Mitochondria-targeted Phosphorescent Iridium(III) Complexes for Living Cell Imaging†

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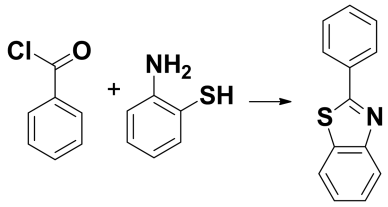
S1. Synthesis

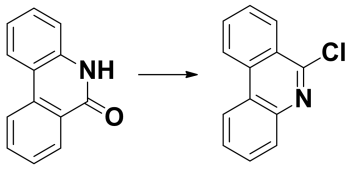
Benzoyl chloride, 2-aminothiophenol, triphenylphosphine and 6-bromocaproic acid were purchased from Sinopharm; 6(5*H*)-phenanthridinone, 2-benzothienylboronic acid and 4,4'-dimethyl-2,2'-bipyridine from Chemlin; 3-bromopropionitrile from J&K Chemical. Other chemicals and solvents were commercially available in analytical purity and used directly except otherwise specified.

2-Phenylbenzothiazole (BT)



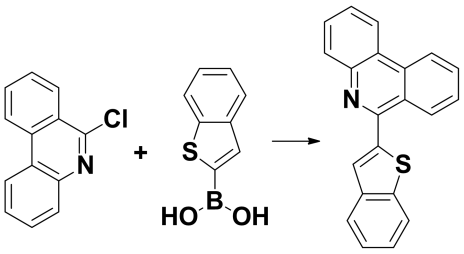
BT was synthesized according to Chang *et al*[1] with benzoyl chloride in place of benzaldehyde. Colorless acicular crystal. Yield 95%. GC-MS: m/z (M^+) calcd 211.05, found 211.1. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.11 (dddd, J = 8.3, 5.6, 1.2, 0.6 Hz, 3H), 7.92 (ddd, J = 8.0, 1.3, 0.7 Hz, 1H), 7.53-7.48 (m, 4H), 7.40 (ddd, J = 8.0, 7.2, 1.2 Hz, 1H).

6-Chlorophenanthridine



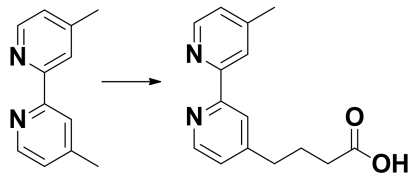
The mixture of 6(5*H*)-phenanthridone (5.11 g, 26.2 mmol) and phosphorus pentachloride (6.12 g, 29.4 mmol) was refluxed in phosphorus oxychloride (60 ml) (ATTENTION: Phosphorus oxychloride is highly toxic. The operator must be properly protected!!!) at 100 °C under N_2 protection for 2 h. After removing most solvent, the residue was poured into aqua ammonia generate a solid, and the solid was extracted with ethyl acetate. After drying and evaporation, the obtained solid was purified by silica gel column chromatography (eluent: Hexane/CH_2Cl_2 = 20 : 1) to give a light yellow powder (5.1 g, yield 91%). GC-MS: m/z ($[M-H]^+$) calcd 213.0, found 211.3. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.60 (d, J = 8.3 Hz, 1H), 8.55-8.45 (m, 2H), 8.09 (dd, J = 8.1, 1.0 Hz, 1H), 7.90 (ddd, J = 8.3, 7.1, 1.3 Hz, 1H), 7.79-7.65 (m, 3H).

6-(Benzothien-2-yl)phenanthridine (BTPhen)



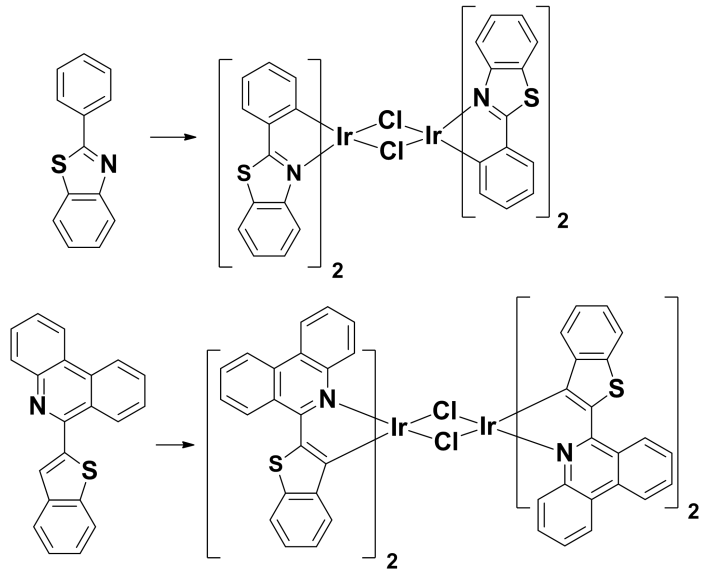
BTPhen was synthesized through Suzuki coupling of 6-chlorophenanthridine and 2-benzothienylboronic acid. Light yellow frazil crystal. Yield 95%. GC-MS: m/z (M^+) calcd 311.1, found 310.1. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.70 (d, J = 8.3 Hz, 1H), 8.65 (d, J = 8.3 Hz, 1H), 8.59 (d, J = 7.8 Hz, 1H), 8.24 (dd, J = 8.2, 1.0 Hz, 1H), 7.97-7.84 (m, 4H), 7.79-7.65 (m, 3H), 7.46-7.38 (m, 2H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 154.26, 143.87, 142.83, 140.95, 140.23, 133.85, 130.97, 130.61, 129.20, 128.22, 127.79, 127.59, 126.24, 125.38, 125.02, 124.73, 124.50, 123.89, 122.65, 122.48, 122.15.

4-(4'-Methyl-2,2'-bipyridin-4-yl)butyric acid (MBBA)



MBBA was synthesized according to Tanaka *et al*[2] with 3-bromopropionitrile instead of 5-bromovaleronitrile. White powder. Total yield 23%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.59 (dd, J = 10.3, 5.0 Hz, 2H), 8.16 (dd, J = 11.0, 0.9 Hz, 2H), 7.17 (td, J = 5.3, 1.3 Hz, 2H), 2.77 (t, J = 7.6 Hz, 2H), 2.48-2.39 (m, 5H), 2.12-2.02 (m, 2H).

$[Ir(bt)_2]_2(\mu\text{-}Cl)_2$ and **$[Ir(btphen)_2]_2(\mu\text{-}Cl)_2$**



$[Ir(bt)_2]_2(\mu\text{-}Cl)_2$ and **$[Ir(btphen)_2]_2(\mu\text{-}Cl)_2$** were synthesized according to Nonoyama[3], Lamansky *et al*[4], and used directly without further purification and charaterization. **$[Ir(bt)_2]_2(\mu\text{-}Cl)_2$**, yellow powder, yield 92%; **$[Ir(btphen)_2]_2(\mu\text{-}Cl)_2$**, dark red powder, yield 89%. **$[Ir(bt)_2]_2(\mu\text{-}Cl)_2$** and **$[Ir(btphen)_2]_2(\mu\text{-}Cl)_2$** were used directly without further purification.

1 W.-C. Chang, A. T. Hu, J.-P. Duan, D. K. Rayabarapu and C.-H. Cheng, *J. Organomet. Chem*., 2004, 689, 4882-4888.

2 K. Tanaka, K. Tainaka, T. Kamei and A. Okamoto, *J. Am. Chem. Soc.*, 2007, 129, 5612-5620.

3 M. Nonoyama, *Bull. Chem. Soc. Jpn.*, 1974, 47, 767-768.

4 S. Lamansky, P. Djurovich, D. Murphy, F. Abdel-Razzaq, R. Kwong, I. Tsyba, M. Bortz, B. Mui, R. Bau and M. E. Thompson, *Inorg. Chem.*, 2001, 40, 1704-1711.

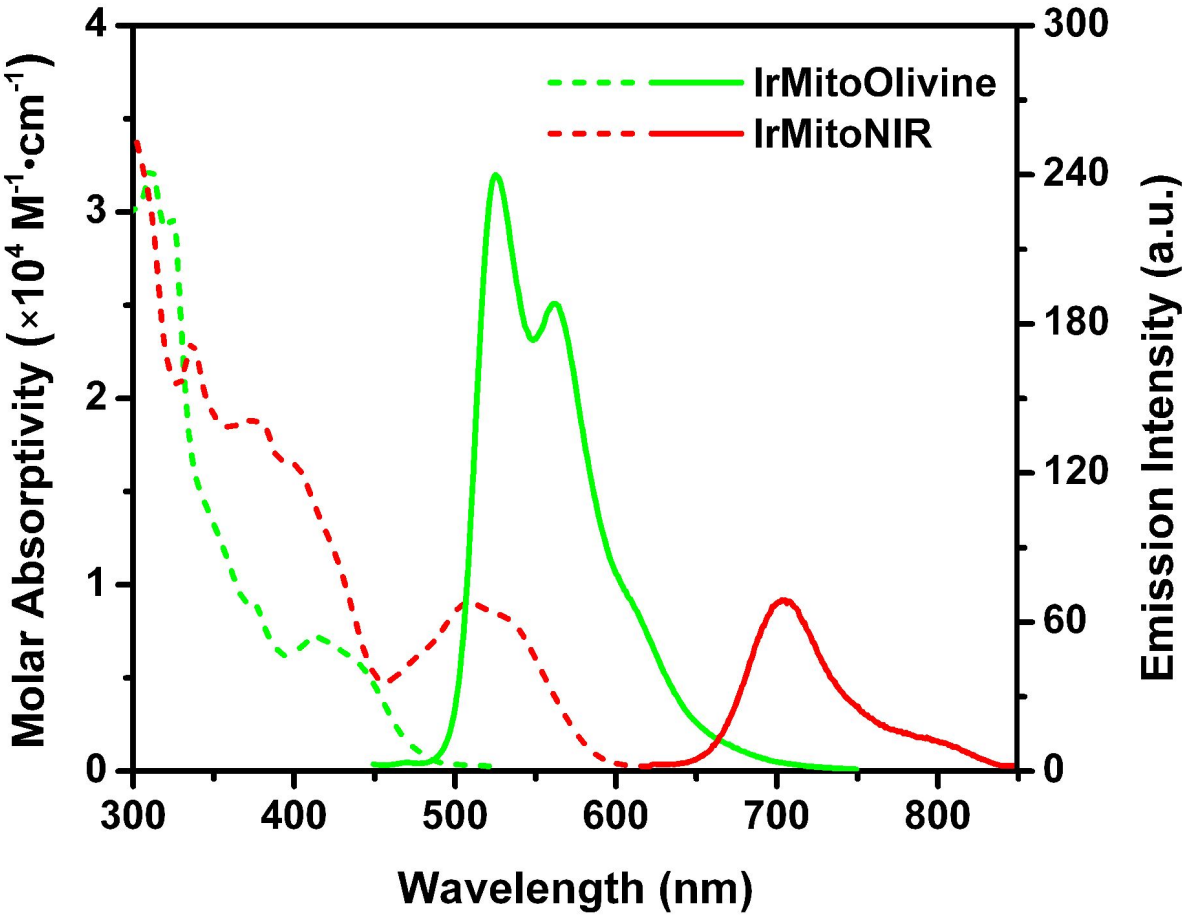


Fig. S1 Absorption (dashed) and emission (solid) spectra of **IrMitoOlivine** and **IrMitoNIR** in DMSO/PBS (2 vol.%). Ex: **IrMitoOlivine**, 411 nm**; IrMitoNIR**, 504 nm.

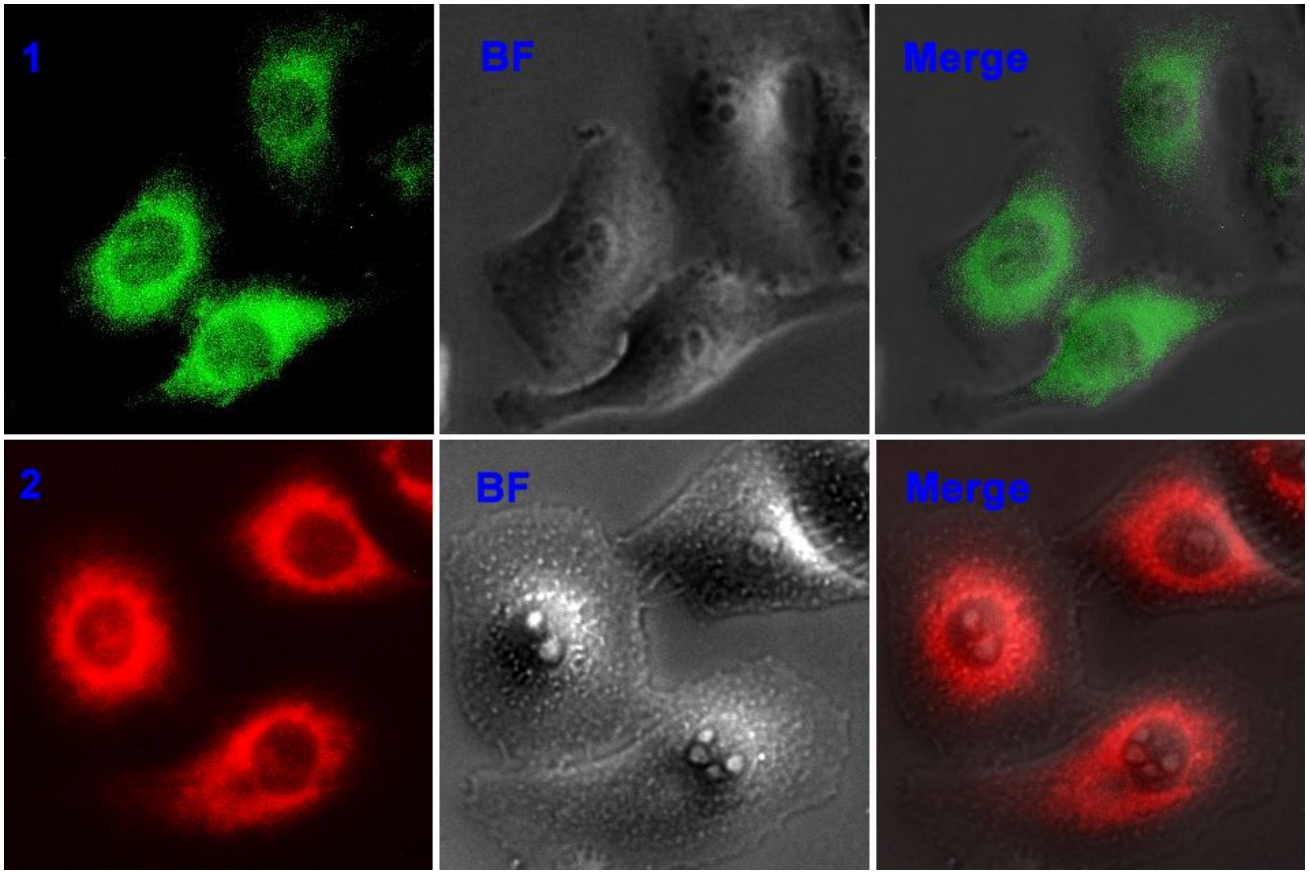


Fig. S2 Confocal cell imaging of $[Ir(bt)_2]_2$(bpy-COOH) (1) and $[Ir(btphen)_2]_2$(bpy-COOH) (2) in living HeLa cells. Upper: 1, $[Ir(bt)_2]_2$(bpy-COOH), Ex 488 nm, Em 500-530 nm; lower: 2, $[Ir(btphen)_2]_2$(bpy-COOH), Ex 561 nm, Em 662-737 nm.