

Introduction

Circadian Rhythms are biological cycles with a period of 24 hour that are observed in most of the organisms from cyanobacteria to fungi to humans. Circadian rhythms has two properties: period and entrained phase. Disruption of phase property of circadian rhythm has been linked to many chronic diseases, such as obesity, diabetes, sleep disorder, etc. Even though genes that are responsible for period are known, genes that are responsible for phase have remained unknown. Since phase is quantitative trait, quantitative genetics approach helps identify multiple genetic loci for responsible for complex phenotype. My project will try to identify and characterize the phase QTL gene of chromosome 6 in *Neurospora crassa*. This project will give insight about molecular understanding of phase property of circadian rhythm.

Background

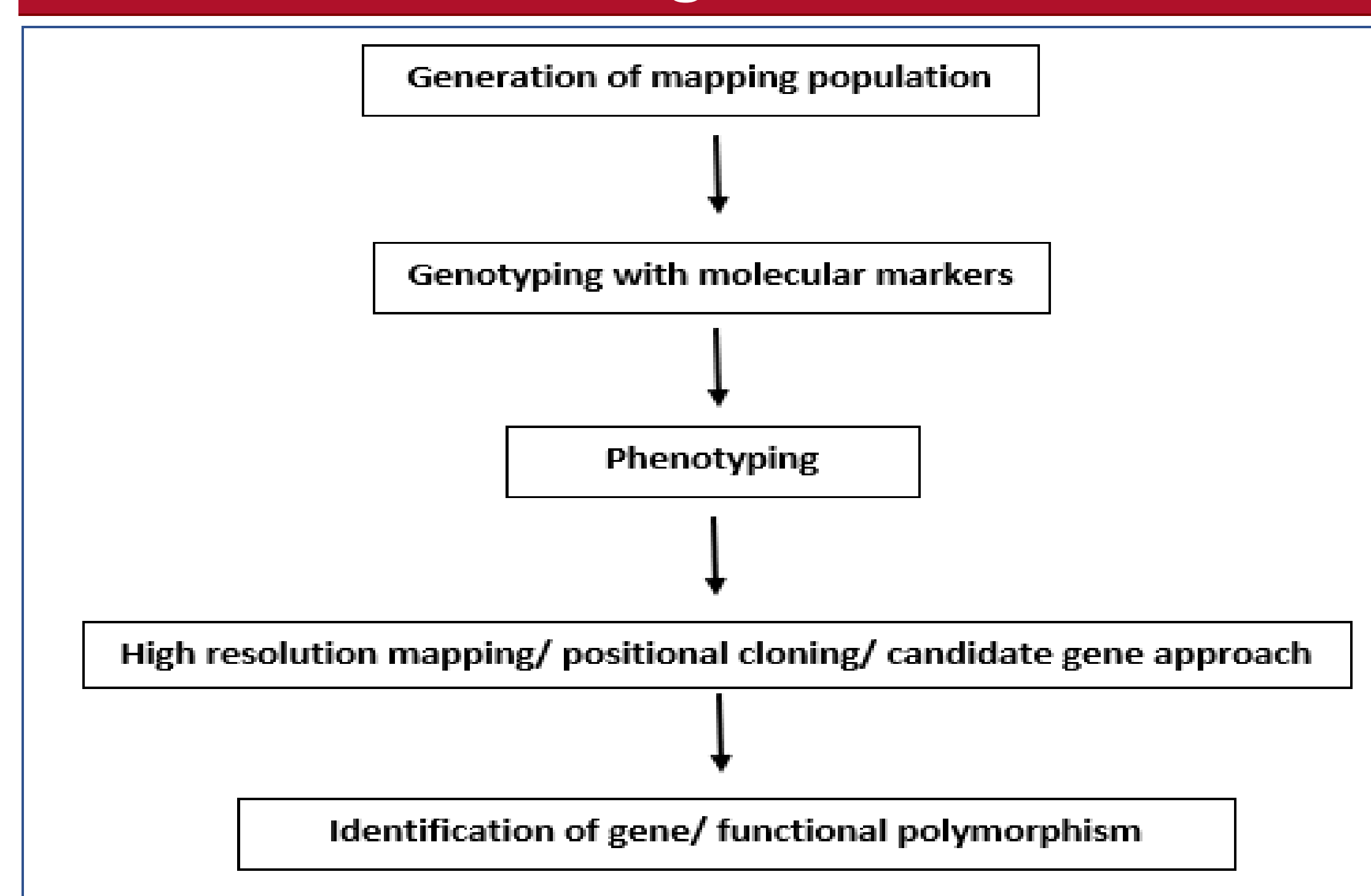
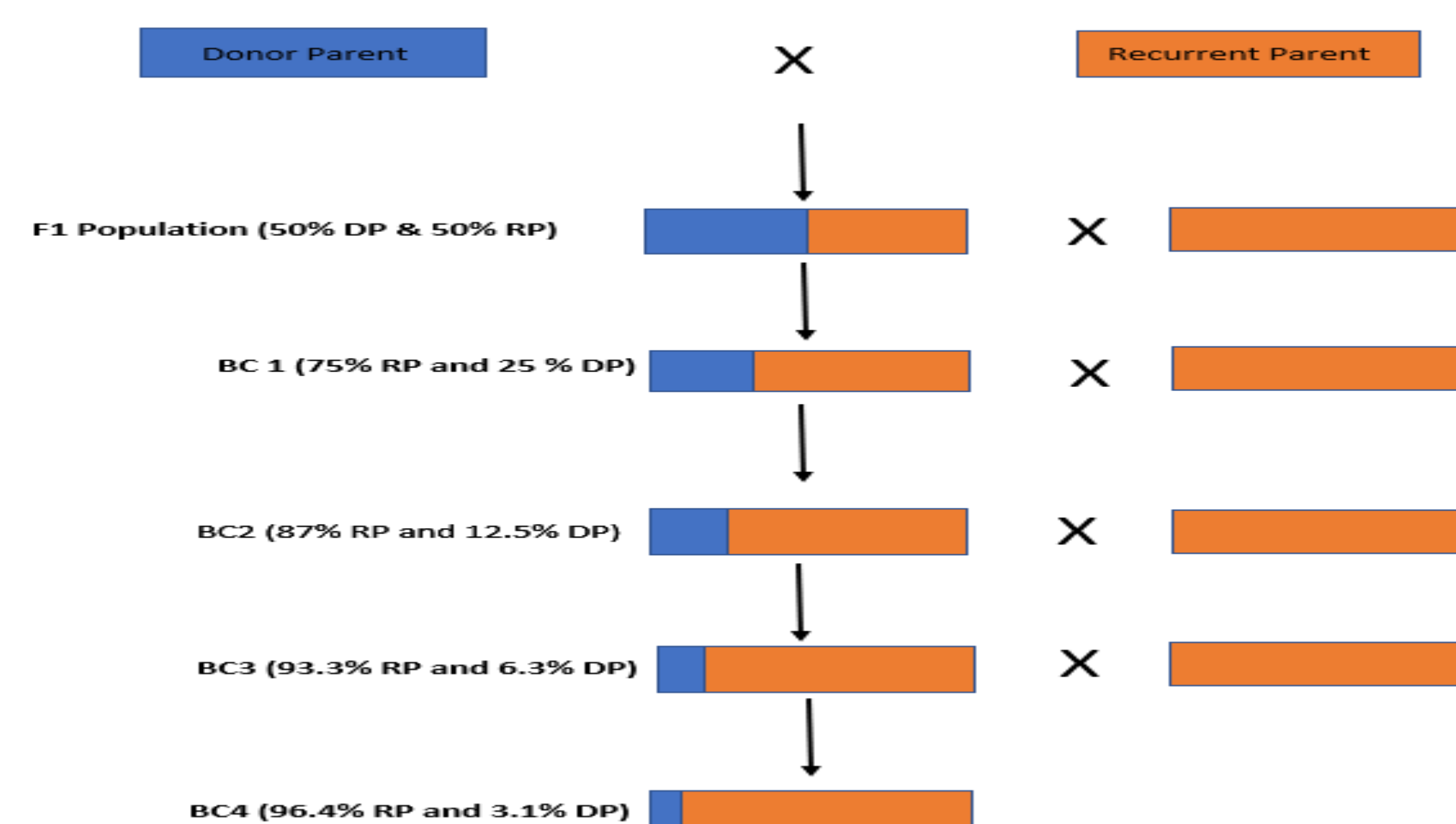


Figure: Gene Discovery Procedure by QTL Approach

Methodology



Results

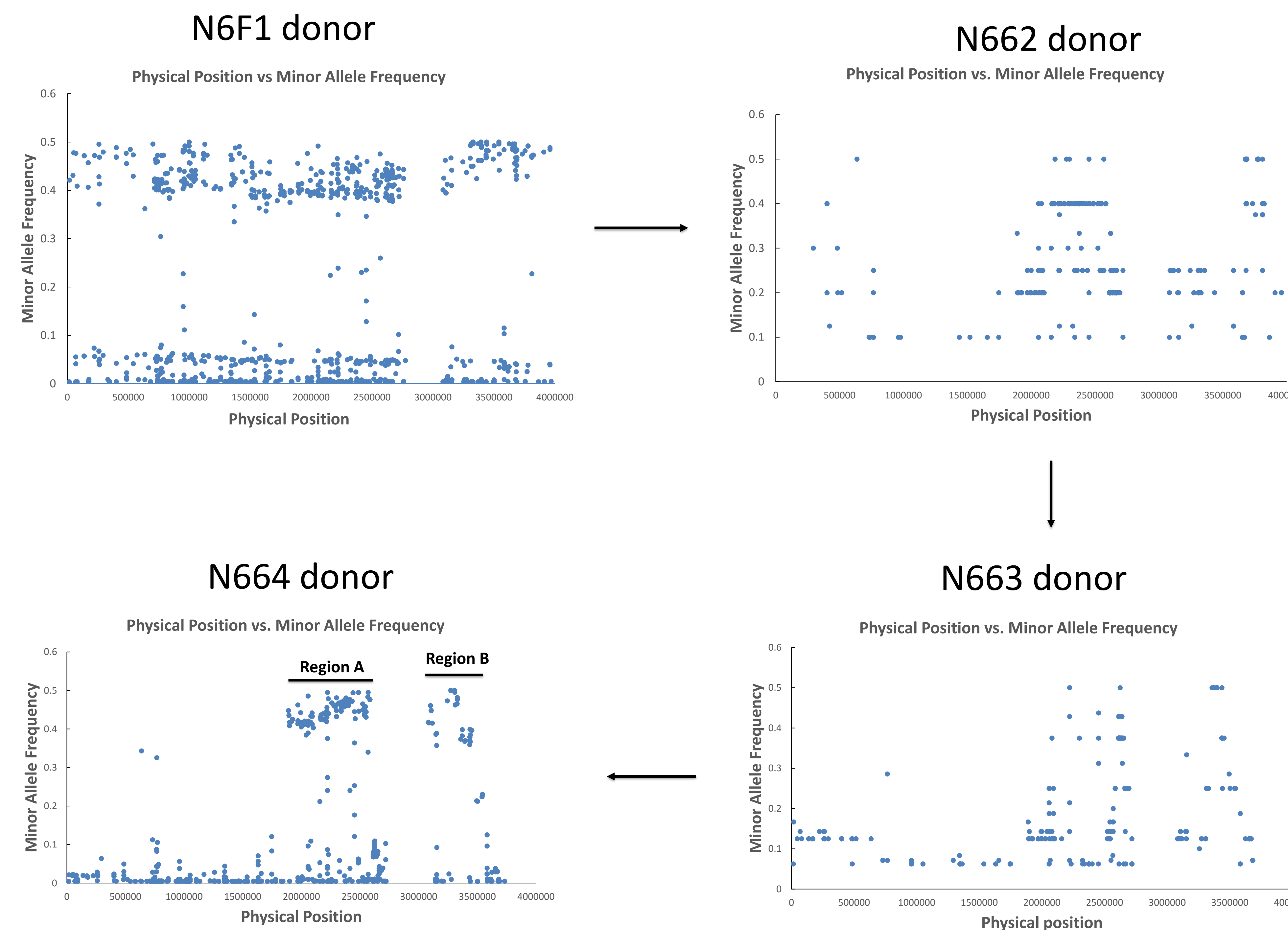


Figure: Cleaning up of genetic background during backcross in chromosome 6

| Gene ID | Biological Function |
|----------|--|
| NCU05150 | Hypothetical protein |
| NCU05149 | Hypothetical protein |
| NCU05148 | Hypothetical protein |
| NCU05147 | Hypothetical protein |
| NCU05146 | Hypothetical protein |
| NCU05145 | Hypothetical protein |
| NCU05143 | Zinc finger transcription factor-59 |
| NCU05142 | Hypothetical protein |
| NCU05141 | Hypothetical protein |
| NCU10883 | Hypothetical protein |
| NCU05138 | Hypothetical protein |
| NCU05137 | Non-anchored cell wall protein 1 |
| NCU05136 | Endo alpha-1,4 polygalactosaminidase precursor |
| NCU05135 | Hypothetical protein |
| NCU05134 | Hypothetical protein |
| NCU05133 | UDP-glucose 4-epimerase |
| NCU05132 | Hypothetical protein |
| NCU05131 | Hypothetical protein |
| NCU05130 | Hypothetical protein |
| NCU05129 | Anthranilate synthase component I |
| NCU17136 | Hypothetical protein |
| NCU05128 | Hypothetical protein |
| NCU05127 | D-alanyl-alanine synthetase A |
| NCU05126 | Hypothetical protein |

Figure: Candidate genes in Region A

| Gene ID | Biological Function |
|----------|---------------------------------|
| NCU04077 | Assimilatory sulfate reductase |
| NCU04078 | Alcohol dehydrogenase-11 |
| NCU12107 | Hypothetical protein |
| NCU04079 | Hypothetical protein |
| NCU04080 | Palmitoyltransferase SWF1 |
| NCU04081 | Guanine triphosphate binding-20 |

Figure: Candidate genes in Region B

Discussion

- Donor segments were reduced in half in each backcross (50%- 25%-12.5%- 6.25%). That is how genetic background was cleared.
- After fourth backcross, two QTL regions were identified.
- Using Fungidb, 30 genes were found in these two regions.
- Region A had 24 genes total, in which 15 were genes located on the forward strand, and 11 genes were located on the reversed strand.
- Region B had 6 genes total, in which 4 genes were located on the forward strand, and 2 genes were located on the reversed strand.
- Out of 30 genes, the function of 20 genes have remained unknown.
- We believe genes that are responsible for phase phenotype could be from these 20 genes.

Conclusions and Directions for Future Research

- Thirty genes are found using fungidb.org from two QTL regions. From these 30 genes, genes that are possibly responsible for phase phenotype will be further identified and characterized.
- By using knockout library, race tube analysis will be performed to further identify the genes that are linked with phase phenotype.

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References

Kim, L., Logsdon, B.A., Park, S., Mezey, J.G., & Lee, K. (2007). Quantitative Trait Loci for the Circadian Clock in *Neurospora Crassa*. *Genetics*, 177(4), 2335-2347. <http://doi.org/10.1534/genetics.107.077958>

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