Dietary MicroRNA Database (DMD): A database and analytical tool for microRNAs in human foods

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Background

With many tools publicly available from various academic and commercial sources, there is a large amount of information on microRNAs. Empowered by the emerging deep sequencing technology, microRNAs have been extensively discovered in various dietary resources including plants (e.g., rice, tomato, grape) and animals (e.g., milk and meats). Given the broad implications of microRNA in health and disease, research enthusiasm for functional impacts of exogenous food microRNA in human cellular phenotypes is rising, which warrants the effort to build related bioinformatics tools and databases.

The Dietary MicroRNA Database (DMD) introduced here represents the first repository in this domain for archiving and distributing the published food-borne microRNAs in literature and publication databases, as well as novel microRNAs discovered in our group.

Outline

Using microRNAs that may be present in human diets found through literature search. The following workflow diagram illustrates the process of data aggregation and analysis using cross-species sequence comparison and pathway enrichment analysis to produce the structured data that is presentable to the users of the database.

Datasets

Included in the database are 15 dietary species and can be found in the table below. Also integrated is 5,865 dietary pre-microRNA. 1203 Kegg pathways are included with over 87,694 distinct gene-pathway relationships. There are also 21,478 disease entries, of which some are associated with dietary microRNAs.

Public Data Aggregation

The database consists of information integrated from multiple sources. Below is a table describing each source and its purpose.

<table>
<thead>
<tr>
<th>Source</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>miRBase</td>
<td>General microRNA information, including sequence, description, fold, structure, and references.</td>
</tr>
<tr>
<td>miTarBase</td>
<td>Experimentally validated microRNA-target interactions.</td>
</tr>
<tr>
<td>Human microRNA Disease Database</td>
<td>Diseases associated with human microRNAs</td>
</tr>
<tr>
<td>Phenomir</td>
<td>Differentially regulated microRNA expression in diseases and other biological processes</td>
</tr>
<tr>
<td>Kegg</td>
<td>Gene Pathway Information</td>
</tr>
</tbody>
</table>

The aggregated information is displayed to the viewer in a series of panels for each mature dietary microRNA.

General Information

The first feature is the ability to see the mature dietary microRNA's physical characteristics, including the sequence, structure, and annotation, along with its pre-microRNA's information as shown below.

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DMD also shows the homologous microRNA for each entry. The tool CD-Kit is used to identify microRNAs that have highly similar sequences. The highlighted first row shows the microRNA you’re currently viewing. There is an option to limit the cluster to only dietary microRNAs.
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In addition to the microRNA homologs, users are able to view the validated gene targets for each entry, along with is experiment type and support type.
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Having all this data viewable in a single page is highly informative.

Accessiblity

Users of the database may also upload their novel findings of any food microRNA prior to publication. These novel microRNA sequences are subjected to computation target prediction and gene network inference. This may be for the user’s research or added to DMD as a novel microRNA and may be made viewable to the visitors of the site. Also available is a download of microRNA data in format that is easily parsed.

The database may be accessed at http://sbbi.unl.edu/dmd/.

References


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