

Figure S1: Visualization of naked DNA molecules. The left column presents the AFM image of the molecular system and while the right column corresponds to the L-weight filter processed images. All images contain 512×512 pixels with a physical dimension of $2 \times 2 \ \mu\text{m}^2$. (A-B) Naked circular, supercoiled DNAs (c-DNAs) at a concentration of 0.8 nM. Subimages indicated with white boxes contain 160×160 pixels and were cropped for use in Figs. 3A-B. (C-D) Naked linearized DNAs (l-DNAs) at a concentration of 0.8 nM. Boxed subimages are composed of 160×160 pixels, and were used in Figs. 4A-B; see details in the main text.

In this work, natively supercoiled DNA extracted and purified from bacteria was used either without further treatment or after linearization. The following terminology is used throughout the text: "partially open" DNA conformation describes a non-compact DNA where a couple of twists or cross-overs are visible; "compact" DNA conformation describes a DNA with a low appearance of DNA duplex sections; "condensed" DNA conformation describes a further compacted DNA due to binding of DrHU.

Figure S2



Figure S2: AFM images of DrHU-DNA complexes at a lower scan resolution. All images have a physical size of $2 \times 2 \ \mu m^2$ with 512×512 pixels. The boxed regions were imaged by AFM at a higher scan resolution, and the resulting images are presented in the main text; see details in the main text. (A) The parent image of image 5C and 3C, from left to right, respectively. (B) The parent image of image 3E. (C) The parent image of images 4C and 5D.

Figure S3



Figure S3: Comparison of AFM images of naked linearized DNA and DrHU-linearized DNA oblong complexes demonstrating the common DNA origin of these intriguing shapes but some noticeable differences when observing the rough surface of DrHU bound complexes versus the smooth surface of bare DNA. The left column presents the AFM image of the molecular system while the right column corresponds to the L-weight filter processed images. (A) The image was cropped from a larger scan size of bare linearized DNA and has a final size of 204 x 204 pixels with a magnification of (x4) and a physical size of 200 x 200 nm². (B) Cropped image from **Fig. 5A** that contains DrHU bound to linearized DNA at a molar ratio of 5. The image has a final size of 128 x 128 pixels with a magnification of (x2) and a physical size of 125 x 125 nm². Note that the two structures have different sizes where the diameter of A) is about 155 nm whereas that in B) is about 90 nm.