Supplemental Figure 1. BAT transplantation decreases body weight, fat mass, and effects metabolic parameters. (A-D) Male C57BL/6 mice were transplanted with 0.1g BAT into the visceral cavity. Mice were studied at indicated times post-transplantation. (A), Body weight, (B) fat mass, (C) lean mass, and (D) food intake. Data are means ± s.e.m. Asterisks represent statistically significant differences between 0.1g BAT and control groups (n=8-24/group; **P*<0.05). (**E-G**) At 12 weeks post-transplantation mice were housed in metabolic cages for 48 hours. Data are expressed as AUC for (E) Total energy expenditure, (F) Activity, and (G) RER. Data are means ± s.e.m. Asterisks indicate a significant difference between 0.1g BAT and control groups (n=9-15/group; **P*<0.05). **(H)** GTT of mice transplanted with 0.1g BAT into the Visceral and Subcutaneous cavity (n=8/group). (**I-J**) Quantitation of western blots of BAT transplanted into Visceral and Subcutaneous cavity to determine (I) vascularization measured by CD31 and (J) innervation measured by tyrosine hydroxylase (TH). Data are means ± s.e.m. (n=6/group; ***P*<0.01). **(K)** GTT of mice receiving autonomous transplanted BAT. Data are means ± s.e.m. (n=4/group; **P*<0.05 0.1g BAT transplant vs. Sham; $^{\#}P$<0.05 autonomous BAT transplant vs. Sham).

Supplemental Figure 2. BAT transplantation increases visceral white adipose tissue GLUT1, decreases adipocyte size, and does not change histology of heart. **A,** Mice were transplanted with 0.1g BAT or Sham-operated and GLUT1 was measured 12 weeks post-transplantation. GLUT1 protein was significantly increased in the visceral WAT of the mice transplanted with 0.1g BAT compared to Sham 12 weeks post-transplantation. Data are means ± s.e.m. (n=8/group; ****P*<0.001). **B-C**, Basal glycogen content was significantly increased in mice transplanted with 0.1g BAT compared to Sham-operated mice when normalized per mg of tissue weight (B), and trended to be increased when normalized for total fat mass (C) (P=0.07). Data are means ± s.e.m. (n=5/group; ***P*<0.01). (**D-F**) Mice were transplanted with 0.1g BAT

or were Sham-operated and 12 weeks following transplantation hemotoxylin and eosin (H&E) staining of visceral WAT was performed in (D) adipocyte size was measured on the H&E slides with ImageJ software with three sections of three slides per animal. Sham and (E) 0.1g BAT-transplanted mice and (F). Data are means ± s.e.m. (n=6/group,**P<0.01). **(G)** Cross sections of the hearts of mice that were either Sham-operated or transplanted with 0.1g BAT were taken and H&E stains were performed 12 weeks post-transplantation. No difference was observed in general heart histology or morphology between groups (n=6/group).

Supplemental Figure 3. Concentration of FGF21 in *Il-6*$^{-/-}$ mice. (A-B). FGF21 was measured in the liver of 12-wk old wild-type (WT) and *Il-6*$^{-/-}$ mice at room temperature (A) and serum FGF21 was measured after 24h cold exposure (4^0C) (B). Data are means ± s.e.m. (n=3-6/group; *P<0.05)

Supplemental Figure 4. Characterization of transplanted (transplanted) BAT. (**A-B**) At 12 weeks post-transplantation, awake mice were housed at 4^oC and body temperature measured. Data are means ± s.e.m. (n=6/group; *P<0.05 compared to Sham). (**C-D**) H&E stains of transplanted BAT at 2 and 12 weeks post-transplantation. (C) Arrows indicate the presence of some multilocular droplets at 2 weeks, which are absent at 12 weeks. (D) H&E staining of endogenous BAT from Sham and BAT-transplanted mice. (**E**) Tyrosine hydroxylase was measured by qPCR. (n=6/group). (**F-G**), Immunofluorescence of transplanted BAT 12 weeks post-transplantation of (F) tyrosine hydroxylase and (G) UCP1. Data are displayed with (+) and without (-) primary anitbody. (**H**) Glucose uptake in transplanted BAT from mice transplanted with 0.1g or 0.4g BAT. (n=6/group; *P<0.05 compared to Basal).

Supplementary Table 1. Muscle and liver triglyceride content. Mice were sham-operated (Sham) or transplanted with 0.1g BAT and studied 12 weeks post-transplantation. Data are means ± s.e.m. (n=5/group).

	Sham	0.1g BAT	P Value
Muscle Triglycerides (mg/g)	12.4 ± 1.3	10.1 ± 0.6	P=0.12
Liver Triglycerides (mg/g)	26.7 ± 2.9	21.9 ± 2.9	P=0.30

Supplementary Table 2. Blood pressure and heart rate. Mice were sham-operated (Sham) or transplanted with 0.1g BAT and studied 12 weeks post-transplantation. Data are means ± s.e.m. (n=12/group).

	Sham	0.1g BAT	P Value
Resting Heart Rate (beats/min)	612 ± 18	625 ± 22	P=0.66
Systolic Blood Pressure (mmHg)	102 ± 2	106 ± 3	P=0.27
Diastolic Blood Pressure (mmHg)	74 ± 3	78 ± 2	P=0.32

Supplementary Table 3. Circulating hormone and lipid levels. Mice were sham-operated (Sham) or transplanted with 0.1g or 0.4g BAT and studied 12 weeks post-transplantation. Data are means ± s.e.m. (n=23, 23, and 9 for Sham, 0.1g BAT, and 0.4g BAT). Asterisks indicate statistical significance compared to Sham (*P<0.05, **P<0.01).

	Sham	0.1g BAT	0.4g BAT	P Value
Insulin (ng/mL)	0.61 ± 0.13	0.37 ± 0.06*	0.38 ± 0.05*	P=0.03
Cholesterol (mg/dL)	132 ± 12	104 ± 6*	121 ± 10	P=0.04
Triglycerides (mg/dL)	83.0 ± 20	66.7 ± 7.2	71.1 ± 9.8	P=0.67
Free Fatty Acid (mEq/mL)	0.74 ± 0.13	0.54 ± 0.04	0.51 ± 0.09	P=0.28
Adiponectin (µg/mL)	10.6 ± 1.1	8.9 ± 1.0	8.2 ± 1.4	P=0.27
Leptin (ng/mL)	9.8 ± 0.9	6.4 ± 0.7**	4.5 ± 0.8**	P=0.007
T3 (ng/mL)	1.7 ± 0.5	1.4 ± 0.1	n.d.	P=0.68
TNF-α (pg/mL)	16 ± 4	13 ± 3	14 ± 5	P=0.86
Norepinephrine (ng/mL)	2.0 ± 0.3	4.3 ± 0.6**	3.3 ± 0.6*	P=0.01

Supplementary Table 4. Characterization of endogenous brown adipose tissue and transplanted brown adipose tissue. Citrate synthase are results of enzyme activity assay; all other data are protein expression determined by Western blotting. Mice were sham-operated (Sham mice) or transplanted with 0.1g BAT (BAT mice) and studied 12 weeks post-transplantation. Data are mean ± s.e.m. (n=4-6/group; **P*<0.05, ***P*<0.01). Asterisks indicate statistical significance compared to endogenous BAT.

	Endogenous BAT		**Transplanted BAT**	
	Sham mice	**BAT mice**		**P Value**
Citrate Synthase (nmol/mg/min)	2641 ± 103	2590 ± 46	1135 ± 27**	P=0.0001 vs. endogenous
Glut1 (A.U.)	17.9 ± 0.9	18.3 ± 0.6	19.4 ± 0.8	P=0.70
Glut4 (A.U.)	16.9 ± 1.1	16.3 ± 1.2	14.2 ± 2.6	P=0.69
UCP1 (A.U.)	39.3 ± 3.9	39.9 ± 5.8	29.8 ± 6.2	P=0.06 vs. endogenous
PRDM16 (A.U.)	53.8 ± 2.9	50.6 ± 4.2	37 .0 ± 1.1*	P=0.02 vs. endogenous
CD36 (A.U.)	16.4 ± 0.6	19.3 ± 0.6	14.1 ± 1.3	P=0.83
ACC (A.U.)	24.7 ± 0.4	26.6 ± 1.5	21.6 ± 3.8	P=0.67
eNOS (A.U.)	39.0 ± 2.7	42.4 ± 2.6	n.d.	P=0.41
Stat3 (A.U.)	19.5 ± 4.0	22.4 ± 3.9	n.d.	P=0.62
pStat3 (A.U.)	13.8 ± 0.6	15.4 ± 2.9	n.d.	P=0.61

Supplementary Table 5. Characterization of visceral white adipose tissue. Citrate synthase are results of enzyme activity assay; all other data are protein expression determined by Western blotting. Mice were sham-operated (Sham) or transplanted with 0.1g BAT and studied 12 weeks post-transplantation. Data are means ± s.e.m. (n=4-6/group; **P*<0.05, ***P*<0.01).

	Sham	**0.1g BAT**	**P Value**
Citrate Synthase (nmol/mg/min)	11.6 ± 1.0	18.1 ± 2.0*****	P=0.05
Glut1 (A.U.)	6.1 ± 1.2	22.8 ± 4.4******	P=0.01
Glut4 (A.U.)	11.3 ± 0.8	11.8 ± 0.6	P=0.65
UCP1 (A.U.)	11.8 ± 1.3	14.6 ± 0.8	P=0.08
PRDM16 (A.U.)	22.6 ± 1.8	24.6 ± 2.6	P=0.82
CD36 (A.U.)	21.5 ± 1.3	22.5 ± 0.8	P=0.51
FATP1 (A.U.)	7.1 ± 5.3	14.0 ± 1.9	P=0.19
ACC (A.U.)	11.5 ± 6.5	9.3 ± 1.0	P=0.71
COX4 (A.U.)	22.8 ± 0.6	18.3 ± 5.4	P=0.61
eNOS (A.U.)	35.1 ± 0.8	36.8 ± 2.5	P=0.66
Stat3 (A.U.)	15.9 ± 3.8	20.3 ± 1.2	P=0.34
pStat3 (A.U.)	33.4 ± 10.3	41.9 ± 28.4	P=0.79

Supplementary Table 6. Characterization of heart tissue. Mice were sham-operated (Sham) or transplanted with 0.1g BAT and studied 12 weeks post-transplantation. Data are protein expression determined by Western blotting, and are expressed mean ± s.e.m (n=4-6/group; (**P<0.01).

	Sham	0.1g BAT	P Value
Glut1 (A.U.)	15.7 ± 0.4	17.8 ± 0.5**	P=0.008
Glut4 (A.U.)	18.6 ± 0.4	18.5 ± 0.7	P=0.92
UCP1 (A.U.)	14.9 ± 2.2	15.1 ± 0.5	P=0.90
CD36 (A.U.)	17.4 ± 0.2	16.3 ± 2.1	P=0.82
FATP1 (A.U.)	55.0 ± 15.1	69.0 ± 23.4	P=0.59
ACC (A.U.)	18.0 ± 2.1	19.9 ± 0.6	P=0.33
COX4 (A.U.)	24.5 ± 0.1	24.5 ± 0.1	P=0.49

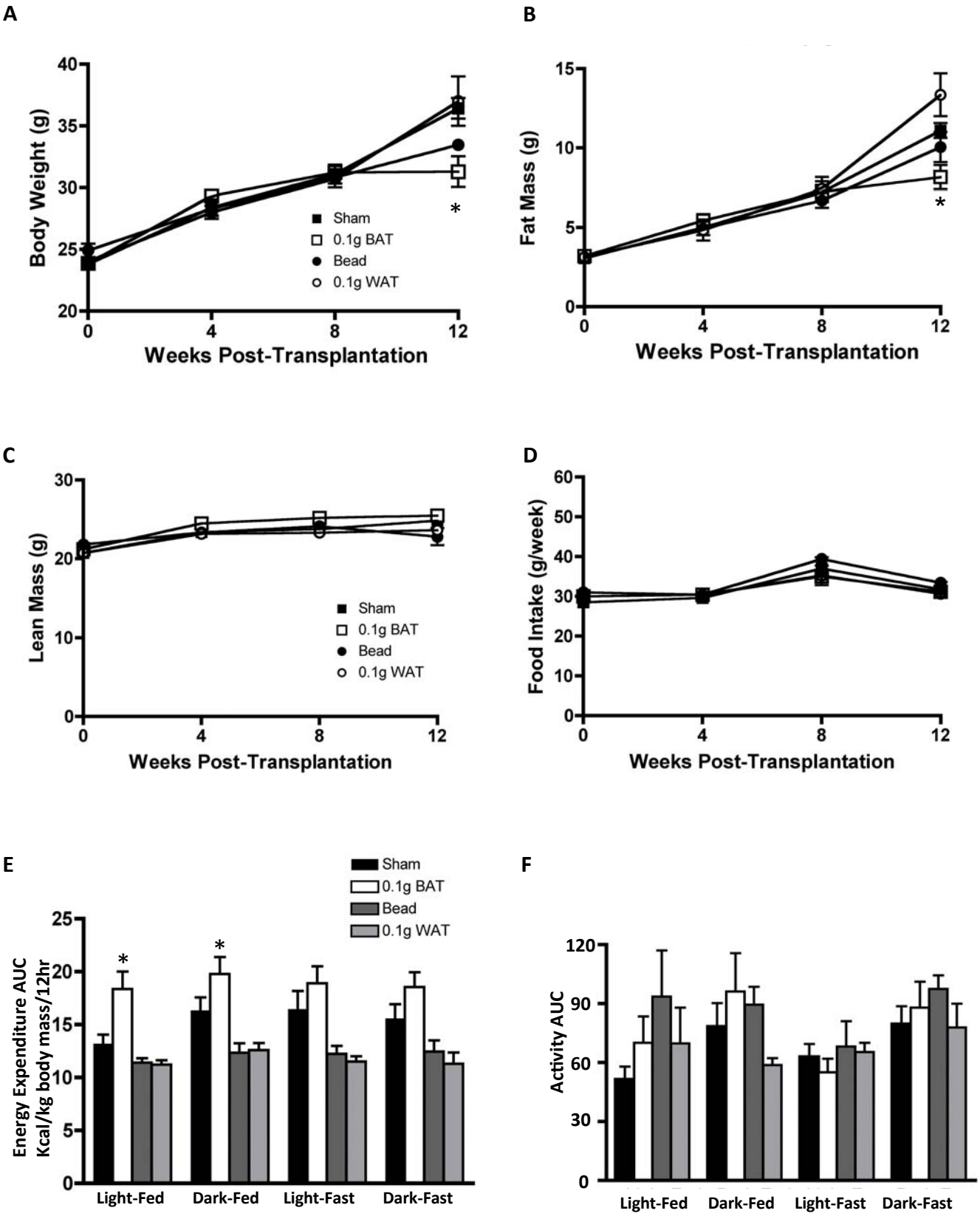
Supplementary Table 7. Characterization of gastrocnemius tissue. Mice were sham-operated (Sham) or transplanted with 0.1g BAT and studied 12 weeks post-transplantation. Data are protein expression determined by Western blotting, and are expressed mean ± s.e.m. (n=4-6/group).

	Sham	0.1g BAT	P Value
Glut1 (A.U.)	22.3 ± 0.4	22.4 ± 0.1	P=0.91
Glut4 (A.U.)	22.2 ± 0.3	22.3 ± 0.1	P=0.89
UCP1 (A.U.)	18.9 ± 1.7	19.1 ± 0.7	P=0.90
CD36 (A.U.)	12.5 ± .9	13.3 ± 1.4	P=0.62
FATP1 (A.U.)	10.1 ± 0.2	10.8 ± 0.5	P=0.07
ACC (A.U.)	19.3 ± 0.9	18.1 ± 1.0	P=0.41
COX4 (A.U.)	24.4 ± 0.3	23.9 ± 0.5	P=0.58

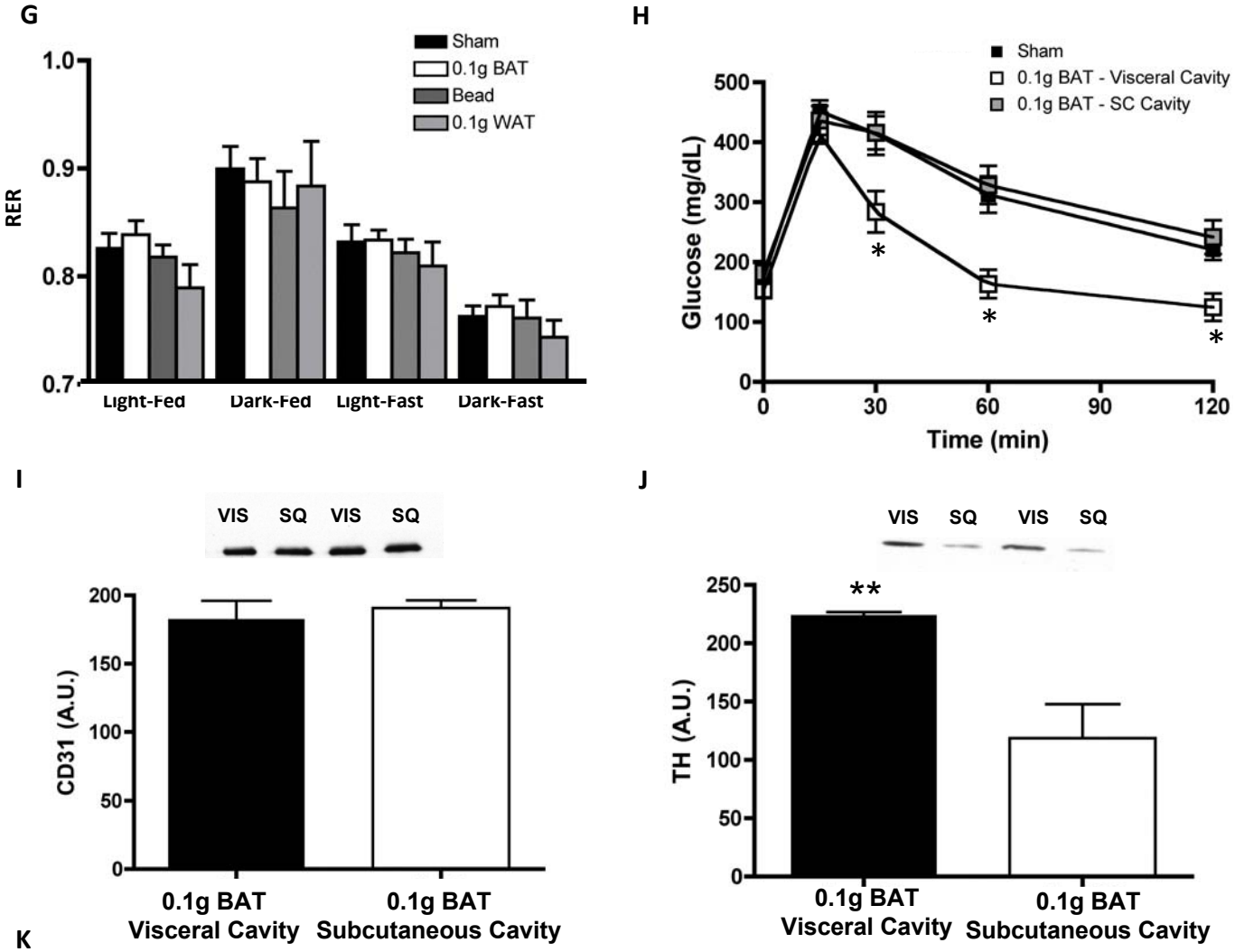
Supplementary Table 8. Characteristics of mice transplanted with transplanted BAT from WT and *Il-6*$^{-/-}$ mice. Mice were sham-operated (Sham) or transplanted with 0.1g WT BAT or 0.1g *Il-6*$^{-/-}$ BAT and studied 12 weeks post-transplantation. Data are mean ± s.e.m.; (n=6/group**)**. Asterisks represent statistical significance compared to both Sham and 0.1g *Il6*$^{-/-}$ BAT (**P*<0.05; ***P*<0.01) with the exception of norepinephrine, where 0.1g WT BAT vs. 0.1g *Il6*$^{-/-}$ BAT *P*=0.07.

	Sham	**0.1g WT BAT**	**0.1g *Il6*$^{-/-}$ BAT**	**P Value**
IL-6 (pg/mL)	0.2 ± 0.1	8 ± 5*	1.4 ± 0.6	P<0.05
Norepinephrine (ng/mL)	3.4 ± 0.6	6.0 ± 0.4**	4.9 ± 0.3	P<0.01; P=0.07
% Fat Mass	32 ± 2	28 ± 2*	35 ± 1	P<0.05
% Lean Mass	68 ± 2	72 ± 1*	67 ± 2	P<0.05

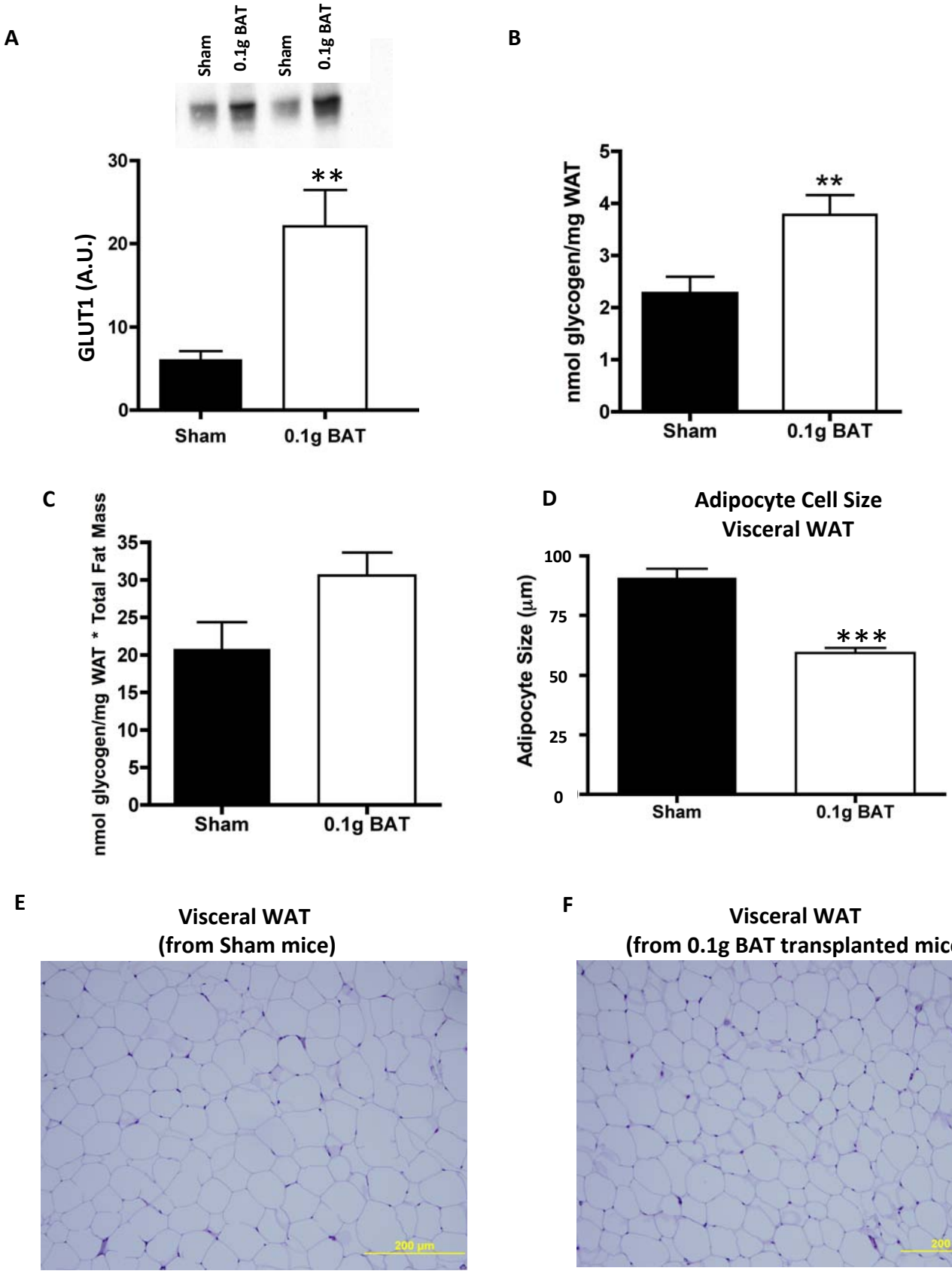
Supplemental Figure 1



Supplemental Figure 1

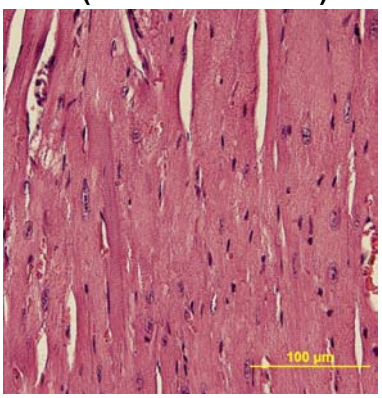


Supplemental Figure 2

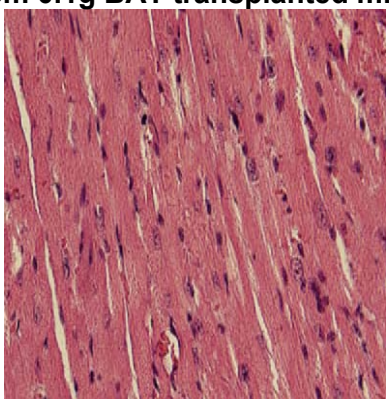


G

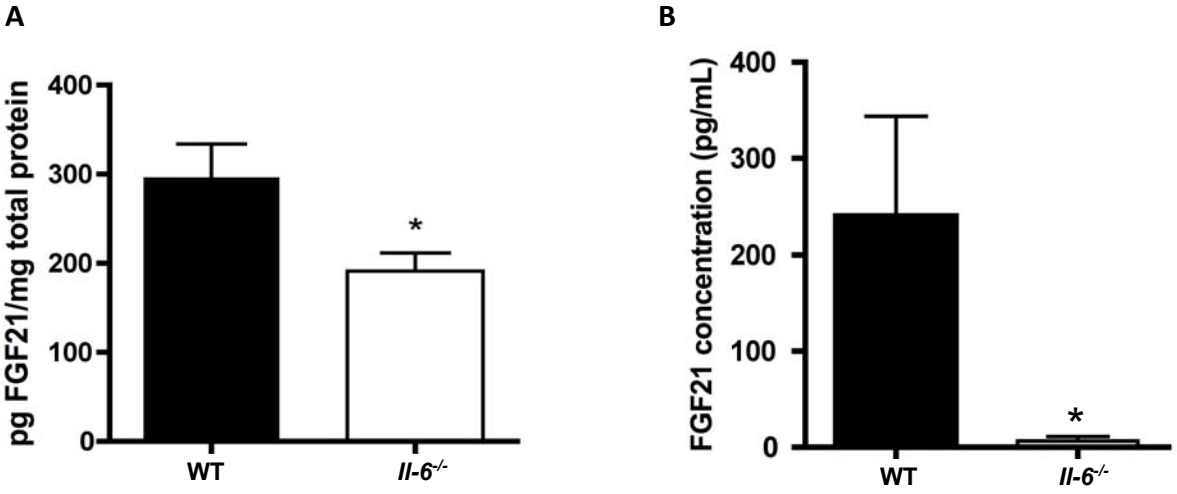
Heart
(from Sham mice)



Heart
(from 0.1g BAT transplanted mice)

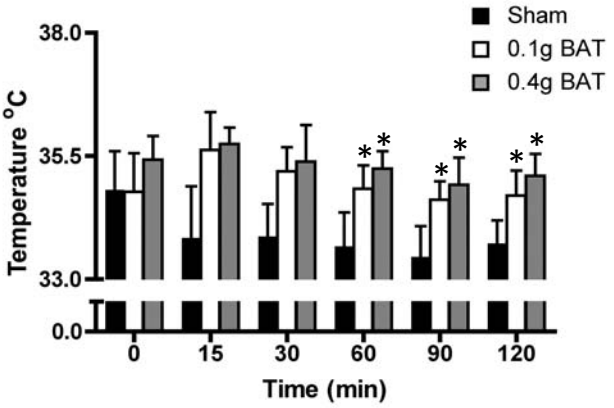


Supplemental Figure 3



Supplemental Figure 4

A



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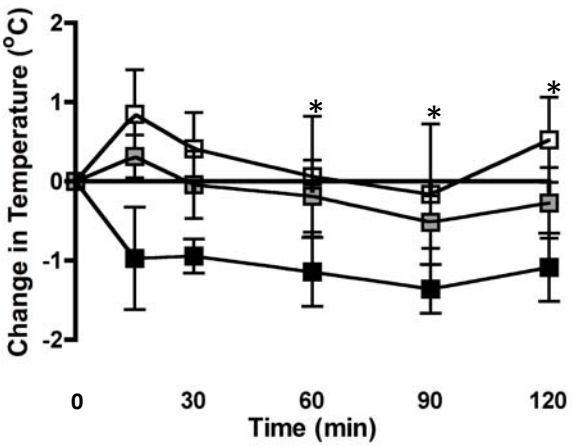
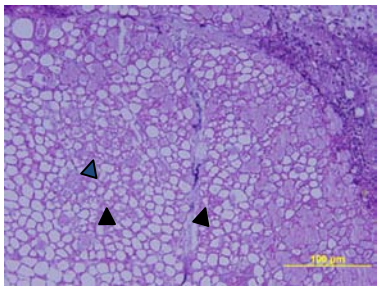


C

Transplanted BAT – 2wks



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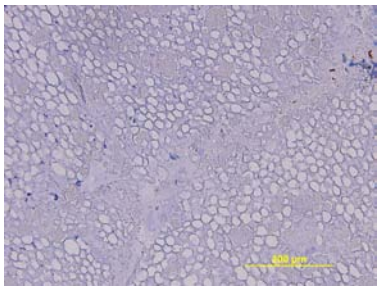
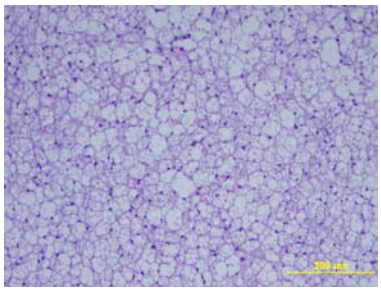
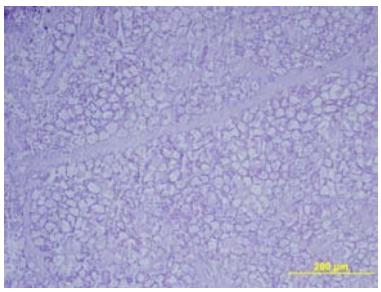


D

Endogenous BAT - Sham



Endogenous BAT - 0.1g BAT



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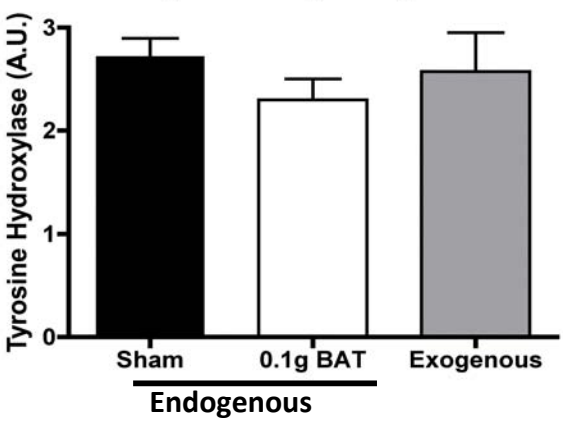

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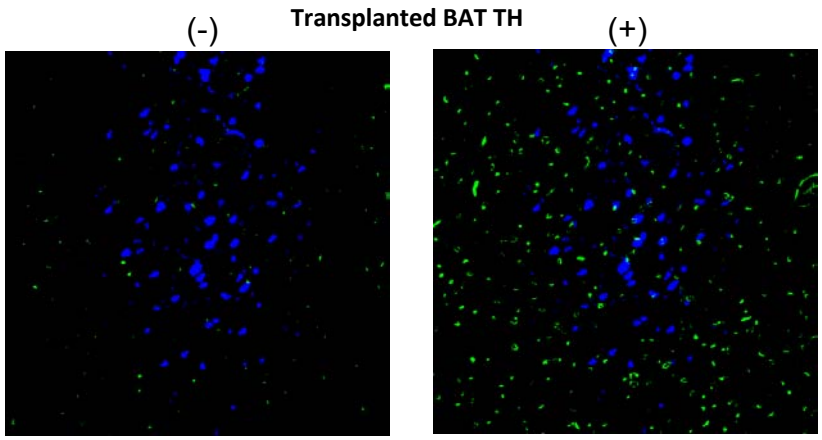
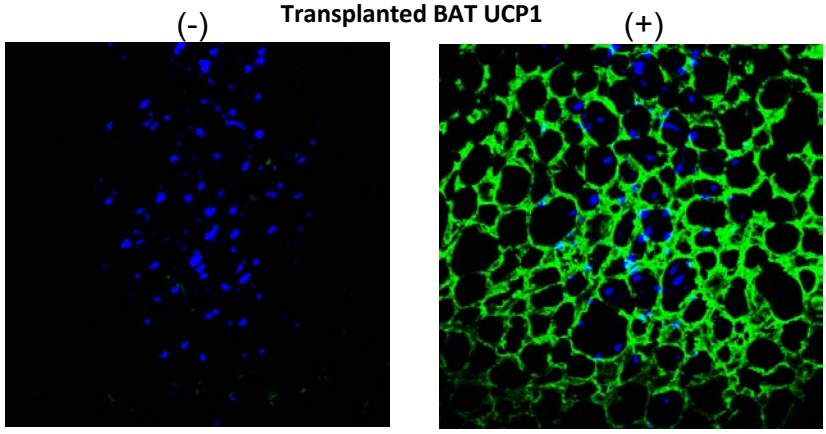
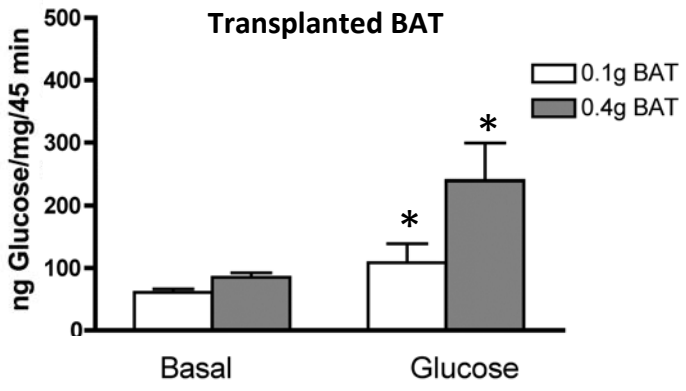

Transplanted BAT TH
(-)
(+)

G


Transplanted BAT UCP1
(-)
(+)

H


Transplanted BAT
ng Glucose/mg/45 min
500
400
300
200
100
0
0.1g BAT
0.4g BAT
*
*
Basal
Glucose