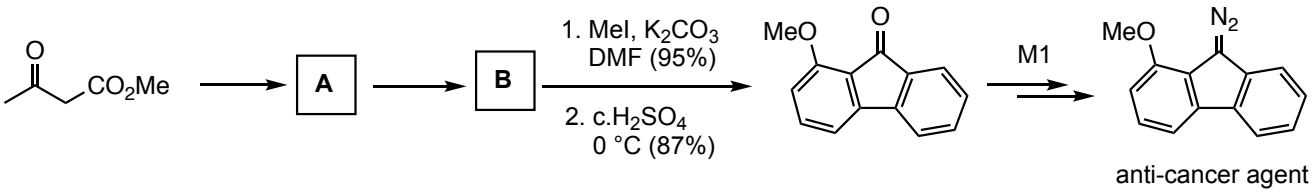
Q1: Propose reasonable reaction mechanisms of the following transformations.

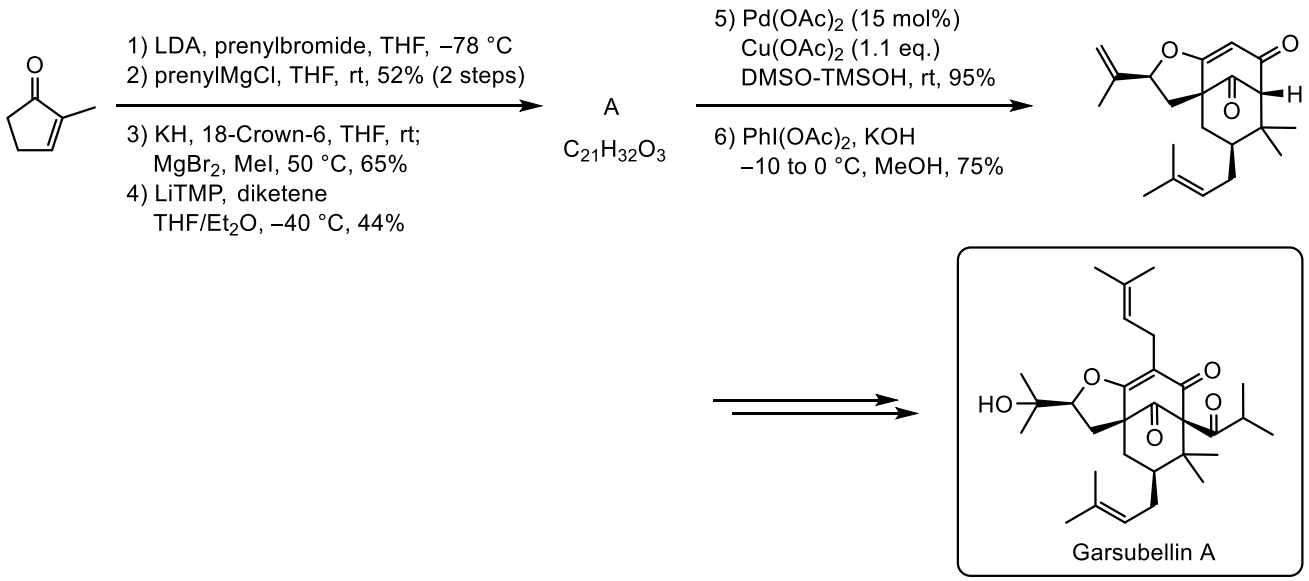
Q2: Propose another synthetic plan to obtain the target compound (anti-cancer agent).



Compound A ($C_{14}H_{16}O_3$). NaH (60% dispersion in mineral oil, 280 mg, 7.00 mmol) was washed three times with anhydrous hexane and suspended in anhydrous THF (17.0 mL). To this stirred suspension was added dropwise methyl acetoacetate (581 mg, 5.00 mmol) with stirring at 0 °C. The solution was stirred at 0 °C for 30 min, and then *n*-BuLi (1.60 M in hexane, 4.70 mL, 7.50 mmol) was added dropwise at 0 °C. The resulting mixture was stirred at 0 °C for 30 min and cinnamyl chloride (839 mg, 5.50 mmol) was added dropwise at 0 °C. The reaction mixture was warmed up to room temperature and stirred for 1 h. The reaction was quenched by addition of saturated aqueous NH_4Cl solution at 0 °C, and then the organic solvent was removed under reduced pressure. The residue was extracted three times with EtOAc. The combined organic layers were washed with saturated aqueous NaCl solution, dried over $MgSO_4$, and filtered through Celite. The filtrate was concentrated to afford an oil. The crude product was purified by flash column chromatography with hexane-EtOAc (5:1 v/v) as an eluent to afford **A** (712 mg, 62%) as a colorless oil.
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36-7.24 (m, 4H), 7.21-7.17 (m, 1H), 6.40 (d, J = 16.0 Hz, 1H), 6.16 (dd, J = 6.8, and 16.0 Hz, 1H), 3.72 (s, 3H), 3.46 (s, 2H), 2.71 (t, J = 7.2 Hz, 2H), and 2.49 (2H, dt, J = 6.8, 7.2 Hz). ^{13}C NMR (100 MHz, $CDCl_3$) δ 201.9, 167.6, 137.4, 131.2, 128.6, 128.3, 127.3, 126.1, 52.5, 49.2, 42.6, and 26.9; IR (neat) 1748, 1715.

Compound B ($C_{14}H_{12}O_3$). $Pd(OAc)_2$ (4.50 mg, 0.02 mmol) and $Cu(OAc)_2$ (7.30 mg, 0.04 mmol) were placed in a screw-top test tube, and a solution of **A** (46.5 mg, 0.20 mmol) in DMSO (0.02 mL) was added at room temperature. The reaction mixture was stirred at 50 °C for 24 h under one atmosphere of oxygen. After cooling to room temperature, the palladium residue was removed by filtering through Celite. The organic solvent was removed under reduced pressure, and then the reaction was quenched by addition of saturated aqueous $NaHCO_3$ solution at room temperature. The solution was extracted three times with hexane-EtOAc (4:1 v/v). The combined organic layers were washed with saturated aqueous NaCl solution, dried over $MgSO_4$, and filtered through Celite. The filtrate was concentrated to afford **B** (27.3 mg, 60%) as an oil.
^{1}H NMR (400 MHz, $CDCl_3$) δ 10.6 (s, 1H), 7.43-7.32 (m, 4H), 7.27-7.22 (m, 2H), 7.02-6.99 (m, 1H), 6.81-6.80 (m, 1H), and 3.48 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.4, 161.3, 144.9, 142.7, 133.7, 128.1, 127.6, 126.8, 122.6, 116.6, 112.1, and 51.7.

T. Takabatake, H. Tomita, S. Okada, N. Hayashi, T. Matsuo, M. Toyota
Tetrahedron Lett. **2020**, *61*, 152267. https://doi.org/10.1016/j.tetlet.2020.152267



T. J. Maimone *et al. Nat. Commun.* **2020**. *11. 508.*