Cu(II) and Co(II) ternary complexes of quinolone antimicrobial drug enoxacin and levofloxacin: Structure and biological evaluation

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**Table S1** Selected bond lengths (Å) and angles (deg) for complex 1–4.

<table>
<thead>
<tr>
<th></th>
<th>Cu(1)-O(1)</th>
<th>Cu(1)-O(2)</th>
<th>Cu(1)-N(6)</th>
<th>Cu(1)-N(5)</th>
<th>Cu(1)-N(1)</th>
<th>Cu(2)-O(5)</th>
<th>Cu(2)-O(4)</th>
<th>Cu(2)-N(11)</th>
<th>Cu(2)-N(12)</th>
<th>Cu(2)-N(7)</th>
<th>O(1)-Cu(1)-O(2)</th>
<th>O(1)-Cu(1)-N(6)</th>
<th>O(1)-Cu(1)-N(5)</th>
<th>O(2)-Cu(1)-N(5)</th>
<th>O(2)-Cu(1)-N(7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.930(6)</td>
<td>1.939(6)</td>
<td>1.982(7)</td>
<td>2.015(7)</td>
<td>2.278(8)</td>
<td>1.917(6)</td>
<td>1.943(6)</td>
<td>2.000(7)</td>
<td>2.002(8)</td>
<td>2.291(7)</td>
<td>93.9(3)</td>
<td>166.1(3)</td>
<td>91.6(3)</td>
<td>80.7(3)</td>
<td>89.6(3)</td>
</tr>
<tr>
<td>2</td>
<td>2.046(3)</td>
<td>2.073(2)</td>
<td>2.072(3)</td>
<td>2.096(3)</td>
<td>91.6(3)</td>
<td>166.1(3)</td>
<td>2.097(3)</td>
<td>2.106(3)</td>
<td>97.24(12)</td>
<td>97.24(12)</td>
<td>175.81(10)</td>
<td>84.48(10)</td>
<td>89.34(10)</td>
<td>89.72(11)</td>
<td>92.32(12)</td>
</tr>
</tbody>
</table>
Table S2 Hydrogen bonds (Å and °) for complexes 1–4.

<table>
<thead>
<tr>
<th></th>
<th>D–H⋯A</th>
<th>d (H⋯A)</th>
<th>d (D⋯A)</th>
<th>&lt; DHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N7-H7–O16</td>
<td>2.26</td>
<td>3.157(11)</td>
<td>167.4</td>
</tr>
<tr>
<td></td>
<td>N1-H1–O13</td>
<td>2.33</td>
<td>3.129(12)</td>
<td>145.8</td>
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<tr>
<td></td>
<td>O16-H16B–O9</td>
<td>2.20(8)</td>
<td>2.924(19)</td>
<td>143(12)</td>
</tr>
<tr>
<td></td>
<td>O16-H16A–O3</td>
<td>2.17(9)</td>
<td>2.876(11)</td>
<td>140(11)</td>
</tr>
<tr>
<td></td>
<td>O15-H15A–O3</td>
<td>1.99(10)</td>
<td>2.83(2)</td>
<td>166(34)</td>
</tr>
</tbody>
</table>

Symmetry code: A) –x + 1, –y + 2, –z + 1; B) –x + 1, –y + 1, –z. For 4, A) –x + 1, y, –z + 3/2.
O(12)-H(12C)...O(5)  1.953(16)  2.802(5)  172(7)
O(12)-H(12D)...O(11)  2.12(5)  2.826(7)  140(6)
N(3)-H(3A)...O(9)D  2.12  3.008(10)  166.7
N(3)-H(3B)...O(3)B  1.82  2.712(4)  168.6

Symmetry code: A) x + 1, y, z; B) –x + 1, –y + 1, –z + 1; C) –x + 1, –y + 1, –z; D) x, y + 1, z

O(9)-H(9A)...O(10)A  1.92(3)  2.708(5)  154(5)
O(9)-H(9B)...O(11)  1.905(13)  2.751(6)  172(5)
O(10)-H(10A)...O(5)A  2.35(4)  3.021(7)  136(5)
O(11)-H(11F)...O(3)B  2.17(4)  2.820(6)  133(5)

Symmetry code: A) –x + 1, –y + 1, –z + 1; B) –x, –y + 1, –z + 1.

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Fig. S1. Time-dependent stability studies on complexes 1-4 in TBS buffer solution monitored by UV-vis absorption spectra.
Fig. S2. π–π stacking (purple dashed lines) between the aromatic planes of the HEn ligand and bipyridine of complex 1.

Fig. S3. 2D supramolecular network of 3 constructed by hydrogen bonding (green dashed lines) and π–π stacking interactions (purple dashed lines) in the ac plane.
Fig. S4. UV absorption spectra of 2 (A), 3 (B), HEn (C) and HLevo (D) in the absence (---) and presence (—) of CT DNA with increasing [DNA]/[compound] ratios. The arrows show the changes upon increasing amounts of CT DNA. Inset: plot of [DNA]/(ε_a-ε_f) versus [DNA].
Fig. S5. Circular dichromism spectra of CT DNA bound with HEn, Hlevo and complexes 2-4 with [DNA] = 1 × 10^{-4} M.
Fig. S6. Fluorescence emission spectra of EB-DNA in the absence (dashed line) and presence (colored solid lines) of HEn, HLevo and complexes 2-4 as competitive agents with increasing [compound]/[EB] ratios from 1:1 to 6:1.

Fig. S7. Stern-Volmer quenching plot of EB bound to CT-DNA by complexes 1-4 and HEn, HLevo.
Fig. S8. Emission spectra (λ_{exit} = 295 nm) for HSA ([HSA] = 3 µM) in buffer solution in the absence (dashed line) and presence (colored solid lines) of increasing amounts of compound (r = [compound] / [HSA] = 0-10).
Fig. S9. Emission spectra ($\lambda_{\text{ext}} = 295$ nm) for BSA ([BSA] = 3 µM) in buffer solution in the absence (dashed line) and presence (colored solid lines) of increasing amounts of compound ($r = [\text{compound}] / [\text{BSA}] = 0-10$, except $r = 0-7$ for 3 and $r = 0-6$ for 4).
Fig. S10. Stern-Volmer quenching plot of HSA for complexes 1-4 and HE\text{en}, HLe\text{vo} ligand, respectively.
Fig. S11. Stern-Volmer quenching plot of BSA for complexes 1-4 and HEn, HLevo ligand, respectively.

Equations:

\[
\frac{[DNA]}{(\varepsilon_a - \varepsilon_f)} = \frac{[DNA]}{(\varepsilon_b - \varepsilon_f)} + \frac{1}{K_b(\varepsilon_b - \varepsilon_f)} \quad \text{Eq. (S1)}
\]

where [DNA] is the concentration of DNA in base pairs, \(\varepsilon_f\) is the extinction coefficient for the free compound at the corresponding \(\lambda_{\text{max}}\), \(\varepsilon_a = \frac{A_{\text{obsd}}}{[\text{compound}]}\) and \(\varepsilon_b\) is the extinction
coefficient for the compound in the fully bound form.

\[ \frac{I_0}{I} = 1 + K_{sv}[Q] \]  
Eq. (S2)

where \( I_0 \) and \( I \) are the emission intensities in the absence and the presence of the complex, respectively.

\[ \frac{I_0}{I} = 1 + k_q \tau_o[Q] = 1 + K_{sv}[Q] \]  
Eq. (S3)

where \( I_0 \) = the initial tryptophan fluorescence intensity of SA, \( I \) = the tryptophan fluorescence intensity of SA after the addition of the quencher, \( k_q \) = the quenching rate constants of SA, \( K_{sv} \) = the dynamic quenching constant, \( \tau_o \) = the average lifetime of SA without the quencher, \([Q]\) = the concentration of the quencher respectively, \( K_{sv} = k_q \tau_o \) (taking as fluorescence lifetime \( (\tau_o) \) of tryptophan in SA at around \( 10^{-8} \) s).

\[ \frac{\Delta I}{I_0} = \frac{\Delta I}{[Q]} = nK - K \frac{\Delta I}{I_0} \]  
Eq. (S4)

Where \( n \) is the number of binding sites per albumin and \( K \) (M\(^{-1}\)) is the association binding constant, \( K \) (M\(^{-1}\)) may be calculated from the slope in plots \( \Delta I/(I_0[Q]) \) versus \( \Delta I/I_0 \) and \( n \) is given by the ratio of y intercept to the slope.