Supporting information



Scheme S1. Synthesis of CyRLA library from CyR compounds.

Reagents and conditions: (a) DCM/ACN (7:1), NaHCO $_3$, r.t., 6 h.





| CyRLA-677 1155.7 1155.6 90 803 820 CyRLA399 1197.7 1197.6 94 803 820 CyRLA399 1121.7 1121.6 82 803 821 CyRLA521 1141.7 1141.6 84 805 820 CyRLA544 1087.7 1087.6 90 802 820 CyRLA544 1087.7 1087.6 90 802 820 CyRLA535 1175.6 1175.5 93 801 819 CyRLA303 1175.7 1175.5 92 804 820 CyRLA329 1185.6 1185.7 89 802 823 CyRLA329 1183.7 1137.6 92 803 820 CyRLA484 1197.7 1197.6 82 803 822 CyRLA484 1197.7 1197.6 82 803 822 CyRLA479 1139.7 1175.6 81 803 822 CyRLA44 | Compound Code | M ⁺ (calc.) | M ⁺ (exp.) ^a | Purity (%) ^b | λ_{abs}/nm | λ _{em} /nm |
|--|---------------|------------------------|------------------------------------|-------------------------|--------------------|---------------------|
| CyRLA-599 1197.7 1197.6 94 803 820 CyRLA-396 1121.7 1121.6 82 803 821 CyRLA-368 1137.7 1137.6 93 804 822 CyRLA-565 1167.7 1167.6 90 802 820 CyRLA-565 1175.6 1175.5 93 801 819 CyRLA-365 1175.6 1175.5 92 804 820 CyRLA-330 1175.7 1175.5 92 804 820 CyRLA-335 1135.7 1135.6 93 801 820 CyRLA-388 1137.7 1137.6 92 802 823 CyRLA-388 1137.7 1137.6 93 804 823 CyRLA-380 1197.7 1137.6 80 820 820 CyRLA-391 1167.7 1167.6 89 801 820 CyRLA-391 1167.7 1167.6 89 801 820 | CyRLA-677 | 1155.7 | 1155.6 | 90 | 803 | 820 |
| CyRLA-396 1121.7 1121.6 82 803 821 CyRLA-354 1137.7 1137.6 93 804 822 CyRLA-574 1087.7 1107.6 90 802 820 CyRLA-565 1167.7 1167.6 86 803 820 CyRLA-565 1175.6 1175.5 93 801 819 CyRLA-305 1175.7 1175.5 92 804 820 CyRLA-335 1135.7 1135.6 93 801 820 CyRLA-384 1197.7 1175.6 81 803 822 CyRLA-384 1197.7 1137.6 93 804 823 CyRLA-479 1139.7 1137.6 81 803 822 CyRLA-479 1139.7 1137.6 81 803 822 CyRLA-479 1139.7 1175.6 81 803 822 CyRLA-30 1187.7 1175.6 81 803 823 | CyRLA-599 | 1197.7 | 1197.6 | 94 | 803 | 820 |
| CyRLA-221 1141.7 1141.6 84 805 820 CyRLA-388 1137.7 1137.6 93 804 822 CyRLA-388 1137.7 1167.6 90 802 820 CyRLA-262 1167.7 1167.6 86 803 820 CyRLA-365 1175.5 93 801 820 CyRLA-329 1185.6 1185.7 89 802 823 CyRLA-335 1137.7 1137.6 92 803 820 CyRLA-388 1137.7 1137.6 92 803 820 CyRLA-399 1143.7 1143.6 92 803 820 CyRLA-479 1139.7 1197.6 82 803 820 CyRLA-479 1139.7 1197.6 82 803 822 CyRLA-30 1129.7 1175.6 81 803 822 CyRLA-319 1167.7 1167.6 89 801 820 CyRLA-320 | CyRLA-396 | 1121.7 | 1121.6 | 82 | 803 | 821 |
| CyRLA-358 1137.7 1137.6 93 804 822 CyRLA-574 1087.7 1087.6 90 802 820 CyRLA-565 1175.6 1175.5 93 801 819 CyRLA-303 1175.7 1175.5 92 804 820 CyRLA-329 1185.6 1185.7 89 802 823 CyRLA-339 1135.7 1137.6 92 803 820 CyRLA-399 1143.7 1143.6 92 803 820 CyRLA-399 1143.7 1197.6 82 803 822 CyRLA-548 1197.7 1197.6 82 803 822 CyRLA-548 1197.7 1175.6 81 804 823 CyRLA-360 1129.7 1129.6 91 804 823 CyRLA-361 1129.7 1167.6 89 801 820 CyRLA-361 1129.7 1129.6 91 804 820 | CyRLA-221 | 1141.7 | 1141.6 | 84 | 805 | 820 |
| CyRLA-574 1087.7 1087.6 90 802 820 CyRLA-565 1167.7 1167.6 86 803 820 CyRLA-565 1175.6 1175.5 93 801 819 CyRLA-330 1175.7 1175.5 92 804 820 CyRLA-335 1135.7 1135.6 93 801 820 CyRLA-388 1137.7 1137.6 92 802 819 CyRLA-388 1137.7 1137.6 93 804 823 CyRLA-479 1139.7 1139.6 93 804 823 CyRLA-548 1197.7 1197.6 82 803 822 CyRLA-548 1197.7 1175.6 81 803 822 CyRLA-360 1129.7 1179.6 91 804 820 CyRLA-344 1129.7 1187.6 92 802 820 CyRLA-344 1129.8 1187.7 93 803 819 | CyRLA-358 | 1137.7 | 1137.6 | 93 | 804 | 822 |
| CyRLA-262 1167.7 1167.6 86 803 820 CyRLA-365 1175.6 1175.5 93 801 819 CyRLA-330 1175.7 1175.5 92 804 820 CyRLA-335 1135.6 1135.6 93 801 820 CyRLA-388 1137.7 1137.6 92 802 821 CyRLA-399 1143.7 1143.6 93 804 823 CyRLA-479 1139.7 1197.6 82 803 820 CyRLA-422 1059.7 1059.6 90 802 821 CyRLA-424 1167.7 1175.6 81 803 822 CyRLA-319 1167.7 1167.6 89 801 820 CyRLA-319 1167.7 1167.6 89 801 820 CyRLA-319 1167.7 1183.6 92 802 820 CyRLA-33 1187.8 1187.7 93 803 821 | CyRLA-574 | 1087.7 | 1087.6 | 90 | 802 | 820 |
| CyRLA-565 1175.6 1175.5 93 801 819 CyRLA-330 1175.7 1175.5 92 804 820 CyRLA-332 1185.6 1185.7 89 802 823 CyRLA-338 1137.7 1137.6 92 803 820 CyRLA-388 1137.7 1137.6 92 803 820 CyRLA-79 1139.7 1139.6 93 804 823 CyRLA-548 1197.7 1197.6 82 803 820 CyRLA-548 1197.7 1175.6 81 803 822 CyRLA-60 1129.7 1129.6 91 804 823 CyRLA-319 1167.7 1167.6 89 801 820 CyRLA-319 1167.7 1167.6 89 801 820 CyRLA-319 1167.7 1187.6 84 804 820 CyRLA-319 1167.7 1149.6 84 804 820 < | CyRLA-262 | 1167.7 | 1167.6 | 86 | 803 | 820 |
| CyRLA-330 1175.7 1175.5 92 804 820 CyRLA-329 1185.6 1185.7 89 802 823 CyRLA-335 1135.7 1135.6 93 801 820 CyRLA-338 1137.7 1137.6 92 802 819 CyRLA-348 1197.7 1139.6 93 804 823 CyRLA-4479 1139.7 1197.6 82 803 820 CyRLA-447 1175.7 1059.6 90 802 821 CyRLA-447 1175.7 1175.6 81 803 822 CyRLA-300 1129.7 1129.6 91 804 823 CyRLA-319 1167.7 1167.6 89 801 820 CyRLA-344 1129.8 1129.7 83 802 820 CyRLA-345 1149.7 1149.6 84 804 820 CyRLA-311 1122.7 1122.6 72 803 821 | CyRLA-565 | 1175.6 | 1175.5 | 93 | 801 | 819 |
| CyRLA-329 1185.6 1185.7 89 802 823 CyRLA-335 1135.7 1135.6 93 801 820 CyRLA-388 1137.7 1137.6 92 803 820 CyRLA-479 1139.7 1139.6 93 804 823 CyRLA-479 1139.7 1139.6 93 804 823 CyRLA-479 1139.7 1059.6 90 802 821 CyRLA-447 1175.7 1075.6 81 803 822 CyRLA-360 1129.7 1129.6 91 804 823 CyRLA-319 1167.7 1167.6 89 801 820 CyRLA-319 1167.7 1167.6 89 801 820 CyRLA-201 1183.7 1183.6 92 802 820 CyRLA-219 1161.7 1101.7 89 801 820 CyRLA-215 1149.7 1149.6 84 804 820 CyRLA-216 1089.7 1089.6 89 802 820 <td< td=""><td>CyRLA-330</td><td>1175.7</td><td>1175.5</td><td>92</td><td>804</td><td>820</td></td<> | CyRLA-330 | 1175.7 | 1175.5 | 92 | 804 | 820 |
| CyRLA-335 1135.7 1135.6 93 801 820 CyRLA-388 1137.7 1137.6 92 802 819 CyRLA-399 1143.7 1143.6 92 803 820 CyRLA-548 1197.7 1197.6 82 803 820 CyRLA-548 1197.7 1197.6 81 803 822 CyRLA-360 1129.7 1129.6 91 804 823 CyRLA-360 1129.7 1167.6 89 801 820 CyRLA-319 1167.7 1167.6 89 801 820 CyRLA-340 1183.7 1183.6 92 802 820 CyRLA-193 1187.7 133 803 819 CyRLA-193 1187.7 133 801 820 CyRLA-193 1187.7 1149.6 84 804 820 CyRLA-193 1149.7 1149.6 84 804 820 CyRLA-192 101.7 1010.7 89 801 820 CyRLA-167 103.7 | CyRLA-329 | 1185.6 | 1185.7 | 89 | 802 | 823 |
| CyRLA-388 1137.7 1137.6 92 802 819 CyRLA-399 1143.7 1143.6 92 803 820 CyRLA-479 1139.7 1139.6 93 804 823 CyRLA-478 1197.7 1197.6 82 803 820 CyRLA-422 1059.7 1059.6 90 802 821 CyRLA-360 1129.7 1129.6 91 804 823 CyRLA-319 1167.7 1167.6 89 801 820 CyRLA-319 1167.7 1183.6 92 802 820 CyRLA-324 1183.7 1183.6 92 803 819 CyRLA-324 1149.7 1187.6 84 804 820 CyRLA-324 1101.7 1101.7 89 801 820 CyRLA-615 1089.7 1089.6 89 802 820 CyRLA-4165 1103.7 1139.6 93 801 820 | CyRLA-335 | 1135.7 | 1135.6 | 93 | 801 | 820 |
| CyRLA-399 1143.7 1143.6 92 803 820 CyRLA-479 1139.7 1139.6 93 804 823 CyRLA-548 1197.7 1197.6 82 803 820 CyRLA-548 1197.7 1155.6 90 802 821 CyRLA-360 1129.7 1129.6 91 804 823 CyRLA-319 1167.7 1167.6 89 801 820 CyRLA-319 1167.7 1183.6 92 802 820 CyRLA-319 1167.7 1183.6 92 803 819 CyRLA-324 1129.7 1138.6 92 802 820 CyRLA-384 1129.8 1129.7 83 802 820 CyRLA-384 1129.7 1149.6 84 804 820 CyRLA-384 1129.7 1101.7 89 801 820 CyRLA-311 1122.7 1122.6 72 803 821 CyRLA-405 1139.7 1103.6 92 803 820 <td< td=""><td>CyRLA-388</td><td>1137.7</td><td>1137.6</td><td>92</td><td>802</td><td>819</td></td<> | CyRLA-388 | 1137.7 | 1137.6 | 92 | 802 | 819 |
| CyRLA-479 1139.7 1139.6 93 804 823 CyRLA-548 1197.7 1197.6 82 803 820 CyRLA-222 1059.7 1059.6 90 802 821 CyRLA-474 1175.7 1175.6 81 803 822 CyRLA-319 1167.7 1167.6 89 801 820 CyRLA-319 1167.7 1167.6 89 801 820 CyRLA-319 1187.8 1187.7 93 803 819 CyRLA-193 1187.8 1129.7 83 802 820 CyRLA-193 1197.7 1149.6 84 804 820 CyRLA-192 1101.7 1101.7 89 801 820 CyRLA-165 1089.7 108.6 92 803 821 CyRLA-167 1103.7 1103.6 92 803 820 CyRLA-414 1156.6 1185.5 92 803 820 CyRLA-457 1139.7 1139.6 93 801 820 | CyRLA-399 | 1143.7 | 1143.6 | 92 | 803 | 820 |
| CyRLA-548 1197.7 1197.6 82 803 820 CyRLA-222 1059.7 1059.6 90 802 821 CyRLA-360 1129.7 1129.6 91 804 823 CyRLA-360 1129.7 1129.6 91 804 823 CyRLA-240 1183.7 1183.6 92 802 820 CyRLA-240 1183.7 1183.6 92 802 820 CyRLA-240 1183.7 1183.6 92 802 820 CyRLA-319 1167.7 1149.6 84 804 820 CyRLA-324 1129.7 1149.6 84 804 820 CyRLA-311 1122.7 1122.6 72 803 821 CyRLA-165 1089.7 1089.6 89 801 820 CyRLA-165 1089.7 103.6 93 801 820 CyRLA-414 1156.8 1156.7 93 801 820 | CyRLA-479 | 1139.7 | 1139.6 | 93 | 804 | 823 |
| CyRLA-222 1059.7 1059.6 90 802 821 CyRLA-447 1175.7 1175.6 81 803 822 CyRLA-360 1129.7 1129.6 91 804 823 CyRLA-319 1167.7 1167.6 89 801 820 CyRLA-240 1183.7 1183.6 92 802 820 CyRLA-240 1183.7 1183.6 92 803 819 CyRLA-384 1129.8 1129.7 83 804 820 CyRLA-275 1149.7 1149.6 84 804 820 CyRLA-275 1149.7 1122.6 72 803 821 CyRLA-165 1089.7 1089.6 89 802 820 CyRLA-165 1089.7 1089.6 92 803 820 CyRLA-165 1133.7 1139.6 93 801 820 CyRLA-405 1139.7 1139.6 92 803 820 CyRLA-414 1156.8 1156.7 93 801 819 <td< td=""><td>CyRLA-548</td><td>1197.7</td><td>1197.6</td><td>82</td><td>803</td><td>820</td></td<> | CyRLA-548 | 1197.7 | 1197.6 | 82 | 803 | 820 |
| CyRLA-447 1175.7 1175.6 81 803 822 CyRLA-360 1129.7 1129.6 91 804 823 CyRLA-319 1167.7 1167.6 89 801 820 CyRLA-240 1183.7 1183.6 92 802 820 CyRLA-193 1187.8 1187.7 93 803 819 CyRLA-193 1187.8 1187.7 93 803 819 CyRLA-275 1149.7 1149.6 84 804 820 CyRLA-111 1122.7 1122.6 72 803 821 CyRLA-167 1103.7 103.6 92 803 822 CyRLA-167 1103.7 1103.6 92 803 820 CyRLA-405 1139.7 1139.6 93 801 820 CyRLA-414 1156.8 1156.7 93 801 820 CyRLA-572 1199.6 1199.5 92 803 820 CyRLA-572 1199.6 1199.5 92 803 821 | CyRLA-222 | 1059.7 | 1059.6 | 90 | 802 | 821 |
| CyRLA-3601129.71129.691804823CyRLA-3191167.71167.689801820CyRLA-2401183.71183.692802820CyRLA-1931187.81129.783803819CyRLA-2751149.71149.684804820CyRLA-2751149.71101.789801820CyRLA-1111122.71122.672803821CyRLA-1651089.71089.689802820CyRLA-1651139.71139.692803822CyRLA-4051139.71139.693801819CyRLA-4141156.81156.793801819CyRLA-4771139.71139.692803820CyRLA-541143.81143.793802823CyRLA-5721199.61199.592805820CyRLA-5721199.61199.592803819CyRLA-1001211.81211.791803819CyRLA-2741147.71166.690803823CyRLA-2111121.71108.792803823CyRLA-4031141.71041.691802822CyRLA-4121087.71085.689802823CyRLA-2111121.71108.689803823CyRLA-4291143.71166.690803823CyRLA-4 | CyRLA-447 | 1175.7 | 1175.6 | 81 | 803 | 822 |
| CyRLA-3191167.71167.689801820CyRLA-2401183.71183.692802820CyRLA-1931187.81187.793803819CyRLA-3841129.81129.783802820CyRLA-2751149.71149.684804820CyRLA-2751149.71101.789801820CyRLA-921101.71101.789801820CyRLA-1651089.71089.689802820CyRLA-1671103.71103.692803822CyRLA-4051139.71139.693801819CyRLA-4141156.81156.793801819CyRLA-4141156.81156.793802823CyRLA-4771139.71139.692803820CyRLA-5541143.81143.793802823CyRLA-5721199.61199.592805820CyRLA-1801085.71085.692804820CyRLA-2111121.71121.693803821CyRLA-2401141.71041.691802822CyRLA-2411087.71108.792803823CyRLA-4031141.71041.691803821CyRLA-4031141.71041.691803823CyRLA-4031141.71041.685804820CyRLA-4 | CyRLA-360 | 1129.7 | 1129.6 | 91 | 804 | 823 |
| CyRLA-2401183.71183.692802820CyRLA-1931187.81187.793803819CyRLA-3841129.81129.783802820CyRLA-2751149.71149.684804820CyRLA-2751149.71101.789801820CyRLA-1921101.71101.789801820CyRLA-1651089.71089.689802820CyRLA-1651139.71103.692803822CyRLA-4051139.71139.693801820CyRLA-3411185.61185.592803820CyRLA-3411156.81156.793801819CyRLA-3541143.81143.793802823CyRLA-5541143.81143.793802823CyRLA-5541143.81143.791803819CyRLA-1001211.81211.791803819CyRLA-1111121.71121.693803823CyRLA-2111121.71166.690803821CyRLA-4031141.71041.691802822CyRLA-4121107.711075.681803821CyRLA-321121.71121.689802820CyRLA-3411152.71152.682802820CyRLA-3511157.71105.681803821CyRLA- | CyRLA-319 | 1167.7 | 1167.6 | 89 | 801 | 820 |
| CyRLA-1931187.81187.793803819CyRLA-3841129.81129.783802820CyRLA-2751149.71149.684804820CyRLA-2751101.71101.789801820CyRLA-1251101.71101.789801820CyRLA-1651089.71122.672803821CyRLA-1671103.71103.692803822CyRLA-051139.71139.693801820CyRLA-4051139.71139.692803820CyRLA-4141156.81156.793801819CyRLA-5721199.61199.592803820CyRLA-5721199.61199.592803820CyRLA-1801085.71085.692804820CyRLA-1801085.71085.692804820CyRLA-1801085.71085.692803823CyRLA-1801085.71085.692804820CyRLA-2741117.71117.693803821CyRLA-2741117.7110.685804820CyRLA-4201087.71087.792803823CyRLA-4211087.71087.792803823CyRLA-4221101.71101.685804820CyRLA-321121.71121.689802820CyRLA-32< | CyRLA-240 | 1183.7 | 1183.6 | 92 | 802 | 820 |
| CyRLA-3841129.81129.783802820CyRLA-2751149.71149.684804820CyRLA-921101.71101.789801820CyRLA-1111122.71122.672803821CyRLA-1651089.71089.689802820CyRLA-1651103.71103.692803822CyRLA-4051139.71139.693801820CyRLA-4141185.61185.592803820CyRLA-4771139.71139.692803820CyRLA-5741143.81143.793801819CyRLA-5721199.61199.592805820CyRLA-1001211.81211.791803819CyRLA-1111121.71121.693803823CyRLA-2741117.71117.692802820CyRLA-2741117.71101.685804820CyRLA-4031141.71041.691802822CyRLA-4031141.71041.691802823CyRLA-4121087.71108.792803823CyRLA-422101.71101.685804820CyRLA-321121.71121.689802820CyRLA-311152.71152.675804822CyRLA-3151125.71152.675804822CyRLA-315< | CyRLA-193 | 1187.8 | 1187.7 | 93 | 803 | 819 |
| CyRLA-2751149.71149.684804820CyRLA-921101.71101.789801820CyRLA-1111122.71122.672803821CyRLA-1651089.71089.689802820CyRLA-1671103.71103.692803822CyRLA-4051139.71139.693801820CyRLA-3411185.61185.592803820CyRLA-4141156.81156.793801819CyRLA-5541143.81143.793802823CyRLA-5721199.61199.592805820CyRLA-1001211.81211.791803819CyRLA-2741112.71121.693803823CyRLA-3591166.71166.690803823CyRLA-4031141.71041.691802822CyRLA-4031141.71041.691802822CyRLA-4031141.71041.691803823CyRLA-421087.711087.792803823CyRLA-421087.71108.685804820CyRLA-42105.71125.675804822CyRLA-3751125.71125.675804822CyRLA-3751125.71125.675804822CyRLA-4291113.71143.685803820 | CyRLA-384 | 1129.8 | 1129.7 | 83 | 802 | 820 |
| CyRLA-921101.71101.789801820CyRLA-1111122.71122.672803821CyRLA-1651089.71089.689802820CyRLA-1671103.71103.692803822CyRLA-4051139.71139.693801820CyRLA-3411185.61185.592803820CyRLA-4141156.81156.793801819CyRLA-4771139.71139.692803820CyRLA-5721199.61199.592803820CyRLA-5721199.61199.592805820CyRLA-1001211.81211.791803819CyRLA-1801085.71085.692804820CyRLA-2741117.71117.692802820CyRLA-3591166.71166.690803821CyRLA-4031141.71041.691802822CyRLA-4031141.71107.792803823CyRLA-6021101.71101.685804820CyRLA-3751125.71125.675804822CyRLA-3611152.71125.675804822CyRLA-3751125.71125.675804822CyRLA-4291113.71113.690803820 | CyRLA-275 | 1149.7 | 1149.6 | 84 | 804 | 820 |
| CyRLA-1111122.71122.672803821CyRLA-1651089.71089.689802820CyRLA-1671103.71103.692803822CyRLA-4051139.71139.693801820CyRLA-3411185.61185.592803820CyRLA-4141156.81156.793801819CyRLA-4771139.71139.692803820CyRLA-5541143.81143.793802823CyRLA-5721199.61199.592805820CyRLA-1001211.81211.791803819CyRLA-1111121.71121.693803823CyRLA-2741117.71117.692802820CyRLA-3591166.71166.690803821CyRLA-4031141.71041.691802822CyRLA-4121087.711087.792803823CyRLA-421087.711087.792803823CyRLA-4121101.71101.685804820CyRLA-4121101.71102.681803821CyRLA-3751125.71125.675804822CyRLA-4291113.71143.685803820CyRLA-4291113.71113.690803820 | CyRLA-92 | 1101.7 | 1101.7 | 89 | 801 | 820 |
| CyRLA-1651089.71089.689802820CyRLA-1671103.71103.692803822CyRLA-4051139.71139.693801820CyRLA-3411185.61185.592803820CyRLA-4141156.81156.793801819CyRLA-4771139.71139.692803820CyRLA-5541143.81143.793802823CyRLA-5721199.61199.592805820CyRLA-1001211.81211.791803819CyRLA-1101211.81211.791803823CyRLA-2111121.71121.693803823CyRLA-2741117.71117.692802820CyRLA-3591166.71166.690803821CyRLA-4031141.71041.691802822CyRLA-4031141.711087.792803823CyRLA-4021101.71101.685804820CyRLA-321121.71121.689802820CyRLA-3751125.71152.675804822CyRLA-3751125.71125.675804822CyRLA-4291113.71143.685803820 | CyRLA-111 | 1122.7 | 1122.6 | 72 | 803 | 821 |
| CyRLA-1671103.71103.692803822CyRLA-4051139.71139.693801820CyRLA-3411185.61185.592803820CyRLA-4141156.81156.793801819CyRLA-4771139.71139.692803820CyRLA-5541143.81143.793802823CyRLA-5721199.61199.592805820CyRLA-1001211.81211.791803819CyRLA-1801085.71085.692804820CyRLA-2741117.71121.693803823CyRLA-3591166.71166.690803821CyRLA-4031141.71041.691802822CyRLA-4031141.711087.792803823CyRLA-321101.71101.685804820CyRLA-3551125.71152.682802820CyRLA-3751125.71152.682802820CyRLA-3751125.71125.675804822CyRLA-4121143.71143.685803820CyRLA-4291113.71143.685803820 | CyRLA-165 | 1089.7 | 1089.6 | 89 | 802 | 820 |
| CyRLA-4051139.71139.693801820CyRLA-3411185.61185.592803820CyRLA-4141156.81156.793801819CyRLA-4771139.71139.692803820CyRLA-5541143.81143.793802823CyRLA-5721199.61199.592805820CyRLA-1001211.81211.791803819CyRLA-1101085.71085.692804820CyRLA-2111121.71121.693803823CyRLA-2741117.71117.692802820CyRLA-3591166.71166.690803821CyRLA-4031141.71041.691802822CyRLA-421087.711087.792803823CyRLA-221101.71101.685804820CyRLA-321121.71121.689802820CyRLA-321121.71121.689802820CyRLA-351125.71125.675804822CyRLA-3751125.71152.675804822CyRLA-4121143.71143.685803820CyRLA-4291113.71113.690803820 | CyRLA-167 | 1103.7 | 1103.6 | 92 | 803 | 822 |
| CyRLA-3411185.61185.592803820CyRLA-4141156.81156.793801819CyRLA-4771139.71139.692803820CyRLA-5541143.81143.793802823CyRLA-5721199.61199.592805820CyRLA-1001211.81211.791803819CyRLA-1801085.71085.692804820CyRLA-2111121.71121.693803823CyRLA-2741117.71117.692802820CyRLA-3591166.71166.690803821CyRLA-4031141.71041.691802822CyRLA-421087.711087.792803823CyRLA-321121.71121.689802820CyRLA-321121.71121.689802820CyRLA-3551125.71152.681803821CyRLA-3751125.71125.675804822CyRLA-4121143.71143.685803820CyRLA-4291113.71113.690803820 | CyRLA-405 | 1139.7 | 1139.6 | 93 | 801 | 820 |
| CyRLA-4141156.81156.793801819CyRLA-4771139.71139.692803820CyRLA-5541143.81143.793802823CyRLA-5721199.61199.592805820CyRLA-1001211.81211.791803819CyRLA-1801085.71085.692804820CyRLA-2111121.71121.693803823CyRLA-2741117.71117.692802820CyRLA-3591166.71166.690803821CyRLA-4031141.71041.691802822CyRLA-4021087.711087.792803823CyRLA-6021101.71101.685804820CyRLA-321121.71121.689802820CyRLA-3611152.71152.675804822CyRLA-3751125.71125.675804822CyRLA-4121143.71143.685803820CyRLA-4291113.71113.690803820 | CyRLA-341 | 1185.6 | 1185.5 | 92 | 803 | 820 |
| CyRLA-4771139.71139.692803820CyRLA-5541143.81143.793802823CyRLA-5721199.61199.592805820CyRLA-1001211.81211.791803819CyRLA-1801085.71085.692804820CyRLA-2111121.71121.693803823CyRLA-2741117.71117.692802820CyRLA-3591166.71166.690803821CyRLA-4031141.71041.691802822CyRLA-4031141.711087.792803823CyRLA-6021101.71108.689802820CyRLA-321121.71121.689802820CyRLA-3611152.71152.681803821CyRLA-3751125.71125.675804822CyRLA-4121143.71143.685803820CyRLA-4291113.71113.690803820 | CyRLA-414 | 1156.8 | 1156.7 | 93 | 801 | 819 |
| CyRLA-5541143.81143.793802823CyRLA-5721199.61199.592805820CyRLA-1001211.81211.791803819CyRLA-1801085.71085.692804820CyRLA-2111121.71121.693803823CyRLA-2741117.71117.692802820CyRLA-3591166.71166.690803821CyRLA-4031141.71041.691802822CyRLA-6021101.711087.792803823CyRLA-6021101.71101.685804820CyRLA-321121.71121.689802820CyRLA-3611152.71152.681803821CyRLA-3751125.71125.675804822CyRLA-4121143.71143.685803820CyRLA-4291113.71113.690803820 | CyRLA-477 | 1139.7 | 1139.6 | 92 | 803 | 820 |
| CyRLA-5721199.61199.592805820CyRLA-1001211.81211.791803819CyRLA-1801085.71085.692804820CyRLA-2111121.71121.693803823CyRLA-2741117.71117.692802820CyRLA-3591166.71166.690803821CyRLA-4031141.71041.691802822CyRLA-4031101.711087.792803823CyRLA-6021101.71101.685804820CyRLA-321121.71121.689802820CyRLA-3611152.71075.681803821CyRLA-3751125.71125.675804822CyRLA-4121143.71143.685803820CyRLA-4291113.71113.690803820 | CyRLA-554 | 1143.8 | 1143.7 | 93 | 802 | 823 |
| CyRLA-1001211.81211.791803819CyRLA-1801085.71085.692804820CyRLA-2111121.71121.693803823CyRLA-2741117.71117.692802820CyRLA-3591166.71166.690803821CyRLA-4031141.71041.691802822CyRLA-4021087.711087.792803823CyRLA-6021101.71101.685804820CyRLA-321121.71121.689802820CyRLA-3611152.71075.681803821CyRLA-3751125.71125.675804822CyRLA-4121143.71143.685803820CyRLA-4291113.71113.690803820 | CyRLA-572 | 1199.6 | 1199.5 | 92 | 805 | 820 |
| CyRLA-1801085.71085.692804820CyRLA-2111121.71121.693803823CyRLA-2741117.71117.692802820CyRLA-3591166.71166.690803821CyRLA-4031141.71041.691802822CyRLA-4021087.711087.792803823CyRLA-6021101.71101.685804820CyRLA-321121.71121.689802820CyRLA-3611152.71152.681803821CyRLA-3751125.71125.675804822CyRLA-4121143.71143.685803820CyRLA-4291113.71113.690803820 | CyRLA-100 | 1211.8 | 1211.7 | 91 | 803 | 819 |
| CyRLA-2111121.71121.693803823CyRLA-2741117.71117.692802820CyRLA-3591166.71166.690803821CyRLA-4031141.71041.691802822CyRLA-4021087.711087.792803823CyRLA-6021101.71101.685804820CyRLA-321121.71121.689802820CyRLA-3611152.71075.681803821CyRLA-3751125.71125.675804822CyRLA-4121143.71143.685803820CyRLA-4291113.71113.690803820 | CyRLA-180 | 1085.7 | 1085.6 | 92 | 804 | 820 |
| CyRLA-2741117.71117.692802820CyRLA-3591166.71166.690803821CyRLA-4031141.71041.691802822CyRLA-4421087.711087.792803823CyRLA-6021101.71101.685804820CyRLA-321121.71121.689802820CyRLA-3611152.71075.681803821CyRLA-3751125.71125.675804822CyRLA-4121143.71143.685803820CyRLA-4291113.71113.690803820 | CyRLA-211 | 1121.7 | 1121.6 | 93 | 803 | 823 |
| CyRLA-3591166.71166.690803821CyRLA-4031141.71041.691802822CyRLA-4421087.711087.792803823CyRLA-6021101.71101.685804820CyRLA-321121.71121.689802820CyRLA-311075.71075.681803821CyRLA-3611152.71152.682802820CyRLA-3751125.71125.675804822CyRLA-4121143.71143.685803820CyRLA-4291113.71113.690803820 | CyRLA-274 | 1117.7 | 1117.6 | 92 | 802 | 820 |
| CyRLA-4031141.71041.691802822CyRLA-4421087.711087.792803823CyRLA-6021101.71101.685804820CyRLA-321121.71121.689802820CyRLA-3171075.71075.681803821CyRLA-3611152.71152.682802820CyRLA-3751125.71125.675804822CyRLA-4121143.71143.685803820CyRLA-4291113.71113.690803820 | CyRLA-359 | 1166.7 | 1166.6 | 90 | 803 | 821 |
| CyRLA-4421087.711087.792803823CyRLA-6021101.71101.685804820CyRLA-321121.71121.689802820CyRLA-1771075.71075.681803821CyRLA-3611152.71152.682802820CyRLA-3751125.71125.675804822CyRLA-4121143.71143.685803820CyRLA-4291113.71113.690803820 | CyRLA-403 | 1141.7 | 1041.6 | 91 | 802 | 822 |
| CyRLA-6021101.71101.685804820CyRLA-321121.71121.689802820CyRLA-1771075.71075.681803821CyRLA-3611152.71152.682802820CyRLA-3751125.71125.675804822CyRLA-4121143.71143.685803820CyRLA-4291113.71113.690803820 | CyRLA-442 | 1087.7 | 11087.7 | 92 | 803 | 823 |
| CyRLA-321121.71121.689802820CyRLA-1771075.71075.681803821CyRLA-3611152.71152.682802820CyRLA-3751125.71125.675804822CyRLA-4121143.71143.685803820CyRLA-4291113.71113.690803820 | CyRLA-602 | 1101.7 | 1101.6 | 85 | 804 | 820 |
| CyRLA-1771075.71075.681803821CyRLA-3611152.71152.682802820CyRLA-3751125.71125.675804822CyRLA-4121143.71143.685803820CyRLA-4291113.71113.690803820 | CyRLA-32 | 1121.7 | 1121.6 | 89 | 802 | 820 |
| CyRLA-3611152.71152.682802820CyRLA-3751125.71125.675804822CyRLA-4121143.71143.685803820CyRLA-4291113.71113.690803820 | CyRLA-177 | 1075.7 | 1075.6 | 81 | 803 | 821 |
| CyRLA-3751125.71125.675804822CyRLA-4121143.71143.685803820CyRLA-4291113.71113.690803820 | CyRLA-361 | 1152.7 | 1152.6 | 82 | 802 | 820 |
| CyRLA-412 1143.7 1143.6 85 803 820 CyRLA-429 1113.7 1113.6 90 803 820 | CyRLA-375 | 1125.7 | 1125.6 | 75 | 804 | 822 |
| CyRLA-429 1113.7 1113.6 90 803 820 | CyRLA-412 | 1143.7 | 1143.6 | 85 | 803 | 820 |
| ··· ··· ··· ··· | CyRLA-429 | 1113.7 | 1113.6 | 90 | 803 | 820 |

 Table S1. Characterization by HPLC-MS and photophysical property of CyRLA library

Multiplex SERS nanotags for teratoma detection

| CyRLA-135 | 1175.6 | 1175.5 | 92 | 801 | 819 |
|-----------|--------|--------|----|-----|-----|
| CyRLA-201 | 1149.7 | 1149.6 | 92 | 804 | 820 |
| CyRLA-374 | 1107.7 | 1107.6 | 91 | 805 | 823 |
| CyRLA-364 | 1141.7 | 1141.6 | 92 | 802 | 820 |
| CyRLA-185 | 1087.7 | 1087.6 | 92 | 801 | 819 |
| CyRLA-164 | 1099.7 | 1099.6 | 89 | 802 | 820 |
| CyRLA-395 | 1151.7 | 1151.6 | 85 | 803 | 823 |

^aESI-MS m/z corresponding to [M⁺] values. ^bPurities were determined by integration of the UV absorbance signal at 780 nm. 54-member CyRLA compounds were characterized by HPLC-MS analysis. The purities of the whole library were determined by integration of the UV absorbance signal at 780 nm. The spectra of 10 μM in DMSO solution was recorded in SpectraMax M2 plate reader.

Characterization data of representative CyRLA compounds

CyRLA-442 (7 mg, 20%)



 $^1\text{H-NMR}$ (500 MHz, CDCl₃): δ 0.87-1.60 (m, 18 H), 1.65 (s, 6 H), 1.66 (s, 6 H), 1.7-1.92 (m, 14 H), 2.14-2.72 (m, 12 H), 3.03-3.28 (m, 11 H), 3.48-3.72 (m, 13 H), 4.0-4.1 (m, 6 H), 6.12 (d, 1 H, J=13.5 Hz), 6.24 (d, 1 H, J=13.5 Hz), 7.04-7.44 (m, 8 H), 7.52 (d, 1H, J=13 Hz), 7.55 (d, 1H, J=13 Hz).

ESI-MS *m*/*z* (M⁺), calc'd: 1087.7, found 1087.4.

CyRLA-572 (9 mg, 17%)



¹H-NMR (500 MHz, CDCl₃): δ 1.06-1.62 (m, 18 H), 1.66 (s, 6 H), 1.68 (s, 6 H), 1.69-2.06 (m, 9 H), 2.18-2.78 (m, 10 H), 3.04 -3.31 (m, 11 H), 3.44-3.73 (m, 13 H), 3.93-4.06 (m, 6 H), 6.14 (d, 1 H, *J*=14.5 Hz), 6.17 (d, 1 H, *J*=14.5 Hz), 6.99-7.43 (m, 12 H), 7.53 (d, 1 H, *J*=14.5 Hz), 7.56 (d, 1 H, *J*=14.5 Hz). ESI-MS *m/z* (M⁺), calc'd: 1199.6, found 1201.1 (due to bromine isotope).

CyRLA-364 (7.5 mg, 15%)



¹H-NMR (500 MHz, CDCl₃): δ 1.06-1.62 (m, 18 H), 1.67 (s, 6 H), 1.68 (s, 6 H), 1.70-1.92 (m, 9 H), 1.99-2.46 (m, 10 H), 2.52-2.62 (m, 6 H), 2.72 (m, 2 H), 3.0-3.72 (m, 15 H), 4.0-4.12 (m, 6 H), 4.53 (s, 2 H), 6.10 (d, 1 H, *J*=14.5 Hz), 6.16 (d, 1 H, *J*=14.5 Hz), 7.07-7.49 (m, 12 H), 7.52 (d, 1 H, *J*=15 Hz), 7.55 (d, 1 H, *J*=15 Hz). ESI-MS *m*/*z* (M⁺), calc'd: 1141.7, found 1141.4.

CyRLA-335 (8.2 mg, 18%)



¹H-NMR (500 MHz, CDCl₃): δ 1.09-1.57 (m, 18 H), 1.61 (s, 6 H), 1.63 (s, 6 H), 1.71-2.03 (m, 11 H), 2.16-2.80 (m, 10 H), 3.05 -3.33 (m, 11 H), 3.54-3.76 (m, 13 H), 3.96-4.17 (m, 6 H), 6.14 (d, 1 H, *J*=13.5 Hz), 6.17 (d, 1 H, *J*=13.5 Hz), 7.09-7.45 (m, 13 H), 7.56 (d, 1 H, *J*=13.5 Hz), 7.59 (d, 1 H, *J*=13.5 Hz). ESI-MS *m/z* (M⁺), calc'd: 1135.7, found 1135.6.

CyRLA-240 (6 mg, 12%)



¹H-NMR (500 MHz, CDCl₃): δ 1.04-1.51 (m, 16 H), 1.62 (s, 6 H), 1.64 (s, 6 H), 1.69-1.90 (m, 8 H), 1.99-2.43 (m, 10 H), 2.50-2.61 (m, 6 H), 2.76 (m, 2 H), 3.05-3.74 (m, 15 H), 3.97-4.13 (m, 6 H), 4.64 (s, 2 H), 6.10 (d, 1 H, *J*=14 Hz), 6.16 (d, 1 H, *J*=14 Hz), 7.05-7.53 (m, 17 H), 7.54 (d, 1 H, *J*=13.5 Hz), 7.57 (d, 1 H, *J*=13.5 Hz). ESI-MS *m*/*z* (M⁺), calc'd: 1183.7, found 1183.6.

SERS spectra of different Raman reporters



Figure S1. Normalized SERS spectra of CyRLA-329, CyRLA-335, CyRLA-240 and CyRLA-572 after chemisorption on 60 nm gold nanoparticle. Spectra were measured in a Raman microscope (785 nm laser excitation, 1.2 mW laser power, and acquisition time: 10 s.



SERS measurement of three different Raman reporters

Figure S2. Normalized SERS spectra of (A) Cy7.5LA, (B) Cy7LA, (C) CyRLA-572 and (D) mixture of three (Cy7.5LA, Cy7LA, CyRLA-572) after chemisorption on 60 nm gold nanoparticle. Spectra were measured in a Raman microscope (785 nm laser excitation, 1.2 mW laser power, and acquisition time: 10 s. SERS spectra was measured in low concentration when all three AuNPs-Reporters were mixed.



UV-Vis spectroscopy

Figure S3. A: UV-Vis-NIR electronic absorbance of Raman reporters (Cy7LA, Cy7.5LA and CyRLA-572; 20 µM in deionized water. B: UV-Vis-NIR surface Plasmon resonance (SPR) of citrate stabilized gold nanoparticles with NIR or without Raman reporters.





Figure S4. Time course SERS measurement of CyRLA-572@AuNPs@PEG in deionized water. SERS intensities of the highest Raman peaks (i.e. 523 cm^{-1}) are plotted as means ± standard deviation of 5 independent measurements taken from the same sample at different time points.



Figure S5. Time course SERS measurement of CyRLA-240@AuNPs@PEG in deionized water. SERS intensities of the highest Raman peaks (i.e. 523 cm^{-1}) are plotted as means ± standard deviation of 3 independent measurements taken from the same sample at different time points.



Figure S6. Time course SERS measurement of CyRLA-364@AuNPs@PEG in deionized water. SERS intensities of the highest Raman peaks (i.e. 523 cm^{-1}) are plotted as means ± standard deviation of 3 independent measurements taken from the same sample at different time points.



Transmission electron microscopy

Figure S7. Transmission electron microscopy (TEM) images of: A: PEG-coated Cy7.5LA@AuNPs@PEG; B: Cy7LA; C: CyRLA-572 nanotag; Scale bar: 50 nm for Cy7 and Cy7.5.

Antibody conjugation to SERS nanotags



Figure S8. Surface plasmon resonance spectra of Cy7LA@AuNPs@PEG nanotags before and after conjugation of antibody.



Figure S9. Bright field, SERS mapping images, merged images and complementary SERS spectra of differentiated mouse embryonic stem cells (mESC) treated with CyRLA-572@AuNPs@PEG. The mapping experiments were scanned at multiplex peaks of corresponding nanotags (523 cm⁻¹) at an interval of 2 μ m (785 nm excitation) and the intensities were normalized between the lowest (0) and the highest color (1) values. Scale bar: 20 μ m.



Figure S10. Bright field, SERS mapping images, merged images and complementary SERS spectra of differentiated mouse embryonic stem cells (mESC) treated with AuNPs@CyRLA@PEG-anti-HER2. The mapping experiments were scanned at multiplex peaks of corresponding nanotags (523 cm⁻¹) at an interval of 2 μ m (785 nm excitation) and the intensities were normalized between the lowest (0) and the highest color (1) values. Scale bar: 20 μ m.



Figure S11. *In vivo* spectra from liver site after injection of pegylated AUNPs i.e Cy7LA@AuNPs@PEG. The spectra were scanned at an interval of 2 μ m (785 nm excitation wavelength) and the intensities were normalized after baseline corrections; acquisition time: 30 s.



Figure S12. *In vivo* spectra from liver site after injection of mixture of three nanotags i.e Cy7LA@AuNPs@PEG-anti-CD184, Cy7.5LA@AuNPs@PEG-anti-Notch1 and CyRLA-572@AuNPs@PEG-anti-CD34 nanotgas. The spectra were scanned at an interval of 2 µm (785 nm excitation wavelength) and the intensities were normalized after baseline corrections; acquisition time: 30 s.



Figure S13. *In vivo* imaging of teratoma in animal model model. Three different multplexed peaks i.e 503 cm⁻¹, 523 cm⁻¹, and 584 cm⁻¹ and one common peak 554 cm⁻¹ for Cy7LA and CyRLA-572 were applied to scan the teratoma location for getting the images.