Fat Shadow Atlas

First Edition

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Preface

This Fat Shadow Atlas is developed to provide the entire dataset analyzed in the paper *"Fat Shadows" from DXA for the Qualitative Assessment of Lipodystrophy: When a Picture is Worth a Thousand Numbers* by Meral R et al. Some additional pediatric Familial Partial Lipodystrophy (FPLD) patients not included in the study are also presented. We hope that this will serve as a beginning of a global project that will enable the collection and comparison of fat shadows. If any researchers are interested in collaboration and further participation in the atlas, please contact the corresponding author of the manuscript.

This atlas is organized first to provide readers with a protocol to obtain fat shadows with the enCore (v14.10) software to obtain fat shadows from total body composition scans obtained with a GE Lunar (Chicago, IL) Dual Energy X-ray Absorptiometry (DXA) system. Control cases of females and males are presented separately across a continuous spectrum of BMI. The lipodystrophy patients are organized according to subtype and broken into the genotype groupings. The atlas section only labels the gender category and age in years for each subject. In addition, BMI is shown for controls and assigned subgroup for the lipodystrophy patients. More information on each patient can be found in the appendix. As lipodystrophy syndromes are heterogeneous in etiology and presentation, we followed the Online Mendelian Inheritance in Man (OMIM, www.omim.org) classification for the subtypes of lipodystrophy based on genetic findings. The most common genetic cause of FPLD was mutations in the Lamin A/C gene (*LMNA*), which causes FPLD type 2 (FPLD2), also known as the Dunnigan variety (1-5). FPLD2 are shown together as a group to demonstrate the typical presentation, as well as the exceptions to the rule (phenotypic heterogeneity in laminopathies (6; 7)). In the last section, all other FPLD subtypes were grouped together as FPLDX, which included FPLD type 1 (FPLD1, Köbberling variety), defined as FPLD with no mutations in confirmed pathogenic genes (8); FPLD3 (due to mutations in Peroxisome Proliferator-Activated Receptor-γ, *PPARg* (9)), genetic subtypes not numbered in standard nomenclature, and all patients in whom the variants of unknown significance (VUS) in different genes have not yet been verified.

As more research is done into the molecular pathways of lipodystrophy, additional subtypes are defined, and new subgroups break off from FPLD1. Patients who once fell into the category of FPLD1 may be redefined as another subtype (10-15). In addition, more research may show that some variants which were considered pathogenic at one point are not in reality pathogenic as more functional work is carried out. For example, some *PPARG* variants previously thought to be pathogenic, and thus were classified as FPLD3, do not classify as pathogenic variants according to the recently introduced Missense InTerpretation by Experimental Response (MITER) classifier (16), suggesting that some of these patients may have to be reclassified as FPLD1. We expect that within the FPLD1 population, there will be more subgroups that are yet to be defined, in addition to the classical presentation of FPLD1 described by Köbberling et al (3; 17; 18). The fat shadow method described here may prove useful as a phenotyping tool and help investigators to identify similarities and disparities within the FPLDX population and other subtypes of the diseases.

We are grateful to all patients and controls for their participation in the study, and Lipodystrophy United for their help in patient recruitment into various lipodystrophy trials. We dedicate this paper to those patients whom we have lost since 2009 and especially to Mrs. Natalie K. Hunt-Embry who fought her disease with great courage and passion. We are indebted to Laura Foess-Wood for performing all the DXA scans at the Michigan Clinical Research Unit, and for her positive personality that cheers us up every time we see her. We thank Dr. Kong Y. Chen and Dr. Robert J. Brychta for performing the DXA scans at the Metabolic Clinical Research Unit at the NIDDK. We also acknowledge support from the NIH on grants: R01 DK088114, P30 DK089503, DK034933 which allowed the DXA scans presented here to be performed, and from the Intramural Research Program of the National Institutes of Health, the National Institute of Diabetes and Digestive and Kidney Diseases. BJR was supported by NIH T32 DK007245. Finally, the work was supported by generous gifts to the Lipodystrophy Fund at the University of Michigan made by the Sopha family, Ionis Pharmaceuticals and the White Point Foundation of Turkey.

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Units and Abbreviations

%fat	%	Tissue %fat measured by DXA
BMI	Kg/m^2	Body Mass Index
DXA		Dual Energy X-ray Absorptiometry
F		Female
FFMI	Kg/m^2	Fat Free Mass Index
Hisp or Lat		Hispanic or Latino
M		Male
MITER		Missense InTerpretation by Experimental Response (16)
		http://miter.broadinstitute.org/
		Prevalence set to: 0.2
NIH		National Institutes of Health
OMIM		Online Mendelian Inheritance in Man
UM		University of Michigan

Subtypes of Lipodystrophy		**Affected Gene**	**OMIM ID**
AGL	Acquired Generalized Lipodystrophy		
APL	Acquired Partial Lipodystrophy		
CGL	Congenital Generalized Lipodystrophy		
CGL1	Congenital Generalized Lipodystrophy type 1	*AGPAT2*	#608594
CGL2	Congenital Generalized Lipodystrophy type 2	*BSCL2*	#269700
FPLD	Familial Partial Lipodystrophy syndrome		
FPLD1	Familial Partial Lipodystrophy type 1, Köbberling variety		%608600
FPLD2	Familial Partial Lipodystrophy type 2, Dunnigan variety	*LMNA*	#151660
FPLD3	Familial Partial Lipodystrophy type 3	*PPARG*	#604367
FPLDX	All FPLD other than FPLD2		

Gene names		**OMIM ID**
AGPAT2	1-Acylglycerol-3-Phosphate O-Acyltransferase 2	*603100
BSCL2	Berardinelli-Seip Congenital Lipodystrophy 2	*606158
LMNA	Lamin A/C gene	*150330
PCYT1A	Phosphate Cytidylyltransferase 1, Choline, α-Isoform	*123695
POLD1	Polymerase (DNA-Directed), Δ1, Catalytic Subunit	*174761
PPARG	Peroxisome Proliferator-Activated Receptor-γ gene	*601487

Legend for blinded assessments presented in the appendix

n	Not FPLD
y	FPLD

Investigators:

NM	Noemi Malandrino's FPLD predictions (NIH)
RB	Rebecca J. Brown's FPLD predictions (NIH)
RM	Rasimcan Meral's FPLD predictions (UM)
EO	Elif A. Oral's FPLD predictions (UM)
BA	Barış Akıncı's FPLD predictions (independent, Dokuz Eylul University)

Please note that after independent assessments, investigators were asked to reach a consensus on disagreed cases. Thus, individual investigators' performance may differ from the accuracies reported in the manuscript.

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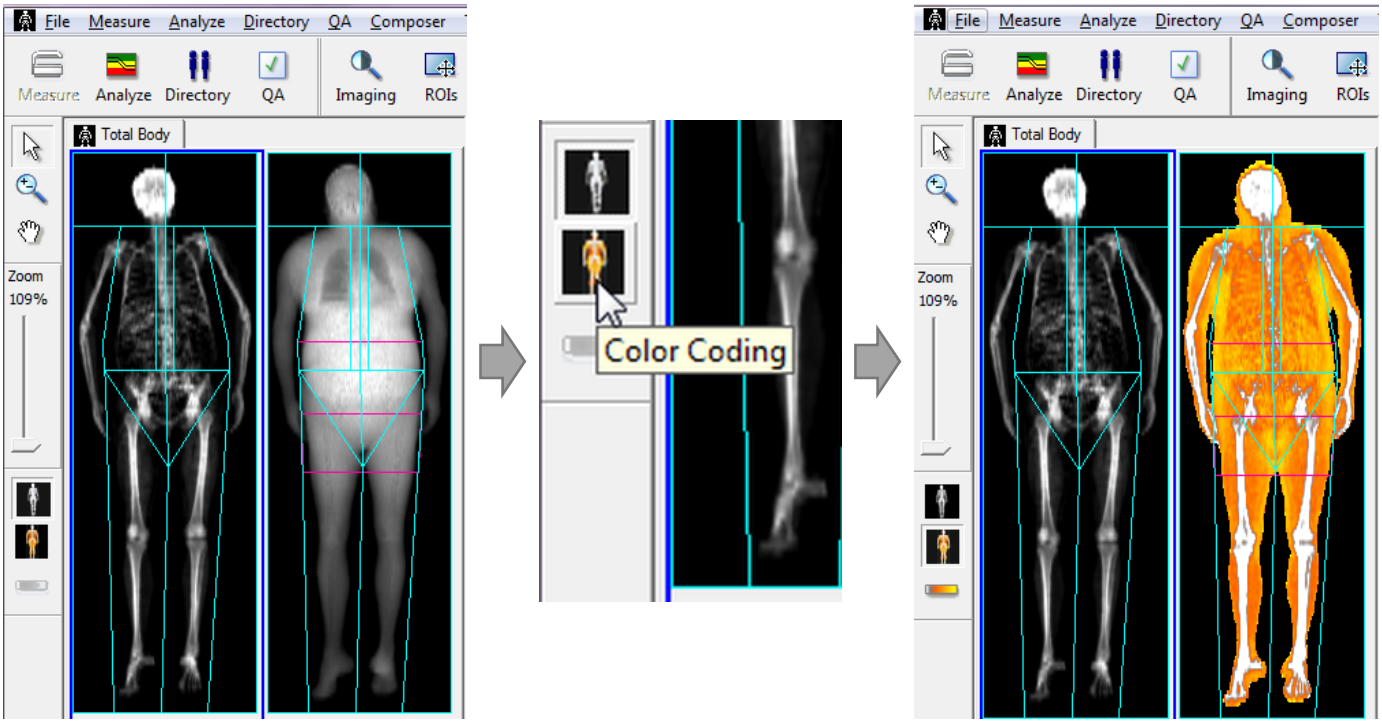
Protocol: Generating a fat shadow image in enCore v14.10

GE Lunar (Chicago, IL) DXA systems are delivered with the enCore software for the acquisition and analysis of DXA total body composition scans. All the steps described are possible with the built in features of the enCore software version 14.10. Exporting the image is not possible in the current version of the software, and the only way to save the generated fat shadow is to screen capture.

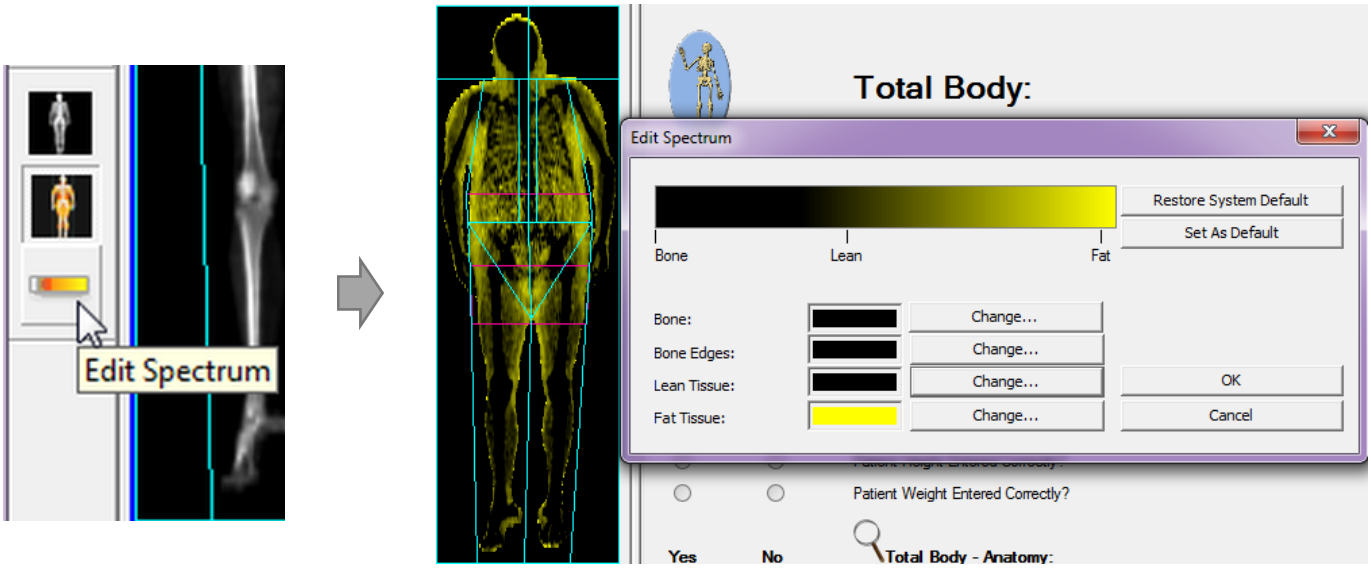
Step 1: Navigate to the analysis page of the DEXA scan.

Step 2: Enable “color coding”



Step 3: Open the “edit spectrum” dialogue

Step 4: Highlight fat signal by setting everything other than fat to the background color, enabling easier visualization of subcutaneous fat in lipoatrophic areas.



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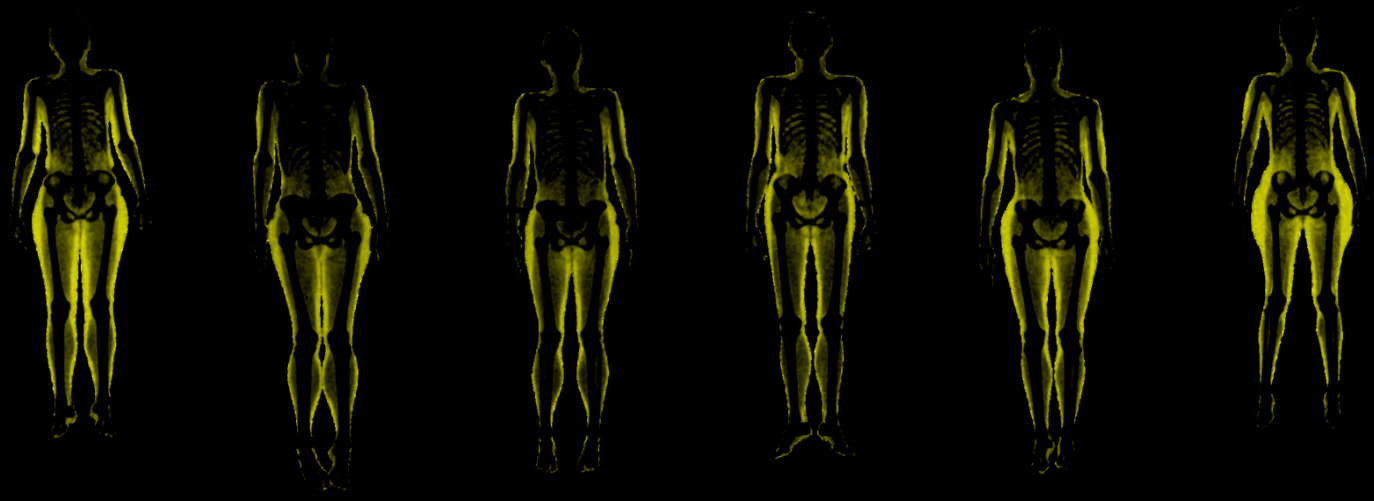
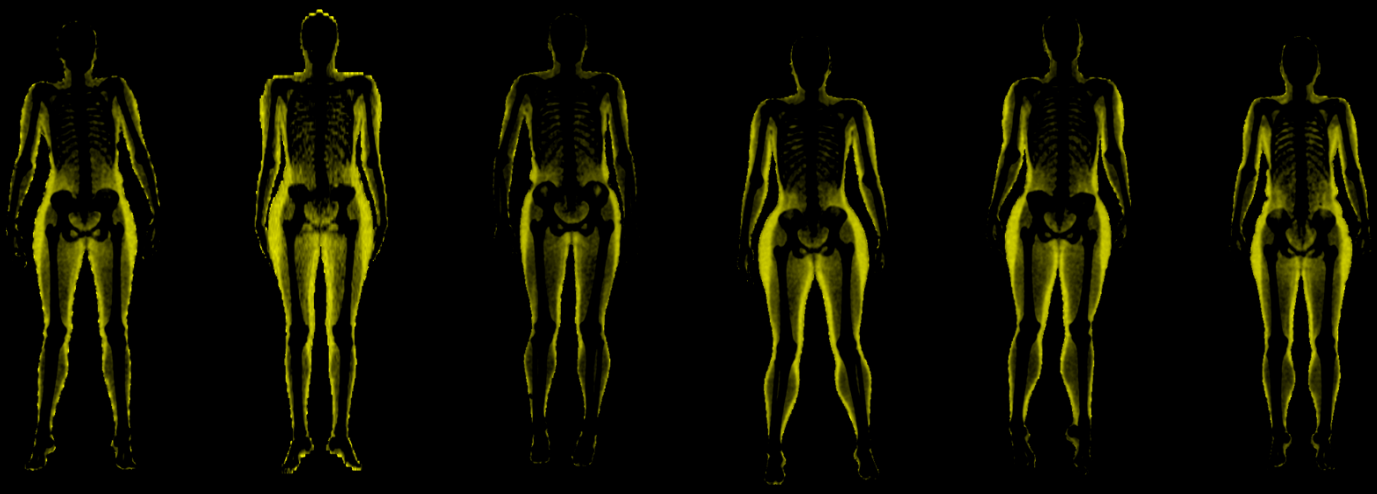
A						
	Female, 58 BMI=19.5	Female, 63 BMI=19.5	Female, 44 BMI=20.2	Female, 61 BMI=20.2	Female, 61 BMI=20.3	Female, 40 BMI=20.5
B						
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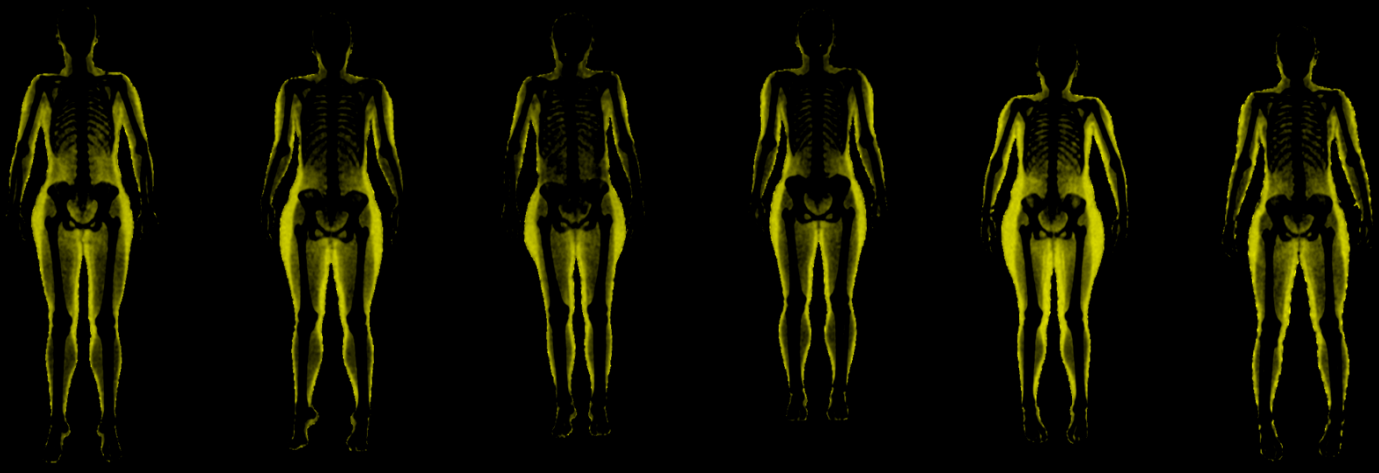
C						
	Female, 29 BMI=22.4	Female, 20 BMI=22.4	Female, 59 BMI=22.5	Female, 23 BMI=22.8	Female, 18 BMI=22.9	Female, 19 BMI=23

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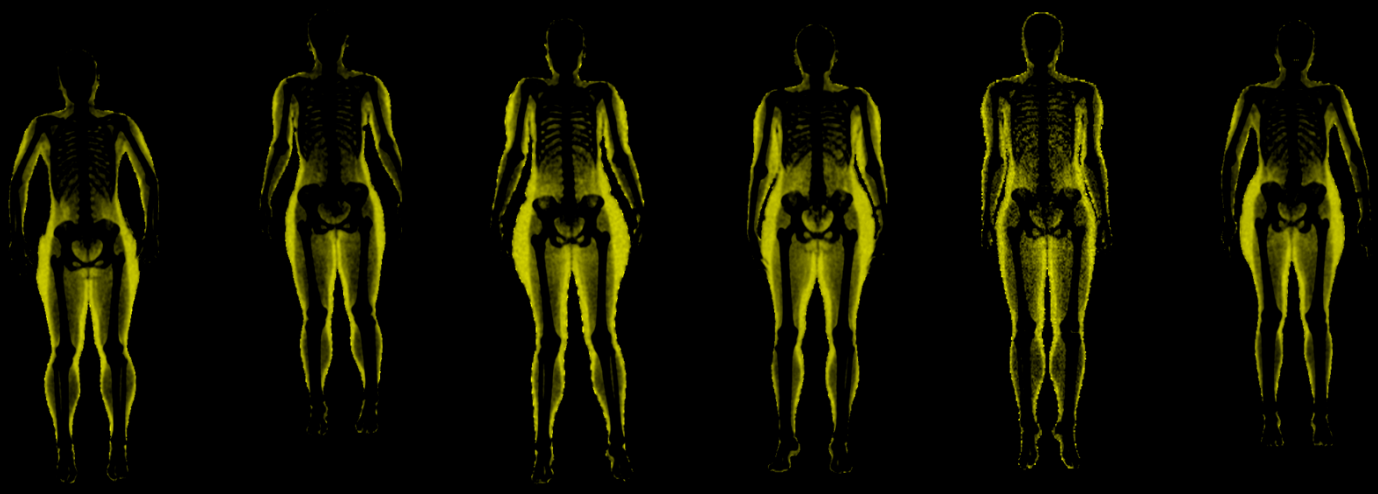
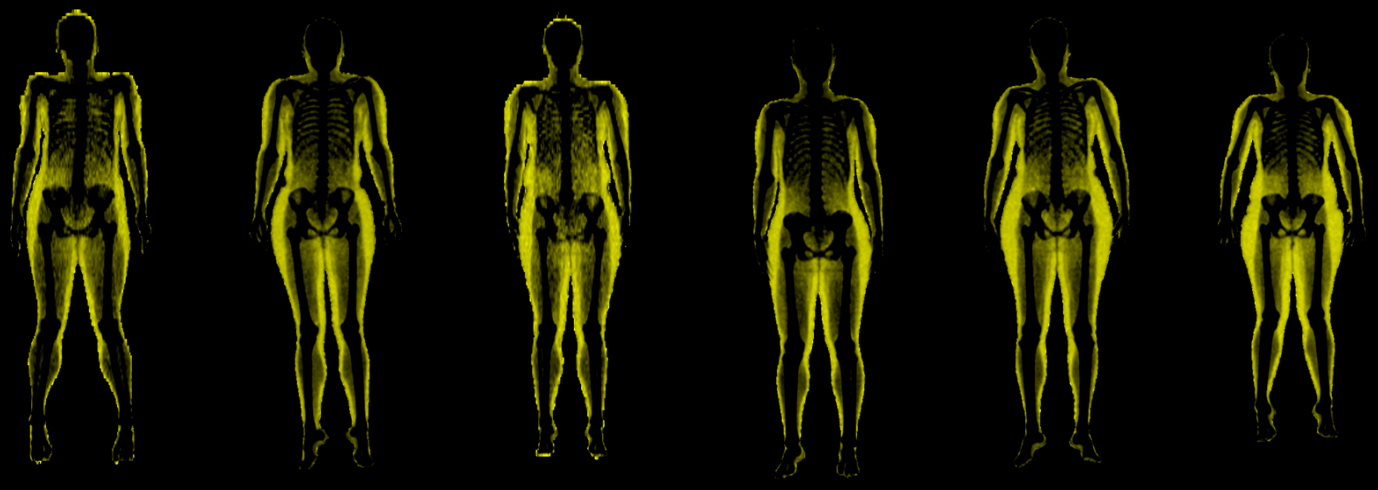
A						
	Female, 25 BMI=23.2	Female, 23 BMI=23.3	Female, 28 BMI=23.4	Female, 65 BMI=23.5	Female, 19 BMI=23.6	Female, 54 BMI=24.1
B						
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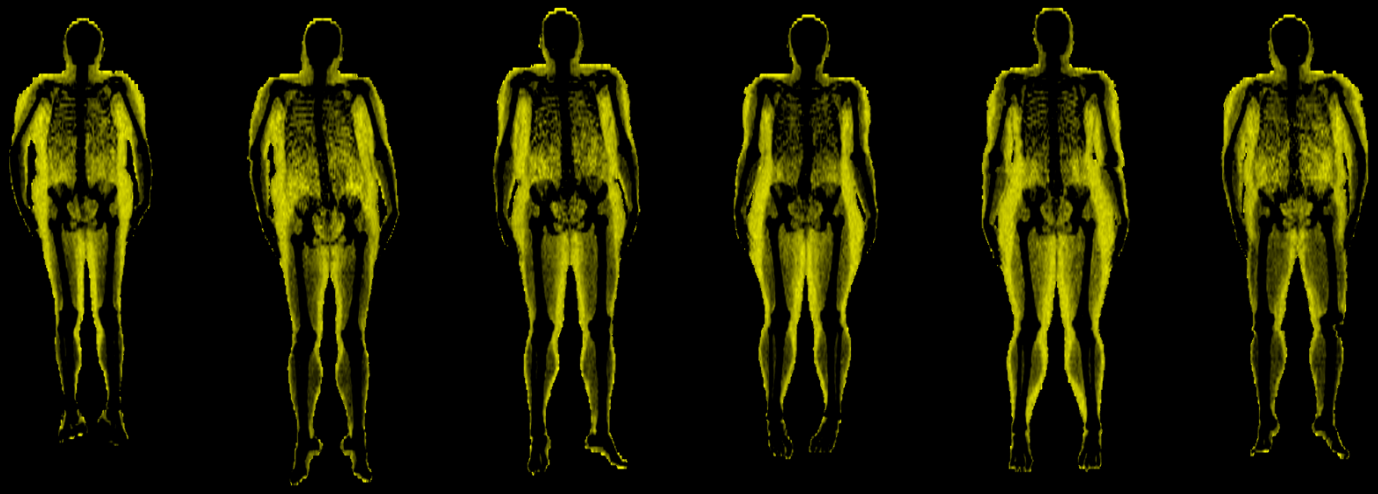
C						
	Female, 63 BMI=27.5	Female, 50 BMI=29.1	Female, 53 BMI=30.1	Female, 26 BMI=30.2	Female, 29 BMI=30.6	Female, 68 BMI=31.2

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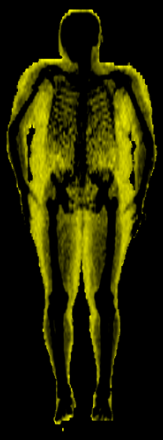
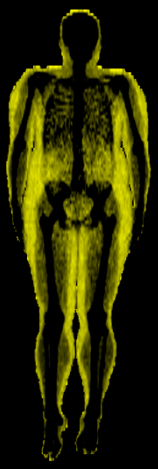
A						
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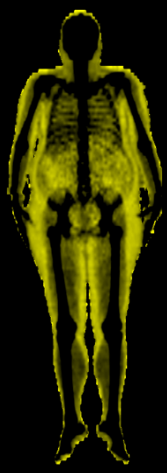
B						
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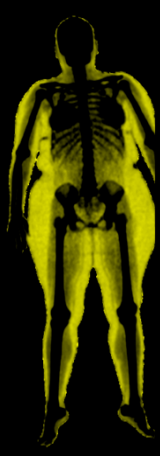
C						
	Female, 55 BMI=34	Female, 38 BMI=34.1	Female, 30 BMI=34.3	Female, 30 BMI=34.7	Female, 60 BMI=34.8	Female, 56 BMI=35.9

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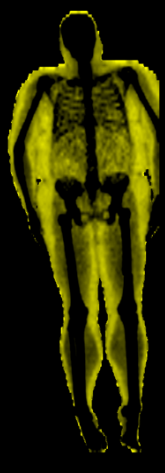
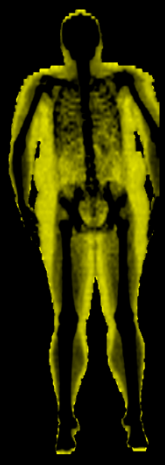
A						
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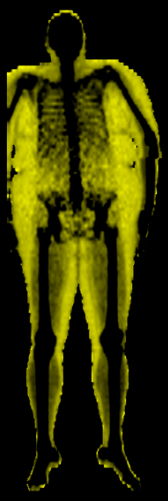
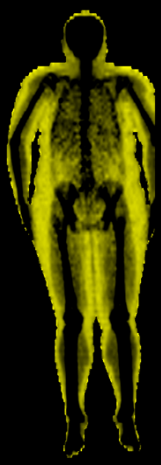
C						
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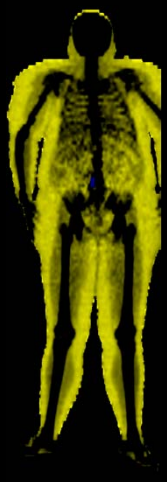
B						
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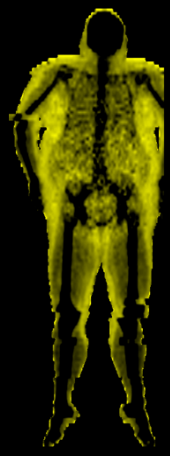
C						
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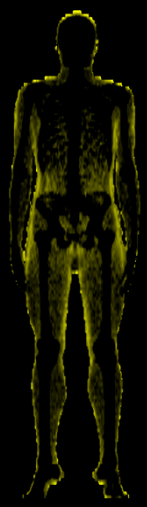
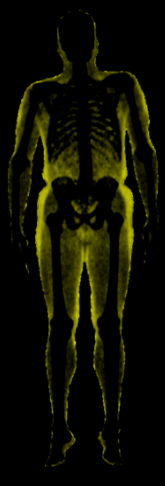
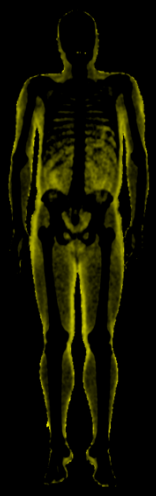
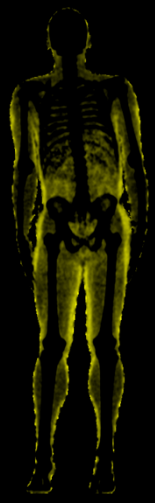
A						
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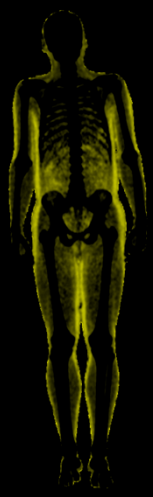
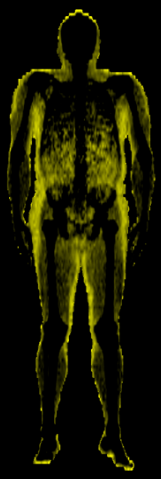
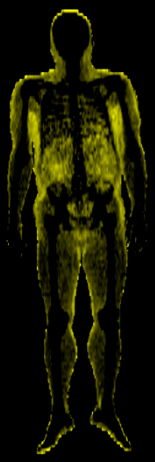
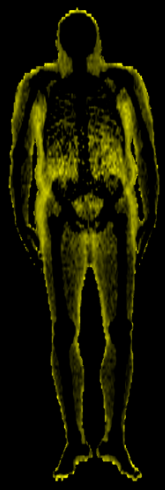
B						
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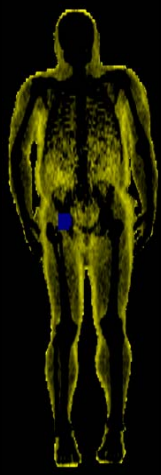
C						
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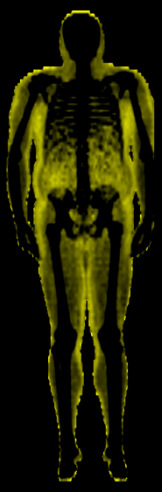
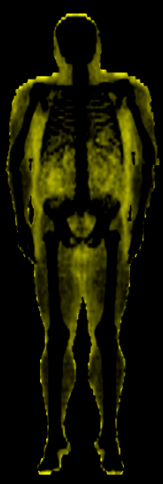
A						
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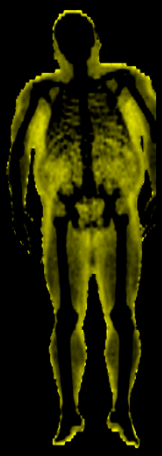
B						
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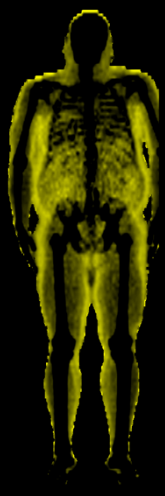
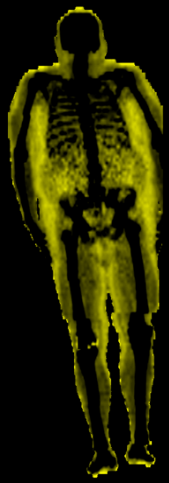
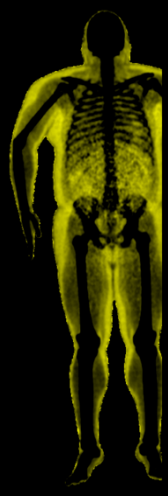
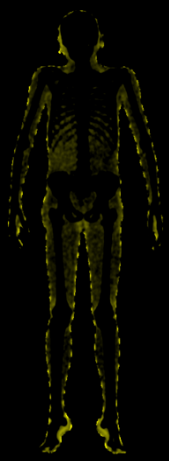
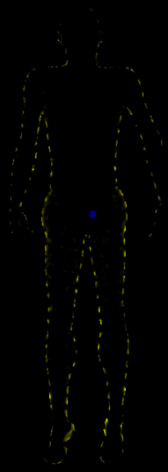
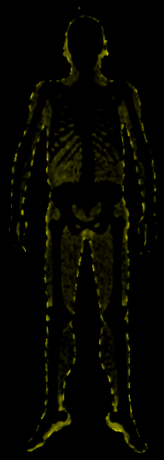
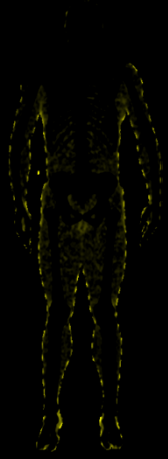
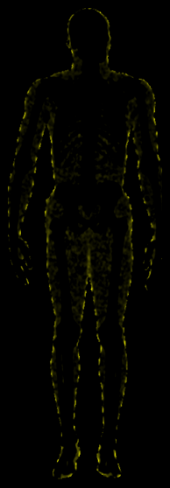
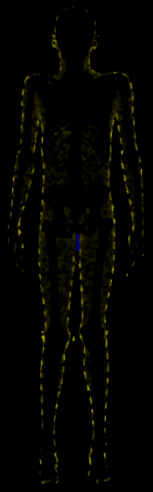
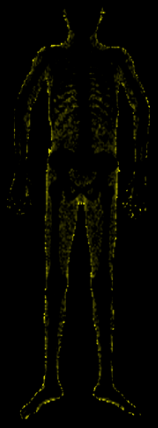
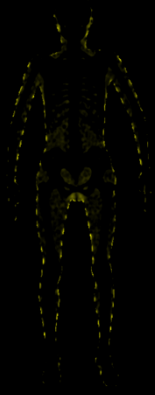
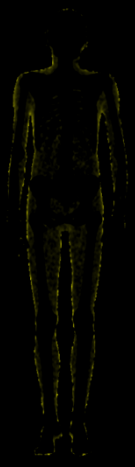
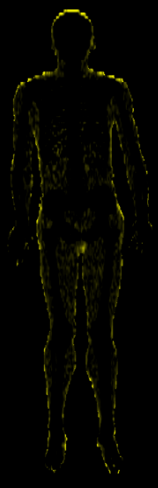
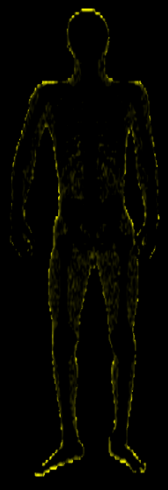
C						
	Male, 57 BMI=37.7	Male, 62 BMI=40.4	Male, 47 BMI=40.9	Male, 64 BMI=41	Male, 44 BMI=41.7	Male, 60 BMI=43.1

	1	2	3	4	5	6
A						
	Female, 33 CGL1	Female, 14 CGL1	Female, 33 CGL1	Female, 32 CGL1	Female, 20 CGL1	Female, 20 CGL1
B						
	Male, 25 CGL1	Female, 14 CGL2	Male, 16 CGL2	Male, 18 CGL2	Female, 13 GL LMNA p.T10I-linked	Female, 27 CGL PCYT1A-linked
C						
	Female, 40 AGL	Female, 19 AGL	Male, 20 AGL	Male, 15 AGL		

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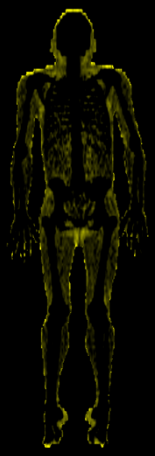
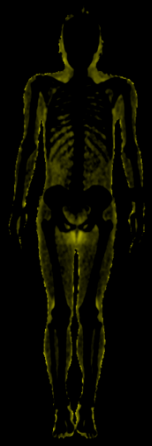
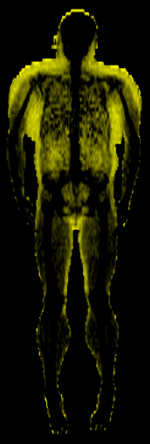
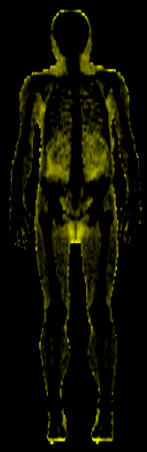
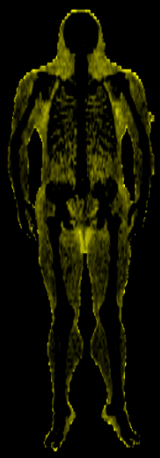
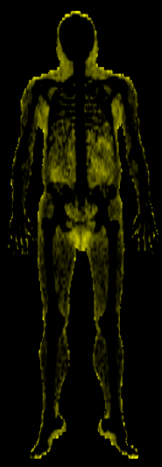
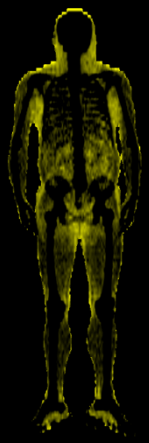
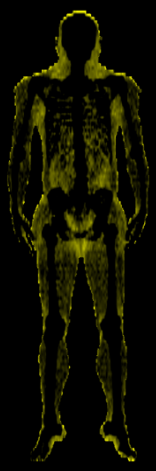
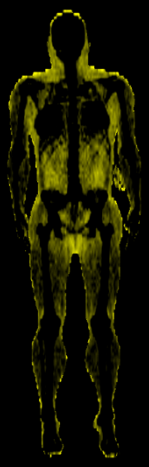
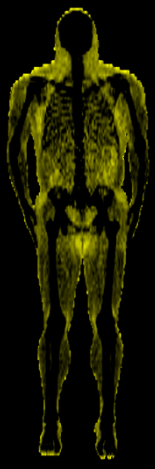
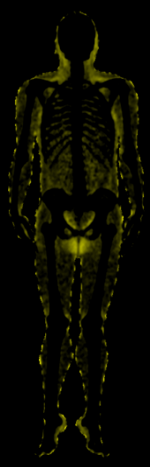
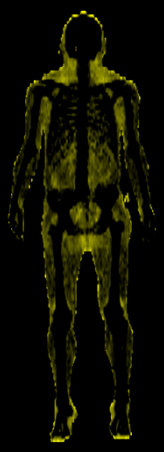
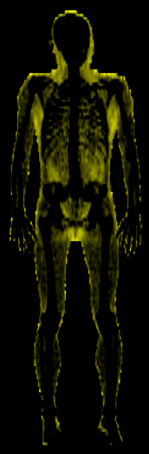
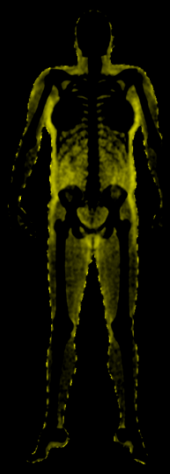
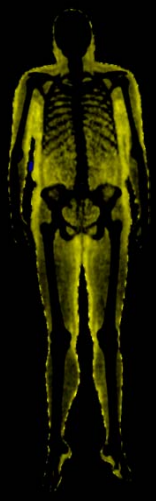
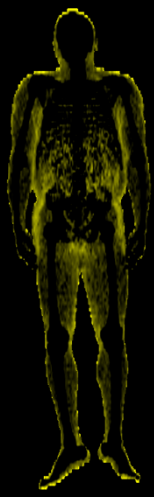
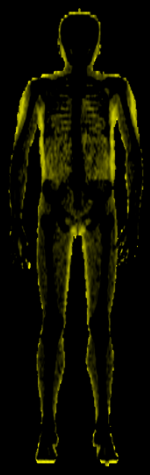
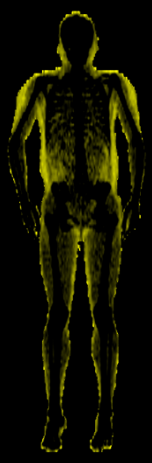
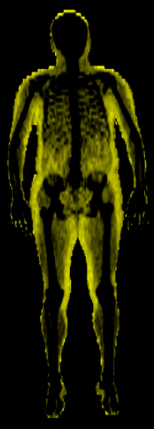
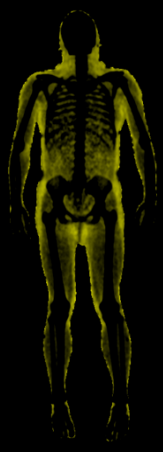
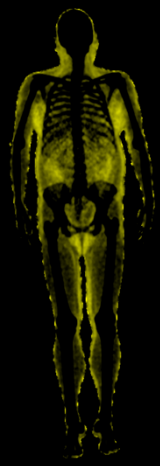
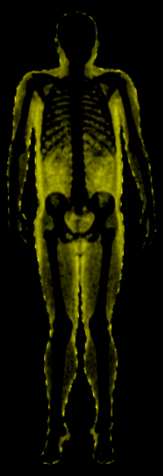
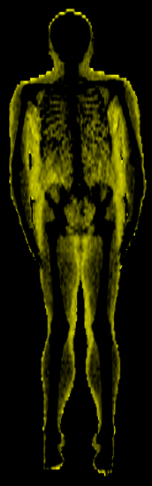
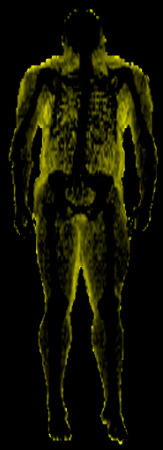
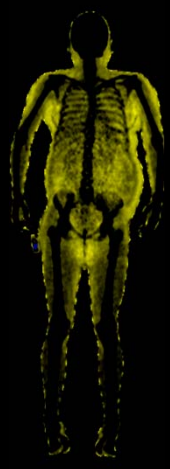
A						
	Female, 33 FPLD2	Female, 15 FPLD2	Female, 37 FPLD2	Female, 59 FPLD2	Female, 30 FPLD2	Female, 59 FPLD2
B						
	Female, 55 FPLD2	Female, 42 FPLD2	Female, 49 FPLD2	Female, 57 FPLD2	Female, 49 FPLD2	Female, 40 FPLD2
C						
	Female, 40 FPLD2	Female, 30 FPLD2	Female, 62 FPLD2	Female, 38 FPLD2	Female, 41 FPLD2	Female, 19 FPLD2

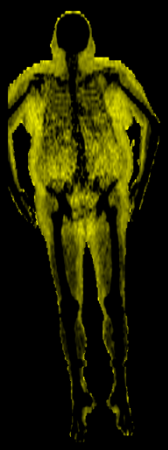
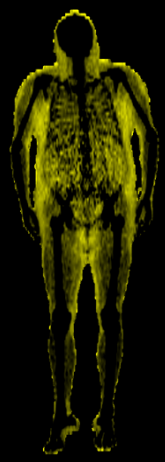
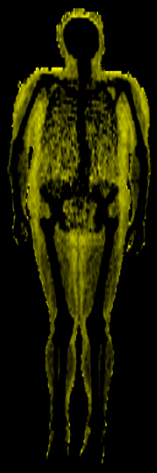
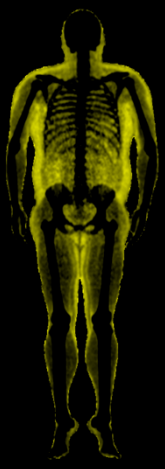
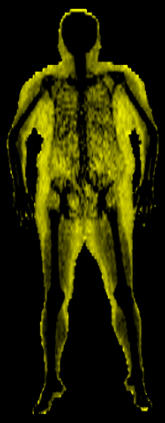
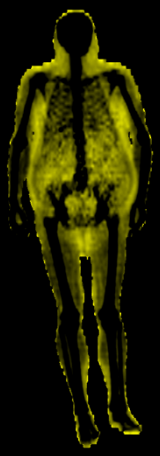
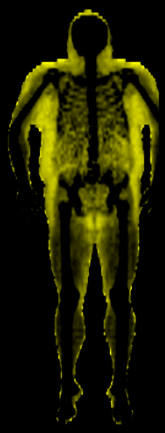
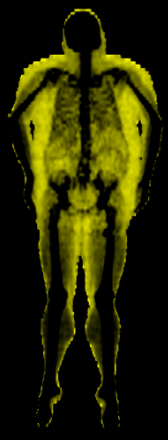
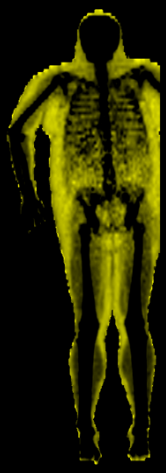
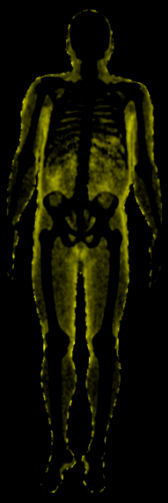
A

1	2	3	4	5	6
					
Female, 58 FPLD2	Female, 45 FPLD2	Female, 33 FPLD2	Female, 18 FPLD2	Male, 49 FPLD2	

B

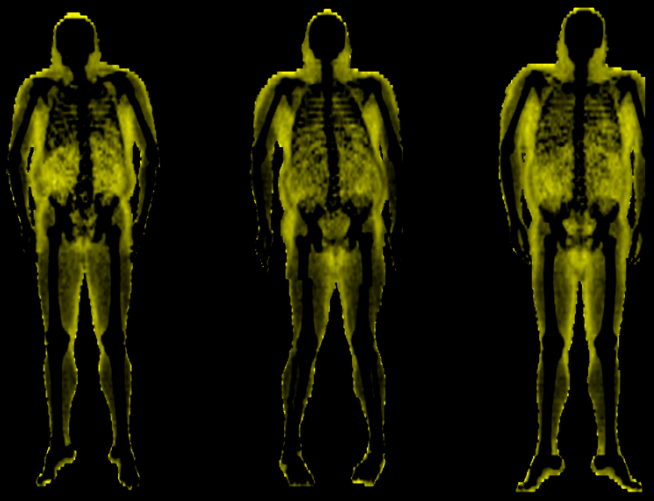
C

	1	2	3	4	5	6
A						
	Female, 64 FPLDX	Female, 34 FPLDX	Female, 27 FPLDX	Female, 54 FPLDX	Female, 51 FPLDX	Male, 52 FPLDX
B						
	Female, 34 FPLDX	Female, 14 FPLDX	Female, 12 FPLDX	Female, 54 FPLDX	Female, 45 FPLDX	Female, 47 FPLDX
C						
	Female, 16 FPLDX	Female, 45 FPLDX	Female, 33 FPLDX	Female, 63 FPLDX	Female, 23 FPLDX	Female, 41 FPLDX

	1	2	3	4	5	6
A						
	Female, 13 FPLDX	Female, 63 FPLDX	Female, 58 FPLDX	Female, 54 FPLDX	Female, 58 FPLDX	Female, 39 FPLDX
B						
	Female, 29 FPLDX	Female, 57 FPLDX	Female, 51 FPLDX	Female, 53 FPLDX	Female, 65 FPLDX	Female, 39 FPLDX
C						
	Female, 45 FPLDX	Female, 55 FPLDX	Female, 34 FPLDX	Female, 32 FPLDX	Male, 65 FPLDX	Male, 46 FPLDX

1 2 3 4 5 6

A



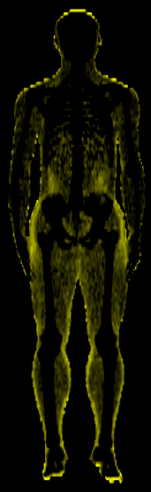
Male, 62
FPLDX

Male, 38
FPLDX

Male, 34
FPLDX

B

C

	1	2	3	4	5	6
A	 Female, 40 APL	 Male, 24 APL				
B						
C						

p.	Row	Col	Group	Genetic comments	NM	RB	RM	EO	BA	Sex	Race	Hispanic or Latino	Age	BMI	FFMI	Arms %fat	Legs %fat	Trunk %fat	Total %fat	Site	Table	ID
5	A	1	Control		n	n	n	n	n	F	White		58	19.5	13.8	33.6	38.6	23.1	30.7	NIH	iDXA	KFQ39
5	A	2	Control		n	n	n	n	n	F	White		63	19.5	15.6	21.8	26.9	16.1	21.2	NIH	iDXA	QUN74
5	A	3	Control				n	n		F	White		44	20.2	16.5	21.5	26.2	13.2	19.7	NIH	iDXA	WQW90
5	A	4	Control		n	n	n	n	n	F	White		61	20.2	15.1	24.6	24.6	29.5	26.8	NIH	iDXA	XDE96
5	A	5	Control		n	n	n	n	n	F	White		61	20.3	15.0	30.1	33.1	24.3	27.9	NIH	iDXA	JHD98
5	A	6	Control		n	n	n	n	n	F	White		40	20.5	13.4	36.2	40.4	34.4	36.2	NIH	iDXA	VZP99
5	B	1	Control		n	n	n	n	n	F	White		30	20.6	14.8	27.5	33.8	28.0	29.6	NIH	iDXA	OPG61
5	B	2	Control		n	n			n	F	White		21	21.3	13.7	36.5	39.4	34.3	35.6	UM	Prodigy	IDL87
5	B	3	Control				n	n		F	White		30	21.8	17.1	19.7	25.2	21.1	22.5	NIH	iDXA	UNQ13
5	B	4	Control		n	n	n	n	n	F	White		27	22.2	15.7	32.5	34.3	26.5	30.1	NIH	iDXA	YAS44
5	B	5	Control		n	n	n	n	n	F	White		28	22.3	16.3	28.6	32.0	25.9	28.3	NIH	iDXA	ZDO81
5	B	6	Control		n	n	n	n	n	F	White		54	22.4	16.3	29.4	30.0	28.6	28.8	NIH	iDXA	BFE14
5	C	1	Control		n	n	n	n	n	F	White		29	22.4	15.4	31.5	31.3	35.2	32.4	NIH	iDXA	PXF64
5	C	2	Control		n	n	n	n	n	F	White		20	22.4	16.0	29.6	35.6	26.2	29.6	NIH	iDXA	UYQ24
5	C	3	Control		n	n	n	n	n	F	White		59	22.5	17.6	28.2	33.4	13.7	23.2	NIH	iDXA	ANF11
5	C	4	Control		n	n	n	n	n	F	White		23	22.8	17.1	29.1	31.1	22.6	26.9	NIH	iDXA	MII85
5	C	5	Control		n	n	n	n	n	F		Yes	18	22.9	13.4	45.1	48.3	41.4	42.9	NIH	iDXA	JSD88
5	C	6	Control		n	n	n	n	n	F	White		19	23.0	15.9	33.8	36.8	30.2	32.6	NIH	iDXA	PVA92
6	A	1	Control		n	n	n	n	n	F	White		25	23.2	16.5	31.1	34.2	28.1	30.2	NIH	iDXA	ALS78
6	A	2	Control		n	n	n	n	n	F	White		23	23.3	17.6	28.2	31.0	22.4	26.0	NIH	iDXA	CHM79
6	A	3	Control		n	n	n	n	n	F	White		28	23.4	15.0	34.5	41.6	35.3	37.1	NIH	iDXA	KIT67
6	A	4	Control				n	n		F	White		65	23.5	15.2	37.8	39.4	36.9	37.1	NIH	iDXA	UJR41
6	A	5	Control		n	n			n	F	White		19	23.6	16.5	28.3	30.6	30.7	29.9	UM	Prodigy	LEK63
6	A	6	Control				n	n		F	White		54	24.1	17.0	24.8	36.6	27.1	30.6	NIH	iDXA	ONQ49
6	B	1	Control		n	n			n	F	White		44	24.2	15.9	38.5	33.2	35.2	34.1	UM	Prodigy	FJS39
6	B	2	Control		n	n	n	n	n	F	White		26	24.5	16.1	37.1	39.7	33.7	35.6	NIH	iDXA	IYY32
6	B	3	Control		n	n			n	F	White		35	24.6	14.8	39.6	38.9	41.8	39.6	UM	Prodigy	NNK49
6	B	4	Control		n	n	n	n	n	F	Other		28	24.9	16.5	35.8	36.6	34.2	34.4	NIH	iDXA	ZQL51
6	B	5	Control		n	n	n	n	n	F	White		44	25.0	15.2	40.9	40.9	41.5	40.1	NIH	iDXA	AZA20
6	B	6	Control		n	n	n	n	n	F		Yes	19	27.1	15.3	45.0	47.2	44.3	44.1	NIH	iDXA	HNJ96
6	C	1	Control		n	n			n	F	White	No	63	27.5	15.4	42.4	39.5	51.7	46.1	UM	Prodigy	AEX51
6	C	2	Control							F			50	29.1	16.7	37.8	32.8	52.3	44.6	UM	Prodigy	MXN95
6	C	3	Control		n	n			n	F			53	30.1	17.9	39.1	38.8	47.0	42.6	UM	Prodigy	FYQ82
6	C	4	Control		n	n			n	F	White		26	30.2	17.8	35.3	41.0	43.6	40.8	UM	Prodigy	UXQ25
6	C	5	Control							F	White		29	30.6	16.5	41.0	48.4	47.1	45.9	UM	Prodigy	LMO86
6	C	6	Control		n	n			y	F	White	No	68	31.2	18.3	42.5	30.9	50.7	42.7	UM	Prodigy	IYZ81
7	A	1	Control		n	n			n	F	White	No	52	31.4	18.7	41.9	39.7	44.4	41.6	UM	Prodigy	LUT53
7	A	2	Control		n	n			n	F	Black	No	66	32.0	17.8	39.5	41.9	52.3	46.4	UM	Prodigy	OPI79
7	A	3	Control		n	n			n	F	White	No	59	32.1	19.9	37.2	35.1	44.7	40.0	UM	Prodigy	COH37
7	A	4	Control		n	n			n	F	Black	No	58	32.1	18.8	39.2	39.5	47.2	42.7	UM	Prodigy	DCF67
7	A	5	Control		n	n	n	n	n	F	White		46	32.2	16.2	48.3	49.6	55.5	51.1	NIH	iDXA	PXU92
7	A	6	Control		n	n			n	F	White		40	32.3	18.7	39.7	37.5	47.5	42.0	UM	Prodigy	ANV47
7	B	1	Control		n	n			n	F	White		40	32.3	18.2	38.2	38.8	48.6	43.6	UM	Prodigy	XNX63

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p.	Row	Col	Group	Genetic comments	NM	RB	RM	EO	BA	Sex	Race	Hispanic or Latino	Age	BMI	FFMI	Arms %fat	Legs %fat	Trunk %fat	Total %fat	Site	Table	ID
7	B	2	Control		n	n			n	F	White		44	32.5	17.2	45.6	44.5	51.1	47.1	UM	Prodigy	RQK74
7	B	3	Control		n	n			n	F	White	No	64	32.7	18.2	42.9	44.9	48.6	45.8	UM	Prodigy	XFY88
7	B	4	Control		n	n			n	F	White	No	61	32.8	18.7	43.8	40.8	50.5	46.0	UM	Prodigy	STH18
7	B	5	Control		n	n			n	F	White	No	63	33.6	18.7	39.6	41.1	51.4	45.9	UM	Prodigy	MRE71
7	B	6	Control		n	n			n	F	Black		27	33.9	17.6	42.5	51.3	48.5	47.9	UM	Prodigy	DLR23
7	C	1	Control				n	n		F	White		55	34.0	17.6	45.4	46.6	54.9	49.5	NIH	iDXA	YHA27
7	C	2	Control		n	n			n	F	White		38	34.1	17.9	45.3	51.8	46.5	47.3	UM	Prodigy	SIC75
7	C	3	Control		n	n			n	F	White		30	34.3	17.1	41.7	53.2	51.6	50.1	UM	Prodigy	IVL26
7	C	4	Control		n	n			n	F	White		30	34.7	19.0	40.0	45.0	48.3	45.2	UM	Prodigy	PAU13
7	C	5	Control		n	n	n	n	n	F	White		60	34.8	18.6	47.8	53.1	46.9	48.3	NIH	iDXA	VMX61
7	C	6	Control		n	n	n	n	n	F	White		56	35.9	16.6	52.4	56.2	57.6	54.9	NIH	iDXA	XZI46
8	A	1	Control		n	n			n	F	White	No	65	36.1	19.1	41.6	44.3	53.6	48.7	UM	Prodigy	HUD71
8	A	2	Control		n	n			n	F	White	No	59	36.2	18.4	45.4	51.6	52.2	50.4	UM	Prodigy	GZS88
8	A	3	Control		n	n			n	F	White		39	36.2	21.8	32.0	39.6	43.2	39.8	UM	Prodigy	WGY35
8	A	4	Control		n	n			n	F	White		24	36.3	20.0	44.1	47.0	45.2	44.9	UM	Prodigy	LHJ12
8	A	5	Control		n	n			n	F	White	No	49	36.4	21.8	44.2	40.0	46.5	43.5	UM	Prodigy	FCG85
8	A	6	Control		n	n			n	F	White		37	36.4	19.0	43.7	40.5	54.8	47.8	UM	Prodigy	SAE10
8	B	1	Control		n	n	n	n	n	F	White		48	36.6	17.0	53.9	47.3	54.6	50.6	NIH	iDXA	IGU10
8	B	2	Control		n	n	n	n	n	F	White		55	37.0	17.0	58.7	54.3	58.2	55.3	NIH	iDXA	OET15
8	B	3	Control		n	n			n	F	Black		24	37.2	19.3	43.1	48.9	50.2	48.0	UM	Prodigy	WTY40
8	B	4	Control		n	n	n	n	n	F	White		35	38.1	20.1	48.9	48.1	51.2	48.6	NIH	iDXA	UOX70
8	B	5	Control		n	n	n	n	n	F		Yes	20	38.3	19.3	52.9	48.8	52.2	49.8	NIH	iDXA	GZO39
8	B	6	Control		n	n	n	n	n	F	White		48	38.4	20.2	51.2	47.5	52.1	49.2	NIH	iDXA	NAC28
8	C	1	Control		y	y			n	F	White	No	67	38.7	21.1	29.5	35.7	53.3	45.8	UM	Prodigy	JOL74
8	C	2	Control		n	n			n	F	White	No	61	38.8	19.6	51.2	44.0	56.5	52.2	UM	Prodigy	SDW74
8	C	3	Control		n	n	n	n	n	F	White		36	39.1	18.5	52.0	44.5	60.2	53.0	NIH	iDXA	WUI60
8	C	4	Control		n	n			n	F	White		25	39.4	22.8	37.3	37.4	47.7	42.0	UM	Prodigy	IRZ78
8	C	5	Control		n	n			n	F	Asian		29	39.5	20.8	45.0	45.5	50.9	47.3	UM	Prodigy	PPF17
8	C	6	Control		n	n	n	n	n	F	White		27	39.5	18.4	49.0	55.9	56.1	54.1	NIH	iDXA	VQT58
9	A	1	Control		n	n			n	F	Black		26	39.6	21.1	47.4	48.5	47.6	46.7	UM	Prodigy	BMK37
9	A	2	Control		n	n	n	n	n	F	White		42	39.6	18.4	55.6	53.6	56.7	54.3	NIH	iDXA	CYX49
9	A	3	Control		n	n			n	F	White	No	51	39.6	19.6	50.6	50.0	53.7	51.2	UM	Prodigy	PTP54
9	A	4	Control		n	n			n	F	White	No	52	40.0	20.4	43.9	52.1	52.3	50.3	UM	Prodigy	FNB62
9	A	5	Control		n	n			n	F	White	No	64	41.2	22.1	49.6	51.4	49.5	49.3	UM	Prodigy	VHH62
9	A	6	Control		n	n	n	n	n	F	White		51	41.3	20.9	52.9	46.4	53.9	50.3	NIH	iDXA	HZY68
9	B	1	Control		n	n			n	F	Black	No	61	41.3	21.9	41.7	52.3	50.4	49.1	UM	Prodigy	KBU80
9	B	2	Control		n	n	n	n	n	F	White		39	42.2	19.9	49.4	50.1	58.6	53.5	NIH	iDXA	BRS38
9	B	3	Control		n	n	n	n	n	F	White		52	42.4	21.0	51.9	53.6	52.4	51.7	NIH	iDXA	GXH69
9	B	4	Control		n	n	n	n	n	F	White		38	42.4	19.8	49.1	56.3	55.4	54.0	NIH	iDXA	PTE72
9	B	5	Control		n	n	n	n	n	F	White		50	42.5	21.4	46.1	45.2	57.0	51.0	NIH	iDXA	TLI73
9	B	6	Control		n	n			n	F	White	No	54	42.9	21.1	55.5	54.1	53.7	53.1	UM	Prodigy	ATB52
9	C	1	Control		n	n	n	n	n	F	White		41	43.0	19.5	53.2	52.0	60.8	55.5	NIH	iDXA	PMK61
9	C	2	Control		n	n	n	n	n	F	White		53	44.3	21.0	48.4	48.9	59.6	53.4	NIH	iDXA	UUY97

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p.	Row	Col	Group	Genetic comments	NM	RB	RM	EO	BA	Sex	Race	Hispanic or Latino	Age	BMI	FFMI	Arms %fat	Legs %fat	Trunk %fat	Total %fat	Site	Table	ID
9	C	3	Control		n	n	n	n	n	F		Yes	19	44.3	20.9	54.1	54.3	56.9	54.3	NIH	iDXA	ZRO74
9	C	4	Control		n	y			n	F	White	No	57	44.7	24.0	44.0	39.4	53.0	47.6	UM	Prodigy	MTZ18
9	C	5	Control		n	n	n	n	n	F	White		50	45.5	22.2	52.8	50.7	55.1	52.1	NIH	iDXA	YQJ88
9	C	6	Control		n	n	n	n	n	F	White		32	49.1	22.8	51.7	47.8	58.7	52.7	NIH	iDXA	VUN71
10	A	1	Control		n	n			n	M	White		30	22.2	18.2	16.0	17.2	20.8	18.9	UM	Prodigy	EJO49
10	A	2	Control		n	n			n	M	White		20	22.8	18.6	14.5	19.1	19.4	18.8	UM	Prodigy	EWG59
10	A	3	Control		n	n	n	n	n	M	White		62	23.5	19.4	19.5	21.0	17.4	19.1	NIH	iDXA	WIU51
10	A	4	Control		n	n	?	n	n	M	White		64	24.4	19.1	17.9	21.7	26.5	23.4	NIH	iDXA	LGD67
10	A	5	Control		n	n	n	n	n	M	White		54	24.5	18.3	20.8	22.1	31.5	26.6	NIH	iDXA	CBG29
10	A	6	Control		n	n	n	n	n	M	White		48	24.8	18.6	20.7	27.6	27.4	26.4	NIH	iDXA	WVT82
10	B	1	Control		n	n	n	n	n	M	White		49	25.3	19.1	21.0	21.8	31.1	26.0	NIH	iDXA	GLF38
10	B	2	Control		n	n			n	M	White	No	65	27.1	19.3	22.8	25.3	36.4	30.7	UM	Prodigy	BLC25
10	B	3	Control		y	y			n	M		No	58	27.8	20.6	25.0	16.0	38.2	29.6	UM	Prodigy	VGB36
10	B	4	Control		n	n			n	M	White	No	65	28.5	19.1	25.5	25.9	39.1	32.8	UM	Prodigy	AMK51
10	B	5	Control		n	y			n	M	White	No	62	29.9	20.6	22.9	20.3	41.4	32.1	UM	Prodigy	EVP48
10	B	6	Control		n	y			n	M	White	No	67	29.9	19.7	30.7	26.1	42.3	35.4	UM	Prodigy	YBG67
10	C	1	Control		n	n	n	n	n	M	White		63	30.0	23.0	19.5	18.5	29.4	24.5	NIH	iDXA	MEB58
10	C	2	Control		n	n			n	M	White	No	60	30.1	20.2	24.3	27.7	40.4	33.4	UM	Prodigy	TLP75
10	C	3	Control		n	y			n	M	White	No	24	31.0	23.6	18.4	17.0	33.5	25.8	UM	Prodigy	SNA53
10	C	4	Control		n	n			n	M	White		58	31.1	19.5	29.7	28.4	47.6	38.4	UM	Prodigy	BZY86
10	C	5	Control		n	y			n	M	Asian	No	44	31.5	22.3	25.3	22.4	36.6	30.4	UM	Prodigy	YBV41
10	C	6	Control		n	y			n	M	Black	No	56	31.8	20.5	29.8	31.2	43.7	37.2	UM	Prodigy	WJY11
11	A	1	Control		y	y			y	M	White	No	55	32.5	22.3	24.3	24.7	38.7	32.6	UM	Prodigy	MRP51
11	A	2	Control		n	n			n	M			60	32.6	20.3	31.4	33.7	44.3	38.4	UM	Prodigy	XBS75
11	A	3	Control		n	n			n	M	White	No	62	33.0	21.1	33.8	28.9	44.0	37.2	UM	Prodigy	QOS38
11	A	4	Control		y	y			n	M	White	No	52	33.1	23.6	25.7	20.4	37.8	30.3	UM	Prodigy	JSP42
11	A	5	Control		n	n			n	M	Black		32	34.2	22.3	27.0	28.4	41.8	34.6	UM	Prodigy	PZR33
11	A	6	Control		n	n			n	M	White	No	64	35.5	20.3	32.4	33.8	50.0	43.4	UM	Prodigy	LCL49
11	B	1	Control		n	n			n	M	White		24	35.6	22.3	31.7	29.3	44.2	37.1	UM	Prodigy	NEX71
11	B	2	Control		n	n			n	M	Black		22	36.0	22.0	32.9	39.9	41.0	38.6	UM	Prodigy	QVO22
11	B	3	Control		n	n			n	M	White	No	65	36.1	20.1	35.4	42.0	50.5	45.2	UM	Prodigy	MUW65
11	B	4	Control		n	n			n	M	White		35	36.4	21.0	36.1	34.7	49.1	42.3	UM	Prodigy	AUL87
11	B	5	Control		n	n			n	M	White	No	57	36.8	23.3	31.6	30.5	45.3	38.0	UM	Prodigy	KQR47
11	B	6	Control		n	y			n	M	White	No	44	37.6	22.8	32.4	32.9	46.8	40.0	UM	Prodigy	TRV14
11	C	1	Control		n	n			n	M	White	No	57	37.7	24.2	26.7	33.1	42.8	37.4	UM	Prodigy	XUT61
11	C	2	Control		n	n			n	M	White	No	62	40.4	23.9	31.6	37.8	45.1	41.0	UM	Prodigy	HVL92
11	C	3	Control		n	n	n	n	n	M	White		47	40.9	22.9	34.4	37.3	52.6	45.0	NIH	iDXA	BKD94
11	C	4	Control		n	n			n	M	White		64	41.0	27.1	30.5	26.6	42.8	35.1	UM	Prodigy	KQO60
11	C	5	Control		n	n	n	n	n	M	White		44	41.7	24.1	39.2	32.1	52.7	44.1	NIH	iDXA	IBA47
11	C	6	Control		n	n			n	M	White	No	60	43.1	23.6	40.8	45.3	50.2	46.5	UM	Prodigy	LAJ54
12	A	1	CGL1	AGPAT2						F	White		33	16.8	15.7	9.4	7.2	4.2	6.9	NIH	iDXA	VDF29
12	A	2	CGL1	AGPAT2						F		Yes	14	18.6	16.3	18.1	16.4	9.6	13.6	NIH	iDXA	MCN25
12	A	3	CGL1	AGPAT2						F		Yes	33	18.7	17.2	13.4	8.9	6.7	9.3	NIH	iDXA	IFF99

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SUPPLEMENTARY DATA

p.	Row	Col	Group	Genetic comments	NM	RB	RM	EO	BA	Sex	Race	Hispanic or Latino	Age	BMI	FFMI	Arms %fat	Legs %fat	Trunk %fat	Total %fat	Site	Table	ID
12	A	4	CGL1	AGPAT2						F	White		32	19.9	19.2	4.2	4.6	4.0	5.2	NIH	iDXA	HSE26
12	A	5	CGL1	AGPAT2						F		Yes	20	20.9	19.0	11.5	10.8	10.0	11.2	NIH	iDXA	JRD21
12	A	6	CGL1	AGPAT2						F	Black		20	25.4	23.7	7.0	7.8	6.8	7.5	NIH	iDXA	VSH16
12	B	1	CGL1	AGPAT2						M	Black		25	24.9	23.3	6.4	7.6	5.3	7.3	NIH	iDXA	XHD64
12	B	2	CGL2	Presumed BSCL2. Gene sequence information not available						F	White		14	18.2	17.1	10.8	8.0	6.3	8.4	NIH	iDXA	VXI60
12	B	3	CGL2	BSCL2						M	Asian		16	16.6	15.4	11.1	10.0	6.0	9.0	NIH	iDXA	UIW42
12	B	4	CGL2	BSCL2						M	White		18	24.2	22.9	6.4	8.1	5.3	7.2	NIH	iDXA	GEW39
12	B	5	GL LMNA p.T10I-linked	LMNA p.T10I Sahinoz et al (19), Hussain et al (20)						F	Black	No	13	14.7	13.5	10.2	11.0	5.4	8.8	UM	Prodigy	QOI19
12	B	6	CGL PCYT1A-linked	PCYT1A Payne et al (21)						F	White		27	14.4	13.4	8.9	7.5	7.4	8.9	NIH	iDXA	HKV51
12	C	1	AGL							F	White		40	17.0	16.0	12.1	7.3	4.5	7.3	NIH	iDXA	PBN25
12	C	2	AGL							F	White	No	19	21.3	20.0	5.7	6.6	5.1	6.7	UM	Prodigy	AFC45
12	C	3	AGL							M		Yes	20	18.8	17.8	7.4	7.4	4.3	6.8	NIH	iDXA	FMN85
12	C	4	AGL							M	White	No	15	19.2	13.3	6.1	9.1	6.7	8.4	UM	Prodigy	KAC12
13	A	1	FPLD2	LMNA, non-hotspot	y	y			y	F		No	33	21.6	18.5	14.3	15.6	12.5	14.3	UM	Prodigy	ONR25
13	A	2	FPLD2	LMNA, non-hotspot						F		Yes	15	21.6	18.4	17.1	15.9	15.0	16.0	NIH	iDXA	ZLX34
13	A	3	FPLD2	LMNA, non-hotspot Ajluni et al (8)	y	y			y	F	White	No	37	27.2	18.6	37.4	11.2	40.7	33.1	UM	Prodigy	DSC40
13	A	4	FPLD2	LMNA p.R482L Ajluni et al (22)	y	y			y	F	White	No	59	20.5	15.8	16.8	14.4	30.6	23.8	UM	Prodigy	GZA67
13	A	5	FPLD2	LMNA p.R482L Ajluni et al (22)	y	y			y	F	White	No	30	31.8	25.1	21.6	16.2	26.4	22.7	UM	Prodigy	ILQ65
13	A	6	FPLD2	LMNA p.R482Q Ajluni et al (8)	y	y			y	F			59	21.9	17.1	17.5	14.4	29.3	23.5	UM	Prodigy	VFQ93
13	B	1	FPLD2	LMNA p.R482Q Ajluni et al (22)	y	y			y	F	White		55	22.7	17.1	20.9	20.1	32.4	27.3	UM	Prodigy	WQF13
13	B	2	FPLD2	LMNA p.R482Q Ajluni et al (8)	y	y			y	F	White	No	42	24.0	19.7	15.5	16.8	25.1	21.4	UM	Prodigy	PLU27
13	B	3	FPLD2	LMNA p.R482Q Ajluni et al (22)	y	y			y	F	White	No	49	24.5	17.6	24.7	17.8	38.4	29.8	UM	Prodigy	FAW92
13	B	4	FPLD2	LMNA p.R482Q Ajluni et al (8)	y	y			y	F	White	No	57	24.9	19.6	15.0	12.8	29.6	22.9	UM	Prodigy	OZF80
13	B	5	FPLD2	LMNA p.R482Q Ajluni et al (8)	y	y			y	F			49	25.3	18.7	22.6	17.6	34.2	27.5	UM	Prodigy	BIA63
13	B	6	FPLD2	LMNA p.R482Q Ajluni et al (22)	y	y			y	F	White		40	29.9	20.8	24.7	22.8	37.4	31.2	UM	Prodigy	VKF34
13	C	1	FPLD2	LMNA p.R482Q Ajluni et al (22)	y	y			y	F	White		40	32.9	21.6	28.5	24.4	43.7	36.0	UM	Prodigy	ZYS55
13	C	2	FPLD2	LMNA p.R482Q	y	y			y	F	White	No	30	33.6	24.8	22.4	21.3	29.8	26.4	UM	Prodigy	TSI97
13	C	3	FPLD2	LMNA p.R482Q Ajluni et al (22)	y	y			y	F	White	No	62	38.1	23.1	31.9	30.5	46.5	40.0	UM	Prodigy	SZK30
13	C	4	FPLD2	LMNA p.R482W	y	y	y	y	y	F	White		38	23.8	20.7	13.6	10.8	16.1	14.7	NIH	iDXA	VHI21
13	C	5	FPLD2	LMNA p.R482W Ajluni et al (8)						F	White	No	41	26.1	19.9	22.7	18.7	28.6	25.3	UM	Prodigy	BBB10
13	C	6	FPLD2	LMNA p.R482W	y	y	y	y	y	F	White		19	26.6	20.7	22.7	16.5	26.8	23.1	NIH	iDXA	NXH65
14	A	1	FPLD2	LMNA, non-hotspot	y	y			y	F	White	No	58	23.2	18.3	14.6	18.4	25.3	22.0	UM	Prodigy	OBM76
14	A	2	FPLD2	LMNA, non-hotspot Ajluni et al (22)						F	White	No	45	27.7	18.8	27.4	19.4	39.9	32.5	UM	Prodigy	YZM31
14	A	3	FPLD2	LMNA, non-hotspot Ajluni et al (8)	y	y			y	F	White	No	33	19.8	15.4	22.8	14.1	31.3	24.7	UM	Prodigy	GUX67
14	A	4	FPLD2	LMNA, variant to be verified	y	y	y	y	y	F	White		18	26.5	20.7	19.8	17.0	26.7	22.7	NIH	iDXA	XBM73
14	A	5	FPLD2	LMNA p.R482Q	y	y			y	M	White	No	49	37.8	27.8	25.7	18.3	32.9	27.3	UM	Prodigy	ZRZ36
15	A	1	FPLDX	PPARG p.A261V, FPLD3 by OMIM, MITER probability of pathogenicity=65.7%, Ajluni et al	n	n			n	F	White		64	31.7	19.9	33.5	30.8	44.8	38.5	UM	Prodigy	GEJ25
15	A	2	FPLDX	PPARG p.G161V, FPLD3 by OMIM, MITER probability of pathogenicity=99.7%	n	y			n	F	White	Yes	34	25.9	20.0	24.7	22.5	26.7	24.9	UM	Prodigy	CHD38
15	A	3	FPLDX	PPARG, FPLD3 by OMIM	y	y	y	y	y	F	White		27	23.6	18.6	19.5	13.0	28.1	22.5	NIH	iDXA	QGS50
15	A	4	FPLDX	PPARG, FPLD3 by OMIM			y	y		F	White		54	24.2	17.4	24.4	18.3	37.3	29.6	NIH	iDXA	LTP90

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p.	Row	Col	Group	Genetic comments	NM	RB	RM	EO	BA	Sex	Race	Hispanic or Latino	Age	BMI	FFMI	Arms %fat	Legs %fat	Trunk %fat	Total %fat	Site	Table	ID
15	A	5	FPLDX	PPARG, FPLD3 by OMIM	y	y	y	y	y	F	White		51	28.6	17.9	39.5	27.2	40.3	35.7	NIH	iDXA	XNN72
15	A	6	FPLDX	PPARG, p.E352K, FPLD3 by OMIM, MITER probability of pathogenicity=98.2%	y	y			n	M	White	No	52	28.4	22.9	15.5	18.8	23.1	20.9	UM	Prodigy	WDA15
15	B	1	FPLDX	POLD1 p.E1067K Ajluni et al (8)	n	n			y	F	White	Yes	34	17.6	15.5	15.6	7.9	15.4	12.7	UM	Prodigy	IGX98
15	B	2	FPLDX	POLD1 p.E1067K Ajluni et al (8)						F	White	Yes	14	18.3	15.2	25.0	16.0	22.4	19.9	UM	Prodigy	HDI83
15	B	3	FPLDX							F	White	No	12	17.7	14.2	18.1	13.0	25.9	21.0	UM	Prodigy	IDY52
15	B	4	FPLDX		y	y			n	F	White	No	54	24.0	15.5	36.9	30.6	41.4	36.9	UM	Prodigy	CES33
15	B	5	FPLDX		y	y	y	y	n	F	White		45	26.0	19.0	30.0	23.0	30.6	28.1	NIH	iDXA	NLA27
15	B	6	FPLDX		y	y	y	y	y	F	White		47	26.7	18.2	28.6	19.7	41.4	33.1	NIH	iDXA	CFT80
15	C	1	FPLDX							F	White		16	26.8	17.8	26.0	22.9	44.4	34.8	NIH	iDXA	PWR43
15	C	2	FPLDX		n	y			n	F	White	No	45	27.0	18.1	29.0	24.4	41.5	34.4	UM	Prodigy	PKT82
15	C	3	FPLDX		y	y			y	F	White	No	33	27.8	17.1	35.0	23.8	48.0	39.8	UM	Prodigy	MTJ87
15	C	4	FPLDX		y	y			y	F	White	No	63	28.0	15.6	42.7	31.4	54.4	45.7	UM	Prodigy	ECD84
15	C	5	FPLDX		y	y			y	F	Black		23	30.2	24.5	17.7	11.6	25.3	20.4	UM	Prodigy	ZQB70
15	C	6	FPLDX		y	y	y	y	y	F	White		41	30.3	18.9	38.5	19.8	46.8	38.5	NIH	iDXA	YSD77
16	A	1	FPLDX							F	White	No	13	30.5	19.7	37.9	31.0	42.4	37.5	UM	Prodigy	GFV67
16	A	2	FPLDX		n	n			n	F	White	No	63	30.7	18.3	41.3	30.6	48.9	42.4	UM	Prodigy	NEG22
16	A	3	FPLDX		y	y			y	F	White	No	58	31.0	17.0	37.1	28.4	54.6	46.1	UM	Prodigy	EQN50
16	A	4	FPLDX		n	n	n	n	n	F	White		54	31.0	17.2	43.0	37.1	51.3	44.9	NIH	iDXA	UTU82
16	A	5	FPLDX		y	y			y	F	White	No	58	31.0	20.6	32.7	24.9	40.6	34.7	UM	Prodigy	XOQ50
16	A	6	FPLDX		y	y			y	F	White	No	39	31.1	21.2	36.9	26.2	38.4	33.6	UM	Prodigy	TSZ36
16	B	1	FPLDX		y	y	y	y	y	F	White		29	31.6	19.8	36.9	23.4	47.9	38.9	NIH	iDXA	YGE23
16	B	2	FPLDX							F	White	No	57	32.1	17.0	45.5	35.1	56.5	48.7	UM	Prodigy	AFP45
16	B	3	FPLDX		y	y			y	F		No	51	33.7	18.9	29.1	28.9	52.5	44.3	UM	Prodigy	BPZ32
16	B	4	FPLDX		y	y			y	F	White	No	53	35.8	22.5	36.6	28.9	43.4	37.9	UM	Prodigy	MDW89
16	B	5	FPLDX		y	y			y	F	Other	Yes	65	37.0	24.1	33.8	27.2	39.7	34.7	UM	Prodigy	RNQ70
16	B	6	FPLDX		y	y	y	y	y	F	White		39	37.8	21.1	37.9	26.3	54.8	45.0	NIH	iDXA	CLR70
16	C	1	FPLDX							F	White	No	45	38.2	24.3	39.5	22.2	45.7	38.2	UM	Prodigy	QKC43
16	C	2	FPLDX		y	y			y	F	White	No	55	38.7	20.7	45.1	34.3	55.0	47.0	UM	Prodigy	LAM96
16	C	3	FPLDX		y	y			n	F	White	No	34	38.8	25.2	28.6	24.6	44.1	36.8	UM	Prodigy	EYO66
16	C	4	FPLDX		n	n			n	F	White	No	32	40.9	22.2	41.0	34.0	51.6	46.0	UM	Prodigy	VKN31
16	C	5	FPLDX		n	y	?	?	n	M	White		65	26.0	20.0	20.5	19.2	28.3	24.1	NIH	iDXA	TGQ88
16	C	6	FPLDX		y	y	y	y	n	M	White		46	32.1	25.3	13.5	13.4	30.2	22.7	NIH	iDXA	LQP70
17	A	1	FPLDX		n	y			y	M	White	No	62	32.9	20.5	29.1	24.1	50.4	39.5	UM	Prodigy	QNT60
17	A	2	FPLDX		y	y			y	M	White	No	38	33.1	22.7	28.3	21.6	39.5	33.0	UM	Prodigy	EYC46
17	A	3	FPLDX		n	n			n	M	White	No	34	34.0	20.5	33.4	29.0	47.0	40.7	UM	Prodigy	NSF35
18	A	1	APL							F	White	No	40	29.5	20.8	14.5	35.3	31.5	31.0	UM	Prodigy	FTR25
18	A	2	APL							M	White	No	24	24.0	20.7	5.1	17.9	14.8	14.5	UM	Prodigy	WII47

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