Spacek et al., 2021, Figure 6

Figure 6a$_1$

(1) Comparing RMI during suppression against 0

```
# Fixed effect intercept only,
# random intercept for neurons,
# random intercept for experiments, nested within series
lmer.6a1.1 = lmer(suppressionrmi ~ 1 + (1 | uid) + (1 | sid/eid),
                  data = tbw %>% drop_na(suppressionrmi))

display(lmer.6a1.1)
```

```
## lmer(formula = suppressionrmi ~ 1 + (1 | uid) + (1 | sid/eid),
##     data = tbw %>% drop_na(suppressionrmi))
## coef.est  coef.se
##     0.18     0.03
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.12
##  eid:sid  (Intercept) 0.02
##  sid      (Intercept) 0.08
##  Residual             0.11
## ---
## number of obs: 126, groups: uid, 64; eid:sid, 22; sid, 10
## AIC = -94.9, DIC = -115.2
## deviance = -110.0
```

Mean firing rate RMI

Suppression: RMI = 0.18 ± 0.06
n = 64 neurons from 6 mice

Figure 6a$_1$

(2) Slope of regression line

```
# Random intercept for neurons,
# random intercept for experiments, nested in series
lmer.6a1.2 = lmer(feedbackrmi ~ suppressionrmi + (1 | uid) + (1 | sid/eid),
                  data = tbw %>% drop_na(feedbackrmi, suppressionrmi))

display(lmer.6a1.2)
```

```
## lmer(formula = feedbackrmi ~ suppressionrmi + (1 | uid) + (1 |
##     sid/eid), data = tbw %>% drop_na(feedbackrmi, suppressionrmi))
##                 coef.est coef.se
## (Intercept)     0.14     0.04
## suppressionrmi 0.51     0.06
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.03
##  eid:sid  (Intercept) 0.04
##  sid      (Intercept) 0.13
##  Residual             0.09
## ---
## number of obs: 126, groups: uid, 64; eid:sid, 22; sid, 10
## AIC = -171.8, DIC = -200.6
## deviance = -192.2
```

```
anova(lmer.6a1.2)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                  Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## suppressionrmi 0.70964 0.70964     1 88.474  78.979 6.733e-14 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Slope = 0.51 ± 0.12
n = 64 neurons from 6 mice

Figure 6a$_1$

(3) Average effect of feedback on firing rate RMI

```
# Random intercept for neurons,
# random intercept for experiments, nested in series
lmer.6a1.3 = lmer(meanrate ~ feedback + (1 | uid) + (1 | sid/eid),
                  data = tbl %>% drop_na(meanrate))

display(lmer.6a1.3)
```

```
## lmer(formula = meanrate ~ feedback + (1 | uid) + (1 | sid/eid),
##     data = tbl %>% drop_na(meanrate))
##             coef.est coef.se
## (Intercept) 0.20     0.05
## feedback    0.03     0.01
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.10
##  eid:sid  (Intercept) 0.07
##  sid      (Intercept) 0.12
##  Residual             0.11
## ---
## number of obs: 252, groups: uid, 64; eid:sid, 22; sid, 10
## AIC = -242, DIC = -276.2
## deviance = -265.1
```

```
anova(lmer.6a1.3)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##            Sum Sq  Mean Sq NumDF  DenDF F value  Pr(>F)
## feedback 0.053771 0.053771     1 168.34  4.2957 0.03973 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Predicted average effect on firing rate RMI

Feedback: RMI = 0.23
Suppression: RMI = 0.20
n = 64 neurons from 6 mice

Figure 6a$_2$

(1) Comparing RMI during suppression against 0

```
# Fixed effect intercept only,
# random intercept for neurons,
# random intercept for experiments,nested in series
lmer.6a2.1 = lmer(suppressionrmi ~ 1 + (1 | uid) + (1 | sid/eid),
                  data = tbw_clean %>% drop_na(suppressionrmi))

display(lmer.6a2.1)
```

```
## lmer(formula = suppressionrmi ~ 1 + (1 | uid) + (1 | sid/eid),
##     data = tbw_clean %>% drop_na(suppressionrmi))
## coef.est  coef.se
##    -0.17     0.06
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.13
##  eid:sid  (Intercept) 0.09
##  sid      (Intercept) 0.13
##  Residual             0.21
## ---
## number of obs: 109, groups: uid, 58; eid:sid, 22; sid, 10
## AIC = 28, DIC = 9.9
## deviance = 13.9
```

Mean burst ratio RMI

Suppression: RMI = -0.17 $\pm$ 0.1
n = 58 neurons from 6 mice

Figure 6a$_2$

(2) Slope of regression line

```
# Random intercept for neurons,
# random intercept for experiments, nested in series
lmer.6a2.2 = lmer(feedbackrmi ~ suppressionrmi + (1 | uid) + (1 | sid/eid),
                  data = tbw_clean %>% drop_na(feedbackrmi, suppressionrmi))

display(lmer.6a2.2)
```

```
## lmer(formula = feedbackrmi ~ suppressionrmi + (1 | uid) + (1 |
##     sid/eid), data = tbw_clean %>% drop_na(feedbackrmi, suppressionrmi))
##                 coef.est coef.se
## (Intercept)     -0.20     0.08
## suppressionrmi   0.38     0.10
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.09
##  eid:sid  (Intercept) 0.05
##  sid      (Intercept) 0.21
##  Residual             0.23
## ---
## number of obs: 109, groups: uid, 58; eid:sid, 22; sid, 10
## AIC = 38.4, DIC = 13.9
## deviance = 20.2
```

```
anova(lmer.6a2.2)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                  Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## suppressionrmi 0.75975 0.75975     1 98.391  14.729 0.0002195 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Slope = 0.38 ± 0.2
n = 58 neurons from 6 mice

Figure 6a$_2$

(3) Average effect of feedback on burst ratio RMI

```
# Random intercept for neurons,
# random intercept for experiments, nested in series, nested in mice
lmer.6a2.3 = lmer(meanburstratio ~ feedback + (1 | uid) + (1 | mid/sid/eid),
                  data = tbl %>% drop_na(meanburstratio))

display(lmer.6a2.3)
```

```
## lmer(formula = meanburstratio ~ feedback + (1 | uid) + (1 | mid/sid/eid),
##     data = tbl %>% drop_na(meanburstratio))
##             coef.est coef.se
## (Intercept) -0.17     0.08
## feedback    -0.08     0.03
##
## Error terms:
##  Groups        Name        Std.Dev.
##  uid           (Intercept) 0.11
##  eid:(sid:mid) (Intercept) 0.08
##  sid:mid       (Intercept) 0.00
##  mid           (Intercept) 0.17
##  Residual                  0.24
## ---
## number of obs: 218, groups: uid, 58; eid:(sid:mid), 22; sid:mid, 10; mid, 6
## AIC = 64.9, DIC = 33.9
## deviance = 42.4
```

```
anova(lmer.6a2.3)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##           Sum Sq Mean Sq NumDF  DenDF F value  Pr(>F)
## feedback 0.34763 0.34763     1 154.68   6.279 0.01325 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Predicted average effect on burst ratio RMI

Feedback: RMI = -0.25
Suppression: RMI = -0.17
n = 58 neurons from 6 mice

Figure 6a$_3$

(1) Comparing RMI during suppression against 0

```
# Fixed effect intercept only,
# random intercept for neurons,
# random intercept for experiments, nested in series
lmer.6a3.1 = lmer(suppressionrmi ~ 1 + (1 | uid) + (1 | sid/eid),
                  data = tbw %>% drop_na(suppressionrmi))

display(lmer.6a3.1)
```

```
## lmer(formula = suppressionrmi ~ 1 + (1 | uid) + (1 | sid/eid),
##     data = tbw %>% drop_na(suppressionrmi))
## coef.est  coef.se
##    -0.12     0.02
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.08
##  eid:sid  (Intercept) 0.06
##  sid      (Intercept) 0.03
##  Residual             0.07
## ---
## number of obs: 126, groups: uid, 64; eid:sid, 22; sid, 10
## AIC = -193.3, DIC = -215.2
## deviance = -209.2
```

Mean sparseness RMI

Suppression: RMI = -0.12 $\pm$ 0.04
n = 64 neurons from 6 mice

Figure 6a$_3$

(2) Slope of regression line

```
# Random intercept for neurons,
# random intercept for experiments, nested in series
lmer.6a3.2 = lmer(feedbackrmi ~ suppressionrmi + (1 | uid) + (1 | sid/eid),
                  data = tbw %>% drop_na(feedbackrmi, suppressionrmi))
```

```
## boundary (singular) fit: see ?isSingular
```

```
display(lmer.6a3.2)
```

```
## lmer(formula = feedbackrmi ~ suppressionrmi + (1 | uid) + (1 |
##     sid/eid), data = tbw %>% drop_na(feedbackrmi, suppressionrmi))
##                 coef.est coef.se
## (Intercept)     -0.06     0.02
## suppressionrmi   0.44     0.07
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.04
##  eid:sid  (Intercept) 0.06
##  sid      (Intercept) 0.00
##  Residual             0.07
## ---
## number of obs: 126, groups: uid, 64; eid:sid, 22; sid, 10
## AIC = -237.6, DIC = -269.5
## deviance = -259.5
```

```
anova(lmer.6a3.2)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                  Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## suppressionrmi 0.19204 0.19204     1 102.82  40.074 6.494e-09 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Regression line parameters

Slope of 0.44 ± 0.14
n = 64 neurons from 6 mice

Figure 6a$_3$

(3) Average effect of feedback on sparseness RMI

```
# Random intercept for neurons,
# random intercept for experiments, nested in series
lmer.6a3.3 = lmer(spars ~ feedback + (1 | uid) + (1 | sid/eid),
                  data = tbl %>% drop_na(spars))

display(lmer.6a3.3)
```

```
## lmer(formula = spars ~ feedback + (1 | uid) + (1 | sid/eid),
##     data = tbl %>% drop_na(spars))
##             coef.est coef.se
## (Intercept) -0.13     0.02
## feedback     0.02     0.01
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.06
##  eid:sid  (Intercept) 0.05
##  sid      (Intercept) 0.04
##  Residual             0.08
## ---
## number of obs: 252, groups: uid, 64; eid:sid, 22; sid, 10
## AIC = -411.4, DIC = -450
## deviance = -436.7
```

```
anova(lmer.6a3.3)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##           Sum Sq Mean Sq NumDF  DenDF F value Pr(>F)
## feedback 0.01475 0.01475     1 183.25  2.1126 0.1478
```

Predicted average effect on sparseness RMI

Feedback: Sparseness = -0.11
Suppression: Sparseness = -0.13
n = 64 neurons from 6 mice

Figure 6a$_4$

(1) Comparing RMI during suppression against 0

```
# Fixed effect intercept only,
# random intercept for neurons
# random intercept for experiments
lmer.6a4.1 = lmer(suppressionrmi ~ 1 + (1 | uid) + (1 | eid),
                  data = tbw_clean %>% drop_na(suppressionrmi))

display(lmer.6a4.1)
```

```
## lmer(formula = suppressionrmi ~ 1 + (1 | uid) + (1 | eid), data = tbw_clean %>%
##     drop_na(suppressionrmi))
## coef.est  coef.se
##    -0.11     0.04
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.11
##  eid      (Intercept) 0.16
##  Residual             0.19
## ---
## number of obs: 111, groups: uid, 63; eid, 21
## AIC = 10, DIC = -7
## deviance = -2.5
```

Mean reliability RMI

Suppression: RMI = -0.11 ± 0.09
n = 63 neurons from 6 mice

Figure 6a$_4$

(2) Slope of regression line

```
# Random intercept for neurons,
# random intercept for experiments
lmer.6a4.2 = lmer(feedbackrmi ~ suppressionrmi + (1 | uid) + (1 | eid),
                  data = tbw_clean %>% drop_na(feedbackrmi, suppressionrmi))

display(lmer.6a4.2)
```

```
## lmer(formula = feedbackrmi ~ suppressionrmi + (1 | uid) + (1 |
##     eid), data = tbw_clean %>% drop_na(feedbackrmi, suppressionrmi))
##                 coef.est coef.se
## (Intercept)     0.02     0.03
## suppressionrmi 0.50     0.08
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.16
##  eid      (Intercept) 0.06
##  Residual             0.14
## ---
## number of obs: 111, groups: uid, 63; eid, 21
## AIC = -26.5, DIC = -53.8
## deviance = -45.2
```

```
anova(lmer.6a4.2)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##                  Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## suppressionrmi 0.84606 0.84606     1 98.523  43.851 1.879e-09 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Slope of 0.50 ± 0.15
n = 63 neurons from 6 mice

Figure 6a$_4$

(3) Average effect of feedback on reliability RMI

```
# Random intercept for neurons,
# random intercept for experiments, nested in series
lmer.6a4.3 = lmer(rel ~ feedback + (1 | uid) + (1 | sid/eid),
                  data = tbl %>% drop_na(rel))

display(lmer.6a4.3)
```

```
## lmer(formula = rel ~ feedback + (1 | uid) + (1 | sid/eid), data = tbl %>%
##     drop_na(rel))
##             coef.est coef.se
## (Intercept) -0.09     0.05
## feedback     0.06     0.02
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.14
##  eid:sid  (Intercept) 0.14
##  sid      (Intercept) 0.07
##  Residual             0.18
## ---
## number of obs: 222, groups: uid, 63; eid:sid, 21; sid, 10
## AIC = -20.3, DIC = -52.4
## deviance = -42.4
```

```
anova(lmer.6a4.3)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##           Sum Sq Mean Sq NumDF  DenDF F value  Pr(>F)
## feedback 0.18932 0.18932     1 135.85   6.174 0.01418 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Predicted average effect on reliability RMI

Feedback: RMI = -0.032
Suppression: RMI = -0.091
n = 63 neurons from 6 mice

Figure 6b$_1$

(1) Slope of regression line

```
# Random intercept for neurons,
# random intercept for experiments, nested in series
lmer.6b1_1 = lmer(runfmi ~ sitfmi + (1 | uid) + (1 | sid/eid),
                  data = tbw %>% drop_na(runfmi, sitfmi))

display(lmer.6b1_1)
```

```
## lmer(formula = runfmi ~ sitfmi + (1 | uid) + (1 | sid/eid), data = tbw %>%
##     drop_na(runfmi, sitfmi))
##             coef.est coef.se
## (Intercept) 0.09     0.03
## sitfmi      0.72     0.05
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.04
##  eid:sid  (Intercept) 0.02
##  sid      (Intercept) 0.10
##  Residual             0.11
## ---
## number of obs: 123, groups: uid, 63; eid:sid, 22; sid, 10
## AIC = -136.4, DIC = -166.7
## deviance = -157.5
```

```
anova(lmer.6b1_1)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##        Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## sitfmi 2.5659  2.5659     1 66.425  204.53 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Slope of 0.72 ± 0.10
n = 63 neurons from 6 mice

Figure 6b$_1$

(2) Average effect of locomotion state on firing rate FMI

```
# Random intercept for neurons,
# random intercept for experiments
lmer.6b1_2 = lmer(meanrate ~ run + (1 | uid) + (1 | eid),
                  data = tbl %>% drop_na(meanrate))

display(lmer.6b1_2)
```

```
## lmer(formula = meanrate ~ run + (1 | uid) + (1 | eid), data = tbl %>%
##     drop_na(meanrate))
##             coef.est coef.se
## (Intercept) 0.15     0.03
## run         0.03     0.02
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.19
##  eid      (Intercept) 0.02
##  Residual             0.12
## ---
## number of obs: 246, groups: uid, 63; eid, 22
## AIC = -168.7, DIC = -202.5
## deviance = -190.6
```

```
anova(lmer.6b1_2)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##       Sum Sq  Mean Sq NumDF  DenDF F value  Pr(>F)
## run 0.052679 0.052679     1 172.75   3.458 0.06465 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Predicted average effect on firing rate FMI

Locomotion: 0.18
Quiescence: 0.15
n = 63 neurons from 6 mice

Figure 6b$_2$

(1) Slope of regression line

```
# Random intercept for neurons,
# random effect for experiments, nested in series
lmer.6b2_1 = lmer(runfmi ~ sitfmi + (1 | uid) + (1 | sid/eid),
                  data = tbw_clean %>% drop_na(runfmi, sitfmi))

display(lmer.6b2_1)
```

```
## lmer(formula = runfmi ~ sitfmi + (1 | uid) + (1 | sid/eid), data = tbw_clean %>%
##     drop_na(runfmi, sitfmi))
##             coef.est coef.se
## (Intercept) -0.21     0.07
## sitfmi       0.34     0.07
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.13
##  eid:sid  (Intercept) 0.05
##  sid      (Intercept) 0.21
##  Residual             0.16
## ---
## number of obs: 110, groups: uid, 58; eid:sid, 22; sid, 10
## AIC = -1.6, DIC = -27.4
## deviance = -20.5
```

```
anova(lmer.6b2_1)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##         Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## sitfmi 0.60662 0.60662     1 100.75  22.492 6.962e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Note: the 2 outliers sitting in the top left and bottom right corner have been exluded before fitting the model!

Slope of 0.34 ± 0.15
n = 58 neurons from 6 mice

Figure 6b$_2$

(2) Average effect of locomotion state on burst ratio FMI

```
# Random intercept for neurons,
# random intercept for series
lmer.6b2_2 = lmer(meanburstratio ~ run + (1 | uid) + (1 | sid),
                  data = tbl_clean %>% drop_na(meanburstratio))

display(lmer.6b2_2)
```

```
## lmer(formula = meanburstratio ~ run + (1 | uid) + (1 | sid),
##     data = tbl_clean %>% drop_na(meanburstratio))
##             coef.est coef.se
## (Intercept) -0.19     0.07
## run         -0.08     0.03
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.17
##  sid      (Intercept) 0.19
##  Residual             0.21
## ---
## number of obs: 220, groups: uid, 58; sid, 10
## AIC = 44.5, DIC = 16.8
## deviance = 25.6
```

```
anova(lmer.6b2_2)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##      Sum Sq Mean Sq NumDF  DenDF F value   Pr(>F)
## run 0.31006 0.31006     1 166.93  6.8397 0.009732 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Predicted average effect on burst ratio FMI

Note: the 2 outliers sitting in the top left and bottom right corner have been exluded before fitting the model!

Locomotion: -0.27
Quiescence: -0.19
n = 58 neurons from 6 mice

Figure 6b$_3$

(1) Slope of regression line

```
# Random intercept for neurons,
# random intercept for experiments, nested in series
lmer.6b3_1 = lmer(runfmi ~ sitfmi + (1 | uid) + (1 | sid/eid),
                  data = tbw %>% drop_na(runfmi, sitfmi))
```

```
## boundary (singular) fit: see ?isSingular
```

```
display(lmer.6b3_1)
```

```
## lmer(formula = runfmi ~ sitfmi + (1 | uid) + (1 | sid/eid), data = tbw %>%
##     drop_na(runfmi, sitfmi))
##             coef.est coef.se
## (Intercept) -0.01     0.02
## sitfmi       0.85     0.06
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.05
##  eid:sid  (Intercept) 0.05
##  sid      (Intercept) 0.00
##  Residual             0.08
## ---
## number of obs: 123, groups: uid, 63; eid:sid, 22; sid, 10
## AIC = -196, DIC = -228.7
## deviance = -218.4
```

```
anova(lmer.6b3_1)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##        Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## sitfmi 1.2513  1.2513     1 100.81  196.79 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Slope of 0.85 ± 0.12
n = 63 neurons from 6 mice

Figure 6b$_3$

(2) Average effect of locomotion state on sparseness

```
# Random intercept for neurons,
# random intercept for experiments, nested in series
lmer.6b3_2 = lmer(spars ~ run + (1 | uid) + (1 | sid/eid),
                  data = tbl %>% drop_na(spars))

display(lmer.6b3_2)
```

```
## lmer(formula = spars ~ run + (1 | uid) + (1 | sid/eid), data = tbl %>%
##     drop_na(spars))
##             coef.est coef.se
## (Intercept) -0.14     0.03
## run          0.02     0.01
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.13
##  eid:sid  (Intercept) 0.04
##  sid      (Intercept) 0.07
##  Residual             0.09
## ---
## number of obs: 246, groups: uid, 63; eid:sid, 22; sid, 10
## AIC = -291.4, DIC = -327.9
## deviance = -315.6
```

```
anova(lmer.6b3_2)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##       Sum Sq  Mean Sq NumDF  DenDF F value Pr(>F)
## run 0.020595 0.020595     1 175.66  2.2896  0.132
```

Predicted average effect sparseness FMI

Quiescence: -0.14
Locomotion: -0.13
n = 63 neurons from 6 mice

Figure 6b$_4$

(1) Slope of regression line

```
# Random intercept for neurons,
# random intercept for experiments
lmer.6b4_1 = lmer(runfmi ~ sitfmi + (1 | uid) + (1 | eid),
                  data = tbw_clean %>% drop_na(runfmi, sitfmi))

display(lmer.6b4_1)
```

```
## lmer(formula = runfmi ~ sitfmi + (1 | uid) + (1 | eid), data = tbw_clean %>%
##     drop_na(runfmi, sitfmi))
##             coef.est coef.se
## (Intercept) 0.01     0.02
## sitfmi      0.43     0.07
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.05
##  eid      (Intercept) 0.02
##  Residual             0.16
## ---
## number of obs: 109, groups: uid, 62; eid, 21
## AIC = -55.8, DIC = -85.2
## deviance = -75.5
```

```
anova(lmer.6b4_1)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##         Sum Sq Mean Sq NumDF  DenDF F value    Pr(>F)
## sitfmi 0.99852 0.99852     1 75.912  37.694 3.496e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Note: Outliers (11 observations) been exluded before fitting the model!

Slope of 0.43 ± 0.14
n = 62 neurons from 6 mice

Figure 6b$_4$

(2) Average effect of locomotion state on reliability

```
# Random intercept for neurons,
# random intercept for experiments, nested in series, nested in mice
lmer.6b4_2 = lmer(rel ~ run + (1 | uid) + (1 | mid/sid/eid),
                  data = tbl_clean %>% drop_na(rel))

display(lmer.6b4_2)
```

```
## lmer(formula = rel ~ run + (1 | uid) + (1 | mid/sid/eid), data = tbl_clean %>%
##     drop_na(rel))
##             coef.est coef.se
## (Intercept) -0.07     0.04
## run          0.06     0.02
##
## Error terms:
##  Groups        Name        Std.Dev.
##  uid           (Intercept) 0.14
##  eid:(sid:mid) (Intercept) 0.01
##  sid:mid       (Intercept) 0.03
##  mid           (Intercept) 0.08
##  Residual                  0.17
## ---
## number of obs: 218, groups: uid, 62; eid:(sid:mid), 21; sid:mid, 10; mid, 6
## AIC = -60.4, DIC = -95.3
## deviance = -84.8
```

```
anova(lmer.6b4_2)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##      Sum Sq Mean Sq NumDF  DenDF F value  Pr(>F)
## run 0.17284 0.17284     1 142.65  6.2668 0.01343 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Predicted average effect reliability FMI

Note: Outliers (11 observations) been exluded before fitting the model!

Quiescence: -0.068
Locomotion: -0.012
n = 62 neurons from 6 mice

Figure 6c$_1$

Slope of regression line

```
# Random intercept for neurons,
# random intercept for series
lmer.6c1 = lmer(fmi ~ rmi + (1 | uid) + (1 | sid),
                data = tbw %>% drop_na(fmi, rmi))

display(lmer.6c1)
```

```
## lmer(formula = fmi ~ rmi + (1 | uid) + (1 | sid), data = tbw %>%
##     drop_na(fmi, rmi))
##             coef.est coef.se
## (Intercept) 0.15     0.04
## rmi         0.05     0.07
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.19
##  sid      (Intercept) 0.07
##  Residual             0.06
## ---
## number of obs: 109, groups: uid, 59; sid, 10
## AIC = -111.5, DIC = -138.5
## deviance = -130.0
```

```
anova(lmer.6c1)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##        Sum Sq   Mean Sq NumDF  DenDF F value Pr(>F)
## rmi 0.0023761 0.0023761     1 63.622  0.6537 0.4218
```

Slope of 0.054 ± 0.13
n = 59 neurons from 6 mice

Figure 6c$_2$

Slope of regression line

```
# Random intercept for neurons,
# random intercept for experiments, nested in series
lmer.6c2 = lmer(fmi ~ rmi + (1 | uid) + (1 | sid/eid),
                data = tbw %>% drop_na(fmi, rmi))

display(lmer.6c2)
```

```
## lmer(formula = fmi ~ rmi + (1 | uid) + (1 | sid/eid), data = tbw %>%
##     drop_na(fmi, rmi))
##             coef.est coef.se
## (Intercept) -0.27     0.07
## rmi         -0.10     0.06
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.16
##  eid:sid  (Intercept) 0.07
##  sid      (Intercept) 0.18
##  Residual             0.14
## ---
## number of obs: 101, groups: uid, 56; eid:sid, 22; sid, 10
## AIC = -2.4, DIC = -28.9
## deviance = -21.6
```

```
anova(lmer.6c2)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##       Sum Sq  Mean Sq NumDF  DenDF F value Pr(>F)
## rmi 0.047997 0.047997     1 95.762  2.3546 0.1282
```

```
coef_df = data.frame("intercept" = fixef(lmer.6c2)[1], "slope" = fixef(lmer.6c2)[2], row.names = "")
write_csv(coef_df, "figure_6c2_coefs.csv")
```

Slope of -0.099 $\pm$ 0.13
n = 56 neurons from 6 mice

Figure 6c$_3$

Slope of regression line

```
# Random intercept for neurons,
# random intercept for experiments, nested in series
lmer.6c3 = lmer(fmi ~ rmi + (1 | uid) + (1 | sid/eid),
                data = tbw %>% drop_na(fmi, rmi))

display(lmer.6c3)
```

```
## lmer(formula = fmi ~ rmi + (1 | uid) + (1 | sid/eid), data = tbw %>%
##     drop_na(fmi, rmi))
##             coef.est coef.se
## (Intercept) -0.15     0.04
## rmi          0.00     0.11
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.14
##  eid:sid  (Intercept) 0.03
##  sid      (Intercept) 0.10
##  Residual             0.07
## ---
## number of obs: 109, groups: uid, 59; eid:sid, 22; sid, 10
## AIC = -108.6, DIC = -135.1
## deviance = -127.9
```

```
anova(lmer.6c3)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##         Sum Sq    Mean Sq NumDF  DenDF F value Pr(>F)
## rmi 1.0462e-05 1.0462e-05     1 49.547  0.0019 0.9654
```

Slope of 0.005 ± 0.23
n = 59 neurons from 6 mice

Figure 6c$_4$

Slope of regression line

```
# Random intercept for neurons,
# random intercept for series, nested in mice
lmer.6c4 = lmer(fmi ~ rmi + (1 | uid) + (1 | mid/sid),
                data = tbw %>% drop_na(fmi, rmi))

display(lmer.6c4)
```

```
## lmer(formula = fmi ~ rmi + (1 | uid) + (1 | mid/sid), data = tbw %>%
##     drop_na(fmi, rmi))
##             coef.est coef.se
## (Intercept) -0.04     0.05
## rmi         -0.10     0.06
##
## Error terms:
##  Groups   Name        Std.Dev.
##  uid      (Intercept) 0.13
##  sid:mid  (Intercept) 0.08
##  mid      (Intercept) 0.08
##  Residual             0.11
## ---
## number of obs: 109, groups: uid, 59; sid:mid, 10; mid, 6
## AIC = -68, DIC = -96.2
## deviance = -88.1
```

```
anova(lmer.6c4)
```

```
## Type III Analysis of Variance Table with Satterthwaite's method
##       Sum Sq  Mean Sq NumDF  DenDF F value Pr(>F)
## rmi 0.031043 0.031043     1 97.862  2.4176 0.1232
```

Slope of -0.095 $\pm$ 0.12
n = 59 neurons from 6 mice