An Interactive Software Tool for the Design of Pharmaceutical Products and Processes

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Background

1. Pharmaceutical process engineering is an important topic for current Chemical Engineering curriculum.
2. Design and development of the full-chain process require extensive and tedious calculations, which tend to stifle creative thinking of students.
3. A teaching tool with the proper GUI and engineering contents is needed.
4. In two years time, Kelvin Fung and 4 UG graduate students had developed a software tool, called ProWare. It can simulate the unit operations of “powder processing” in a pharmaceutical process.

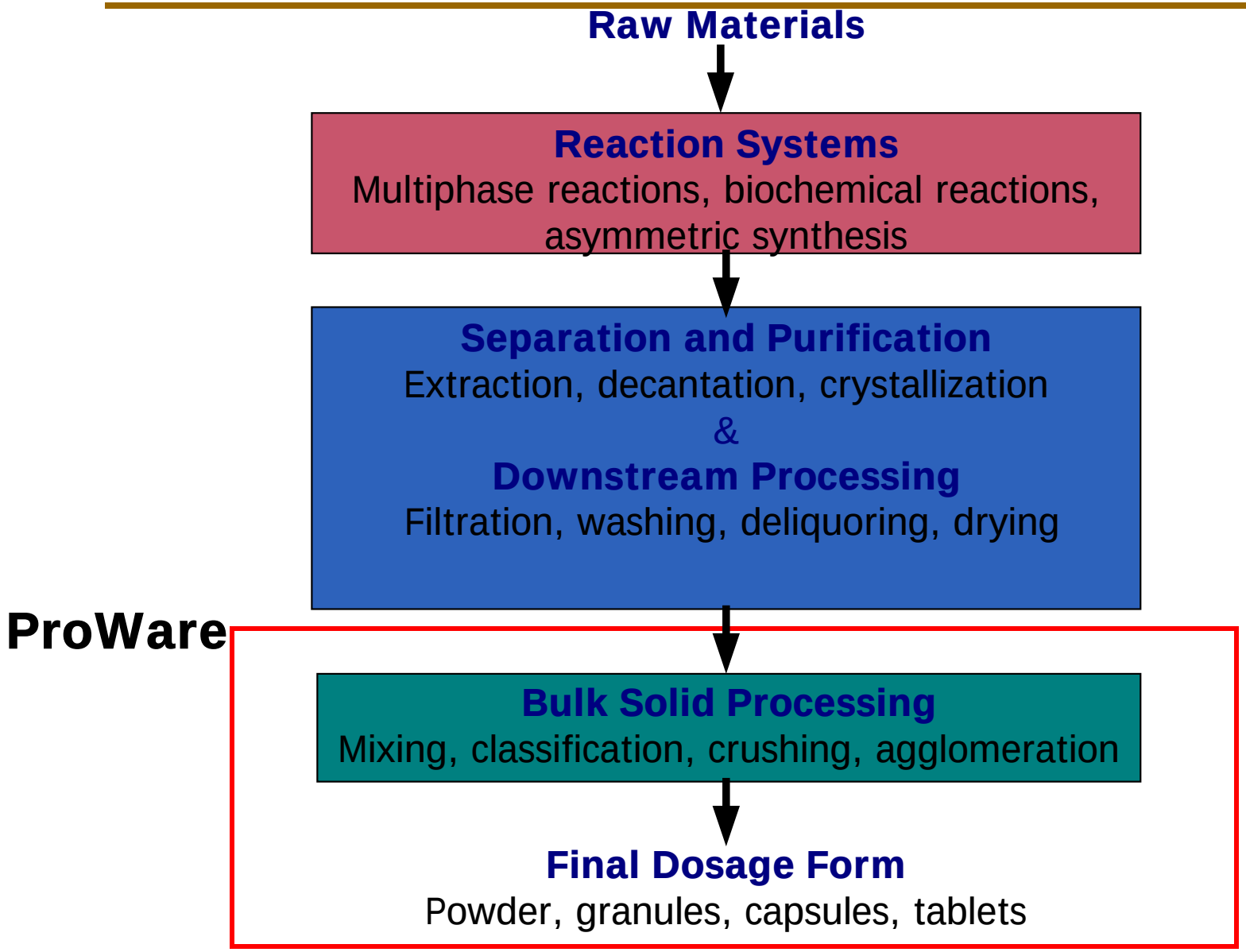
Objectives

To design an interactive software tool to enhance teaching quality and raise students' interests on the design of pharmaceutical products and processes.

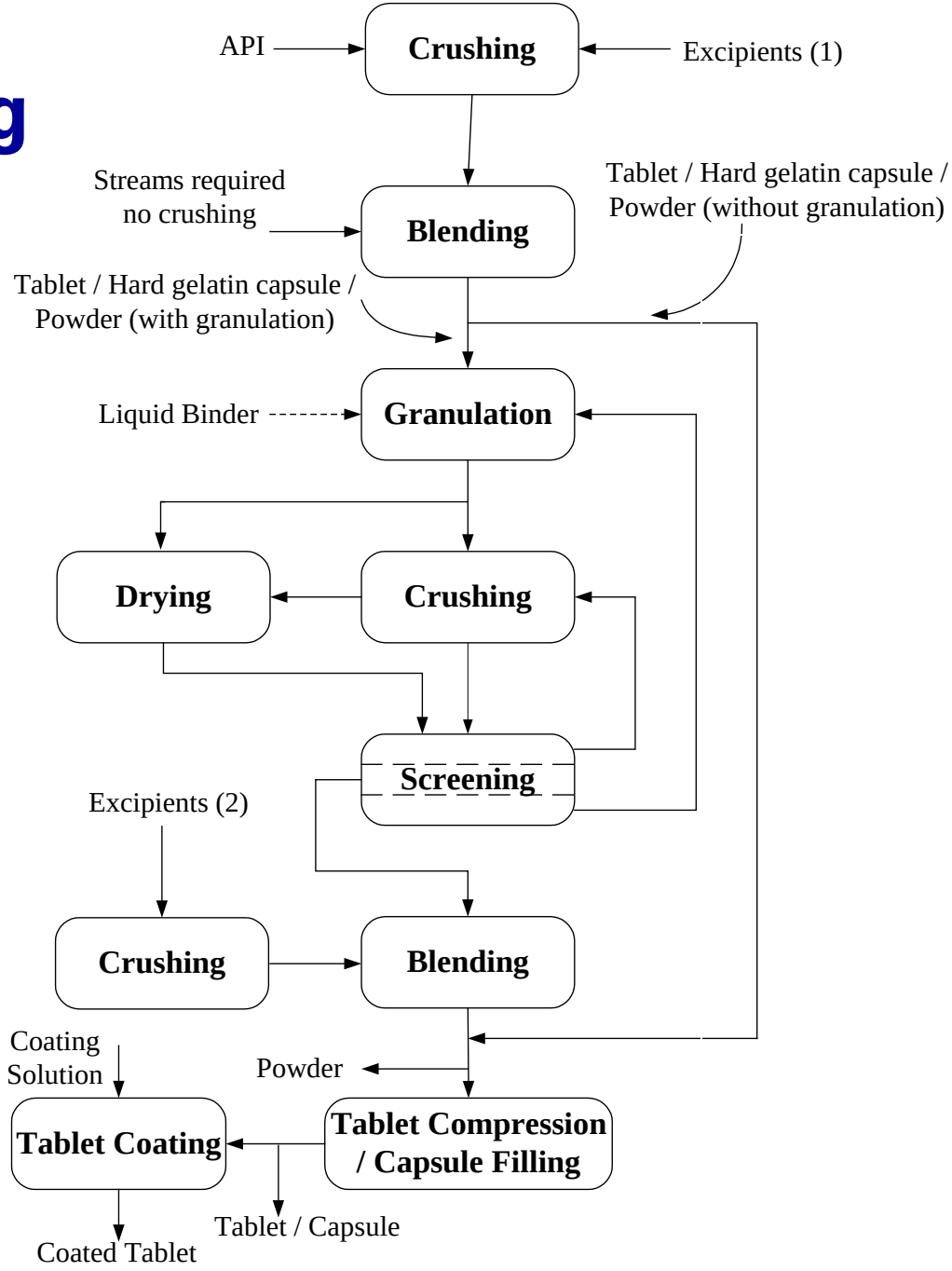
To modify the ProWare software by adding more unit operations of reactions, separations and purifications and final dosage form.

This talk will focus on the current development of ProWare and how it will help teaching and learning of the development of pharmaceutical process engineering.

A Generic Pharmaceutical Process



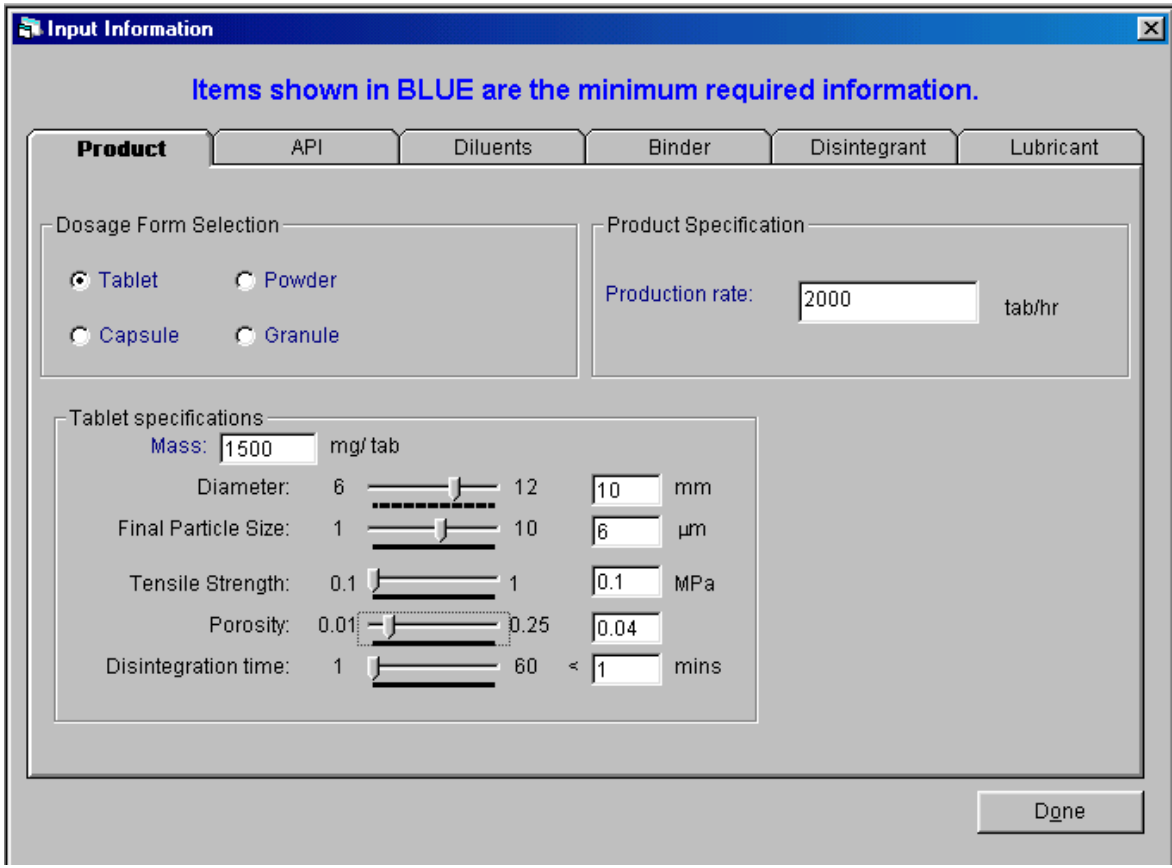
Powder Processing



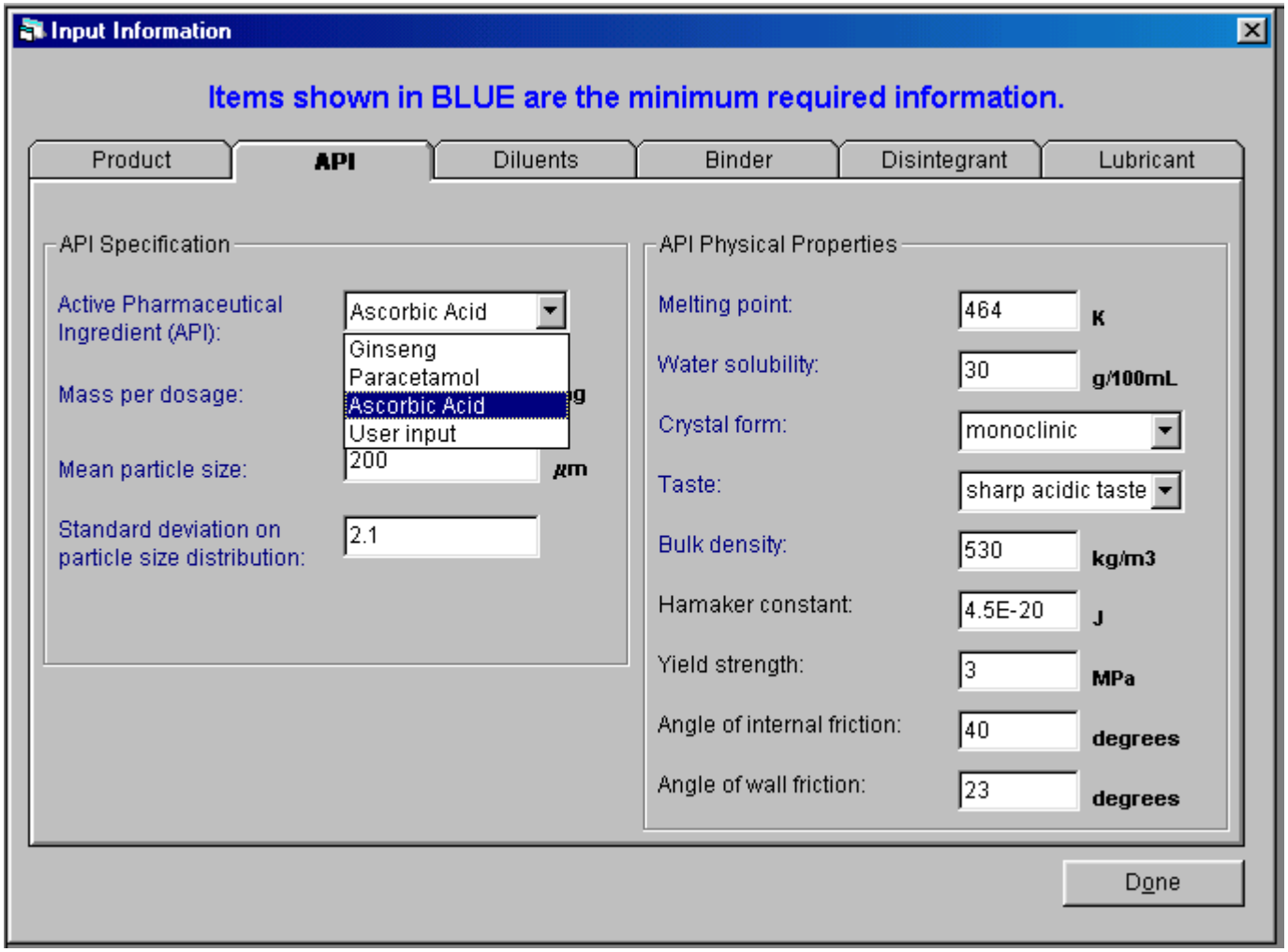
ProWare

Functions and interfaces:

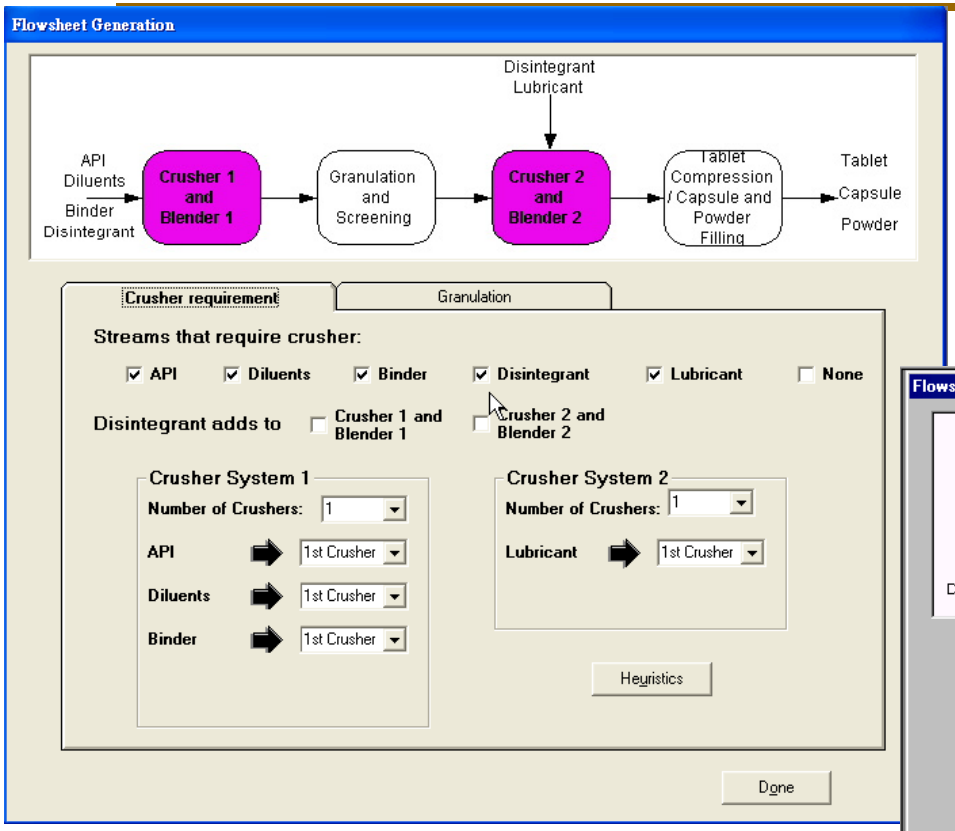
1. API and other excipients input format;
2. Flowsheet generation;
3. Process flow diagram;
4. Particle size distribution calculation; and
5. Data storage

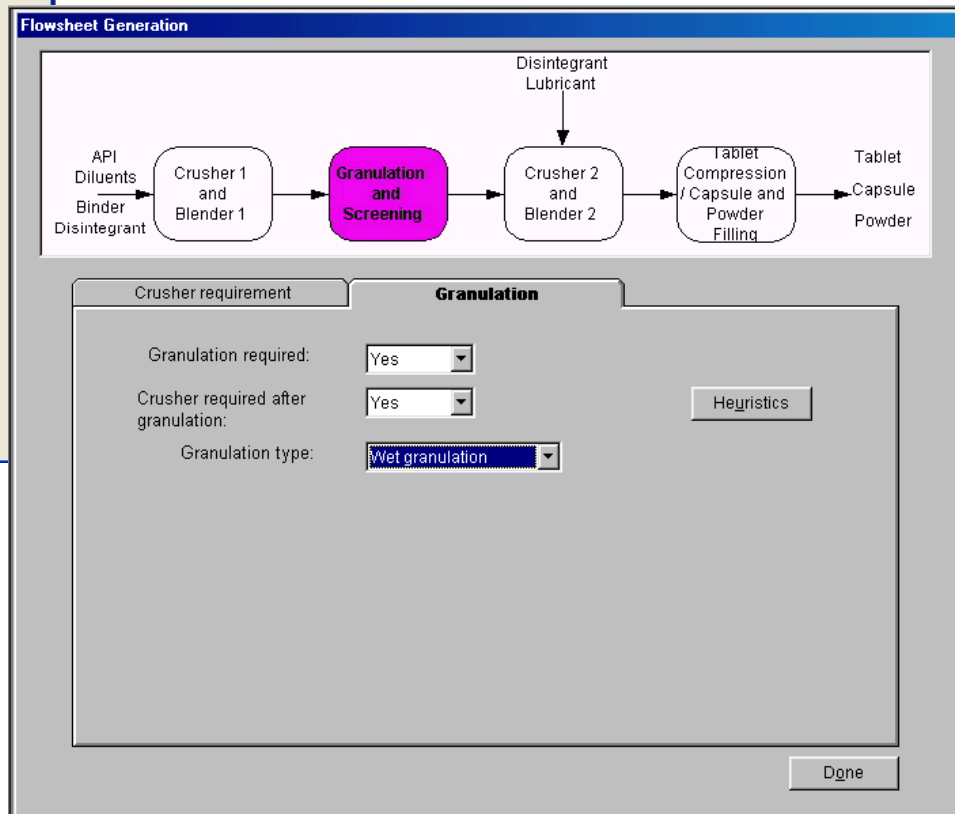


Selection of API and Excipients

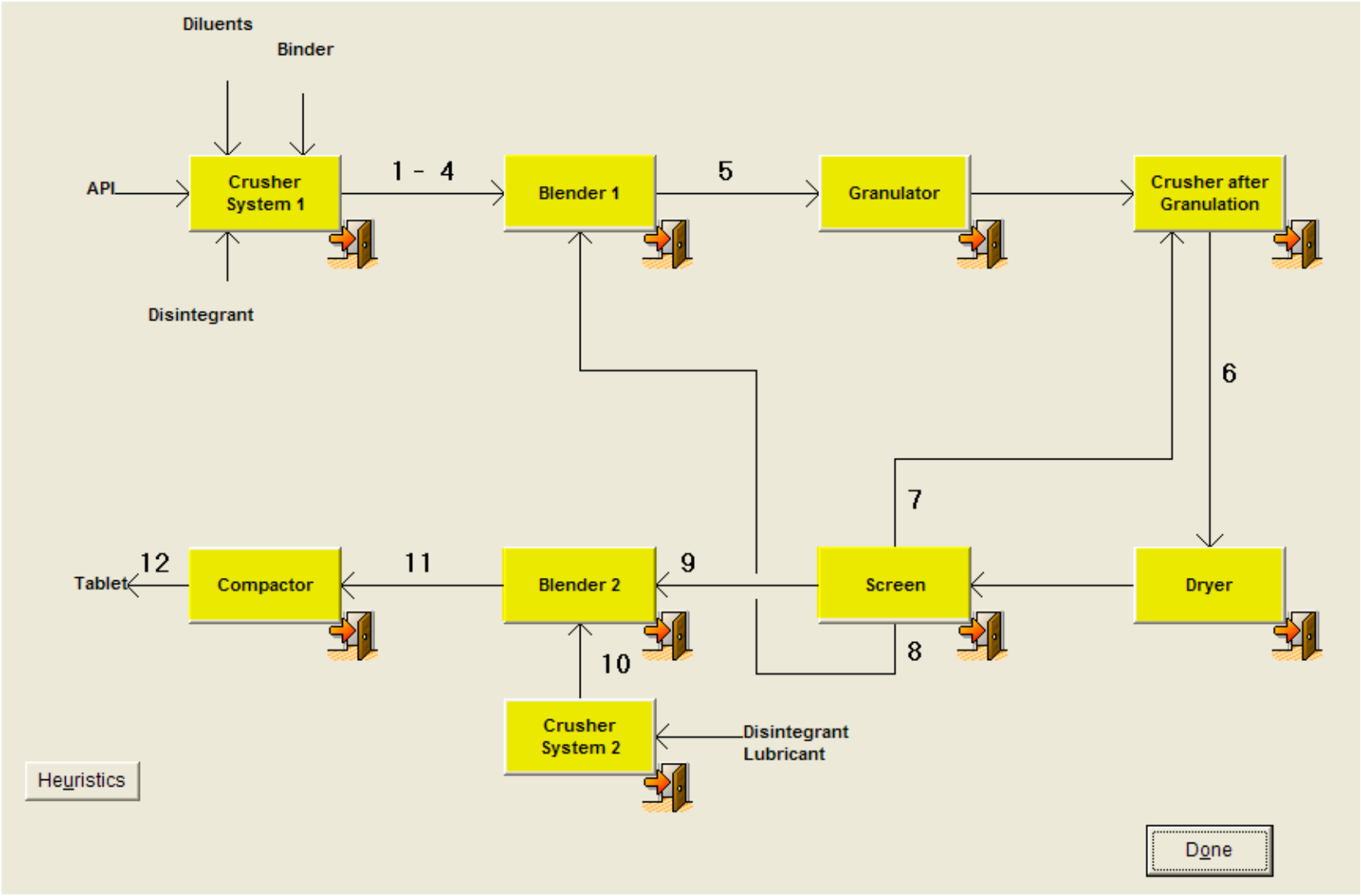


Flowsheet Generation – Crushers and Granulator

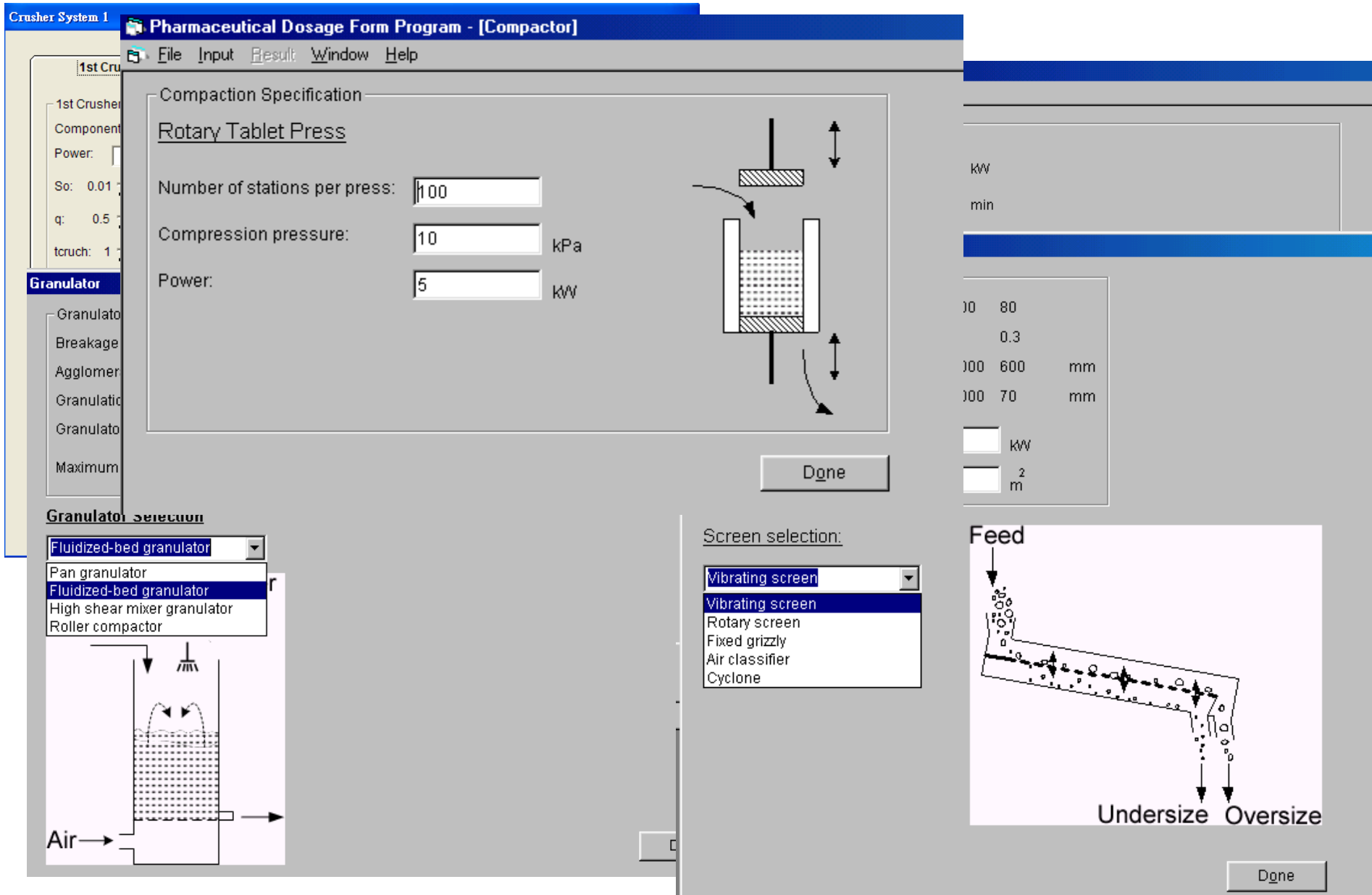




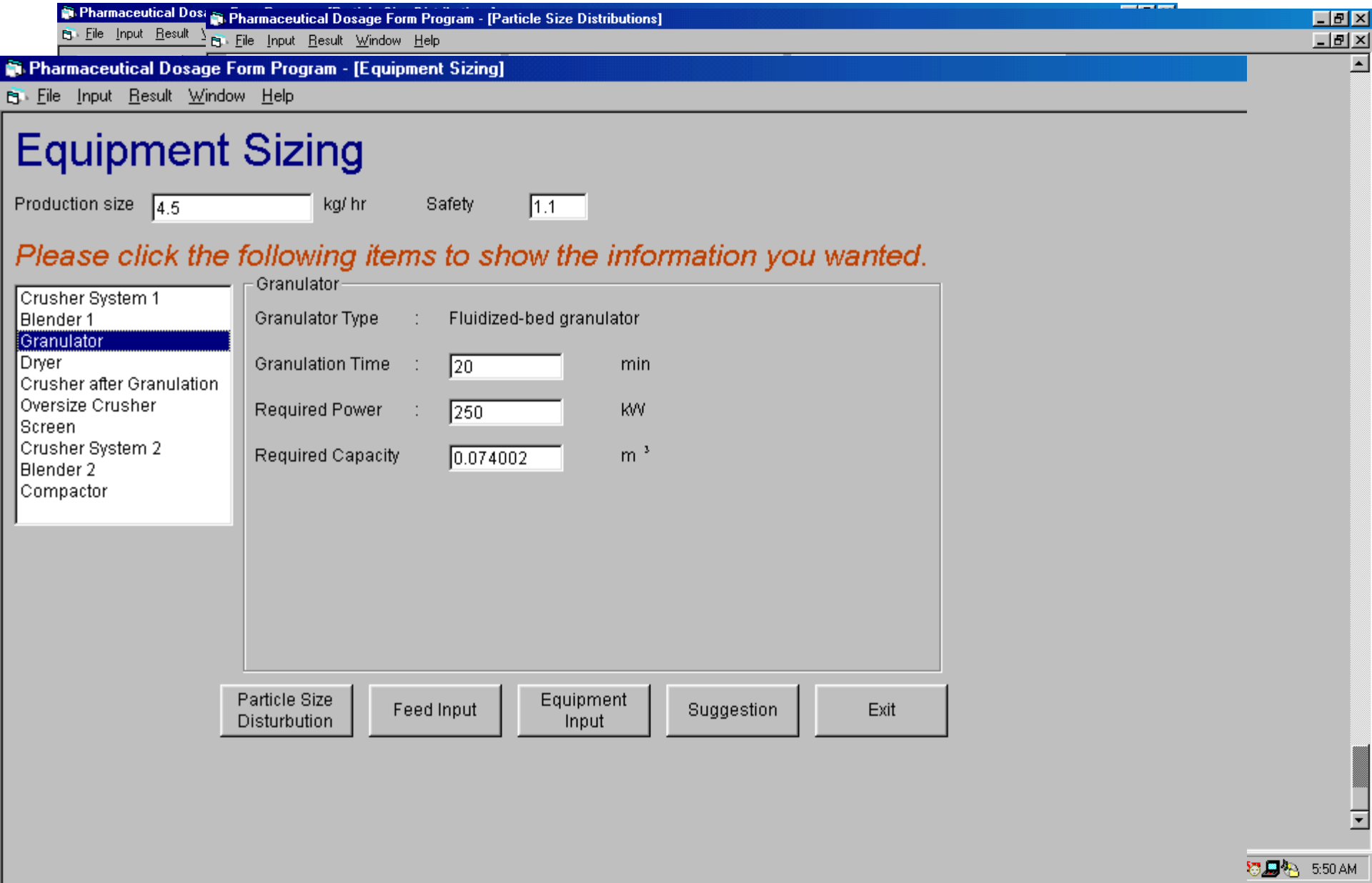
Process Flow Diagram



Unit Operations



Particle Size Distribution



Further Development

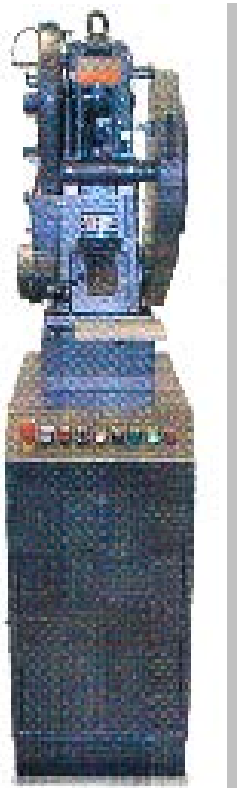
1. To modify the existing GUI of ProWare on bulk solids processing and dosage form design
2. To be more user-friendly
3. To simulate the whole pharmaceutical process by adding unit operations of reactions, separations and purifications

   e.g., reactors, crystallizers, extractors, chromatographic columns, distillation columns, etc.

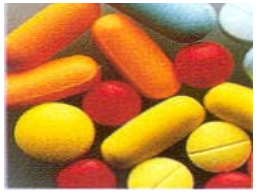
Bulk Solids Processing and Dosage Forms

Obtain empirical relations between the equipment operating parameters and particle size distribution from experimental results.

Granules



Tablets



Unit Operations

Reaction/
Crystallization

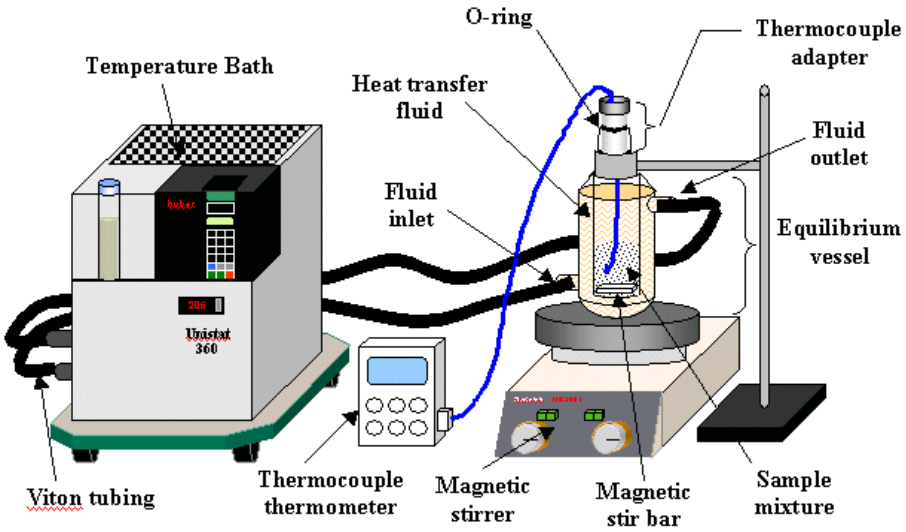
Supercritical
Fluid Extraction

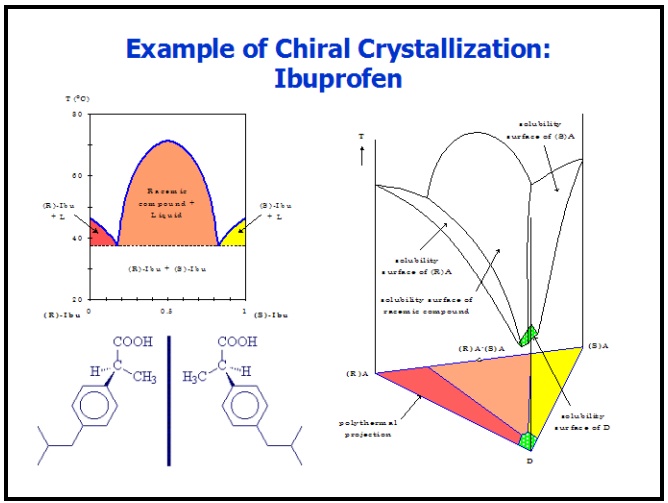
SFChromat

Granulation

Basic Thermodynamics - Phase Diagram

Solid Liquid Equilibrium





Liquid Liquid Equilibrium

Acknowledgements

1. We would like to thank the CLI and UGC for supporting the further development of the software.

2. We would like to thank Y. C. Cheng, H. K. Lee, K. F. Tsang, S. K. Tsang and Kelvin K. Y. Fung on the development of ProWare.