

4. SynBuilder

SynBuilder constructs synteny blocks of multiple species selected by users by using prebuilt whole-genome sequence alignments collected from the UCSC genome browser database.

(1) Selecting a reference species

The screenshot shows the SynBuilder web interface. At the top, there is a navigation bar with links: SYNTENY PORTAL, SynCircos, SynBrowser, SynSearcher, SynBuilder, and Documentation. Below the navigation bar, there is a header section with the text: "SynBuilder constructs synteny blocks of multiple species selected by users." and "Synteny blocks are created by using modules in the inferCars software." A "HELP" link is visible in the top right corner. The main content area features a "Reference" dropdown menu that is currently open, showing a list of species and their assembly versions. The list includes: Human (hg38, GRCh38), Human (hg19, GRCh37), Human (hg18, NCBI36), Human (hg17, NCBI35), Mouse (mm10, GRCm38), Mouse (mm9, NCBI37), Mouse (mm8, NCBI36), Mouse (mm7, NCBI35), Cow (bosTau8, Bos_taurus_UMD_3.1.1), Cow (bosTau7, Baylor_Btau_4.6.1), Cow (bosTau6, Bos_taurus_UMD_3.1), Cow (bosTau4, Baylor_4.0), Cow (bosTau3, Baylor_3.1), Cow (bosTau2, Baylor_2.0), Dog (canFam3, Broad_CanFam3.1), and Don (canFam2, Broad). To the right of the species list, there is a "Resolution (bp)" dropdown menu set to 150,000. Below the species list, there are two columns: "Available" and "Selected".

- Selecting a reference species and its assembly version.

(2) Selecting a resolution

The screenshot shows the SynBuilder web interface. At the top, there is a navigation bar with links: SYNTENY PORTAL, SynCircos, SynBrowser, SynSearcher, SynBuilder, and Documentation. Below the navigation bar, there is a header section with the text: "SynBuilder constructs synteny blocks of multiple species selected by users." and "Synteny blocks are created by using modules in the inferCars software." A "HELP" link is visible in the top right corner. The main content area features a "Reference" dropdown menu set to "Select a reference species". To the right of the reference dropdown, there is a "Resolution (bp)" dropdown menu that is currently open, showing a list of resolution values: 150,000, 300,000, 400,000, and 500,000. Below the resolution dropdown, there are two columns: "Available" and "Selected". Between the columns, there are two buttons: ">>" and "<<".

- Selecting a resolution for building synteny blocks.

(3) Selecting a target species

The screenshot shows the SynBuilder web interface. At the top, there is a navigation bar with links: SYNTENY PORTAL, SynCircos, SynBrowser, SynSearcher, SynBuilder, and Documentation. Below the navigation bar, there is a header section with the text: "SynBuilder constructs synteny blocks of multiple species selected by users." and "Synteny blocks are created by using modules in the inferCars software." A "HELP" link is visible in the top right corner. The main content area features a "Reference" dropdown menu set to "Human (hg19, GRCh37)". To the right of the reference dropdown, there is a "Resolution (bp)" dropdown menu set to 150,000. Below the resolution dropdown, there are two columns: "Available" and "Selected". The "Available" column contains a list of species and their assembly versions: Alpaca (vicPac2), American_alligator (allMis1), Baboon (papHam1), Bushbaby (otoGar1), Chinese_hamster (criGr1), Cow (bosTau7), Elephant (loxAfr3), Fugu (fG), Gibbon (nomLeu1), Guinea_pig (cavPor3), Hedgehog (eriEur2), and Horse (equCab2). The "Selected" column contains a list of species and their assembly versions: Chimpanzee (panTro4), Gorilla (gorGor3), and Mouse (mm10). Between the columns, there are two buttons: ">>" and "<<".

- Users can select target species and their assembly versions by using the '>>' button.
- Also, the selected target species can be unselected by using the '<<' button.

(4) Selecting outgroup species

The screenshot shows a web interface for selecting outgroup species. It features two columns: 'Available' and 'Selected'. The 'Available' column lists various species and their assembly versions, including Alpacaca (vicPac2), American_alligator (allMis1), Baboon (papHam1), Bushbaby (otoGar1), Chinese_hamster (criGr1), Cow (bosTau7), Elephant (loxAfr3), Fugu (fr2), Gibbon (nomLeu1), Guinea_pig (cavPor3), Hedgehog (eriEur2), and Horse (equCab2). The 'Selected' column currently contains Cat (felCat5), Chicken (galGal3), and Dog (canFam3). Between the columns are two buttons: '>>' and '<<'. The title 'Outgroup' is centered at the top.

- Users can select outgroup species and their assembly versions by using the '>>' button.
- Also, the selected outgroup species can be unselected by using the '<<' button.

(5) An example of selected species

The screenshot shows the SynBuilder interface. At the top, it says 'SYNTENY PORTAL' and 'SynBuilder'. Below that, it states 'SynBuilder constructs synteny blocks of multiple species selected by users. Synteny blocks are created by using modules in the inferCars software.' There are dropdown menus for 'Reference' (Human (hg19, GRCh37)) and 'Resolution (bp)' (150,000). The 'Target' section has 'Available' and 'Selected' columns. The 'Available' column lists the same species as in the previous screenshot. The 'Selected' column contains Chimpanzee (panTro4), Gorilla (gorGor3), and Mouse (mm10). Below the 'Target' section are buttons for 'Submit', 'Load an example', 'Clear', and 'Show job status'. The 'Load an example' button is circled in red. The 'Outgroup' section is identical to the previous screenshot, with 'Cat (felCat5)', 'Chicken (galGal3)', and 'Dog (canFam3)' selected. At the bottom, it says 'It may take several minutes depending on selected numbers of target (outgroup) species. The submitted jobs and results are informed in a job status page.'

- User can load an example data set by clicking the 'Load an example' button.

(6) Job submission

This screenshot is identical to the previous one, showing the SynBuilder interface. The 'Load an example' button is circled in red in the previous screenshot, but in this one, the 'Submit' button is circled in red. The rest of the interface, including the species lists and navigation buttons, remains the same.

- Users can submit a job by clicking the 'Submit' button.

(6) Result page

SYNTENY PORTAL Job Status - SynBuilder

Job ID	Description	Status	Result	Circos
1	Resolution: 150000 bp Reference species: Human (hg19) Target species: Chimpanzee (panTro4), Gorilla (gorGor3), Mouse (mm10) Outgroup species: Cat (felCat5), Chicken (galGal3), Dog (canFam3)	Complete	View Download	View Download

** This page will be automatically refreshed in every second. **

If more than 200 chromosomes are included in the results, the Circos plot can't be drawn.

[Reload](#)

[Output file format](#)

Results of SynBuilder (Job ID: 1)

```
#Resolution: 150000 bp
#Reference species: Human (hg19)
#Target species: Chimpanzee (panTro4), Gorilla (gorGor3), Mouse (mm10)
#Outgroup species: Cat (felCat5), Chicken (galGal3), Dog (canFam3)

>1
hg19.chrX:2135047-9688022 +
panTro4.chrX:2190145-9633474 +
gorGor3.chrX:1827876-9537701 +
mm10.chrX:77048434-77663011 +
felCat5.chrX:970800-6444588 +
galGal3.chr1:129005268-132920029 -
canFam3.chrX:1170603-6436066 +

>2
hg19.chrX:2135047-9688022 +
panTro4.chrX:2190145-9633474 +
gorGor3.chrX:1827876-9537701 +
mm10.chrX:77048434-77663011 +
felCat5.chrX:970800-6444588 +
galGal3.chr1:129005268-132920029 -
canFam3.chrX:1170603-6436066 +
```

- Users can check the status of their own jobs in a separated result page, which includes the information of processing and results of searching the syntenic blocks and a Circos plot representing syntenic relationships.
- The Job ID column shows the identifier of each submitted job.
- The Description column shows the details of the submitted job.
- The Status column shows the current status of the job.
- The Result column provides the built syntenic blocks.
 - Waiting → Waiting for finishing the job
 - View → Viewing the result of the built syntenic blocks
 - Download → Downloading the result of the built syntenic blocks.
 - No result → Not existing syntenic regions among the selected species.
- Circos column provides a Circos plot drawn by using built syntenic blocks (reference and target species).
 - Waiting → Waiting for drawing the Circos plot
 - View → Viewing the Circos plot.

- Download box → Selecting and downloading the Circos plot.
- No results → There is no result for drawing the Circos plot.
 - Not existing syntenic regions among the selected species.
 - If more than 200 chromosomes are included in the results, the Circos plot can't be drawn.

(7) Output file format

- Lines starting with '#' contain parameters of the built synteny blocks.
 - Resolution → Minimum size of a reference block in bp
 - Reference species → Selected reference species
 - Target species → Selected target species
 - Outgroup species → Selected outgroup species
- A number in line started with '>' symbol represents the number of built synteny blocks.
- Other result lines represent syntenic regions within the reference, target, and outgroup species genomes.

Example output

```
#Resolution: 150000 bp
#Reference species: Human (hg19)
#Target species: Chimpanzee (panTro4), Gorilla (gorGor3), Mouse (mm10)
#Outgroup species: Cat (felCat5), Chicken (galGal3), Dog (canFam3)

>1
hg19.chrX:2135047-9688022 +
panTro4.chrX:2190145-9633474 +
gorGor3.chrX:1827676-9537701 +
mm10.chrX:77048434-77663011 +
felCat5.chrX:970800-6444588 +
galGal3.chr1:129005268-132920029 -
canFam3.chrX:1170603-6436066 +
```

Output description

```
>Synteny block number
Ref.RefChr:RefStart-RefEnd RefStrand
Tar1.Tar1Chr:Tar1Start-Tar1End Tar1Strand
Tar2.Tar2Chr:Tar2Start-Tar2End Tar2Strand
...
Out1.Out1Chr:Out1Start-Out1End Out1Strand
Out2.Out2Chr:Out2Start-Out2End Out2Strand
...

Ref: Reference species ID
RefStrand: Strand of alignment in reference
Tar1: Target species 1 ID
Tar1Chr: Target 1 chromosome
Tar1Start: Start of alignment in target 1
Tar1End: End of alignment in target 1
Tar1Strand: Strand of alignment in target 1
Out1: Outgroup species 1 ID
Out1Chr: Target 1 chromosome
Out1Start: Start of alignment in outgroup 1
Out1End: End of alignment in outgroup 1
Out1Strand: Strand of alignment in outgroup 1
```