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The sustainability of bariatric surgery on weight loss and metabolic benefits is highly variable between surgery types and individuals. In addition the mechanisms of the superior effect of gastric bypass (GBP) compared to restrictive procedures are not known. Our specific *goals* are: 1) To identify *biomarker predictors* of long-term weight loss and metabolic improvement after bariatric surgery; and 2) To identify the different *mechanisms* by which GBP and adjustable gastric banding (LAGB) exert their effects, i.e. to characterize mechanisms underlying the superior metabolic effects of GBP vs. LAGB. To achieve these goals we will apply metabolomics profiling to samples collected from well-characterized patients that have undergone GBP and LAGB and followed up to 7 years in the Longitudinal Assessment of Bariatric Surgery (LABS) study, and will compare them to non-operated controls with T2DM , matched on initial BMI, who participated in a lifestyle intervention (LSI) from the Action for Health in Diabetes (Look AHEAD) study and followed up to 7/8 years. In Aim 1, we will test the hypothesis that baseline targeted metabolomics signatures, including amino acids and their metabolites, can predict successful long term surgical weight loss. In Aim 2, we will test the hypothesis that baseline metabolomics signatures will show incremental risk predictive capability for T2DM remission at 3 and 7 years, above and beyond well-known clinical predictors. In both aims, we will test the hypothesis that the change of the metabolomic signature will differ between types of intervention, at matched weight loss. This will help identify mechanisms of the superior effect of GBP, independent of weight loss. Both targeted (Aims 1 and 2) and non-targeted (Aim 3) mass spectrometry-based metabolomics and pathway analysis will be performed. Results from this award would support a more personalized approach for the surgical treatment of obesity and T2DM, based on a model integrating patient clinical factors and metabolite levels measured prior to weight loss intervention, rather than simply on BMI and surgeons' preference. Moreover, our data will help uncover novel pathways related to the mechanisms of the effect of GBP, independent of weight loss.