Computer Note

MapChart: Software for the Graphical Presentation of Linkage Maps and QTLs

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Over the last 15 years a wealth of linkage maps and quantitative trait loci (QTL) mapping results have become available. The pace of generating this genetic information is accelerating owing to advances in molecular marker technology and the development of software for linkage analysis and QTL mapping.

A graphical presentation of this information is often needed, both for publication purposes and for easy and intuitive interpretation. However, the development of tools for the graphical presentation of linkage maps and QTLs has lagged behind.

DrawMap (Van Ooijen 1994) was an early program capable of drawing genetic linkage maps. However, the output of this program was not very well suited for use in modern word processors and presentation software. Authors in this field have therefore, of necessity, resorted to the use of general graphics software to compose charts of their linkage and QTL maps. This is always a laborious process, with sometimes disappointing results. Also, each time a map is recalculated when new data become available, this process has to be repeated. For this reason I developed MapChart, a software package that takes as input the linkage and QTL data and generates charts of linkage maps and QTLs. These charts can easily be exported to word processing or presentation software. The charts are exported as vector graphics (Windows enhanced metafiles) rather than bitmaps, which makes them easy to rescale and to edit further if desired.

User Interface

MapChart has a standard Windows interface, with a main menu, toolbar, and pop-up menus. The manual is available from the Help menu in the form of an HTML file with index and links.

Several maps can be opened simultaneously, each in their own subwindow. A map window consists of two tab sheets. One sheet shows a text editor with the map data, the other shows the chart pages. The chart pages can be shown at several magnifications, from a full-page view to a view at printer resolution. Both the charts and the map data can be printed, saved to files, or copied to the Windows clipboard.

Charts

MapChart displays charts of a series of linkage groups. A linkage group chart consists of a vertical bar on which the map positions and names of loci are indicated. Next to the bar, QTL intervals and QTL graphs can be shown, and sections of the bar can be highlighted. Linkage group charts can also be split into segments, which can be useful if they are too large to fit on the page. All the elements of the charts can be formatted with their own color, fill style, text font, etc. An example of a linkage group chart with some of these elements is shown in Figure 1.

By default the linkage groups are shown side by side on one or more pages, but they can also be shifted up or down to align homologous parts. Further, extra horizontal spacing or page breaks can be inserted between linkage groups to emphasize grouping (e.g., corresponding male and female linkage groups), and linkage group charts can be aligned vertically.

Figure 1. Chart of one linkage group, showing the bar, loci in various font styles and font sizes, positions (as absolute map positions), a cross-hatched bar segment, a 1 and 2 LOD QTL interval, and a QTL LOD graph.
The general appearance of the charts.

Chart Options
Many chart options are available to adjust the general appearance of the charts.

QTLs, Graphs, and Bar Segments
To each linkage group a QTLs section, a graphs section, and/or a bar segments section can be added. QTL intervals and bar segments are specified by their start and endpoints; for QTLs an inner and an outer interval (e.g., a 1 LOD and 2 LOD interval) can be specified. Graphs are specified by a reference to a text file containing the map positions and function values (e.g., LOD values) of graph points. Such graph files can be derived from the output of QTL mapping software such as MapMaker/QTL (Lincoln and Lander 1990) or QTL Cartographer (Basten et al. 1999) by extracting the relevant data columns. The output of MapQTL (Van Ooijen 2000; Van Ooijen and Maliepaard 1996) can be read without further editing.

Availability
MapChart is available for Microsoft Windows 95 and Windows NT 3.5 or higher operating systems. It has been developed over a period of 2 years, and the current version (2.0, February 2001) incorporates many suggestions from early users. MapChart can be downloaded and a free license ordered from the website at http://www.joinmap.nl. The installation package includes example files illustrating the various features of MapChart.

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References
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