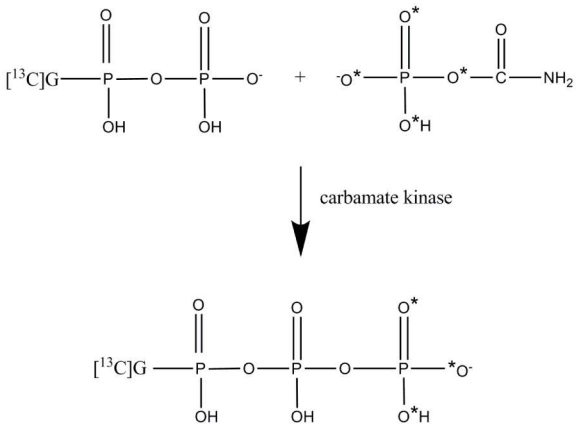
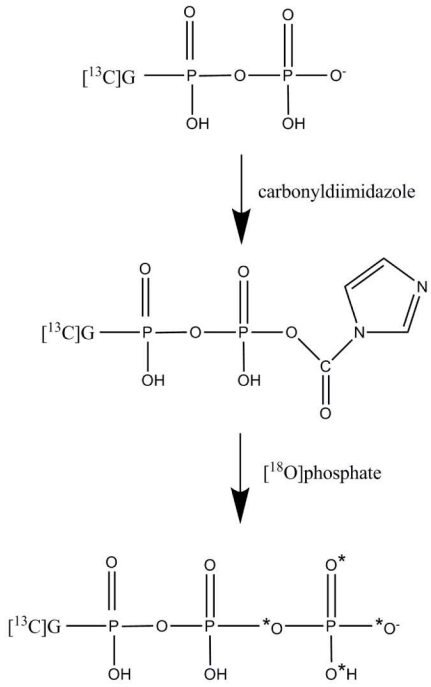
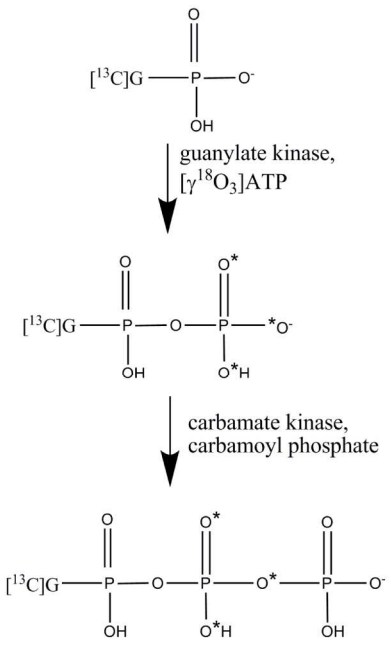
Supplementary materials



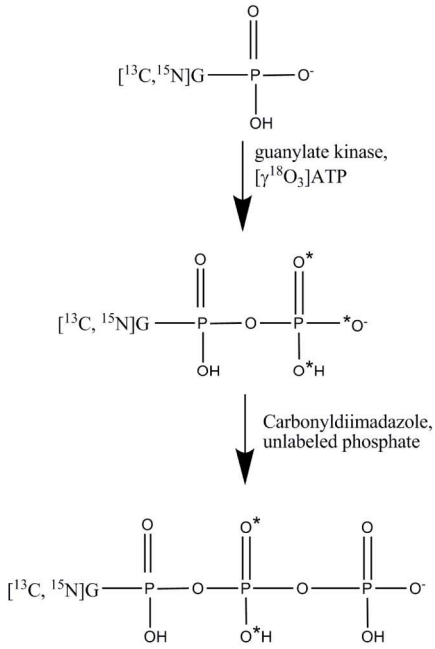
Scheme 1. Synthesis of [^{13}C, $\gamma^{18}O_3$]GTP. G stands for guanosine. O* indicates ^{18}O labeling.



Scheme 2. Synthesis of [^{13}C, $\gamma^{18}O_4$]GTP. G stands for guanosine. O* indicates ^{18}O labeling.

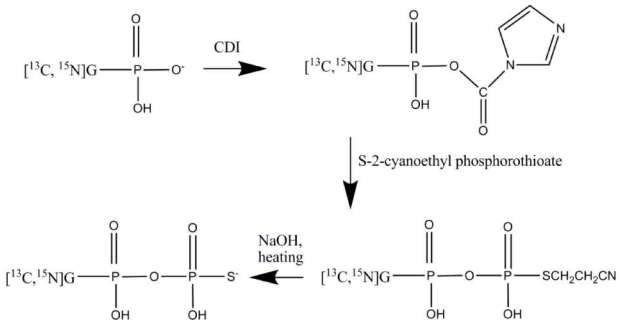


Scheme 3. Synthesis of [^{13}C, $\beta^{18}O_3$]GTP. G stands for guanosine. O* indicates ^{18}O labeling.

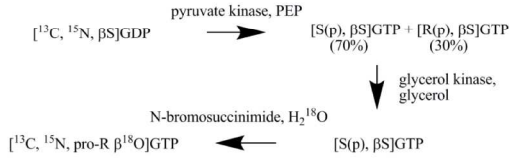


Scheme 4. Synthesis of [^{13}C, ^{15}N, $\beta^{18}O_2$]GTP. G stands for guanosine. O* indicates ^{18}O labeling.

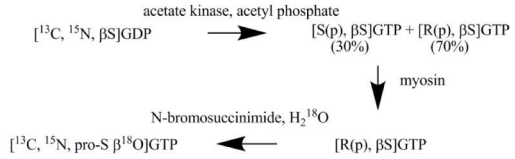
A. Synthesis of [^{13}C, ^{15}N, βS]GDP



B. Synthesis of [^{13}C, ^{15}N, pro-R β^{18}O]GTP



C. Synthesis of [^{13}C, ^{15}N, pro-S β^{18}O]GTP



Scheme 5. Synthesis of [^{13}C, ^{15}N, pro-S, β^{18}O]GTP and [^{13}C, ^{15}N, pro-R, β^{18}O]GTP. G stands for guanosine. O* indicates ^{18}O labeling. CDI and PEP stand for carboyldiimidazole and phosphoenolpyruvate.