# Jarnac Model Syntax

**Empty model:**

```
p = defn model

end;
```

**Including comment lines:**

```
p = defn model
      // This is a comment
 end;
```

**Model with one reaction:**

```
p = defn model
      S1 -> S2; k1*S1;
end;
```

Rate laws can be arbitrary expressions.

**Initialize values:**

```
p = defn model
      S1 -> S2; k1*S1;
end;
p.k1 = 1.2;
p.S1 = 10;
p.S2 = 0;
```

**Model with multiple reactions:**

```
p = defn model
        S1 -> S2; k1*S1;
        S2 -> S3; k2*S2 – k3*S3;
        2 S3 -> S1; k4*S3^2;
        end;
```

**Named reactions:**

```
p = defn model
        J1: S1 -> S2; k1*S1;
        J2: S2 -> S3; k2*S2;
end;
```

**Setting boundary species:**

```
p = defn model
        // Use the '$' character to indicate a boundary species
        J1: $S1 -> S2; k1*S1;
        J2: S2 -> $S3; k2*S2;
end;
```

or alternatively use

```
p = defn model
        ext S1, S3;
        var S2;

        J1: S1 -> S2; k1*S1;
        J2: S2 -> S3; k2*S2;
end;
```

**Assignments in a model:**

```
p = defn model
        v1 = k1*S1;
        v2 = k2*S2;

        J1: S1 -> S2; v1;
        J2: S2 -> S3; v2;
end;
```

**Tricks: Include differential equations**

```
p = defn model
        ODE1: S1 -> $w;    k1*S1;
        ODE2: S2 -> $w;    k1*S1 – k2*S2;
        ODE3: S3 -> $w;    k2*S2;
end;
```

will generate the following ODEs:

$$\frac{dS1}{dt} = k1\ S1$$

$$\frac{dS2}{dt} = k1\ S1 - k2\ S2$$

$$\frac{dS3}{dt} = k3\ S3$$

## Example of a published model in Jarnac script:

```
p = defn Jana_WolfGlycolysis

var Glucose,  fructose_1_6_bisphosphate,  glyceraldehyde_3_phosphate,  glycerate_3_phosphate,
      pyruvate,  Acetyladehyde,  External_acetaldehyde,  ATP,   ADP,  NAD,  NADH;
ext External_glucose,  ethanol,  Glycerol, Sink;

J0: External_glucose -> Glucose; J0_inputFlux;
J1:  Glucose + 2 ATP -> fructose_1_6_bisphosphate + 2 ADP;
J1_k1*Glucose*ATP*(1/(1+pow(ATP/J1_Ki,J1_n)));
J2:  fructose_1_6_bisphosphate -> glyceraldehyde_3_phosphate + glyceraldehyde_3_phosphate;
J2_k*fructose_1_6_bisphosphate;
J3:  glyceraldehyde_3_phosphate + NADH -> NAD + Glycerol; J3_k*glyceraldehyde_3_phosphate*NADH;
J4: glyceraldehyde_3_phosphate + ADP + NAD -> ATP + glycerate_3_phosphate + NADH;
(J4_kg*J4_kp*glyceraldehyde_3_phosphate*NAD*ADP-
J4_ka*J4_kk*glycerate_3_phosphate*ATP*NADH)/(J4_ka*NADH+J4_kp*ADP);
J5:  glycerate_3_phosphate + ADP -> ATP + pyruvate; J5_k*glycerate_3_phosphate*ADP;
J6:  pyruvate -> Acetyladehyde; J6_J6_k*pyruvate;
J7:  Acetyladehyde + NADH -> NAD + ethanol; J7_k*Acetyladehyde*NADH;
J8:  Acetyladehyde -> External_acetaldehyde; J8_k1*Acetyladehyde-J8_k2*External_acetaldehyde;
J9:  ATP -> ADP; J9_k*ATP;
J10:  External_acetaldehyde -> Sink; J10_k*External_acetaldehyde;

end;

p.External_glucose = 0;
p.ethanol = 0;
p.Glycerol = 0;
p.Sink = 0;
p.Glucose = 0;
p.fructose_1_6_bisphosphate = 0;
p.glyceraldehyde_3_phosphate = 0;
p.glycerate_3_phosphate = 0;
p.pyruvate = 0;
p.Acetyladehyde = 0;
p.External_acetaldehyde = 0;
p.ATP = 3;
p.ADP = 1;
p.NAD = 0.5;
p.NADH = 0.5;
p.J0_inputFlux = 50;
p.J1_k1 = 550;
p.J1_Ki = 1;
p.J1_n = 4;
p.J2_J2_k = 9.8;
```

```
p.J3_J3_k = 85.7;
p.J4_kg = 323.8;
p.J4_kp = 76411.1;
p.J4_ka = 57823.1;
p.J4_kk = 23.7;
p.J5_k = 80;
p.J6_k = 9.7;
p.J7_k = 2000;
p.J8_k1 = 375;
p.J8_k2 = 375;
p.J9_k = 28;
p.J10_J10_k = 80;
```