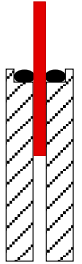


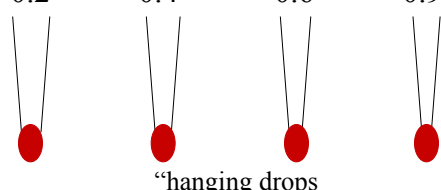
# UNDERSTANDING DIFFERENTIAL PIPETTING requires understanding the *resolution* and *flow* dilemma which bedevils conventional pipettors.

Conventional pipettors use pistons of a single diameter which often compromise resolution vs flow.




	Diameter (inches)	X Scn Area (in <sup>2</sup> )	STROKE Resolution (mm/uL)	Flow rate Maximum (uL/sec)*	Maximum Tip Escape Velocity (meters/sec)* for tip diameters (inches)			
					0.020	0.016	0.012	0.010
Fine Conventional Pipettor	0.062	0.003	0.51	41	0.2	0.4	0.6	0.9 m/sec

This diameter is like a 100 uL syringe and its Stroke Resolution is pretty good for aspirating small samples, but its feeble flow can't blow those small samples off.

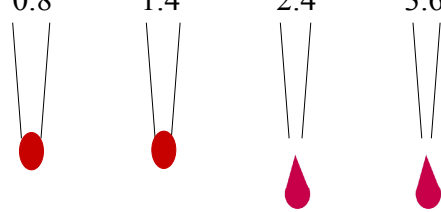


"hanging drops"



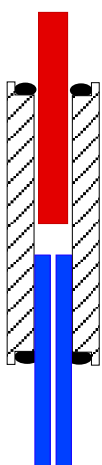
	Diameter (inches)	X Scn Area (in <sup>2</sup> )	STROKE Resolution (mm/uL)	Flow rate Maximum (uL/sec)*	Maximum Tip Escape Velocity (meters/sec)* for tip diameters (inches)			
					0.020	0.016	0.012	0.010
Conventional Pipettor	0.125	0.0123	0.13	170	0.8	1.4	2.4	3.6 m/sec

This diameter is like a 500 uL syringe and does have the flow to blow samples off many tips, but its Stroke Resolution of only 0.13 mm/uL just can't aspirate tiny samples consistently to start with.



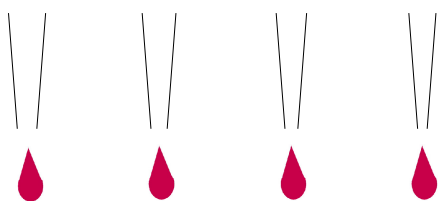
Conventional Pipettors Resolution, Flow and Tip Escape Velocity

Differential Pipetting uses 2 pistons of slightly different diameters to give extremely fine resolution for the small volumes that need it AND built-in large flow power for clean delivery.



	Diameter (inches)	X Scn Area (in <sup>2</sup> )	STROKE Resolution (mm/uL)	Flow rate Maximum (uL/sec)	Maximum Tip Escape Velocity (meters/sec)* for tip diameters (inches)			
					0.020	0.016	0.012	0.010
Differential Pipetting					1.9	3.0	5.3	7.6 m/sec
Single Mode	0.184 0.187	0.026	0.062	390				
Differential	0.033	0.0009	1.8	12				

When the top 0.184" and bottom 0.187" diameter pistons move together, their tiny X-section area difference is that of a single 0.033" piston -- like a 34 uL syringe -- making available a huge 2 mm/uL Stroke Resolution excursion that gives unprecedented resolution and stability. One piston alone gives high flow to blow samples cleanly off contact-free.



Differential Pipettor finer Resolution, higher Flow and abundant Tip Escape Velocity

\* Maximum flow rates are standardized for pipette speed of 0.9 inches per second. 1.5 meters/second is used as the minimum Tip Escape Velocity for clean drop breakaway. 1.0 m/second may be considered adequate for pure aqueous solutions. R60119