A Hypothesised Mechanism for Viral Budding, Supported by Integration of New Protein Associated Curvature Data into a Mathematical Model of the Cell Membrane

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Following replication within cells, new virus particles may be released either upon cell death or gradually, by budding out of the surface of still living cells. To develop treatments that can inhibit or interrupt this process requires a better understanding of how it occurs. Here the hypothesis that for certain viruses budding may driven by viral-protein associated curvature of the cell membrane is supported by the application of a mechanistic mathematical model of the membrane. We show that localised increases in curvature alone are sufficient to generate viral buds, while locally induced increases in stiffness accelerate the process and results in tighter buds. Numerical results show good qualitative and quantitative agreement in bud shape and size with experimental observations for arenavirus, for which recent experimental results have confirmed that viral protein is associated with increased membrane curvature.