

# STR Single-Use Bioreactor

Scalable batch and fed-batch STR platform for cultivating of suspension cell lines

## 5 easy steps to simplified cultivation

1. Remove STR from dual foil bags
2. Mount sensors, add media to the STR and condition the temperature
3. Connect STR with gas in/out
4. Calibrate the pH and DO sensors
5. Inoculate cells and start cultivation



## The advanced CellVessel 21 series STR out-perform the conventional glass/steel STR for batch and fed-batch cultivation



CellVessel 21 series general specifications are:

- PMP (Polymethylpentene) or PC (polycarbonate) vessel
- Polyamide cover integrating three ports for classical PG13.5 sensors
- Advanced aircraft style helical screw impeller for low shear force contribution
- Impeller fixed to an axel rotating hanging in low-friction polyamide bearing secured in the polyamide cover (from 21-2000 and up)
- Clockwise rotation impeller for up-flow integrates sealed-in permanent magnets
- Impeller integrates in its centre a 15 µm pore size sparger disc (from 21-2000 and up)
- Baffled stator for axial vortex mixing, donut shape flow pattern and high mass transfer for increased productivity (from 21-1000)

CellVessel variations, p/n	21-0250	21-1000	21-2000	21-3000	21-5000
Vessel volume/size, ml	250	1,000	2,000	3,500	5,500
Working volume, ml	>50	>350	>600	>1,250	>1,250
Required rpm span	40-250	40-150	20-150	20-150	20-150
Rotating power requirement, Watt	<1		<2	<3	<5
Vessel OD for heating blanket, mm	HSF	HSF	132	151	179
Height, without sensors, mm	140	190	230	250	280
Diameter cover, mm	75	120	155	175	215
Weight, grams	150	300	450	550	700
Sensor length, PG13.5, mm	120	120	160	160	220



## CellVessel 21 single-use platform scalable 1:80

*From screening to research or even small scale production the CellVessel STR family offers freedom and ease of use in cultivation*

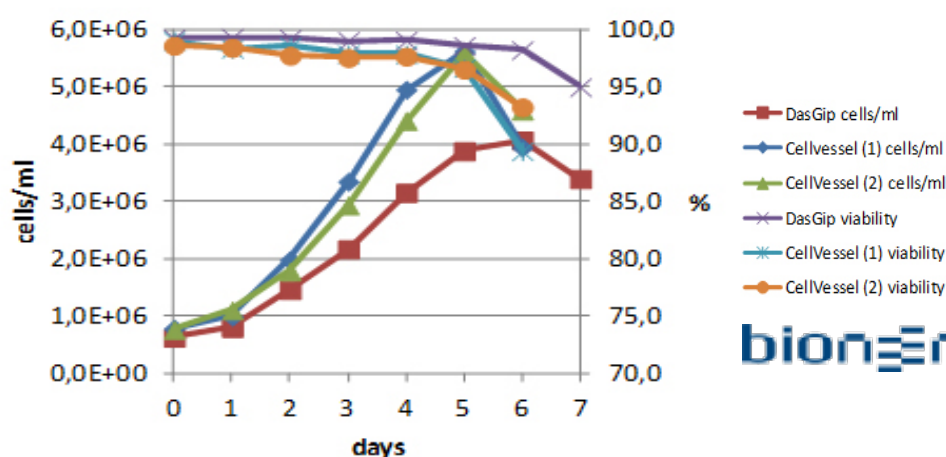
CellVessel™ 21 series of advanced single-use Stirred-Tank-Reactors for batch and fed-batch cultivating of shear sensitive mammalian, stem cell or insect cell lines in suspension are unique as to their agitation system, compact design and >1:80 scalable platform.

All CellVessel is designed for Magnetic-Stirrer-Table (MST) operation handled by most Process-Control-Systems (PCS) and replaces any traditional glass/metal STR. CerCell offer a MST kit for Kollmorgen (Biostat and T300), SEM (BJ), Applikon and other PCS servo motors.

**The range from as small as 50 ml to 4,000 ml working volume in just one platforms is radical and satisfies any need for cultivation in research or small scale production, etc.**

### CellVessel 21 series products:

- operate identical or better than traditional and autoclaved glass/steel bench-top STR
- fit in between your preferred cell lines and your existing Process-Control-System (PCS)
- operate with a variety of turntables or servo motor drives
- facilitate classical format and signal sensors with PG13.5 thread – Re-Use-Sensors and SUS as you wish
- are precision E-beam irradiated and ready to use right out of the bag



### CellVessel 21-2000 vs classical STR ▲

CellVessel is a fully functional STR (cells survive, multiply, and produce antibodies) and it performs identical or better than DasGip STR (for this specific cell line).

Antibody produced amounts to 76 µg/ml for the CellVessel STR as compared to 76 µg/ml for the DasGip STR. Furthermore, the figure above clearly demonstrates, that cell viability during exponential growth is the same for the two reactors

(well above 97 %) and that the maximal cell densities achieved are the same for the two different reactors.

If anything, cell density achieved for the CellVessel STR (5.6x10E+06 cells/ml) is clearly higher than for the DasGip counterpart (4.1x10E+06 cells/ml).

The work was performed Q1/2012 by senior scientist Holger K. Riemann at [www.bioneer.dk](http://www.bioneer.dk) - check Appendix



**CellVessel 23  
single-use  
platform  
scalable 1:120**

*From screening to research or even small scale production the CellVessel STR family offers freedom and ease of use in cultivation.*

**The simple and low-cost CellVessel 23 series present a range of STR that replaces the conventional glass/ steel STR for batch and fed-batch cultivation**

CellVessel 23 series general specifications are:

- PMP (Polymethylpentene) or PC (polycarbonate) vessel
- Polyamide cover integrating three ports for classical PG13.5 sensors
- Twin blade pitch impeller suspended on a shaft with polyamide bearing
- Impeller integrates silicone sealed permanent magnets for clockwise rotation and up-flow media motion
- Impeller integrates in its centre a 15 µm pore size sparger disc from size 23-2000 and up
- Impeller creates the traditional STR radial vortex flow, mixing pattern

CellVessel variations, p/n	23-0250	23-1000	23-2000	23-3000	23-5000	23-7000
Vessel volume, ml	250	1,100	2,400	3,500	5,500	7,500
Working volume, minimum, ml	>50	>350	>600	>1,250	1,250	1,500
Required and max MST, rpm	0-350	0-250	0-250	0-250	0-200	0-200
Required power at 300 rpm, watt	<1		<5			<12
Sparging method	direct	direct	porous bodies			
Height, mm	140	190	230	250	280	300
Diameter cover, mm	75	120	155	175	215	210
Diameter for heating blanket, mm	HSF	HSF	132	151	179	193
Vessel design	conical	conical	conical	conical	conical	cylindrical
Weight, grams	150	300	450	550	700	900
Sensor length, PG13.5, mm	120	120	160	160	220	220



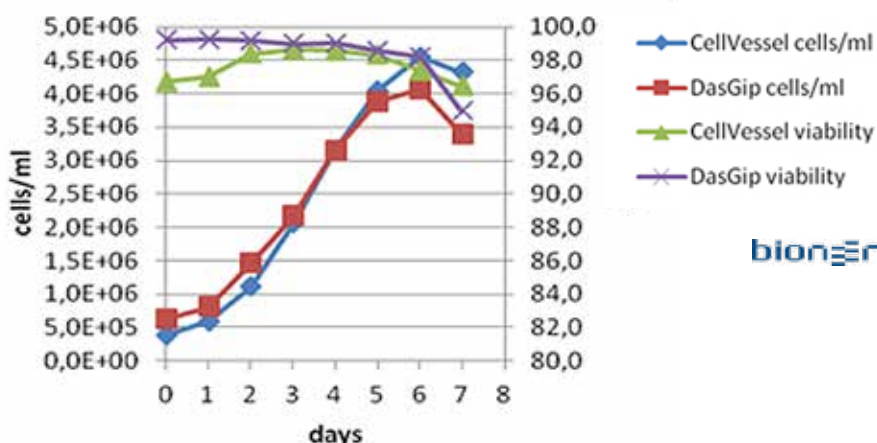
CellVessel™ 23 series of low-cost single-use Stirred-Tank-Reactors (STR) for batch and fed-batch cultivation of mammalian cell lines are unique as to their compact design and ability to accept classical sensors in 1:120 size scalable platform.

All CellVessel's are designed for Magnetic-Stirrer-Table (MST) operation by most Process-Control-Systems. CerCell offer a MST kits for Kollmorgen (Biostat and T300), SEM (BJ), Applikon and other PCS servo motors.

**The range from as small as 50 ml to 6,000 ml working volume in just one platform is radical and satisfies most need for cultivation in research or small scale production, etc.**

**CellVessel 23 series products:**

- operate identical or better than traditional and autoclaved glass/steel bench-top STR
- fit in between your preferred cell lines and your existing Process-Control-System (PCS)
- operate with a variety of turntables or servo motor drives
- facilitate classical format and signal sensors with PG13.5 thread – RUS and SUS as you wish
- are precision E-beam irradiated and ready to use right out of the bag



**CellVessel 23-0250 vs classical STR**

CellVessel STR is fully functional (cells survive, multiply, and produce antibodies) and it performs almost exactly as the DasGip STR (this specific cell line).

Antibody produced amounts to 77 µg/ml for the CellVessel STR as compared to 76 µg/ml for the DasGip STR. Furthermore, the figure above clearly demonstrates, that cell viability during exponential growth is the same for the

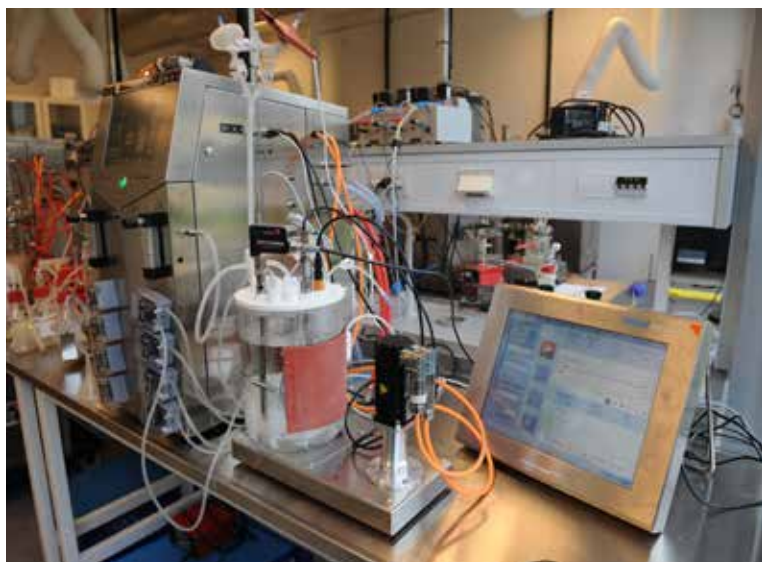
two reactors (well above 98 %) and that the maximal cell densities achieved are the same for the two reactors.

If anything, cell density achieved for the CellVessel STR (4.6x10E+06 cells/ml) is somewhat higher than for the DasGip counterpart (4.1x10E+06 cells/ml).

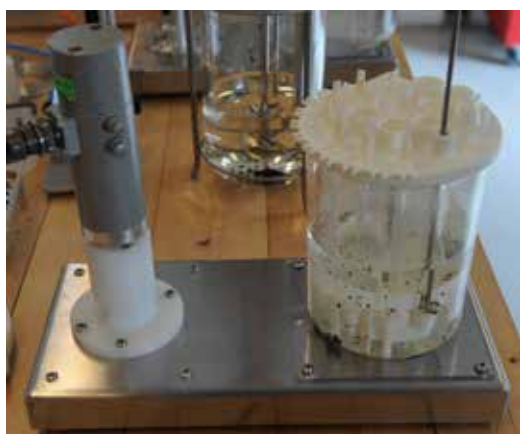
The work was performed Q1/2012 by senior scientist Holger K. Riemann at [www.bioneer.dk](http://www.bioneer.dk) - check Appendix



## Drive methods



CellVessel 21-0250 shown to the right and CellVessel 21-7000 shown above both on the CerCell 2250 MST in this example driven by the Kollmorgen servo motor. The angled blue display is coupled to a capacitance bio mass sensor.



CerCell offer a mechanical Magnetic-Stirrer-Table (MST p/n 2250) for adaptation to various servo motors for easy usage of CellTank and the full range of CellVessel products. The MST may easily be fitted with either the Kollmorgen adaptor or the Applikon adaptor.

### The MST

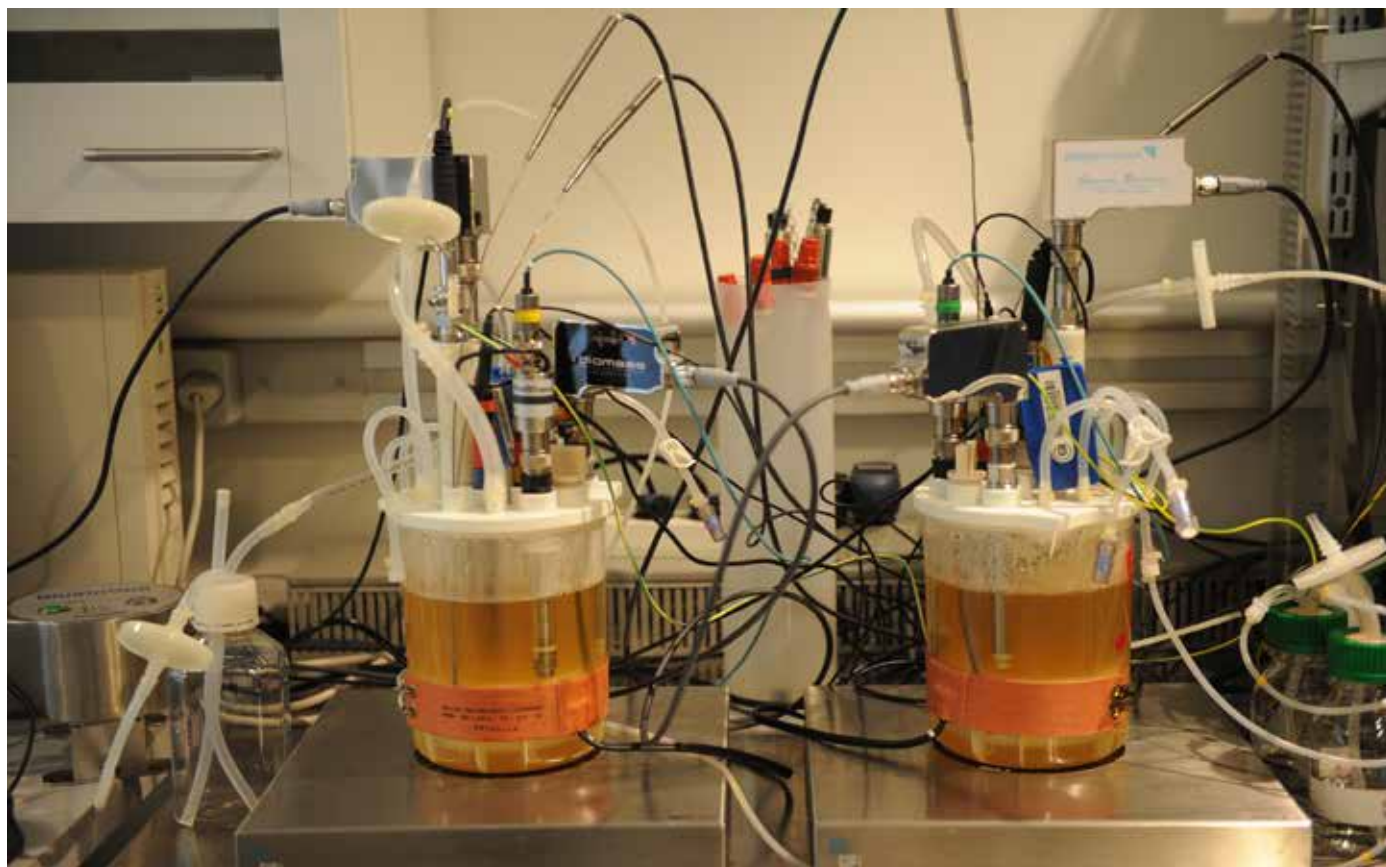
- Is a solid stainless steel construction featuring long life and silent running toothed polyurethane belt, two sealed double-row ball bearings and aluminum sprockets.
- Rotor is equipped with 12 permanent magnets and able to transfer 150 watt of power depending on the particular servo motor capacity.
- RPM span depends on the servo motor amplifier and range mostly from zero and to 1,250.
- Required power to overcome internal friction is 2 watt at 250 rpm and 10 watt at 750 rpm.
- Dim: 390x180x50 mm, weight is 5,7 kilo.



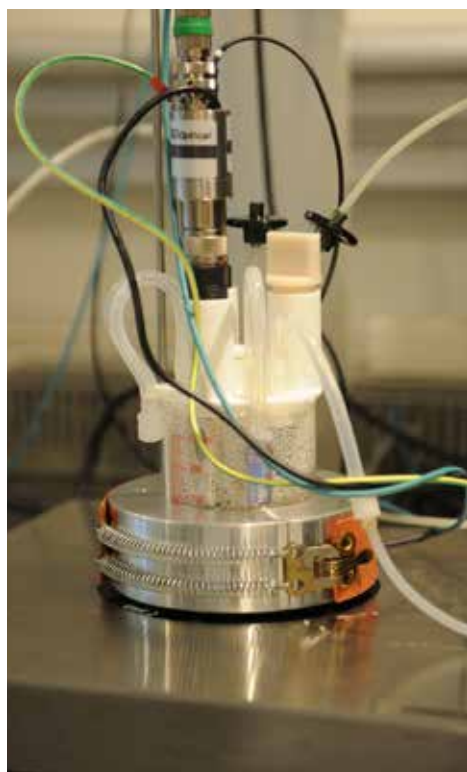
Thermo couple Pt100 are inserted in the tube well in the HSF. Here placed on the electrical heating element and driven by the CerCell MST.

For Biostat or the like a series of water conveying Heating-Cooling-Coils (HCC) is simple to hook-up with the MST. Easy connection to the water heating / cooling system as found on Biostat.





The series of single-use CellVessel's fits also the DasGip Process-Control-System (PCS) with Magnetic-Stirrer-Table able to supply more than 15 watt of rotation energy. The shown two CellVessel 21 series is designed for shear sensitive suspension mammalian as well as stem cell line cultivation and operate similar to traditional re-usable STR. Both SUB's further equipped with OD and pH SUS from Hamilton.



## Operation practise

Smallest CellVessel 23-0250 on well known DasGip MP8 PCS and M10 MST (60-1,500 rpm) for mammalian and stem cell cultivation. The aluminum Heating-Support-Foot (HSF) insure mechanical support and support of the standard DasGip heating blanket.



Smallest CellVessel 23-0250 on well known DasGip MP8 PCS and M10 MST (60-1500 rpm) for mammalian and stem cell cultivation. The aluminum Heating-Support-Foot (HSF) insure mechanical support of the tiny and low thermal mass CellVessel 23-0250 STR and facilitates stable thermal control by the PID of the PCS.

### Experimental trial on 21 series

#### Suspension cultures of identical cells grown in:

- CerCell p/n 21-2000 magnetically agitated STR single-use CellVessel with 1,500 ml media
- DasGip p/n BSO500TPSS magnetically agitated glass STR with stainless steel head plate and pitched blade impeller, 300-600 ml wv
- Batch-mode for both reactors (i.e. no perfusion and no sugar shots)
- Same CD-medium used for both cultures
- Seeding density: DasGip  $6.3E+05$  cells/ml and CellVessel  $7.7E+05$  cells/ml
- Both reactors are sparged from below through tubing
- The two reactors are equipped with identical autoclaved PG13.5x120 mm sensors (oxygen, pH)
- Both bioreactors are guided by the same DasGip MP8 controllers and M10 magnetic/inductive drive
- Controller settings identical for both reactors:
  - Oxygen tension: 30% of ambient air
  - pH 7,0
  - 37°C
- MP8 controller settings for the reactors:
  - Stirring: 80rpm
  - Aeration: 3L/hr mixed gas

### Experimental trial on 23 series

#### Suspension cultures of identical cells grown in:

- CerCell p/n 23-0250 magnetically agitated STR single-use CellVessel, 60-150 ml wv
- DasGip p/n BSO500TPSS magnetically agitated glass STR with stainless steel head plate and pitched blade impeller, 300-600 ml wv
- Batch-mode for both reactors (i.e. no perfusion and no sugar shots)
- Same CD-medium used for both cultures
- Same seeding density for both reactors: Approx.  $5 \times 10^5$  cells/ml
- Both reactors are sparged from below through tubing
- The two reactors are equipped with identical autoclaved PG13.5x120 mm sensors (oxygen, pH)
- Both bioreactors are guided by the same DasGip MP8 controllers and M10 magnetic/inductive drive
- Controller settings identical for both reactors:
  - Oxygen tension: 30% of ambient air
  - pH 7,0
  - 37°C
- MP8 controller settings for the two reactors:
  - Stirring: 80rpm for the DasGip STR versus 60rpm for the CellVessel STR
  - Aeration: 3L/hr for the DasGip STR versus 1L/hr for the CellVessel STR