**Calcium Oxalate Worksheet**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Inhibitor** | **bovine serum albumin (BSA)** | **Transferrin (Tf)** | **chondroitin sulfate A (C4S)** | **citric acid (CA)** | **dimethyl hydroxyglutaric acid (DHG)** |
| **Protein/ Simple Molecule** | Protein | Protein | Simple Structure | Simple Structure | Simple Structure |
| **Description** | Protein derived from cows | Iron-binding blood plasma glycoprotein | Usually found attached to proteins | Natural preservative | Found in urine of people with certain deficiencies |
| **Structure** | http://upload.wikimedia.org/wikipedia/en/4/41/Bovine_serum_albumin_3v03_crystal_structure.jpg | File:Protein TF PDB 1a8e.png | http://www.sigmaaldrich.com/content/dam/sigma-aldrich/articles/biology/Glycobiology/chondroitin-sulfate-a-structure.jpg | File:Zitronensäure - Citric acid.svg | 3-Hydroxyglutaric Acid Dimethyl Ester |
| **MW** | 66,463 | 78,000 | 463.37 | 192.12 | 176.17 |
| **pH of solution/pKa** | pH of 1% solution: 5.2-7 | pKa 6.2 | pKas in range of -3.7 to -1.9 | Three pKas in range of 3.15-5.19 | pKas in the range of -3.1 to 3.79 |
| **H-bond acceptor** | N/A | N/A | 15 | 7 | 5 |
| **H-bond donor** | N/A | N/A | 8 | 4 | 3 |

1. **What does a calcium oxalate crystal look like without any inhibitors? Draw.**
2. **Draw what happens to the calcium oxalate crystal when each inhibitor is added.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **bovine serum albumin (BSA)** | **Transferrin (Tf)** | **chondroitin sulfate A (C4S)** | **citric acid (CA)** | **dimethyl hydroxyglutaric acid (DHG)** |
|  |  |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Inhibitor** | **bovine serum albumin (BSA)** | **Transferrin (Tf)** | **chondroitin sulfate A (C4S)** | **citric acid (CA)** | **dimethyl hydroxyglutaric acid (DHG)** |
| Mark on the crystal where each molecule binds |  |  |  |  |  |

1. **Compare groups of inhibitors. (two groups: proteins and simple structures)   
   Which were the most effective at blocking growth? Speculate why one would be more effective.**
2. **Compare inhibitors within their own group. Which ones were the most effective?   
   Explain why this might be.**
3. **Do the crystals have different shapes when inhibitors are added? What might cause these different shapes? (Think about how steps grow on a crystal surface in all directions but at different rates. How does an inhibitor affect those rates?)**
4. **Of all the inhibitors used today, which do you think would be the best choice as a possible drug? Why?**