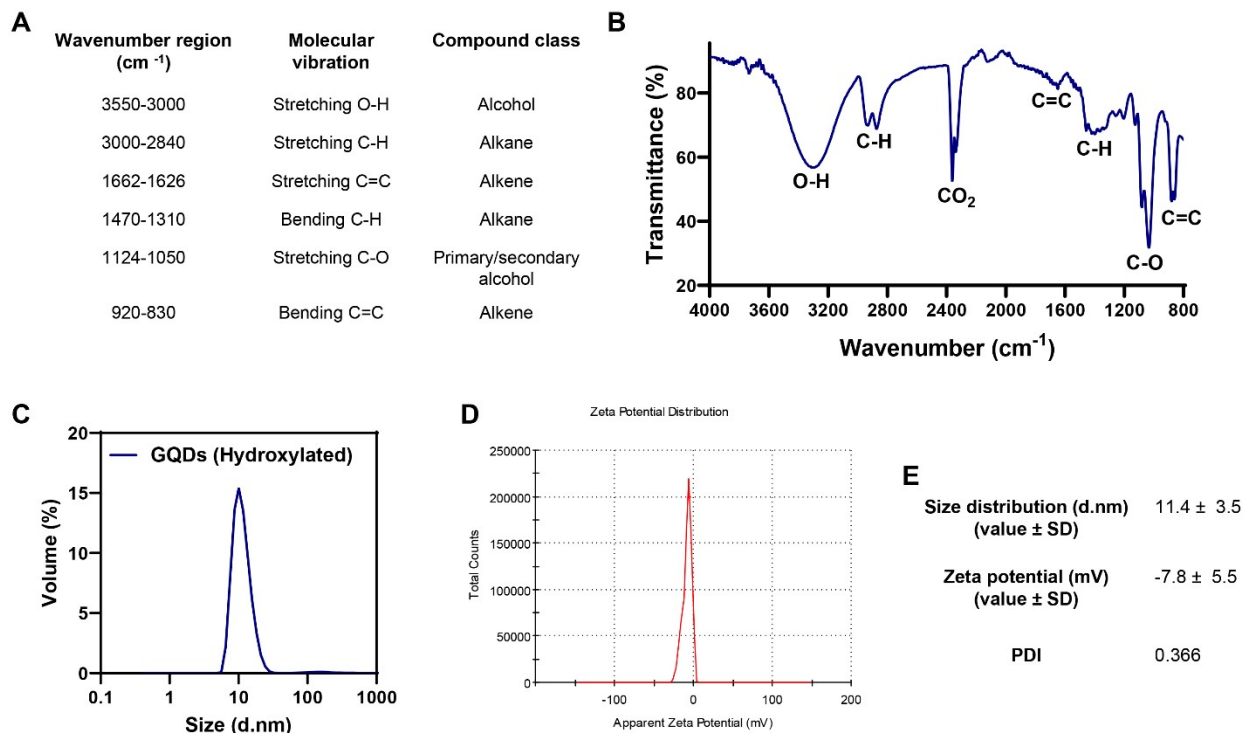


Figure S1. Characterizations of GQDs with Fourier transform infrared (FTIR) spectroscopy and dynamic light scattering (DLS). a) FTIR spectrum table determining the compound class by molecular vibrations (stretching or bending) based on their frequency range (cm⁻¹). b) FTIR spectrum (4000-800 cm⁻¹) of hydroxylated GQDs. c) Size distribution of hydroxylated GQDs (n=1) determined by volume (%). d) Zeta-potential distribution (n=1) of hydroxylated GQDs. e) DLS-derived hydrodynamic size, zeta potential and polydispersity index (PDI) of the hydroxylated GQDs.

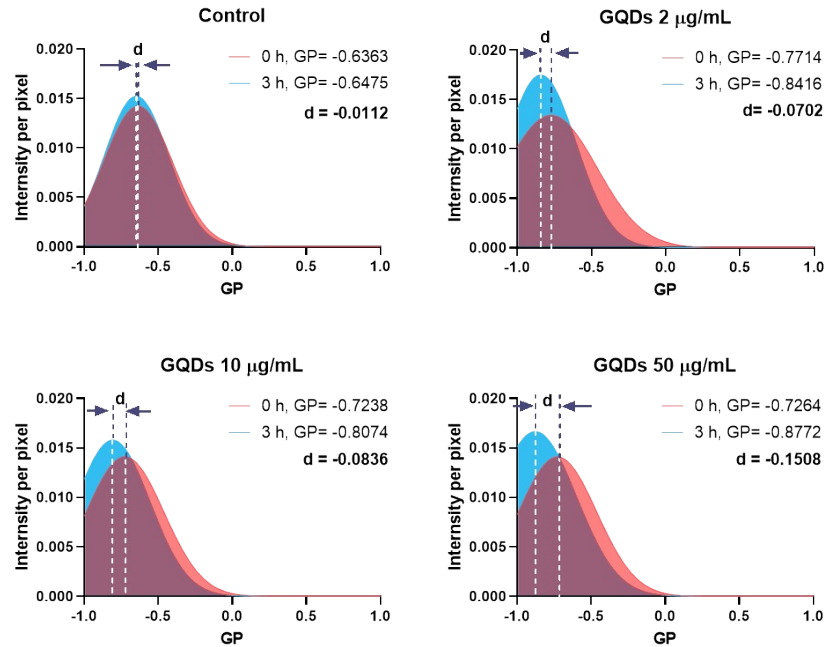


Figure S2. Effect of GQDs on the fluidity of SH-SY5Y cells. GP shifts (d) were recorded after 3 h incubation for the control and treated by GQDs at the concentrations of 2 µg/mL, 10 µg/mL and 50 µg/mL.

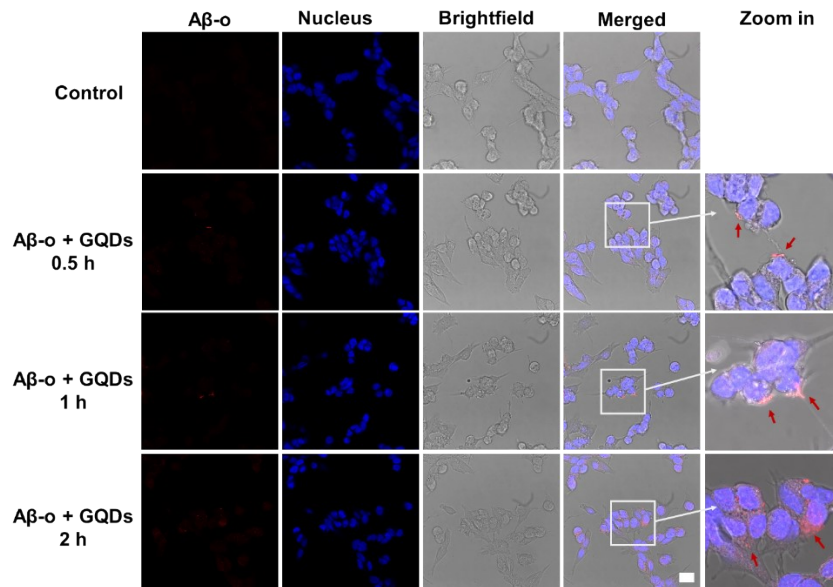


Figure S3. Aβ oligomers distribution on SH-SY5Y cells in the presence and absence of GQDs. Confocal images of Aβ-o (concentration: 20 µM) distribution within a 2 h-treatment, including Aβ-o (red), nucleus (blue), bright-field (gray) and merged images for the three channels. Aβ-o were labeled by A11 antibody *in vitro*. The red arrows in the zoomed-in images indicate the positions of Aβ-o. GQDs: 50 µg/mL. Scale bar: 20 µm.

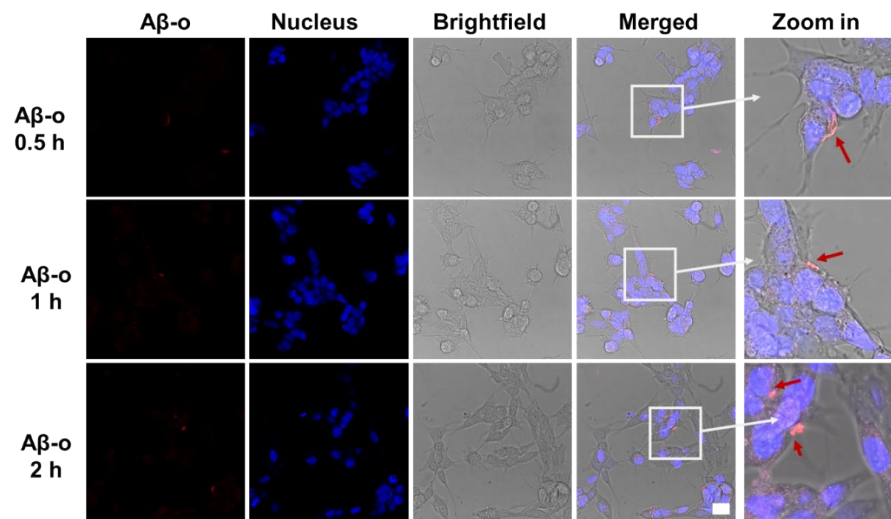


Figure S4. A β oligomers distribution on SH-SY5Y cells over the course of 2 h incubation. A β -o (red), nucleus (blue), bright-field (gray) and merged images for the three channels. A β -o were labeled by A11 antibody *in vitro*. The red arrows in the zoomed-in images indicate the positions of A β -o. A β -o concentration: 20 μ M. Scale bar: 20 μ m.

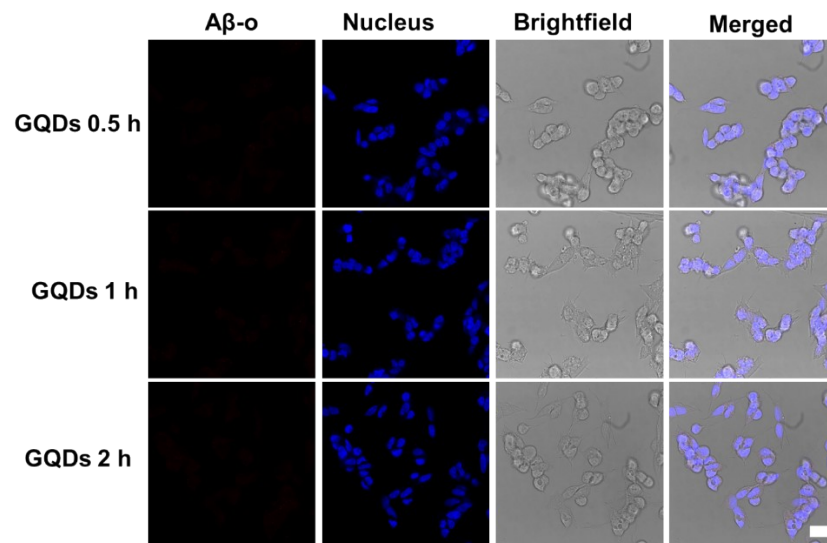


Figure S5. Distribution of GQDs on SH-SY5Y cells over the course of 2 h incubation. A β -o (red), nucleus (blue), bright-field (gray) and merged images for the three channels. Scale bar: 20 μ m.

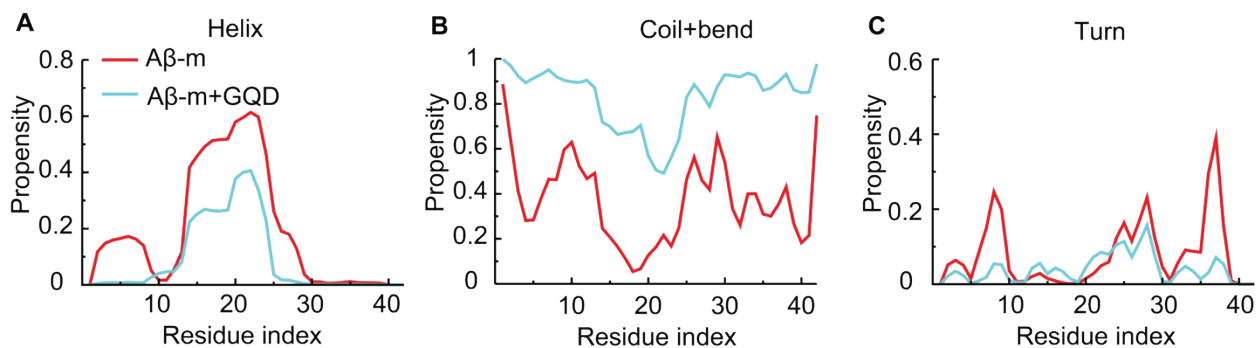


Figure S6. Secondary structure propensities of each Aβ-m residue in the absence and presence of a GQD. (A) Propensity for helices. (B) Propensity for coils and bends. (C) Propensity for turns.

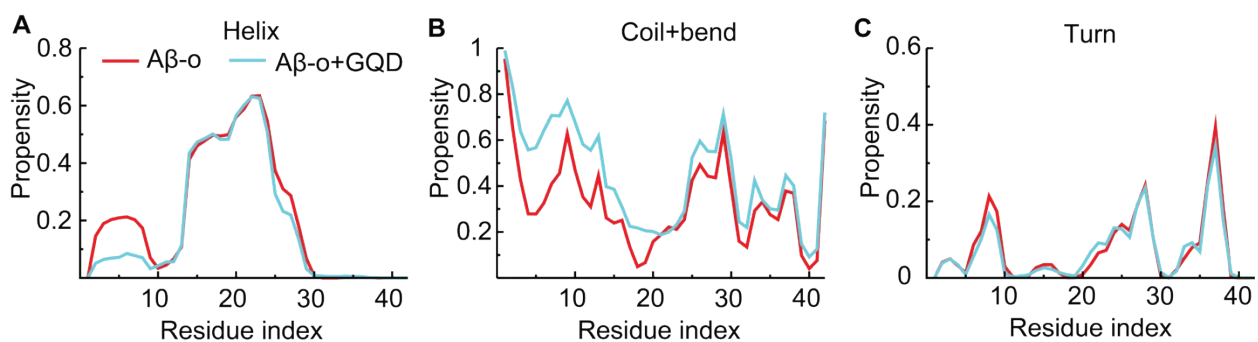


Figure S7. Secondary structure propensities of each Aβ-o residue in the absence and presence of a GQD. (A) Propensity for helices. (B) Propensity for coils and bends. (C) Propensity for turns.

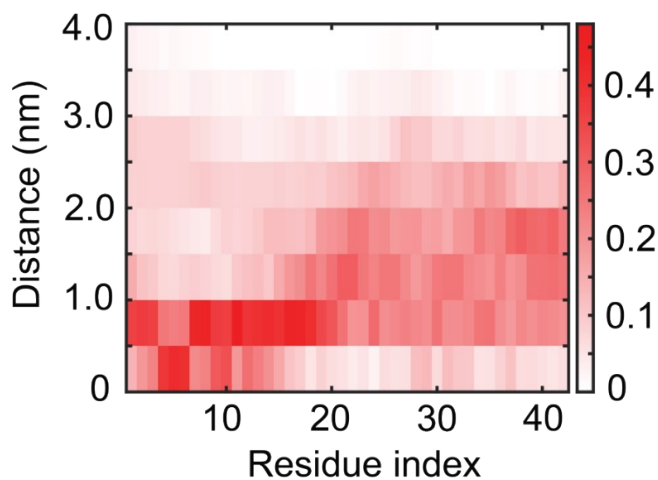


Figure S8. Distance probability distribution of each Aβ-o residue relative to the GQD.